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VOLUME 44 NUMBER 1

JANUARY 1945

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED 112

COVER PHOTOGRAPH

This is Mrs. Aëdes scutellaris var. pseudoscutellaris indulging in a blood meal. Possibly at the same time, in generous exchange, she is liberating in her victim a few matured larval forms of Wuchereria bancrofti which have been undergoing a 14-day developmental cycle in their mosquito host. Even though only one-fifth this pictured size, she is still an undesirable acquaintance. The charming tropical palm trees and hills in the Samoan background depict a favorite habitat of this carrier of filariasis.

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

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Volume 20, 1924, Nos. 2, 5 and 6.
Volume 24, 1926, Nos. 1, 2 and 4.
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PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

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All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

ROBERT C. RANSDELL, *Editor,*
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United States Naval Reserve, Retired.
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United States Naval Reserve.

TABLE OF CONTENTS

CLINICAL NOTES

MEDICAL AND SURGICAL DEVICES

EDITORIALS

BOOK NOTICES

PREVENTIVE MEDICINE

U. S. NAVAL MEDICAL BULLETIN

VOL. 44 JANUARY 1945 NO. 1

SPECIAL ARTICLES

STUDIES ON FILARIASIS IN THE SAMOAN AREA

ELON E. BYRD
Lieutenant H(S) U.S.N.R.

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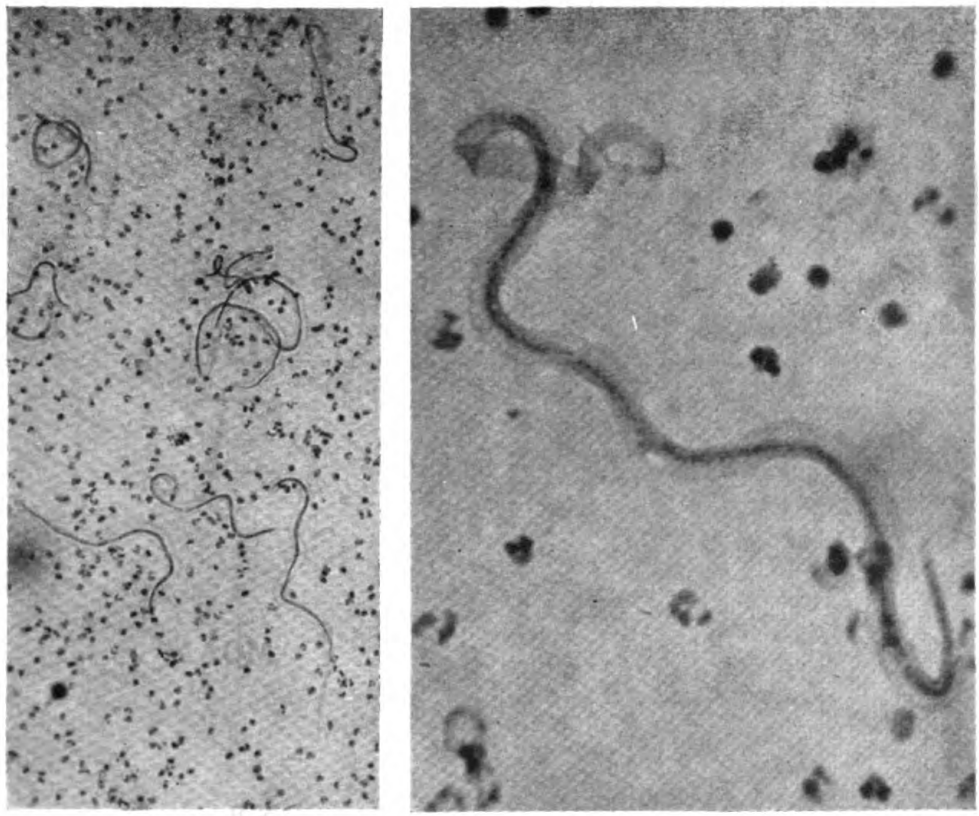
Lieutenant, junior grade H(S) U.S.N.R.
and
LEON BROMBERG
Commander (MC) U.S.N.R.

Field and laboratory investigations from April 1943 to February 1944 confirmed or established for the Samoan area certain important facts regarding recurrent lymphangitis–lymphadenitis (filariasis) among the armed personnel.

It may be affirmed, in the first place, that the disease of recurrent lymphangitis–lymphadenitis is attributed to the presence or recent existence of adolescent or mature Wuchereria bancrofti worms in the tissues of man, and that within the Samoan area filariasis is endemic in the native population. By thick blood smear method it can be demonstrated that between 20 and 50 percent of the native population harbor in their blood stream the microfilariae, which are the first larval stage of the parasite. Some authorities estimate a much higher percentage of infection among natives (80 to 90 percent).

The peak of the infection in the native population is believed to be reached between the twentieth and fortieth years of life. Rarely will a child under two years of age harbor a sufficient number of microfilariae in the blood stream for them to be demonstrated by ordinary routine laboratory procedures, and seldom will a person under the age of twenty develop elephantiasis.

The disease in the Samoan area is transmitted from infected to



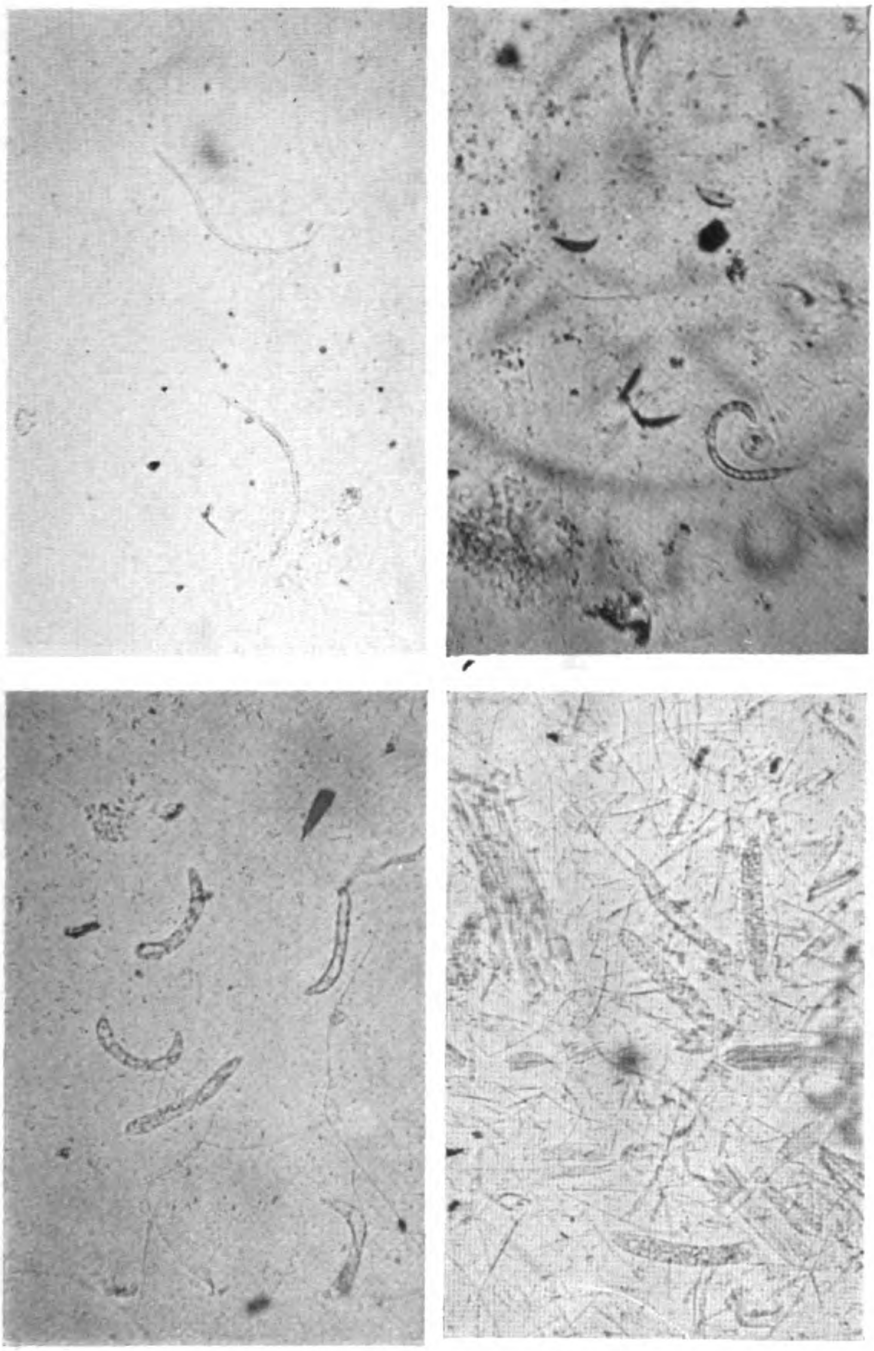
1. Left: Several microfilariae in a dehemoglobinized thick blood smear. Note sheaths. Right: Photomicrograph of a single microfilaria to show the sheath. From same slide as field at left (7.5 x ocular and 45 x objective).

uninfected persons by Aëdes scutellaris var. pseudoscutellaris[1], a "day biting" mosquito, and a period of about 14 days (see figs. 2-9) is required for the mosquito to nurture the larvae before a stage infective for man is reached. This latter may occur between the eleventh and seventeenth days of larval development. Without this developmental cycle, the larvae are unable to establish themselves in human tissue and, unlike the malarial parasite, there is no increase in the number of filarial organisms during this mosquito phase.

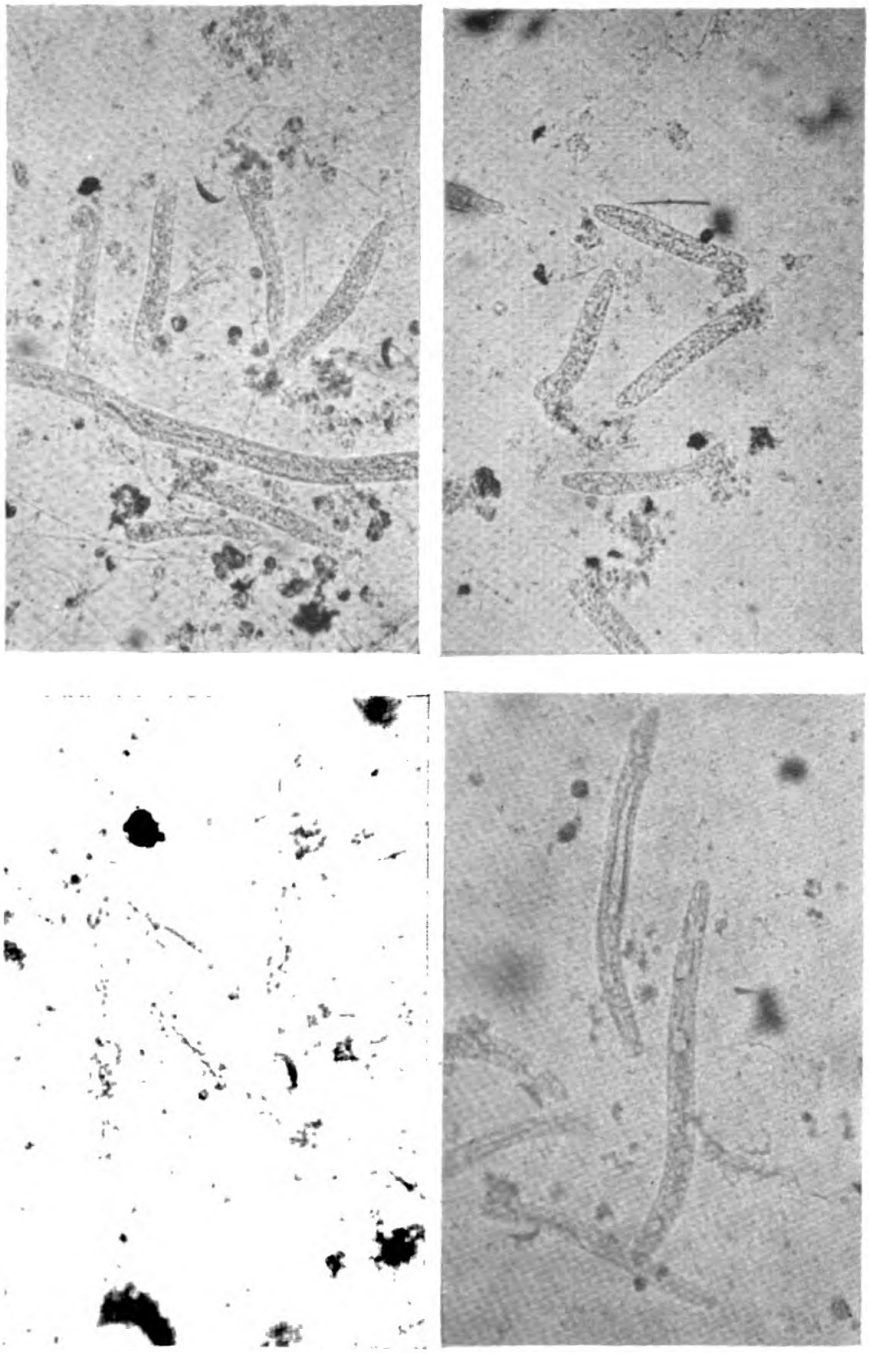
Explanation of following series.

The following illustrations represent larval stages in the life history of Wuchereria bancrofti while in its mosquito host. Culmination will be seen in the final picture, showing four larvae leaving the labium of the mosquito. (All taken with 7.5 x ocular and 10 x objective.)

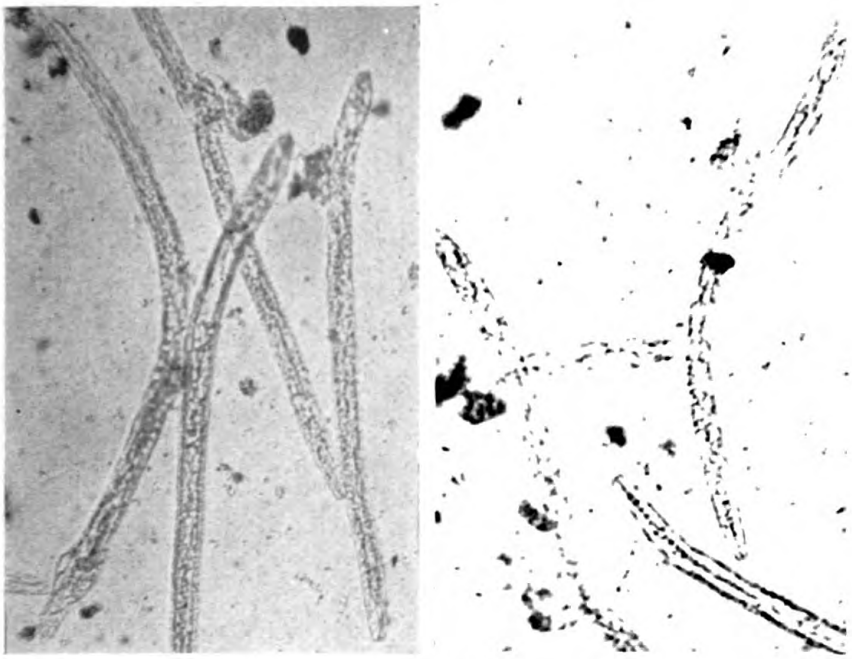
[1] The reader is referred to page 37 regarding latest nomenclature for this species.



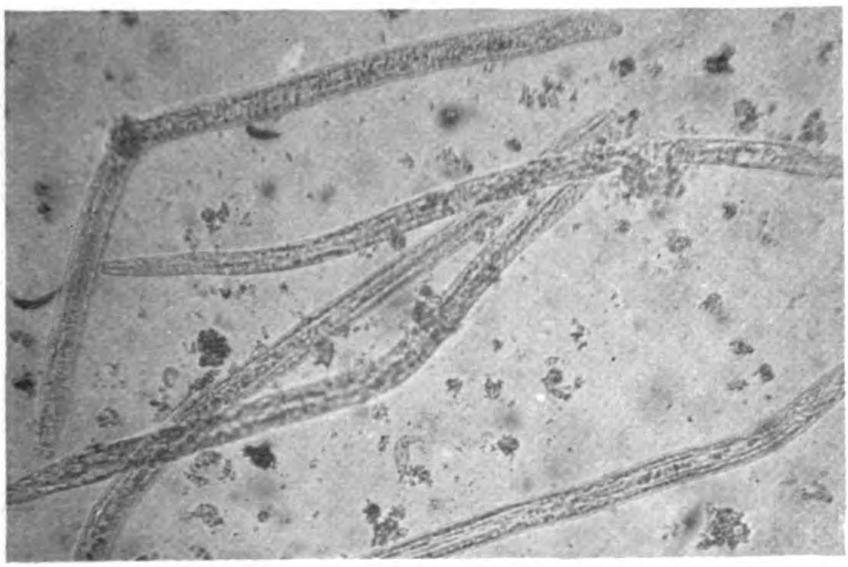
2. Upper left: Two developing larvae after 1 day in the mosquito host. Note shortening and thickening of the larvae. Upper right: After 2 days in the mosquito host. Lower left: Five developing larvae after 3 days in the host. Note short spike-like tail and the appearance of the developing excretory mechanism and the cloaca (vacuole near cephalic and caudal ends respectively). Lower right: Four developing larvae after 4 days.



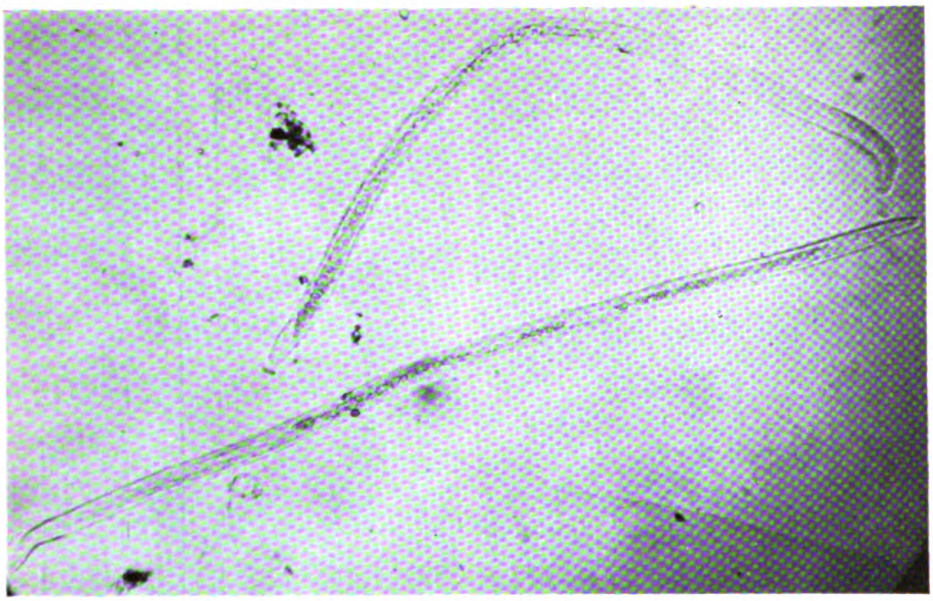
3. Upper left: Six developing larvae after 5 days. The single large worm is about a 12-day old larva from another mosquito. Note comparative size of the two ages and the development of the cloaca in the younger worms. Upper right: After 6 days. Note short spike of a tail and differentiation in area of digestive tract. Lower left: After 7 days. Note indications of moulting and the differentiation in the digestive tract. Lower right: After 8 days. Note development in digestive tract and increase in length within 1 day after moulting.



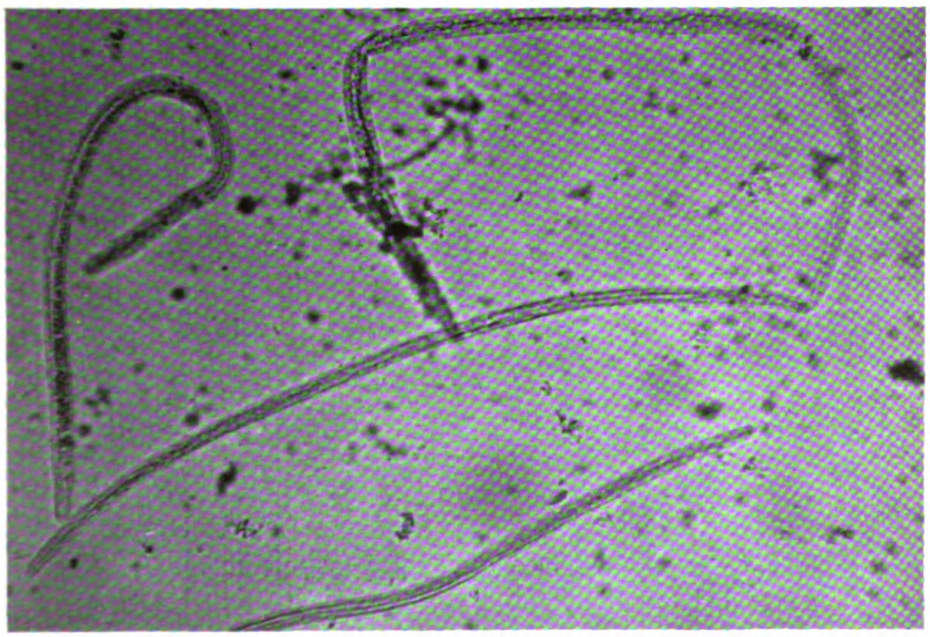
4. Left: Larvae after 9 days in the mosquito host. Note marked increase in length and differentiation in general anatomy. Right: After 10 days.



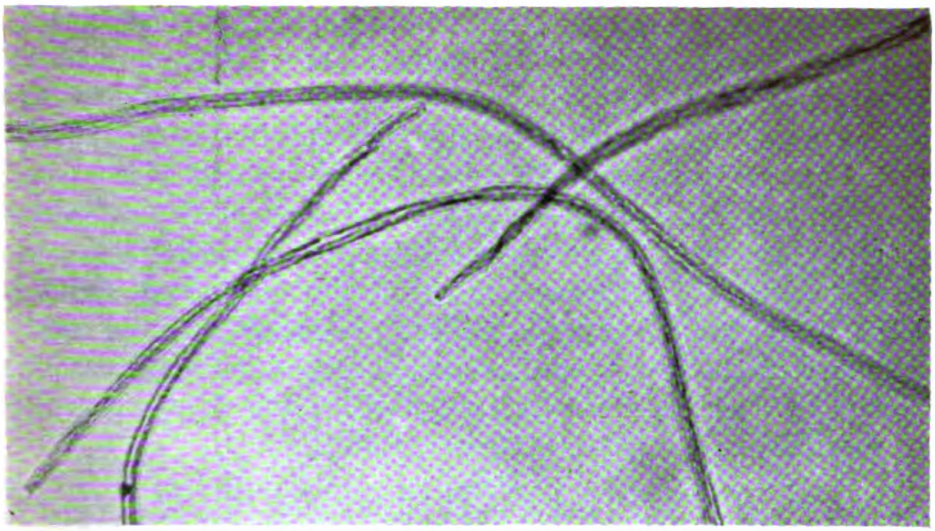
5. Five developing larvae after 11 days in the mosquito host. Note evidence of second moult, and the complete digestive tract.



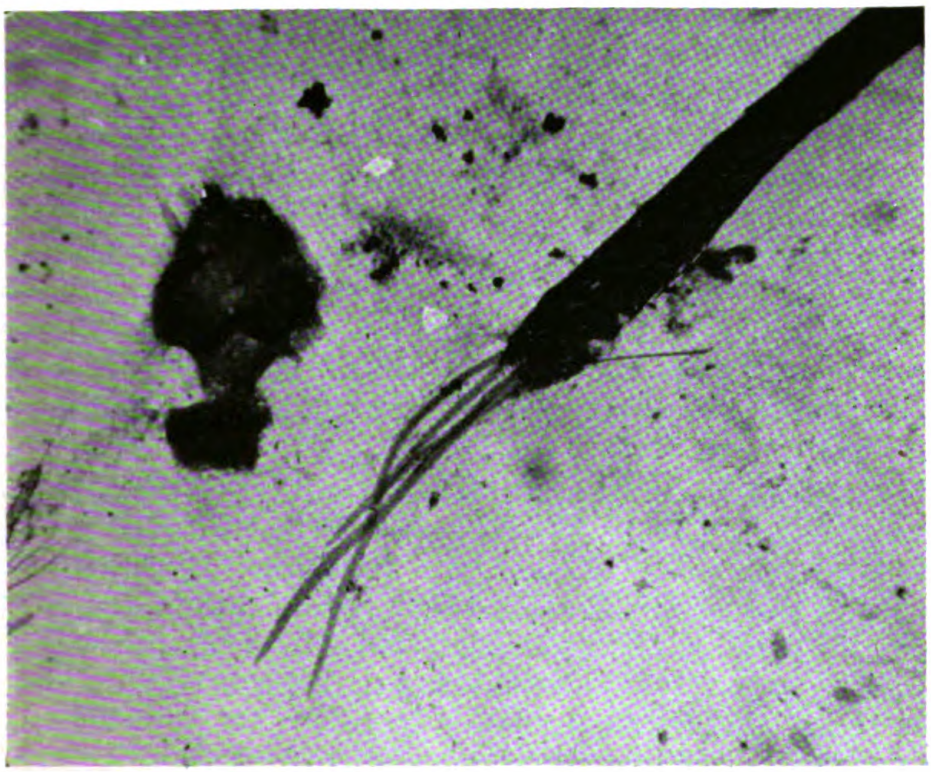
6. Two developing larvae after 12 days in the mosquito host. Note differentiation in upper part of the digestive tract of the straight specimen and the completeness of that system in the posterior portion of the other worm.



7. Four developing larvae after 13 days in the mosquito host. Note thinning and elongation of larvae after second moult.



8. Four developing larvae (infective stage) after 14 days. Specimens came from head and labium of host.



9. Four infective stage larvae leaving the labium of the mosquito host. (Stained slide.)

Within the Samoan area, Aëdes scutellaris var. pseudoscutellaris breeds extensively, particularly in small accumulations of water such as may be found in coconut shells, tin cans, rain barrels, sagging canvas, fallen leaves, rot holes in trees, boxes, bottles, pieces of metal, trailers, and many other objects which can hold a teacup or more of water for several days. The species rarely breeds in ground puddles. It actively feeds throughout all daylight hours. It is most active in its feeding habits in dense shade at dawn and dusk. The species, however, has been observed to attack actively at all hours of the day, even in open, sunlight-flooded areas which are swept by a strong breeze. Rarely will it attack at night except when disturbed.

When not feeding, the transmitting mosquito rests in grass, vines, underbrush, beneath houses and other places which are close to the ground and are well protected from wind and strong light. Usually, however, it remains close to its breeding place.

Despite its extensive breeding habit, its flight range is short. In the field this short flight range is proved by the progressive reduction in the incidence of naturally infected mosquitoes at the periphery of the native village. Within the center of the village the incidence of infection in the mosquito frequently runs as high as 25 percent or more. In sections of a few villages the incidence has been found to be as high as 45 percent. At 25 yards from the periphery of the village the incidence rate drops to 20 percent or less, and at 50 yards only a 4- or 5-percent infection is encountered. At or beyond 100 yards from the village just an occasional infected mosquito is taken. This last fact is better explained on the basis of the movements of infected persons than by the flight range of the mosquito.

The native village, consequently, is considered a hyperendemic focus of infection. This is conclusively demonstrated by the high incidence of infection in the native population as shown by the finding of microfilariae in the blood stream, the high incidence within the village of mosquitoes infected with demonstrable worms in various stages of development, and the almost complete absence of infection in the mosquito host beyond the 100-yard limit from the native village.

FILARIASIS IN THE ARMED PERSONNEL

As a corollary to this observation, the close proximity of troops to the native villages has led to the establishment of the disease of filariasis in an appreciable proportion of the armed personnel. Because of the urgency of the situation when the defense of the

Samoan area was of prime importance, this association was a military necessity.

Clinical manifestations of the disease in the armed personnel have been observed to appear from within a few weeks (six to ten) to many months after arrival. In some cases the appearance of symptoms has been delayed until long after leaving the area.

Although adolescent or mature worms can be demonstrated in the lymph tissues in a considerable percentage of those individuals of the armed personnel having the early symptoms of the disease, microfilariae in the blood stream are practically never found.

EPIDEMIOLOGIC STUDIES

In 1927 Buxton and Hopkins (*1*) listed 6 species as constituting the only mosquito types in the Samoan area. There appear, however to be at least 10 species described[2] from this region. Of these the following 7 have been recognized: Aëdes scutellaris var. pseudoscutellaris, A. aegypti, A. samoana (kochi?), A. vexans, Culex quinquefasciatus (fatigans), C. annulirostris, and C. sitiens. In so far as is known no species of the genus anopheles occurs within the area.

Of the seven species, only Aëdes scutellaris var. pseudoscutellaris and Culex quinquefasciatus have been shown to carry naturally acquired infections of the filarial worm, but from experimental and natural findings it is believed that Aëdes scutellaris var. pseudoscutellaris alone is responsible for the transmission of the disease within this area.

In laboratory experimentation more than 80 percent of the mosquitoes of this species exposed to a single infective blood meal contracted an infection. This was accomplished by permitting the biting of a native in whom 3.5 microfilariae per cubic millimeter of blood could be demonstrated at the time of feeding. Of this group more than 80 percent of those mosquitoes surviving for as long as 15 days following the infective blood meal carried the infective stage larvae.

In the field study, 9.9 percent of all A. scutellaris var. pseudoscutellaris that were dissected proved to be infected. Many of these infected mosquitoes carried more than a single stage in the developmental cycle of the parasite; some carried as many as 3 distinct developmental stages, whereas others carried 2 stages. The majority, however, carried only a single developmental stage.

[2] Verbal communication and a prepared key for the separation of the species as worked out by L. S. St. Amant and Dr. A. Stone of the U. S. National Museum, Washington, from available specimens and the literature in the Museum.

Culex quinquefasciatus, on the contrary, showed only a 7.4-percent infection in the field and never more than 29-percent infection in the laboratory experiments, despite feeding on the same native who infected Aëdes scutellaris var. pseudoscutellaris. Of 25 specimens of Culex quinquefasciatus which survived to the fifteenth day following the infective blood meal, only a single specimen harbored an infective stage larva. This infective stage larva was the only infective form of the parasite obtained in this area from this species of mosquito. Furthermore, it must be pointed out that in no case was there found a larval form in the naturally infected C. quinquefasciatus older than 7 days and only one single mosquito was found to harbor larvae of this age. In one other mosquito, larvae as old as 5 days were seen. All of the remaining specimens, however, carried only recently ingested microfilariae. These are significant findings, considering that 14 days are required to complete the larval cycle.

In carrying the cycle through to completion in laboratory raised and infected Aëdes scutellaris var. pseudoscutellaris and Culex quinquefasciatus, both species were observed to take at least three blood meals during the course of the developmental cycle of 14 days. Considering this fact, as well as the fact that occasional C. quinquefasciatus specimens have been taken in the field with advanced developmental stages and A. scutellaris var. pseudoscutellaris with two and three developmental stages, it would seem logical to assume that in the field both species may ingest two or more blood meals other than the infective meal during the developmental cycle of the parasite. But since less than one percent of C. quinquefasciatus taken in the field harbor developmental stages of the parasite older than recently ingested microfilariae, it is evident that the species is an inefficient transmitting host, which only occasionally develops the larvae to infectivity.

In the absence of suitable traps with which to take mosquitoes in the field, our only means of taking specimens was using human bait, or visiting huts and quarters during the early morning hours and capturing engorged female mosquitoes before they left the premises. This method of making captures has yielded almost all of our "night biting" varieties, Culex quinquefasciatus inclusive. Undoubtedly this method of capturing C. quinquefasciatus has weighted the readable results in favor of microfilarial encounters.

This, however, does not mean that already infected mosquitoes fail to seek blood meals after becoming infected. On the other hand, all of the naturally infected Aëdes scutellaris var. pseudoscutellaris were taken while they sought a second or third, perhaps a fourth, blood meal after the infective one. The readiness with

which this latter species became infected, together with the high percentage of specimens reaching infectivity as contrasted with the directly opposite findings in the case of C. quinquefasciatus, supports the conclusion that A. scutellaris var. pseudoscutellaris is the only important transmitter of filariasis in the Samoan area.

EXPERIMENTAL STUDIES

In determining which species of mosquitoes were responsible for the transmission of filariasis in this area, experimental tests were set up for all the species known to exist on the islands, which could be obtained in large enough numbers. In every case the larvae of the mosquito species tested were collected in the field and allowed to emerge as adults in the laboratory. When a sufficient number of adults was obtained, they were permitted to feed on a volunteer native, and the blooded adults segregated into cages according to the species. Up to the present writing only four of the seven known species have been experimentally infected.

In one experiment 5 of 20 Aëdes aegypti mosquitoes experimentally infected were found to carry developing larvae. The last positive mosquito was dissected on the sixth day and none of the surviving specimens lived beyond the tenth day.

In another experiment involving Culex annulirostris, 25 survived to the fifteenth day following the infective blood meal. None of these, however, carried infections when dissected, but developmental stages of the filarial worm were observed in 6 of the 18 specimens dissected on or before the seventh day following the infective blood meal. No infection was encountered from the eighth day to the conclusion of the experiment.

Twenty-nine percent of more than 100 Culex quinquefasciatus experimentally infected in the laboratory harbored filariae in varying stages of development following the infective blood meal. Of the 22 mosquitoes to survive to the fifteenth day, only a single specimen carried an infective stage larva. Of the 8 specimens, however, which died on the twelfth day, 6 carried developing worms in the following numbers: 3, 1, 1, 1, 2, and 16. In the other attempts to complete the cycle in this species no specimen was found which developed the larvae to the infective stage.

On the other hand, it was demonstrated that from 80 to 90 percent of Aëdes scutellaris var. pseudoscutellaris, which had been fed infected blood, harbored developing filarial worms. In every experiment, slightly over 80 percent surviving 15 or more days following the infective meal harbored the infective stage larvae. In one experiment in which 191 specimens of this species were

infected, 156 were positive for developing filarial worms, 22 were negative, and 13 were too dry for accurate determination of their parasitic character. The mosquito death rate observed in this experiment, with positive and negative readings is summarized in table 1. The experiment was carried through the twenty-fifth day following the infective blood meal. Thirty specimens survived beyond the fourteenth day of infection and of these, 26 harbored the infective larvae.

TABLE 1.—*Record of 191 Aëdes scutellaris var. pseudoscutellaris experimentally infected in the laboratory*

Days after infective blood meal	Number dead	Number killed	Number determined to be negative*
1	5	0	0
2	15	0	3
3	47	0	6
4	30	0	7
5	9	5	0
6	4	0	0
7	0	2	0
8	3	2	0
9	1	3	0
10	1	2	0
11	3	8	0
12	3	3	0
13	0	6	0
14	7	2	2
15	5	0	0
16	7	0	0
17	1	0	0
18	3	1	0
19	1	0	0
20	3	0	2
21	0	0	0
22	1	0	1
23	1	0	0
24	2	0	0
25	0	5	1

* Thirteen mosquitoes were too dry for making positive-negative determinations when found dead in the experimental cage.

COMMON MOSQUITOES OF SAMOA

Of the seven species of mosquitoes in this area Aëdes scutellaris var. pseudoscutellaris, a day biter, and A. samoana, a night biter, are the two most frequently encountered.

Based on the findings of previous workers and because of the general distribution of A. scutellaris var. pseudoscutellaris within the area, Buxton, 1927, accepted this species as the recognized transmitter of filariasis in the Samoan area. It breeds extensively throughout this entire area. Because its breeding habits are confined to small accumulations of water, its distribution on any particular island is not limited to any one type of locality nor is it restricted to the immediate environs of human habitation. In the coconut grove the species finds ample breeding places in fallen coconuts (opened by natives, crabs or rats), in steps cut into the

sides of the palm tree to facilitate climbing, in fallen, woody, boat-like coverings of the coconut bloom and in other small accumulations of water. Where the coconut is absent the species finds breeding possible in rot holes in such trees as the mango, the banyan, the breadfruit, and others. Natives, and now the service personnel, further have provided the species with breeding places in the form of discarded tin cans, boxes, pieces of metal, and myriads of other objects which will hold acceptable amounts of water.

On one occasion the number of coconuts on the ground in one area in the immediate vicinity of one of the largest camps was determined. This area was a strip of ground approximately 60 by 70 feet. Within this location there were 153 coconuts on the ground, 56 of which had holes in them of sufficient size to form suitable breeding places. Twelve of the coconuts were breeding mosquitoes at the time, and it should be pointed out that this count was made during what is called the "dry season" in this area.

On another occasion 15 rot holes in 50 breadfruit trees in the center of a native village contained breeding mosquitoes.

The second most common species of mosquito occurring within this area, Aëdes samoana, breeds exclusively in the small amounts of water which collect in the axils of taro, mat grass, and pandanus plants. Of these three plants the taro has the widest island distribution, the plant being found from the coastal plain to the top of the highest mountain peak. In most areas A. samoana is the principal "night biting" mosquito, and it usually is the one which replaces A. scutellaris var. pseudoscutellaris with the coming of darkness.

In an area where Culex quinquefasciatus was not encountered, approximately three hundred Aëdes scutellaris var. pseudoscutellaris were captured between the hours of 1600 and 1630, whereas between the hours of 2000 and 2400 approximately one hundred A. samoana were taken and but a single A. scutellaris var. pseudoscutellaris. No other mosquito was taken on this occasion. In an area where C. quinquefasciatus is found this species is taken along with A. samoana after nightfall. On one occasion in such an area, where both of the principal "night biting" varieties were present, 70 blooded female C. quinquefasciatus and 20 blooded female A. samoana from the same native hut were captured during the early morning hours.

Substantiating laboratory experiments, dissection records on mosquitoes captured in nature showed A. scutellaris var. pseudoscutellaris to be the species principally involved in the transmission of filariasis in this area.

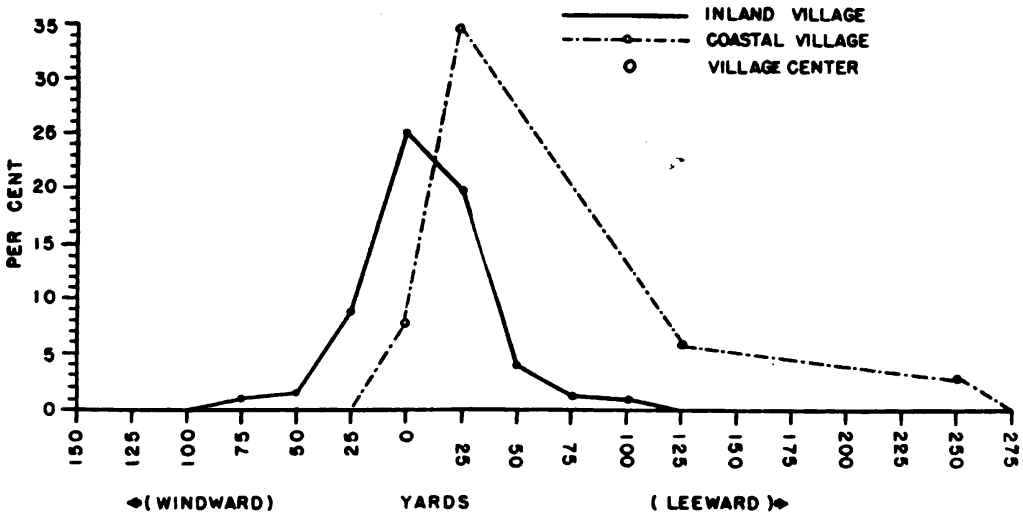
When dissection records on mosquitoes of this species taken from the immediate vicinity of the native village were compared with records on mosquitoes taken from areas where native traffic was restrained, it was noted that the only incidence of infection with filarial worms came from those mosquitoes taken from the environs of the native village.

In one location, a personnel camp from which natives were excluded except for the movies, a single infected mosquito was encountered out of 188 dissected. This infected mosquito came from the immediate vicinity of the outdoor movie. The camp in question was the largest on the island and occupied a rather restricted coastal strip of ground between two large native villages.

Except for the one "positive" mosquito taken from the movie area, no other mosquito was found to harbor the filaria within the compound. Yet when mosquitoes were examined from that portion of the two villages next to the camp, the nearest one of which was no more than 75 yards away, an incidence of 40 percent and 13 percent respectively was obtained. Even those mosquitoes taken from midway between the camp and villages gave entirely negative findings on dissection.

This is in contrast to the finding at one location on another island, where mosquitoes taken from one similarly isolated camp, the nearest native village being a distance of approximately 300 yards, showed a filarial occurrence rate of 13 percent. On investigation of this situation it was found that practically the entire population of the adjacent village passed twice daily through the camp on the way to and from work or for food gathering. Each day, therefore, natives were within the camp area for an undetermined period and usually during early morning and late afternoon, the worst hours of the day. After native traffic through the camp area was discontinued, the incidence of infection in the mosquito transmitter dropped to less than 1 percent. The persistence of this small percentage of infected mosquitoes was believed caused by a small contingent of native laborers retained within the area during daylight hours.

As the work progressed, records of varying incidence of infections in the transmitting mosquito, together with the universal prevalence of the host in the area, suggested that the transmitting mosquito had a very short flight range. To test this condition we selected one of the most inland villages accessible for study. This particular village was selected for three reasons: (1) It was well away from the coast and hence was as well protected from the prevailing wind as any location on the island, being completely surrounded by dense jungle growths; (2) there were no armed per-



Graph.—Showing the incidence of infection in the filarial transmitting mosquito, Aëdes scutellaris var. pseudoscutellaris, for two localities, one an inland village and the other a coastal village. Note that the wind has shifted the distribution of infected mosquitoes to the leeward side of each village.

sonnel stationed within one mile of the village although a small garrison had been quartered there prior to the time of our arrival; and (3) the native population within the village showed one of the highest incidences of infection with microfilariae in the blood stream of any village group on the island.

In working out the incidence rate in the mosquito host from this area an approximately equal number of mosquitoes, between 50 and 60, was taken from the center of the village and at 25-yard intervals from the periphery up to 150 yards. An equal number of samples was taken from both the windward and leeward sides of the village. The results of this study are shown in the accompanying graph.

The highest incidence rate was obtained in those mosquitoes taken within the village itself and for a distance of 25 yards around the village. Beyond the 50-yard limit only an occasional mosquito was taken which was proved to harbor the filarial parasite.

It will be noted also that even in such an isolated and jungle-bound village as the one selected, the prevalence of the wind materially affected the incidence rate in those mosquitoes coming from the windward side. This lower incidence rate on the windward side of an inland village indicates the effect which much stronger and more constant wind must have on mosquito density and hence infection rate to the windward of those villages located along the open beaches.

One such village was studied. This village was located on an

open, windswept beach and was bounded by marsh-like swampy areas to the sides and rear. A footpath led from the village through the swampy area to a personnel camp area approximately 250 yards to the rear (lee). The path was used by both the personnel and the natives in getting to and from the camp to the village. A mosquito control program was in effect within the camp and extended outward for a distance of about 50 yards beyond the occupied area. All mosquito breeding within the camp area was confined to rot holes in trees. Specimens of the transmitting mosquito were taken from the center of the village, at the leeward edge about 25 yards from the center, midway between the village and camp, and from within the camp. It must be pointed out that no mosquitoes were found to the windward of the village, presumably because of the prevailing wind which swept inland from the sea.

The highest incidence of infection came from those mosquitoes taken from the leeward edge of the village. Undoubtedly the percentage of infection observed in the mosquitoes coming from midway between the camp and village was due in part to native traffic along the footpath, whereas that observed in mosquitoes from the camp area was more likely due entirely to native traffic.

Even with the probability that the infection rate in the mosquitoes at a distance of 100 yards or more beyond the village is maintained through native traffic, the sharp drop in the incidence rate at a short distance beyond the hyperendemic center must be emphasized.

What effect the wind has on the general distribution of the mosquito host may be observed from a study of the graph. Undoubtedly the action of the wind causes the hyperendemic center to shift from the center of the village to the leeward side and at the same time extends the area of endemicity beyond its normal limits on that side (the lee) of the village. In the case of the inland village there was no dearth of mosquitoes to the windward side although the area of effective endemicity was greatly reduced.

It is obvious therefore that in those cases involving villages of the type that were studied, a camp site as much as 300 yards to the leeward side of the native village is reasonably safe from filariasis provided that personnel are denied free access to the village during daylight hours and native traffic into and through the camp area is strictly prohibited.

INCIDENCE OF INFECTION

In determining the incidence of infection in the transmitting mosquito, first attention was given to those areas in which both natives and service personnel were quartered. As the work pro-

TABLE 2.—*Record of dissections on all mosquitoes dissected, with number of positives and the percent of incidence of infection with Wuchereria bancrofti*

Species	Number dissected	Number positive	Percent
Aëdes scutellaris var. pseudoscutellaris	6,634	655	9.9
Aëdes samoana	261	0	0
Aëdes aegypti	141	0	0
Aëdes vexans	3	0	0
Culex quinquefasciatus	1,063	79	7.4
Culex annulirostris	35	0	0

gressed records were obtained from isolated camp areas and from purely native villages. The over-all record on incidence of infection in the mosquito population is given in table 2.

The incidence of infection in the transmitting mosquito (A. scutellaris var. pseudoscutellaris) ranged from zero in isolated camp sites to 35 percent in a native village in which troops were quartered.

Six camps considered sufficiently isolated from the native population and in which native traffic was restricted were studied from the standpoint of infectivity rate in the mosquito host. Five hundred fifty-four specimens of the transmitting mosquito were dissected from these six localities. With the exception of *a single mosquito* which was taken from the immediate vicinity of an outdoor movie that was attended daily by both personnel and natives, all mosquitoes were free of the filarial parasite.

One thousand fifty-three A. scutellaris var. pseudoscutellaris were taken from 13 native villages on one island. These villages were selected because no service personnel were quartered within a reasonable distance, although in many of them there was ample evidence of troops having been quartered there prior to the time the study was made. The range of infection in the mosquito host was shown to be from 6 to 35 percent. Four of the 13 villages were located on the north shore of the island, whereas the remainder were on the south shore. No difference in the range of infection was noted between the north and south locations. Throughout the study promiscuous visiting within these villages on the part of the personnel was observed.

Twenty-nine camp-village sites in which both troops and natives were quartered were also studied. These locations were selected because both troops and natives lived and worked in close association. In a few of the locations service personnel occupied quarters insufficiently separated from those of natives for the natural control of filariasis. In others, natives and personnel lived in such close association that often it was impossible to separate the native area from that of the troops.

Frequently under this latter condition troops would occupy native quarters or would be quartered in houses of their own construction and these would be more or less indiscriminately located throughout the native village. Two thousand five hundred eighty-seven specimens of the transmitting mosquito from this type of location were dissected. From 6 to 28 percent of the mosquitoes were found to harbor developing stages of the filarial worm. The average percentage for this group was fourteen.

It must be pointed out that the incidence of infection in the mosquito host varied within a given location as well as from location to location. Within a given location the infection rate varied from section to section, i.e., in one section of a location as high a percentage rate as 45 was found, whereas in another section of the same location only a third or a fourth of this rate was seen. This is particularly true of the larger villages. Furthermore, percentages varied from day to day. From one location a high incidence rate in the mosquito host was obtained, whereas on the following day an approximately equal number of mosquitoes from identically the same locality would give a much lower incidence rate.

The incidence rates, therefore, given in this report represent the percentage obtained from the total number of dissections from any given area.

CONCLUSIONS

Through laboratory and field studies convincing evidence shows that Aëdes scutellaris var. pseudoscutellaris is the only transmitter of importance within the Samoan area. This conclusion is based on the following findings:

1. In both laboratory and field more than 80 percent of the specimens of this species experimentally infected (a single blood meal), harbored the developing filarial worm when dissected.
2. More than 80 percent of the mosquitoes of this species which survived for as long as 14 days following the infective blood meal carried the infective stage larvae.
3. Six hundred fifty-five, or 9.9 percent, of 6,634 specimens of this species were found to be naturally infected in the field within the area.
4. Many of the naturally infected individuals of this species carried dual or triple infections and more than 15 percent of those infected were found to harbor the infective stage larvae when dissected.
5. The species is the most common mosquito to be found within the area.
6. The only other mosquito within the area found to be nat-

urally infected with the filarial worm was Culex quinquefasciatus. In only two instances in this species in nature were found filarial larvae older than the recently ingested microfilariae.

7. Only a single specimen of Culex quinquefasciatus, out of a total of over two hundred experimentally infected, developed the filarial worm to a stage of infectivity.

From field studies aiming at the control of the filarial transmitting mosquito, Aëdes scutellaris var. pseudoscutellaris, the following conclusions are drawn:

1. The species breeds in innumerable small accumulations of water throughout the entire area and can be found breeding in dense jungle areas as well as in the immediate vicinity of human habitation.

2. The breeding habits of the species preclude effective eradication in large jungle-choked areas although an effective control program within smaller areas such as villages and camps can reduce breeding to a point where the density of the species can be maintained at a very low level.

3. Complete eradication of the species is possible only on small atoll islands in which the land mass and dense jungle growth present little or no problem.

4. The species has a very short flight range. This makes possible the establishment of hyperendemic foci about native habitation and materially assists in the effective control of the infection in local areas.

From the known behavior of the filarial transmitting mosquito the following precautions should be taken for the protection of troops against the disease within such areas:

1. Troops and natives should never be quartered within the same area. Personnel camps should be at least five hundred yards from the nearest native habitation.

2. Where it is impossible completely to isolate personnel camps from native habitation, camps should be established to the windward of the native concentration.

3. All natives should be prohibited from entering personnel camps. Where working parties are declared essential every effort should be made to use only those natives who give negative findings for microfilariae in the blood stream. In other arrangements whereby natives are allowed within camp areas a definite incidence of infection in the mosquito host can be expected.

4. Because of the "day biting" habit of the mosquito host, troops should never be permitted within native villages during daylight hours. When it becomes necessary for troops to enter

native villages they should be required to go fully dressed and to be supplied with and to use efficient mosquito repellants.

5. Screened quarters and bed nets should be standard items of equipment within the camp and all camp sanitary officers should maintain a vigorous mosquito control program at all times. The control program should be aimed at the transmitting mosquito primarily but should never lose sight of other potential transmitters and pest mosquitoes.

6. Within this area the control of the filarial transmitting mosquito should be directed toward (a) the removal and destruction of all mosquito breeding places and (b) the removal of all resting places, such as grass, vines, and underbrush. These should be maintained at lawn condition. Both of these control measures should be strictly adhered to and the "clean up" program should be extended for at least 100 yards beyond the periphery of the occupied area.

In the control of filariasis it must be pointed out that the geographic location and topographic features of the terrain will play a major part in the control program. Topographic features and transmitting agents encountered in the Samoan area probably will not be duplicated in other parts of the world. Therefore the control of filariasis in other areas must depend on the findings of epidemiologic investigations for the specific area.

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FILARIASIS IN RETURNING MARINES

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One hundred seventy-two Marines returning from duty in the Pacific area with the diagnosis of filariasis, were interviewed, examined, and their case histories reviewed. They had been returned to duty, but were not to be reassigned to areas where filariasis is known to be endemic. Because of the frequent shifting of these men on routine military orders, it was impossible to maintain complete data on all cases. All men were doing regular duty at the Marine barracks, and this analysis was conducted in the sickbay. In the 6-month period of this study no patients were hospitalized for the disease, although some were referred for other causes, chiefly malarial attacks.

One fact became apparent. In this group neither the time of acquisition of the disease, nor the onset of symptoms was seasonal, but spread out over the entire year. October, November and December had the lowest rate of onset. Chart I shows the number of cases with reference to the month of disembarkation, and the month of onset of symptoms. The Samoan group of islands is now recognized as the place of inoculation with the disease. Many of the men had been on several of these islands. Of 152 cases in which such information was available 93, or 61 percent, of the men had developed filariasis while still on the islands. The incidence as to individual islands is listed in table 1.

The majority had been on American Samoa. It will be noted that one case from the Solomons is listed; this patient had never been in the Samoan group. Since the diagnosis was entirely clinical, however, it may be borne in mind if more instances are reported.

There is no constancy as to the incubation period. Chart II indicates the time spent on the islands, without regard to elapsed time before onset of symptoms. The largest group spent 9 months.

TABLE 1.—*Number of cases*

American Samoa	133
British Samoa	81
Wallis	41
Ellice	1
The Solomons	1

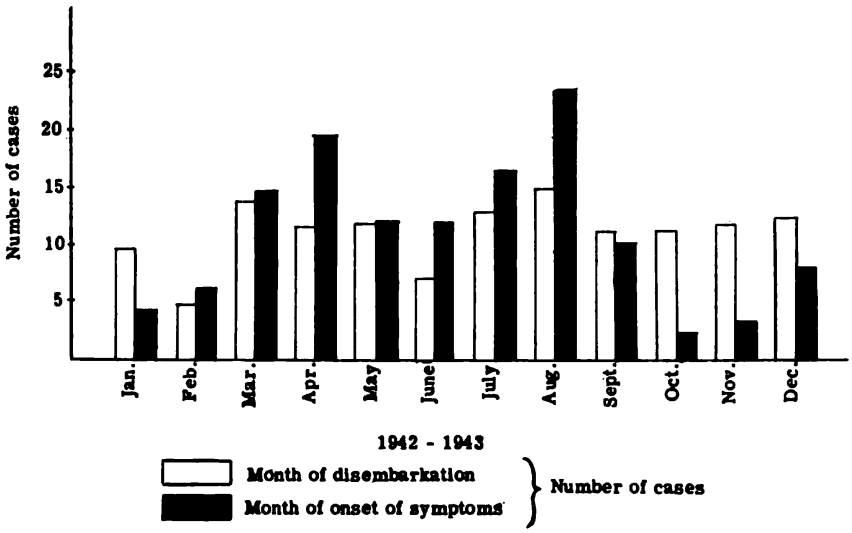
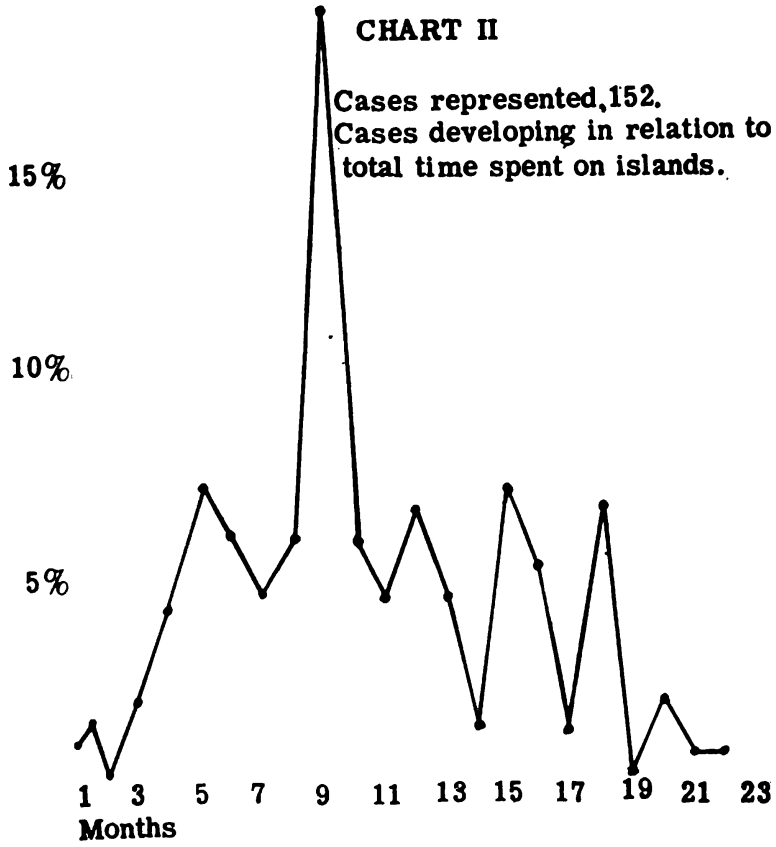
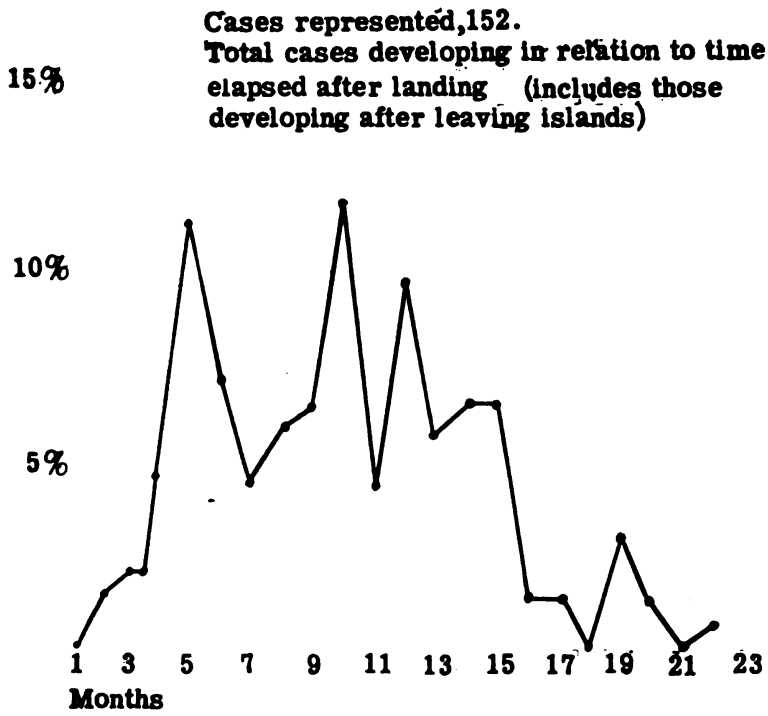


CHART I



This might readily be accounted for by military necessity. However the total time elapsed after landing before onset of symptoms as given in Chart III shows a minimum of 2 months and a maximum of 22 months, with a fairly even plateau from 5 to 14 months, peaks being at the fifth, tenth and twelfth months. This includes those who developed the disease after leaving the islands. Chart IV

CHART III



shows the length of time spent on the islands before symptoms occurred in those whose disease developed while they were on one of the islands. The earliest was 2 months, the latest 5 months.

Onset of symptoms may occur at any time of the day or night. Of this series 35 had onset at night and 12 on arising. If we consider the 2 groups together, we have a total of 47 cases that may be considered nocturnal in onset, and 76 diurnal. Symptoms may begin anywhere. No less than 54 specific or combined locations were noted. The fact that it has been reported as starting most frequently in the epitrochlear glands was borne out only as compared with any other single location with the exception of the testes.

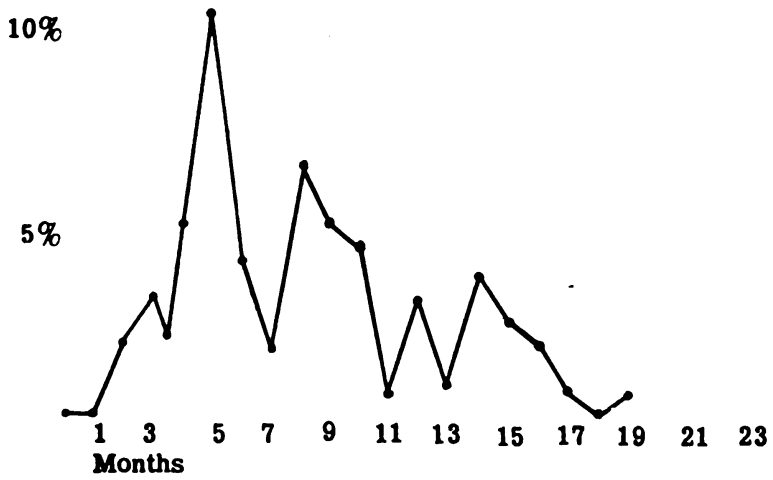
As to mode of onset, only 20 percent of the patients were febrile; in 42 percent the first symptom was drawing pain, and the other 58 percent had a dull ache.

TABLE 2.—*Point of onset of symptoms*

Location	Number of cases		Percent
Epitrochlear gland, right	18		
Epitrochlear gland, left	16	36	24
Epitrochlear gland, bilateral	2		
Testes, followed by epitrochlear glands		24	16
Testes alone		30	20
All other places of onset combined		62	40

CHART IV

Cases represented, 93 or 61% of total of 152 cases.
Cases developing while still on islands.
Elapsed time after disembarkation.



Symptomatology of the group on arrival at this hospital was largely subjective. No cases were febrile. Very few were symptomless. To the general query "Can you do full duty?" the reply was essentially the same, "No, but I am doing it." Most of the men complained of their legs being tired on standing, but specific swelling of the legs was alleged by only 46 percent. To a pointed question "How do you feel?" 27 percent said "good," 38 percent "fair," and 35 percent "not good."

Various locations throughout the body were complained of, the testes being most frequently indicated (53 percent). Of this number 60 percent were bilateral; of the remaining 40 percent the left testis was most frequently complained of in the ratio of 25 to 8. The reverse was true of the arms, the ratio of the right to the left being 17 to 9.

In 22 instances complaints were referred to the groins, 7 patients complaining of the left groin and the remainder of bilateral affection. On physical examination 5 bilateral and 2 left cord swellings were noted. Allergic skin manifestations, such as localized itchy swellings, were present in 32 instances. This seemed to parallel eye complaints. The latter, elicited only on questioning, showed an incidence of 31 percent, but none required the attention of an ophthalmologist. The chief complaint was that the eyes tired readily on reading, that they itched, or were blurred.

In 54 percent of cases the parts were affected bilaterally. Of the 74 unilateral cases, 36 were right-sided, 38 on the left side. Localized swellings recurred frequently but subsided promptly. Among unusual complaints there was one patient who had back pain, two with neck pain, and two with intra-abdominal pain.

Impotence was claimed by only one man, who was unmarried. The remainder had rather pointed comments to make, the most frequent concerning "after-pains." The impression given was one of psychic trauma rather than physical incapacity. Of a group of 120, there were 96 unmarried. The wives of 6 were pregnant, and in 7 instances in which pregnancy had not been achieved the marriages were considered of too short duration to be significant.

Seventy percent of the men believed that weather had no effect on their condition; 13 percent preferred cold climates, 8 percent claimed change to a cold, damp climate aggravated the condition, 5 percent preferred warm weather, and the other 4 percent were noncommittal.

EXAMINATION AND TREATMENT

Physical signs were minimal. None of the testes approximated the size complained of by the patient. Actual enlargements were seriously open to question. The maximum size of testicular swelling was approximately 1½ times normal. There were no scrotal skin swellings, no signs of skin changes elsewhere, or other suggestions of early elephantiasis.

Spindle-shaped swellings were seen on the ulnar aspect of the forearm, about 6 to 10 cm. long, 2 to 3 cm. at the greatest depth, and were occasionally seen on the volar surface. Streaks were noted, similar to those seen in lymphangitis of bacterial origin, except that the line was shorter, broader, paler, more diffuse, and not tender. It was retrograde and was not associated with cellulitis. In two instances, however, suppurating glands developed on the outer surface of the arm, along the edge of the biceps muscle, and had to be incised. Free pus was obtained. A third patient gave a history of a suppurating inguinal gland while he was in Australia.

In the lower extremities similar spindle-shaped swellings with occasional lymphangitis were seen over the calf of the leg. Generalized low-grade lymphadenopathy was noted, the inguinal glands being the most frequently involved. It was strongly suspected that the incidence here was no greater than that seen in any large group of persons. Very few enlarged epitrochlear glands were palpated. The general impression given was that the degree

of swelling claimed was out of proportion to the findings on physical examination.

Ice treatment had been given elsewhere in 10 instances. Three patients said they had been improved, two made worse, and five saw no difference. Sulfur cave treatments had been given in Colorado. Of 13 who received these, 2 were improved, and 11 saw no difference. Massage had been given to 4 patients; 2 were improved, 2 saw no difference. Heat had been applied in 6 cases. Five patients said they were made worse and 1 saw no difference.

Treatment at this base was carried out on 56 cases, or 32 percent. It was continued for 3 months, and then stopped because of failure to get results. It consisted of the administration of sulfathiazole, application of infra-red rays, and occasionally diathermy and whirlpool baths. Later, methyl salicylate and massage was used, with and without the heat. Massage without heat seemed at first to give promise, but later results were nondescript and disappointing. The men all agreed that rest was the only thing that afforded relief.

X-ray treatment was not resorted to in the 53 percent with testicular involvement because of fear of producing sterility, because its use would seriously disrupt the activities at the base and overtax the facilities at the hospital, and because further block of the lymphatics by the x-rays was considered a possibility.

SUMMARY AND CONCLUSIONS

The case histories of 172 Marines who had served in the Samoan Islands were reviewed, the men themselves examined, and some treated. The findings indicated that there was no constancy in the incubation period, mode of onset, time of onset, or part of the body affected. Symptoms showed great variability. The disease caused neither impotence nor sterility in this group. Symptoms seemed to be exaggerated by the patient, and psychic trauma appeared to play a considerable part.

The classic elephantiasis, common among the natives, seemed unlikely to develop among our troops. The disease was not disabling in this group, and did not interfere materially with duties the men were called upon to perform. Hospitalization was not necessary.

Recurrences were frequent but not of major import. Various methods of treatment tried at different places, including this base, failed to afford lasting or uniform relief, although the usual palliative measures seemed to be temporarily effective in a limited number of cases.

CLINICOPATHOLOGIC STUDY OF EARLY FILARIASIS

WITH LYMPH NODE BIOPSIES

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With the occurrence of filariasis in military personnel stationed in the Central and South Pacific islands, valuable clinical data on the characteristic signs, symptoms, and progress of the disease have become available and have been recorded (*1*) (*2*). Opportunity for studying the early stages of filariasis as it occurs in the white man has heretofore been lacking on such a large scale.

After reviewing the clinical course in a large series of filariasis patients in Samoa it became apparent that although the majority of patients usually showed the newly accepted classic signs and symptoms of retrograde lymphangitis, there still remained a small number of patients with a minimal degree of disability. Some of these men who showed only signs of regional or generalized lymphadenitis subsequently developed the necessary diagnostic symptoms of filariasis, while others, in whom a similar type of lymphadenitis was observed, developed a typical mild episode of pain in an extremity or testicle without significant physical findings.

The importance of early lymph node enlargement in filariasis occurring in the natives in endemic areas was mentioned over 15 years ago. Buxton (*3*) stated that although enlarged inguinal nodes were of questionable diagnostic value, nevertheless, after secondary yaws had been excluded, the majority of epitrochlear adenopathies in the native was due to filariasis. Later, O'Connor and Hulse (*4*) brought out the fact that, after a few attacks of acute lymphangitis or lymphadenitis, or in fact without any demonstrable attack, the glands became permanently enlarged. They observed many native children in Puerto Rico without other evidence of filariasis but with an enlarged femoral node. This they believed to be the earliest manifestation of the disease, analogous to the enlarged epitrochlear nodes occurring in newcomers to the filariasis-endemic centers of the Western Pacific.

In the Samoans the relative frequency of lymph node enlargement was found to be similar to that reported by Buxton and by

O'Connor and Hulse. Although the series of cases which showed lymphadenitis with or without minimal clinical symptoms was not large, it appeared that positive identification might be possible by laboratory means. Dissatisfaction with the existing biologic tests led us to attempt a diagnosis by lymph node biopsy. As the pathologic changes occurring in lymphatic channels and lymph nodes containing the adult worm have been studied by others, our attention was directed to the examination of nodes in various parts of the body, away from and not under the direct influence of an acute lymphangitis.

During the course of the investigation it was determined that an absolute diagnosis of filariasis could not be made without a careful clinical correlation unless the parasite was present in the tissue. Although certain changes in the satellite nodes were quite constantly observed, at least some of these changes occurred in other diseases, and it was believed that the biopsy approach, in the light of improved clinical diagnosis, was not desirable in most cases. It was concluded that accuracy in diagnosis was markedly in favor of the clinical approach, augmented at times by biopsy.

The lymph node sections were restudied with the object of establishing, if possible, the relationship between the signs and symptoms observed in the early cases and the microscopic changes manifested in the nodes.

MATERIAL AND CLASSIFICATION

It is not deemed necessary to reiterate the clinical signs and symptoms of filarial lymphangitis, since they have already been excellently described in the literature. The attacks were classified as (1) fulminating or marked, (2) moderate, and (3) mild, based on definite clinical observations. Comment is limited to those cases presenting unusual circumstances.

The pathologic changes in the lymph channels, although previously described, are reviewed in this paper in order to emphasize the characteristic changes as compared to those observed in the lymph nodes. Lymph node biopsies were done on 62 patients, representing various stages of the disease and different anatomic relationships of the nodes to the acute lymphangitic process. Study of the sections from these patients showed a fairly constant histologic picture, but presented variations which merited their classification into four groups.

The lymph nodes in practically all instances followed a very suggestive, if not characteristic trend as to size, shape and periglandular reaction. Although a few nodes measured as much as

2.5 cm. in length, the majority varied from 0.7 cm. to 1.5 cm. They were elongated, discrete, and the overlying skin was freely movable. Generally they were set in a fine, fibrous periglandular network which allowed a clean line of cleavage on sharp dissection. Rarely a dense inflammatory reaction was noted, and firm adherence to adjacent nodes was unusual. On cross section the nodes were firm and homogeneous, the capsule thickened and often edematous and fibrosed.

LYMPHATIC CHANNELS

The characteristic picture was that of a coiled male or female adult worm cut in cross or sagittal section. The staining reaction indicated whether or not the parasite was dead; dead worms were acidophilic and revealed a variety of stages of disintegration. Occasionally liquefaction occurred and a small abscess, often packed with eosinophils remained. None of our cases revealed calcification.

The parasite lay in a granulating lymph channel which was surrounded by epithelioid cells, Langhans' giant cells, plasma cells, and a dense infiltration of eosinophils. The endothelium of the lymph channels revealed a granulomatous hyperplasia with swelling of the cells. Occasionally there were intraluminal papillary excrescences of endothelium. Adjacent lymphatic channels revealed similar endothelial changes with luminal obliterations. Other adjacent channels revealed obliterative endolymphangitis with adventitial fibrosis. Surrounding such granulomatous masses, at times, there were fibroblasts and hyaline connective tissue which was densely infiltrated by eosinophils and plasma cells. Small aggregations of lymphocytes were often seen surrounding the granuloma.

LYMPH NODE BIOPSIES

GROUP 1. (10 CASES.) PRESENCE OF ADULT FILARIAE IN OR OUTSIDE OF LYMPH NODE.

Although this type was found in only 10 patients, the group would have been larger if suspected nodes had been chosen for biopsy. The group included 4 epitrochlear, 3 inguinal, and 1 axillary gland, and 2 chest wall biopsies. Clinically 3 patients who had epitrochlear biopsies done had fulminating attacks of lymphangitis; in the fourth, symptoms were so minimal that the microscopic picture was a definite aid in diagnosis. The 3 patients who had inguinal gland biopsies showed marked signs and symptoms of lymphangitis of the spermatic cord on the same

side from which the biopsy material was removed. The patient on whom axillary gland biopsy was done had a severe retrograde lymphangitis of the arm.

Clinically, both patients who had biopsy specimens taken from the chest wall (lateral pectoralis major border) showed atypical mild local and constitutional symptoms with a generalized adenopathy. The local signs consisted of edema and redness followed by a mild induration. In this instance again the biopsy was a decided help in the final diagnosis.

Histologically the sections revealed the same changes as those seen in the invaded lymphatic channels. There were various degrees of capsular fibrosis and dilatation of the peripheral and hilar sinuses. Marked hyperplasia of the reticulo-endothelial cells of the nodes accounted for the greater part of the node hypertrophy, although edema, dilatation of the sinuses, and granulomatous fibrosis were partially responsible.

Obliterative endolymphangitis and obliterative capillary arteritis were seen. Some nodes revealed complete destruction of the parasites and residual tubercles consisting of radially arranged epithelioid cells with a central small mass of amorphous acidophilic material. Langhans' giant cells were also noted. Such lesions were usually surrounded by masses of hyaline, poorly nucleated connective tissue in which lymphocytes, plasma cells and eosinophils were seen. The hilar lymph channels were dilated and contained phagocytes, plasma cells and eosinophils.

GROUP 2. (7 CASES.) ABSENCE OF ADULT FILARIAE; PRESENCE OF DENSE EOSINOPHILIC INFILTRATION IN THE BIOPSY TISSUE.

Clinically six of the seven patients had acute fulminating attacks of lymphangitis; in one the attack was of 1 month's duration and subsiding, although a marked thickening and tenderness of the spermatic cord with an associated hydrocele still persisted. The nodes were firm and homogeneous. The capsules were thickened and often edematous and fibrosed. The intracapsular lymphatic channels were dilated and the blood vessels were engorged. Bits of periglandular tissue which were removed with the nodes revealed dense eosinophilic infiltration, some plasma cells, and engorged blood vessels. The afferent lymph vessels of the capsule were packed with eosinophils and these cells were found in great numbers throughout the nodes.

Marked hyperplasia of the reticulo-endothelial cells was a constant finding and again accounted in a large part for the increase in the size of the nodes. Trabecular capillaries revealed endothelial proliferation and the lymph capillaries endothelial proliferation

with various degrees of luminal occlusion. An obliterative endolymphangitis and obliterative lymphangitis resulting from adventitial fibrosis were common findings. The lymph follicles did not show constant changes. Some of the nodes revealed hyperplastic follicles, others edematous follicles, and still others small, compressed, atrophic follicles. Hilar sinuses were usually dilated and contained eosinophils and plasma cells.

One node revealed extremely interesting changes, the significance of which will be discussed later. It was removed from a patient with marked thickening, tenderness, and induration of the right spermatic cord with an associated epididymo-orchitis of 6 days' duration. He had previously experienced several episodes of indefinite aching in both arms, during which bilateral epitrochlear and inguinal lymphadenopathy had developed. The biopsy specimen was taken from one of several inguinal nodes which had enlarged 3 months prior to the present acute attack.

Microscopically, the sections revealed a wedge-shaped segment, densely infiltrated by eosinophils, which was contiguous with a segment of capsule in which the afferent lymph channels were packed with eosinophils. The capsule on either side of this area was edematous, but revealed no eosinophils in the afferent lymphatic channels. The constant changes evidenced in other nodes of this group were present except the generalized eosinophilic infiltration.

GROUP 3. (25 PATIENTS.) ABSENCE OF BOTH ADULT WORMS AND EOSINOPHILIC INFILTRATION IN THE BIOPSY TISSUE.

In all instances these nodes were removed from the immediate lymphatic drainage area of an acute lymphangitis, as was done in groups 1 and 2. Sixteen cases, in which the biopsy specimens were obtained from the inguinal region, revealed the classic symptoms and signs of spermatic cord involvement of the same side, 8 with generalized, and 8 with bilateral inguinal lymphadenitis. Seven patients had fulminating attacks with an associated epididymitis, seven moderate, and two mild attacks of spermatic cord involvement unassociated with changes in the epididymis or testicle.

Nine of these 16 patients had had one or more previous attacks, 7 of which involved an extremity at some stage of the disease. All 16 were indistinguishable clinically from those patients represented in group 2.

Three cases deserve special consideration. One patient had developed a generalized lymphadenopathy 2 months prior to biopsy. His only clinical complaints were epigastric distress, anorexia, loss of weight and a generalized weakness. Three weeks subse-

quent to the complete healing of the biopsy wound, he developed a lymphangitis in the spermatic cord on the same side and later on the opposite side.

The other two patients' only complaints were aching pains in the thigh associated with mild weakness of the extremity on exercise. Both had a marked generalized lymphadenitis, and developed characteristic manifestations of lymphangitis of the extremity following excision for biopsy. One of them developed an interesting pattern of lymphangitis involving the gluteal skin lymphatics and radiating to the groin. We have observed this reaction in numerous cases, and have also frequently seen involvement of the superficial lymphatics of any area of the body.

Four patients in whom epitrochlear nodes and one in whom axillary nodes were removed, had typical attacks of lymphangitis of the upper extremity on the affected side. On physical examination all revealed epitrochlear and inguinal lymph node enlargement; two also showed axillary node involvement.

Two patients on whom cervical gland biopsies were done presented an indefinite edema and tenderness of the neck, but subsequently showed characteristic signs of involvement in other parts of their bodies. Both patients revealed a generalized lymph node involvement.

Microscopically, all cases of group 3 revealed the constant histologic changes as noted in group 2, but as stated previously, eosinophils were noticeably absent or relatively few in number. The capsular afferent channels as well as the periglandular fat and connective tissue failed to reveal eosinophils. Seven biopsies in this group showed moderate fibrosis, both capsular and intraglandular, which could not be explained on a basis of chronicity.

GROUP 4. (15 PATIENTS.) ABSENCE OF ADULT WORMS AND EOSINOPHILS IN THE BIOPSY TISSUE.

This group was chosen in order to study the microscopic changes occurring in nodes *separated anatomically from the body area involved in an acute filarial lymphangitis.* All cases showed characteristic signs and symptoms as observed in the other groups and presented no problems in clinical diagnosis.

In five patients, in whom an indirect lymphatic connection was anatomically possible, nodes were removed from the inguinal region. Four of these had fulminating attacks of lymphangitis of the opposite spermatic cord which remained unilateral until the time of the patient's evacuation (1 month or longer). The fifth patient experienced a typical reaction involving the opposite thigh,

which was characterized by an area of lymphangitis and the formation of an elongated indurated area in the middle third which undoubtedly represented the presence of a worm. This case showed no clinical evidence of spermatic cord or thigh involvement on the side from which the node was removed.

In the other 10 cases, lymph nodes were selected at a great distance from the acute involvement in order to preclude any relationship to a direct lymphatic drainage. In two instances in which cervical nodes were excised for biopsy, there were attacks of spermatic cord involvement, preceded by a generalized lymphadenitis. In five cases in which inguinal gland biopsies were done there were definite involvements of an upper extremity, three associated with a generalized, and two with an epitrochlear gland and inguinal lymph node enlargement.

Two patients on whom axillary gland biopsies were done, had fulminating attacks of lymphangitis of the spermatic cords with an associated epididymo-orchitis preceded by a generalized lymphadenopathy. In one instance in which an epitrochlear gland was studied, the patient showed the classic signs and symptoms involving the opposite arm.

Microscopically the nodes of group four revealed two constant histologic changes; various degrees of proliferation of the reticulo-endothelial cells, and hyperplasia of the endothelium of the lymph capillaries, with or without luminal occlusion. Again, as in the nodes previously described, enlargement was due to the reticulum cell hyperplasia. In addition there was a variation in lymphatic sinus dilatation and capsular and intraglandular fibrosis. None of the nodes revealed eosinophilic infiltration. There was some adventitial sclerosis of the lymph capillaries.

Although it was difficult to obtain a control group, five patients who had a symptomless lymphadenitis of unknown origin were studied. Biopsies failed to reveal the histologic changes observed in the other groups, and after prolonged periods of observation, these patients were discharged to duty.

COMMENT

On comparative microscopic study of the lymph nodes in all four groups, there appeared to be certain constant pathologic changes. Marked hyperplasia of the reticulo-endothelial cells and a prominent hyperplastic and obliterative endolymphangitis were observed in all sections, occurring not only in the regional lymph nodes associated with acute fulminating lesions (groups 1, 2 and 3), but also in nodes anatomically distant from the known filarial lesion

(group 4). Since these changes were found in nodes removed from group 4 patients, it would seem to indicate that they were not caused by the immediate presence of an adult worm, either dead or alive, unless adult worms are assumed to have been present in all the lymphatics of the body in order to account for the generalized enlargement of the nodes observed in these patients. However, such an overwhelming infestation seems unlikely.

Our observations in those cases in which signs of a lymphangitis did not develop until many months subsequent to a generalized enlargement of the lymph nodes, and in other cases suspected but undiagnosed in which biopsies were not done, agree in some respects with those of O'Connor and Hulse. They emphasized the appearance of a local or generalized lymph node involvement in the native as the only sign of filariasis. This phenomenon is explained on the basis of the extreme variability of the host-parasite relationship in individuals as well as in races, and the partial immunity and tolerance to adult worms which natives develop.

O'Connor and Hulse also contended that the acute local inflammatory reaction in filarial lymphangitis is allergic and corresponds with the death of a worm. In this series, biopsies of lymph channels and nodes at the time of an acute lymphangitis would tend to bear out this contention, although it must be admitted that absolute verification is impossible without complete anatomic dissection studies of entire extremities. In the cases cited the presence of an acute lymphangitis, even involving the deep lymphatics, would have hardly escaped notice because of the care with which they were examined and observed.

From the findings in this series it would seem probable that, since the lymph nodes enlarge without evidence of a lymphangitis, the entire process should be considered as based on a generalized reaction to the toxic or metabolic products of the worm itself, not to its disintegration products. This reaction as seen in the microscopic sections involved the reticulo-endothelial system as well as the endothelium of the lymphatic channels.

A striking observation in biopsies of nodes in groups 1, 2, and 3, was the variation in degree of eosinophilic infiltration. The presence of eosinophils in sections from lymph nodes and lymphatic channels has previously been emphasized as a part of the microscopic picture, not only in the presence of an adult worm but also in its absence. Consequently, since the clinical course of the disease in these three groups did not differ as to the duration and severity of attacks or location of the manifestations of lymphangitis, it was surprising to note the absence or scarcity of eosino-

phils in group 3, as compared to their abundance in group 1, and their marked increase in group 2.

Unquestionably the nodes of group 1 (containing worms) showed a much more pronounced infiltration of eosinophils and the number of these cells appeared to decrease as the disintegration of the worm progressed. This fact immediately suggested their direct association with the presence of a worm. Also, since eosinophils were absent in group 3 nodes, in which the clinical and operative circumstances were identical to group 2 nodes, it therefore must be assumed that these nodes were not in the immediate drainage area of the worm.

Added confirmation of this fact appeared in biopsy sections from a previously mentioned case in which an inguinal node was removed during a severe attack involving the spermatic cord. The sections showed a selective segmental eosinophilic infiltration of the node, immediately outside of which there was a periglandular eosinophilic infiltration with evidence of a degenerated worm. The remaining portion of the node and its periglandular tissue contained only a few eosinophils. It therefore follows that, although a node is removed for biopsy from the regional lymphatic glands, even during an acute attack, the presence of eosinophils will depend upon the immediate presence of a worm within its direct drainage area.

The marked pathologic changes caused by the death and subsequent disintegration of the parasite in a node were immediately diagnostic. The worm was found in 10 instances, or 23.8 percent of the patients in whom the regional lymph nodes were excised for biopsy. As previously stated, the percentage of nodes revealing adult worms would have been much greater if the site for biopsy had been selected with this in mind.

In reviewing the histories of these 10 cases, the ease of diagnosis from the clinical signs and symptoms, except in 1 instance, was immediately apparent. Also of the remaining cases, in which biopsies of the regional lymph nodes were done, in only two was a biopsy thought necessary for diagnosis. With these facts in mind, it is apparent that biopsies, or in fact any biologic tests, are helpful in only the atypical cases with minimal clinical changes, which do not develop definite positive signs during a period of observation. Biopsy in those cases which reveal the characteristic pathologic changes as described here are of great importance, and no hesitancy should be shown in using this means of diagnosis.

The possibility of bacterial infection as a cause of attacks of acute lymphangitis, as suggested by Grace (*5*) in his investigations in British Guiana, was not indicated in the present series.

There was no histologic evidence in any of the biopsies, including lymph nodes and channels, of bacterial infection. In addition, no clinical improvement was observed in the patients who were receiving sulfonamide therapy.

CONCLUSIONS

1. Infestation by Wuchereria bancrofti is accompanied by a generalized disturbance of the reticulo-endothelial system which manifests itself as a hyperplasia of these specialized cells.
2. The endothelium of the lymph channels is similarly affected and the end-result is an obliterative endolymphangitis.
3. Eosinophilia is due to the presence of a parasite, usually the result of a dying parasite.
4. There was no histologic evidence in this series of bacterial infection as a cause of lymphangitis. Positive and negative findings, together with the noneffectiveness of sulfonamide therapy in these cases, argue against any cause except the worm or its toxic disintegration products as a cause.
5. The plugging of the lymphatic channel by the worm causes a backing up of toxic products centrifugally, which would account for the so-called retrograde lymphangitis.
6. Biopsy is unnecessary for diagnosis in the majority of cases, but is useful as confirmatory evidence in the clinically atypical cases.

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A PRELIMINARY REVISION OF THE SCUTELLARIS GROUP OF THE GENUS AËDES

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The scutellaris group (subgenus Stegomyia, genus Aëdes) is composed of a complex of forms whose combined geographic ranges extend from the Marquesas Islands and the Tuamotu Archipelago in eastern Polynesia westward to the Andaman Islands and from the New Hebrides, Tonga Islands, and Cook Islands northward to the Marianas and the Philippines. Superficially, it appears to be of Polynesian or Melanesian origin having spread westward into the insular parts of the Oriental region. However, since our knowledge of the number and distribution of the members of this group is still meager, it may be necessary subsequently to modify or discard this suggestion. The group is named after the species described by Walker (*29*) in 1859, collected by A. R. Wallace in the Aru Islands. Edwards (*12*) regarded Aëdes variegatus (Doleschall), described from Amboina in 1858 (*10*), as synonymous with Aëdes scutellaris (Walker) and also applied the name variegatus provisionally to similar specimens from the Solomon Islands. However, the name variegatus had been applied to a European species prior to its usage by Doleschall, and Edwards (*13*) then used scutellaris for the Aru Islands, the Amboina and the Solomon Islands forms. He regarded the other Melanesian and Polynesian forms (hebrideus, pseudoscutellaris, and tongae) as varieties of scutellaris. Farner and Bohart (*16*) have shown that Edwards' provisional identification of the Solomon Islands species is probably erroneous since there is no reason to assume it to be the same as the scutellaris from the Aru Islands. However, since the name scutellaris became commonly associated with the Polynesian and Melanesian forms, it seems desirable to refer to this complex of species as the scutellaris group. This is reasonable also since scutellaris is the oldest valid name in the group and since the general thoracic markings of the scutellaris from the Aru Islands (*12*) is typical of the entire group.

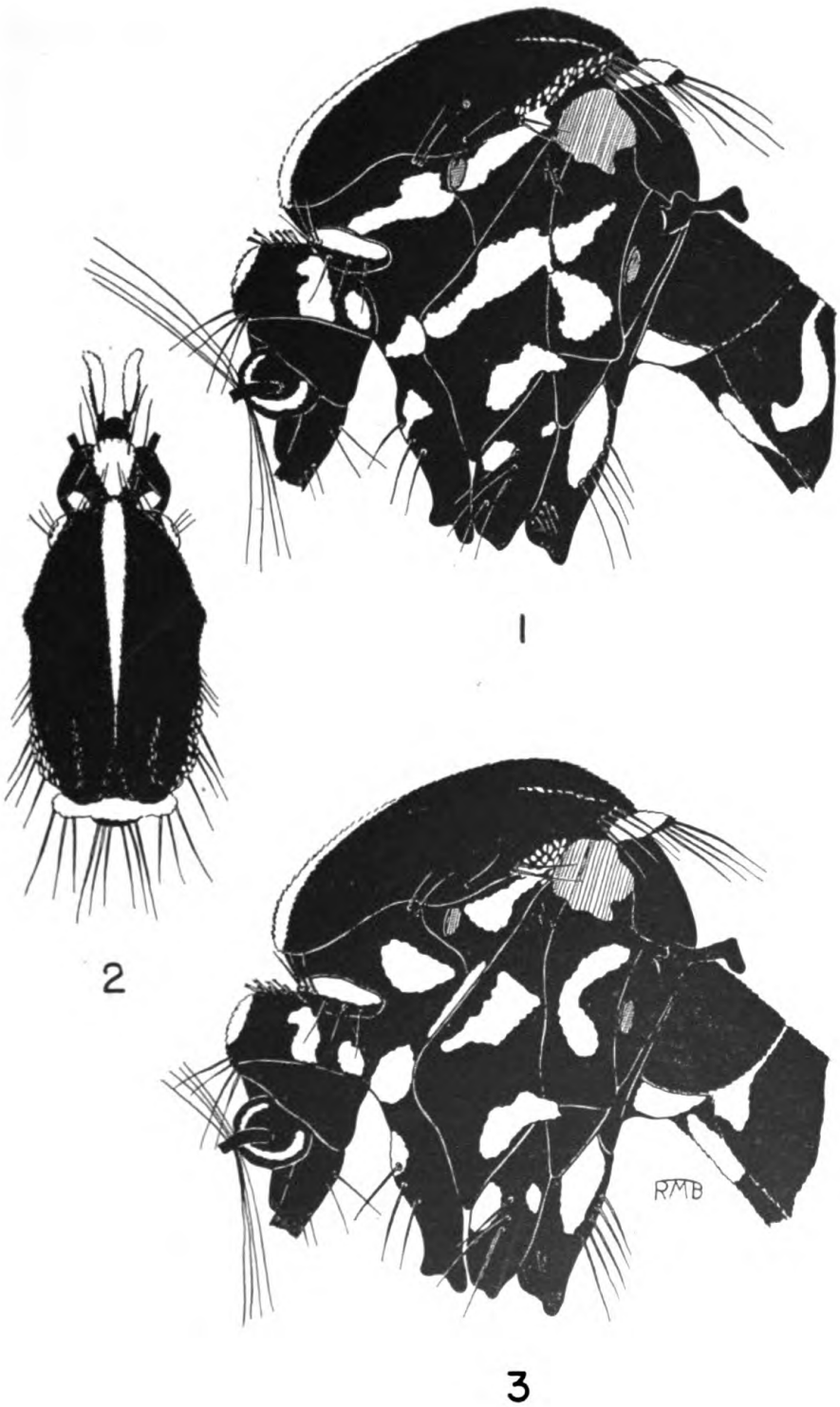

Figure 1, quasiscutellaris male, lateral view of head, thorax and base of abdomen (thoracic pattern typical of all species in the scutellaris group); fig. 2, quasiscutellaris female, dorsal view of head and thorax (pattern typical of both scutellaris and albopictus groups); fig. 3, albopictus male, lateral view of head, thorax and base of abdomen.

Morphologically all members of the scutellaris group are characterized by pleura with conspicuous white scales arranged in two parallel longitudinal stripes and several scattered spots (fig. 1). This pleural configuration distinguishes the scutellaris group from the closely allied albopictus group (fig. 3) of the same subgenus. The mesonotal ornamentation is the same in both groups (fig. 2).

Recent studies of some of the species of the scutellaris group by Farner and Bohart (*16*) and Stone and Bohart (*25*) have revised the geographic ranges of some of the species and have added several new species. These changes, together with the importance of this group in the transmission of filariasis and possibly also of dengue, make a preliminary revision of the known species desirable at the present time. Because the authors have had access to practically no material from western Melanesia, the Moluccas, and the Oriental region, this revision is restricted to those species occurring east of 140° East Longitude. Even in this restricted area there are numerous islands and localities, known or suspected to have scutellaris mosquitoes, which are not represented in the collections available for this study; in other cases only females are available. It is therefore obvious that as more material is collected, additions to and further revisions of this group will be necessary. The authors' study of the larvae has not as yet produced satisfactory results. This is due in part to a lack of sufficient material and in part to the extreme variability, in some species, of the currently used taxonomic characters. An effective systematic revision of the larvae must await the availability of greater amounts of reared and associated material as well as a critical study of the taxonomic characters.

The last systematic and geographic revision of the scutellaris mosquitoes of this area was that of Buxton and Hopkins (*7*) in which four Polynesian and Melanesian forms were treated as varieties of Aëdes variegatus (Doleschall). Edwards (*13*) in 1932 gave them the status of varieties of scutellaris. A careful consideration of the differences in the male genitalia has convinced the authors that the known Australasian members of the scutellaris group should be regarded as separate and distinct species occupying similar ecologic niches. The occurrence of more than one from the same area, e.g., pernotatus and hebrideus on Espiritu Santo and Efate, lends support to this contention.

Identification of the species treated in this revision can be made generally by the use of the markings of the tarsal segments and the abdominal tergites (see table). However, it is always advisable to confirm such identifications by examination of the male genitalia. This is desirable not only as routine verification but also

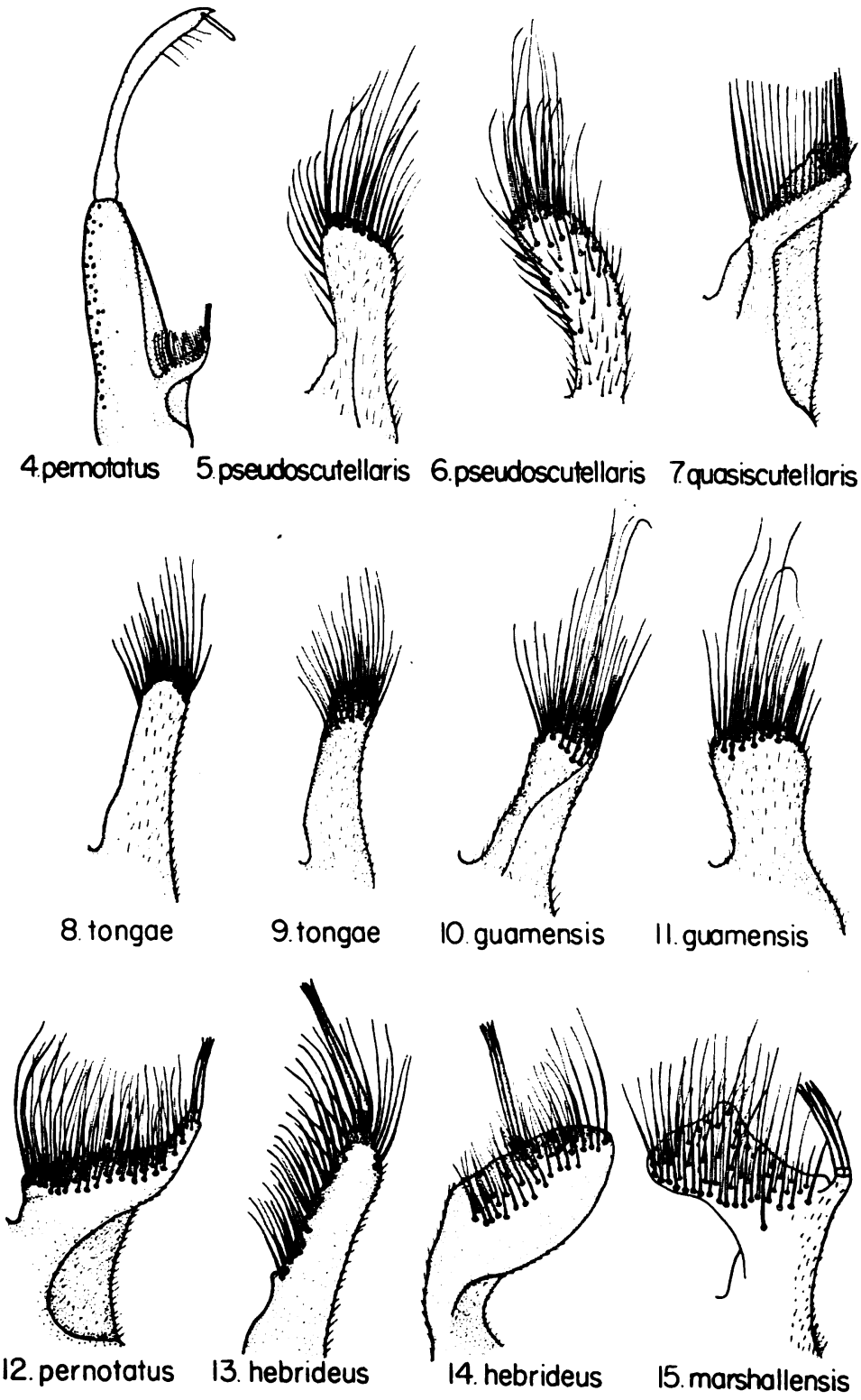

Figure 4, basistyle and dististyle of male genitalia; figs. 5-15, basal lobe of dististyle of male genitalia (figs. 4, 5, 7, 8, 10, 12 and 13 are in ventral view; figs. 6, 9 and 15 are in dorsal view; and figs. 11 and 14 are in lateral view).

because new species are most readily detected in this manner. Male genitalia of the known Australasian species can be identified by comparison with figures 4 through 15.

SYNOPSIS OF THE KNOWN AUSTRALASIAN SPECIES OF THE SCUTELLARIS GROUP

In this synopsis an attempt has been made in the case of each species to cite all of the names which have been given to it in various papers and textbooks. For each name a reference is given to the author, or one of the authors, who has fixed the usage of the name. Frequently, although not always, this is the first reference of the species to that particular name. Collecting records are separated into those examined by the authors (specimens now deposited in the U. S. National Museum) and those cited in the literature. In the cases of the former, the names of the collectors are included parenthetically; in the cases of records taken from the literature the parenthetic names are those of the authors of the publications containing the records. When identification was made under a species name different from that used in this revision, it is so noted. The records as given in the synopsis constitute the basis of the distribution map. Biological and medical notes are designated to allocate the available information to the correct species. They are derived in part from the literature and partly from collecting and field notes.

Aëdes (Stegomyia) pseudoscutellaris (Theobald)

Synonymy.—Stegomyia pseudoscutellaris Theobald 1910. Entomologist, 43: p. 156.

Aëdes variegatus var. pseudoscutellaris (Theobald): Edwards 1926, Bull. Ent. Res., 17: p. 103.

Aëdes (Stegomyia) scutellaris var. pseudoscutellaris (Theobald): Edwards 1932, Gen. Insect. fasc. 194: p. 165.

Stegomyia scutellaris var. pseudoscutellaris Theobald: Mumford and Adamson 1933, V° Cong. Intern. Ent., 2: p. 445.

Aëdes scutellaris pseudoscutellaris (Theobald): Knight, Bohart, and Bohart 1944, Keys to the Mosquitoes of the Australasian Region, Nat. Res. Council, Washington, D. C. p. 55.

Biology.—Larvae have been found in numerous small collections of water in such places as coconut shells, coconut husks, tree holes, cacao pods, open concrete drains, hollow tops of coconut stumps, tin cans, rot holes, holes in lava, crab holes, wooden drums, bamboo stumps, water jugs, hollows among roots, tanks (*7*) (*8*) (*15*) (*22*). According to Buxton and Hopkins (*7*), they are most commonly found in small containers with water of high organic

Identification table for the known Australasian

	pseudoscutellaris	tongae	horrescens	pernotatus
Known geographic distribution.	Fiji; Samoa; Wallis; Ellice Islands; Cook Islands; Society Islands; Tuamotu; Marquesas Islands.	Tonga Islands; Sikiana, Solomon Islands (probably an introduction. Buxton and Hopkins (7), p. 103).	Known only from Taveuni, Fiji.	Espiritu Santo and Efate, New Hebrides.
Fore and mid tarsi.	Basal white patches on segments I and II.	.....	Basal white patches on segments I and II; segment III sometimes with a few basal white scales (Edwards, (15)).	Basal white patches on segments I and II of fore and mid tarsi; also on III and frequently on IV and V of tarsus or on fore and mid tarsi.
Hind tarsi.	Basal white band on segment I interrupted by inner longitudinal line of dark scales; all others complete. Ratio of width of basal white bands to length of segments: I, 0.20–0.25; II, 0.25–0.30; III. 0.40–0.60; IV, 0.60 0.80; V, entirely white.	Bands on hind tarsi rather narrow, that on segment IV, occupying only basal half (Edwards, (12)).	Similar to *pseudo-scutellaris* (Edwards, (15))	Basal white band on segment I interrupted by inner longitudinal line of dark scales; all others complete. Ratio of width of basal white bands to length of segments: I, 0 20-0 25; II, 0.20–0 35; III, 0 50–0.60; IV, 0 60–0.80; V, entirely white.
Abdominal tergites.	Basal lateral white patches on II—VII in both sexes.	Described by Edwards (12) as having variable bands, sometimes broadly interrupted or absent in female; those on II and VII nearly always absent.	According to Edwards (15) similar to *pseudoscutellaris* but with lateral basal patches larger in female and forming more or less complete bands in male.	Basal lateral spots on II–VII in both sexes.
Male genitalia.	(Figures 5, 6) Basal lobe simple; without a specialized group of stout setae; large bristles confined to apex in ventral view, but extending nearly to base in dorsal view; lobe mostly covered with minute bristles ventrally.	(Figures 8, 9) Basal lobe simple; without a specialized group of stout setae: large bristles confined to apex, particularly in ventral view; lobe mostly covered with minute bristles.	"Hypopygium somewhat intermediate between those of var *pseudoscutellaris* and var *hebrideus;* basal lobe with a row of hairs towards the tip only, those actually at the tip not markedly longer than the others . . ." Edwards (15).	(Figure 12) Basal lobe somewhat complex, produced inwardly and subtriangular; narrowed inner apex with 4 strong setae on tubercles; large bristles restricted to a lateral zone extending from base to apex, some of bristles much longer than thickened setae; ventral surface practically without minute setae.
Remarks.	Only known species in which the basal lobe has large bristles extending nearly to the base in dorsal view.	Separable from *pseudoscutellaris*, according to Edwards (12), by a relatively narrow white basal band on segment IV of the hind tarsus; separable from *marshallensis* in having the entire tarsal segment V white.	According to Edwards (15) this species which is close to *pseudoscutellaris* differs from it principally in having a larva which is much more hairy; the lateral and ventral hairs of head have 6–8 plumose branches (2–3 in *pseudoscutellaris*); dorsal and ventral hairs of thorax with 8–12 branches.	All specimens without bands on the abdominal tergites and with fore and mid tarsi as described above are referable to this species. The few males without the characteristic tarsal markings can be identified by the genitalia. A small percentage of females are indistinguishable morphologically from *pseudoscutellaris*.

species of the scutellaris group

hebrideus	quasiscutellaris	marshallensis	guamensis
New Hebrides; eastern New Guinea.	Solomon Islands.	Collected from Kwajalein, Namorik, and Ebon Atolls and Kili Island in the Marshall Islands.	Known from Guam only.
Basal white patches on segments I and II.	Basal white patches on segments I and II; occasionally on III.	Basal white patches on segments I and II, frequently reduced or inconspicuous; that on segment II of fore tarsus greatly reduced or absent.	Basal patches on segments I and II usually reduced or absent, especially on fore leg.
Basal white band on segment I interrupted by inner longitudinal line of dark scales; all others complete. Ratio of width of basal white bands to length of segments: I, 0.20–0.25; II, 0.25–0.30; III, 0.40–0.60; IV, 0.60–0.80; V, entirely white.	Basal white band on segment I interrupted by inner longitudinal line of dark scales; all others complete. Ratio of width of basal white bands to length of segments: I, 0.25–0.30; II, 0.25–0.30; III, 0.40–0.60; IV, 0.75; V, entirely white.	Basal white band on segment I interrupted by inner longitudinal line of dark scales; all others complete but reduced. Ratio of width of basal white bands to length of segments: I, 0.10–0.20; II, 0.10–0.20; III, 0.20–0.30; IV, 0.20–0.40; V, 0.20–0.50.	Basal white bands on *all* segments interrupted by inner longitudinal stripe of dark scales. Ratio of width of basal white bands to length of segments: I, 0.20–0.25; II, 0.20 0.35; III, 0.35–0.50; IV, 0.60–0.75; V, entirely white except for inner longitudinal dark stripe.
Bands on II—VII; broadly interrupted on II, usually interrupted on III, often interrupted on VII.	Bands on II—VII: that on II narrowed medially and often interrupted, often interrupted on VII.	Bands on II—VII, variable: usually interrupted on II and III, also frequently on other segments.	Basal lateral white patches on II—VII.
(Figures 13, 14) Basal lobe somewhat complex, narrow in ventral view and expanded in lateral view; with a specialized group of 4 large setae on tubercles, the setae surpassing surrounding bristles; large bristles in a restricted lateral area extending about half way to base of outer side; ventral surface practically without minute setae.	(Figure 7) Basal lobe complex, with a ventral projection bearing along its oblique apex a row of somewhat thickened bristles, these less crowded toward middle of apical margin and longest toward outer edge; no specialized setal group; most of basal lobe covered with minute bristles.	(Figure 15) Basal lobe complex, expanded laterally and produced inwardly, the inner apex bearing 4 stout setae on tubercles; long bristles restricted to the expanded apex, the longer bristles surpassing the stout setae; ventral surface mostly without minute bristles.	(Figures 8, 9) Basal lobe stout but relatively simple; with a weakly developed group of 4 specialized setae; long bristles confined to apex, longest ones about twice as long as thickened setae; most of basal lobe covered with minute bristles.
Generally separable from *quasiscutellaris* by condition of bands of abdominal tergites as given above. Confirmatory identifications with preparations of male genitalia should be made.	Generally separable from *hebrideus* by condition of bands of abdominal tergites as given above. Confirmatory identifications with mounts of male genitalia should be made.	Only known species with reduced bands on hind tarsus and with white on only *basal* part of segment V of hind tarsus.	Only known species with all basal white bands of hind tarsal segments interrupted by inner longitudinal stripe of dark scales.

content and *not* in leaf axils or ground water of pools and swamps.

The adults are persistent daytime biters, especially on dull days and in deep shade. The flight range of adults is extremely limited, seldom exceeding 100 yards (*7*) (*8*) (*22*). In the Marquesas Islands this species has been recorded up to altitudes of 2900 feet (*14*).

Collecting records

Specimens examined.—Samoa: Tutuila, males and females (K. L. Knight, P. S. Rossiter); Apia, males and females (J. T. Lloyd); no locality given, males and females (W. G. Reddick). Fiji: No locality given, females (R. A. Lever); Cuvu, 1 male (R. Veitch). Wallis Island: Females (K. L. Knight). Marquesas Islands: Eïao, females (A. K. Fisher); Fatu Hiva, females (A. K. Fisher); Hiva Oa, females (A. K. Fisher). Tuamotu Islands: Toau, females (A. K. Fisher). Ellice Islands: Lakuna, females (K. L. Knight).

Records in the literature.—Samoa: "All Samoan Islands except Rose Atoll" (*7*). Fiji: Cuvu (type locality, Theobald (*27*), also Buxton and Hopkins (*7*). Cook Islands; Rarotonga, Aitutaki, Mauki (*7*). Marquesas Islands: Tahuata (*7*) (*11*) (*14*); Hiva Oa (*7*) (*14*); Nuku Hiva (*7*) (*14*); also Fatu Hiva, Ua Huka, Eïao (*14*). Ellice Islands: All except Nurakita (*7*) (*22*). Tahiti: Tautira (*12*); Papeete (*12*); Bora Bora (*7*); Raiatea (*7*). Tuamotu Islands: Fakarava (*7*) (*12*).

Also reported by F. M. Root (unpublished records from material collected by S. M. Lambert (*24*) from Vaitupu, Funafuti, and Nanumanga in the Ellice Islands; Rotuma Island; Viti Levu, Vanua Levu, and numerous islands in the Lau group, Fiji; Samoa; and Rarotonga, Mauki, and Aitutaki in the Cook Islands.

The reports of pseudoscutellaris from the New Hebrides (*9*), and Guam (*26*) are referable to pernotatus and guamensis respectively. The authors have seen specimens of Aëdes albopictus (Skuse) from Saipan identified as pseudoscutellaris.

Medical importance.—This species has been proved experimentally to be the vector of nonperiodic filariasis in Fiji by Bahr (*1*), in the Ellice Islands by O'Connor (*22*), and in Samoa by Byrd et al. (*8*). O'Connor's observation that it is the only species of mosquito in the Tokelau group where filariasis is common implicates it there also. These observations together with the known ranges of filariasis and pseudoscutellaris indicate that this species is the important vector of filariasis in Polynesia.

Aëdes (Stegomyia) tongae Edwards

Synonymy.—Aëdes variegatus var. tongae Edwards 1926. Bull. Ent. Res., 17: p. 103.

Aëdes (Stegomyia) scutellaris var. tongae Edwards: Edward 1932, Gen. Insect. fasc. 194: p. 165.

Aëdes scutellaris tongae Edwards: Knight, Bohart, and Bohart 1944, Keys to the Mosquitoes of the Australasian Region, Nat. Res. Council, Washington, D. C. p. 55.

Biology.—Larvae have been found in coconut husks and tree wells (*7*).

Collecting records

Specimens examined.—Tonga Islands: Vavau, one male (C. L. Edwards).

Records in the literature.—Tonga Islands: Haabai (type locality, Edwards (*12*), also Buxton and Hopkins (*7*); Vavau (*7*) (*12*); Nukualofa (*7*) (*12*). Solomon Islands: Sikiana (*7*) (*12*). Buxton and Hopkins (*7*) regard the Sikiana records of tongae as representing an introduction of this form from Polynesia. According to these authors, the Sikiana people are not Melanesians, like other natives of the Solomons, but are pure Polynesians. They assume that the eggs, which are resistant to drying, were carried in the native canoes. Root's unpublished identifications of Polynesian and Melanesian mosquitoes (*24*) list tongae from Nupani Island in the Santa Cruz group. Since his material consisted of a single male and two females (unavailable to the authors for study), it is felt that confirmation of the occurrence of this species in Santa Cruz is necessary.

Medical importance.—Since this is the only species of the scutellaris group known to occur in the Tonga Islands, it has been assumed to be the vector of nonperiodic filariasis in this group.

Aëdes (Stegomyia) horrescens Edwards

Synonymy.—Aëdes (Stegomyia) scutellaris var. horrescens Edwards 1935. Bull. Ent. Res., 26: p. 129.

Aëdes scutellaris horrescens Edwards: Knight, Bohart, and Bohart 1944. Keys to the Mosquitoes of the Australasian Region, Nat. Res. Council, Washington, D. C. p. 55.

Biology.—Larvae have been collected from tree holes in the forest, holes in coconut trunks, a barrel in a coconut grove, and occasionally in coconut husks (*15*).

Collecting records

Specimens examined.—None.

Records in the literature.—Recorded only from Taveuni, Fiji Islands (type locality, Edwards (*15*)).

Medical importance.—No information.

Aëdes (Stegomyia) pernotatus Farner and Bohart

Synonymy.—Aëdes scutellaris var. pseudoscutellaris (Theobald): Daggy 1944, War Med. 5: p. 293.

Aëdes (Stegomyia) pernotatus Farner and R. Bohart 1944. Proc. Biol. Soc. Wash., 57: p. 118.

Biology.—Larvae have been collected from tin cans, tree holes, a rain barrel, tops of oil drums (from collecting data on specimens collected by K. L. Knight); also from axil of taro leaf (Daggy).

Collecting records

Specimens examined.—New Hebrides: Segond Channel area, Espiritu Santo,

males and females (K. L. Knight); Turtle Bay area, Espiritu Santo, males and females (K. L. Knight); Curtis Creek, Espiritu Santo, one female (K. L. Knight); Vila area, Efate, males and females (K. L. Knight).

Records in the literature.—New Hebrides: Same as above; Segond Channel area is type locality (Farner and Bohart (*16*)). The notes given by Daggy (*9*) on pseudoscutellaris in the New Hebrides are doubtlessly referable to pernotatus.

Medical importance.—The fragmentary information available at the present time indicates that this species has no role in the transmission of filariasis.

Aëdes (Stegomyia) hebrideus Edwards

Synonymy.—Stegomyia sp.[1]: Laveran 1902, Comp. Rend. Soc. Biol. Paris, 54: p. 909.

Aëdes variegatus var. hebrideus Edwards 1926. Bull. Ent. Res., 17: p. 102.

Aëdes (Stegomyia) scutellaris var. hebrideus Edwards: Edwards 1932, Gen. Insect. fasc. 194: p. 165.

Aëdes scutellaris hebrideus Edwards: Knight, Bohart, and Bohart 1944, Keys to the Mosquitoes of the Australasian Region, Nat. Res. Council, Washington, D. C. p. 55.

Biology.—According to Buxton and Hopkins (*7*) in the New Hebrides, larvae are usually found in tree holes, coconut shells, and hollows among roots; also in holes in raised coral, clam shells in a garden, old bottles, shallow wells, rot holes, and a felled log. Daggy (*9*) reports finding larvae in the tops of drums, uncovered tires, sections of Quonset huts, currugated sheet iron, tarpaulins, and bomb crates. Specimens collected in New Guinea by H. R. Roberts give a palm boat, coconut shells, old native pot, old mollusk shells, and a prone tree trunk as larval habitats. The adults attack man readily. Daggy found larvae in the axil of a taro leaf.

Collecting records

Specimens examined.—New Hebrides: Hog Harbor, Espiritu Santo, one female (P. A. Buxton); Aore Island, Espiritu Santo, one female (K. L. Knight); Curtis Creek, Espiritu Santo, one female (K. L. Knight); Aessi Island, Espiritu Santo, females (K. L. Knight); Segond Channel, Espiritu Santo, males and females (K. L. Knight); Sarakata Valley, Espiritu Santo, males and females (K. L. Knight); Tana Island, one male (P. A. Buxton); La Colle, Efate (K. L. Knight). New Guinea: Saidor, males and females (W. S. Ferguson); Kiriwinia, one male (W. S. Ferguson); Milne Bay, males and females (H. R. Roberts); Cape Endaiadere, one female (B. E. Rees); Gilli Gilli, females; Kalo Kalo, Ferguson Island, males and females (B. E. Rees); Vivigani, Goodenough Island, males and females (B. E. Rees); Cape Watutu, Goodenough Island, females (B. E. Rees).

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[1] Of the two species, hebrideus and pernotatus, known to occur in the New Hebrides, Laveran's description of bands on the abdomen definitely identifies his material as hebrideus.

Records in the literature.—New Hebrides: Hog Harbor, Espiritu Santo (type locality, Edwards (*12*), also Buxton and Hopkins (*7*)); Ais Island, Espiritu Santo (*7*); Zagabe, Efate (*7*); Vila and Undine Bay, Efate (*7*) (*12*); Lamalama, Pentecost Island (*7*); Atchen Island near Malekula Island (*7*) (*12*); Port Sandwich, Malekula (*19*); Ambrim Island (*7*) (*12*); Tana Island (*7*) (*12*); Tanoa (*7*); Banks Group (*7*) (*12*).

The presence of this species on New Guinea and in the New Hebrides would seem to make its occurrence in the Solomons highly probable. Although no specimens have been found in several large collections from Guadalcanal, Treasury, and Bougainville, its occurrence in this group should not be precluded. Root's list of identifications (*24*) contains records from Bellona Island and Rennell Island in the Solomons. Because hebrideus and quasiscutellaris can be confused when external morphology is used as the sole basis of differentiation, it seems necessary that these identifications be confirmed by further collections. Lambert's specimens have been unavailable to the authors. Root's list also includes hebrideus from Nupani, Santa Cruz Islands and Futuna in the New Hebrides.

Medical importance.—There is no information indicating a role in the transmission of filariasis by this species. Daggy (*9*) has recently published epidemiologic observations from Espiritu Santo implicating hebrideus as a vector of dengue.

Aëdes (Stegomyia) quasiscutellaris Farner and R. Bohart

Synonymy.—Aëdes variegatus (Doleschall): Edwards 1926, Bull. Ent. Res., 17: p. 101.

Aëdes (Stegomyia) scutellaris (Walker): Edwards 1932, Gen. Insect. fasc. 194: p. 165.

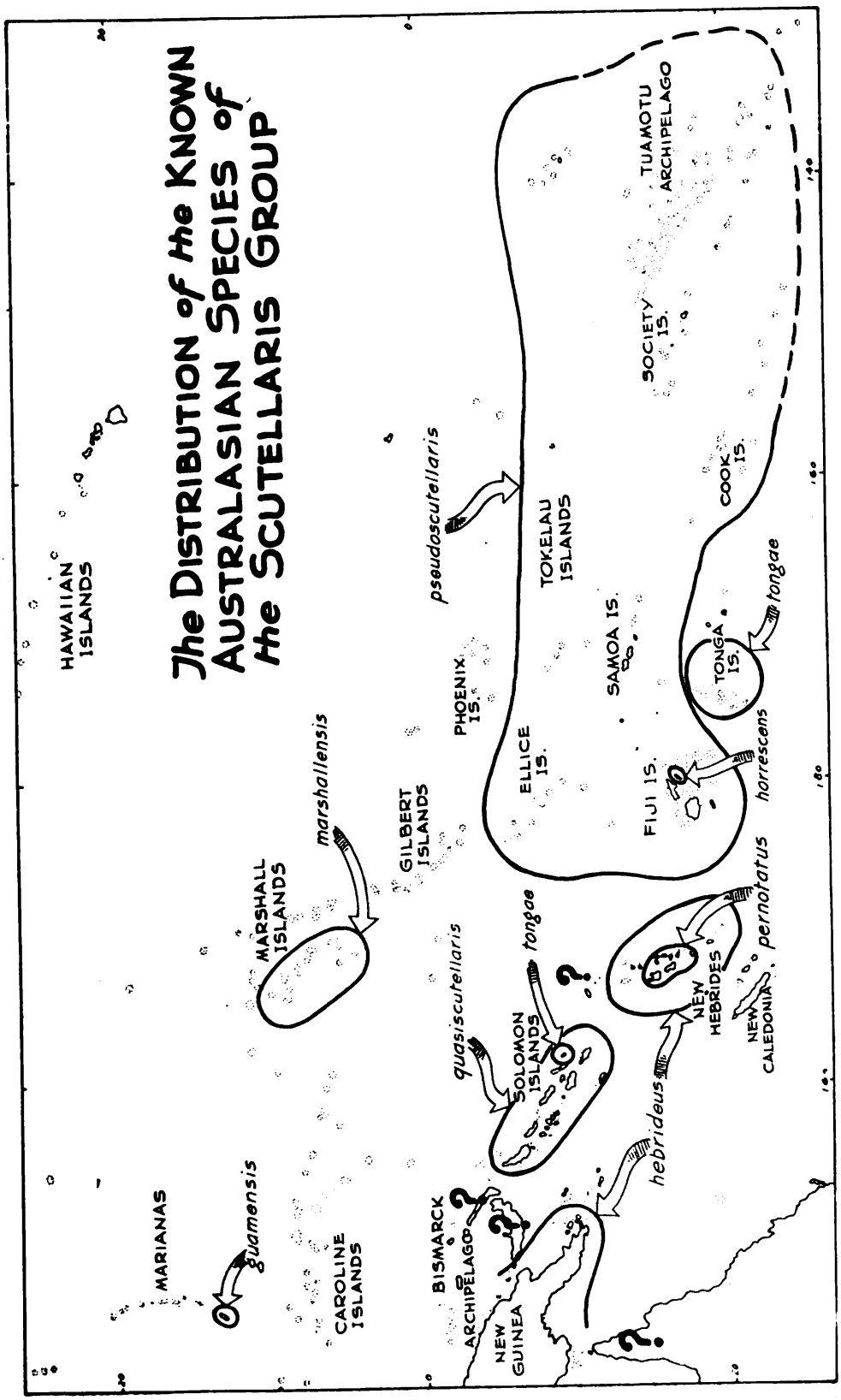
Aëdes scutellaris scutellaris (Walker): Knight, Bohart, and Bohart 1944, Keys to the Mosquitoes of the Australasian Region, Nat. Res. Council, Washington, D. C. p. 55.

Aëdes (Stegomyia) quasiscutellaris Farner and R. Bohart, 1944. Proc. Biol. Soc. Wash., 57: p. 120.

Biology.—Larval habitats are similar to those of other species of this group. Paine and Edwards (*23*) record collections from coconut husks, tree holes, and old tins. Collecting data on specimens in the U. S. National Museum list tree holes, coconut husks, paper container, tank, milk can lid, tin cans, leaf axils, stump holes (A. B. Gurney); tree hole, depression at base of tree trunk, tin can (R. L. Ingram); tree hole and leaf axils (Sgt. Scott); tin can in jungle and pandanus leaf (P. W. Oman). Paine and Edwards (*23*) describe this species as not troublesome in the Eastern Solomons.

Collecting records

Specimens examined.—Solomon Islands: Teneru area, Guadalcanal, males and females (K. L. Knight); Balasuma River, Guadalcanal, one male (K. L. Knight); Lunga area, Guadalcanal, one male (J. R. Douglas); no specific locality, Guadalcanal. males and females (P. W. Oman, J. N. Belkin, A. Wea-



thersby, A. B. Gurney, F. Lechner); Treasury Island, males and females (J. H. Paullus); Bougainville, males and females (A. B. Gurney, C. R. Bruck).

Records from the literature.[2]—Solomon Islands: Same as above; type locality is Guadalcanal (Farner and Bohart (*16*)); also (as scutellaris) Tulagi (*12*); Gela (*12*); Russell group (*23*); Guadalcanal (*23*); Malaita (*23*).

Root's unpublished identifications (*24*) include records from Malaita, Tulagi, Bunana, Kwai, Guadalcanal and Ugi in the Solomon Islands.

Medical importance.—No information.

Aëdes (Stegomyia) marshallensis Stone and R. Bohart

Synonymy.—Aëdes (Stegomyia) marshallensis Stone and R. Bohart 1944. Proc. Ent. Soc. Wash., 46; p. 218.

Biology.—Larvae have been collected in coconut halves, hollow trees, and hollows at base of coconut palm.

Collecting records

Specimens examined.—Marshall Islands: Ennylebagan, Kwajalein Atoll, males and females (D. G. Hall); Berlin Island, Kwajalein Atoll, males and females (D. G. Hall); Namarik, Namarik Atoll, females (D. A. Treat); Ebon Island, Ebon Atoll, males and females (D. A. Treat); Killi Island, males and females (D. A. Treat); Airok Island, Ailinglaplap, male and female (D. A. Treat).

Records in the literature.—Marshall Islands: Same as above (*25*); type locality is Airok Island (Stone and Bohart (*25*)).

Medical importance.—No information.

Aëdes (Stegomyia) guamensis Farner and R. Bohart

Synonymy.—Stegomyia scutellaris (Walker): Fullaway 1912, Ann. Rep. Guam Agric. Exp. Sta. 1911: p. 33.

Aëdes pseudoscutellaris (Theobald): Swezey 1942, Bull. Bernice P. Bishop Mus., 172: p. 199.

Aëdes scutellaris pseudoscutellaris (Theobald): Knight, Bohart, and Bohart 1944, Keys to the Mosquitoes of the Australasian Region, Nat. Res. Council, Washington, D. C. p. 55.

Aëdes (Stegomyia) guamensis Farner and R. Bohart 1944. Proc. Biol. Soc. Wash., 57: p. 117.

Biology.—Swezey (*26*) reports this species as breeding in tree hollows, coconut husks and coconut shells. Oakley's collecting data give carabao wallow, coconut husks, water drum, and water tank.

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[2] G. F. Hill (The distribution of anopheline mosquitoes in the Australian region, with notes on some culicine species. Proceedings Royal Society Victoria (new series) 37: 61-77, May 1925) recorded variegatus from New Britain, New Ireland, Admiralties, and New Guinea. Although these records have been supposed by later writers to refer to the Solomon Islands form, it appears more likely that they were at least partly of hebrideus, and possibly of some undescribed species.

Fullaway (*17*) reported this species as very abundant and troublesome in the forests.

Collecting records

Specimens examined.—Guam: males and females, several localities (D. T. Fullaway, R. G. Oakley, A. Cruz).

Records in the literature.—Guam: Same as above; Mata is type locality (Farner and Bohart (*16*)). The records of scutellaris by Fullaway (*17*) and Swezey (*26*) are referable to guamensis.

Medical importance.—No information.

Mosquitoes of the scutellaris group are known to occur on New Britain and New Ireland. The authors have examined a single female from Rabaul which appears to be referable to hebrideus. However, it could also be quasiscutellaris or an undescribed species with bands on the abdominal tergites. Root's unpublished list (*24*) contains identifications of tongae and hebrideus from the Santa Cruz Islands. The occurrence of the latter species seems plausible on a geographic basis. Likewise scutellaris mosquitoes have been reported from Queensland in Australia; geographically one might assume these to be hebrideus but the occurrence of an undescribed form there is also possible.

Several species of the scutellaris group do not occur in the area covered by this revision. Whether the species described by Bonne-Wepster and Brug (*2*) (*3*) as Aëdes scutellaris is the same as that of Walker (*29*) from the Aru Islands cannot be ascertained at this time. In view of the variable morphology ascribed to it by Bonne-Wepster and Brug, it seems possible that several forms may be involved. These investigators (*2*) have described a distinct form, alorensis, from Alor Island. Edwards (*12*) described andrewsi from Christmas Island south of Java and it seems apparent from Barraud's description[3] that the Andaman Islands form is distinct. Mosquitoes of the scutellaris group are also known to occur in the Philippines. Only females have been examined by the authors and it is not possible to assign them to species.

Apparently there is a tendency in the scutellaris group to form endemic species or species with limited distribution such as guamensis, horrescens, and tongae. In consideration of this and the vast areas in Micronesia, Melanesia, and Malaysia which have not been adequately collected and studied the discovery of additional species in this group seems highly probable.

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[3] Barraud, P. J.: A revision of the culicine mosquitoes of India. Part XXIII. Indian Journal of Medical Research, 15: 653-669, January 1928.

RELATION OF THE SCUTELLARIS GROUP TO FILARIASIS

An examination of the reports of Thorpe (*28*), Brochard (*4*), Leber and Prowazek (*20*), Buxton and Hopkins (*7*), Buxton (*6*), Bahr (*1*), O'Connor (*22*), and Byrd et al. (*8*) shows that the endemic areas of nonperiodic filariasis are Samoa, Fiji, Cook Islands, Ellice Islands, Tokelau Group, and Tuamotu. The autochthonous filariasis of the New Hebrides and New Caledonia is, according to all reports, nocturnal. Bahr (*1*), O'Connor (*22*), and Byrd et al. (*8*) have shown experimentally and in field studies that pseudoscutellaris is the vector of nonperiodic filariasis. Buxton and Hopkins (*6*) (*7*) showed that the geographic evidence indicated that nonperiodic filariasis must be transmitted by the scutellaris group of mosquitoes (regarded by them at that time as varieties of Aëdes variegatus) and their geographic data strongly implicated pseudoscutellaris and tongae. With the recent report of pseudoscutellaris in Guam (Swezey) (*26*) and the New Hebrides (Daggy) (*9*) it appeared that the distribution of this species might be much more widespread than that of nonperiodic filariasis. The present study indicates that the range of pseudoscutellaris is restricted to Polynesia[4] and that its range combined with the range of tongae is almost exactly coincident with that of endemic nonperiodic filariasis. Hence on a geographic basis pseudoscutellaris appears definitely to be the important vector in the transmission of nonperiodic filariasis. The experimental investigations cited above together with the geographic data presented in this paper lead to the conclusion that the geography of this type of filariasis is determined by the geography of pseudoscutellaris. However, since tongae is the only scutellaris mosquito known in the Tonga Islands, where nonperiodic filariasis occurs, it appears necessary to regard it as the vector in this area.

Minor roles in the transmission of nonperiodic filariasis by other members of the scutellaris group should not be precluded at this time in spite of negative geographic and epidemiologic observations. Investigations and observations on natural and experimental infections with other scutellaris group species as well as more investigations concerning the geography of autochthonous nonperiodic filariasis are needed.

SUMMARY

1. A systematic revision and a table for preliminary field iden-

[4] Polynesia as used in this paper includes Samoa, Fiji, Ellice Islands, Tokelau Group, Marquesas Islands, Tuamotu, Society Islands, Cook Islands, Tonga and the smaller islands dispersed among them.

tification of the known Australasian species of the scutellaris group is presented.

2. The careful study of about one thousand specimens from Melanesia, Micronesia, and Polynesia indicates that the distribution of pseudoscutellaris is Polynesian only, and that its range plus the range of tongae is coincident with that of nonperiodic filariasis.

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OUR LEPROSY PROBLEM

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One of the oldest diseases of mankind, leprosy is still regarded as a mysterious and horrible affliction by most medical men as well as laymen. The unfounded fears and revulsion, born largely of ignorance, have hindered scientific study and the dissemination of accurate knowledge. Leprosy, as an infectious disease undoubtedly spread by contagion and prevalent nearly everywhere in the tropics and subtropics, has more than a passing interest and importance to us in our world-wide war effort. It has little tactical significance because the number of servicemen who may be infected is relatively small and any resulting incapacity will almost surely be delayed for years, probably until long after the end of the present war. But it is important because infections among troops serving in endemic areas are bound to occur in appreciable numbers, and because any part we play in bringing order out of chaos in the postwar world must include a recognition of the extent of the leprosy problem and a knowledge of accepted control measures.

It is the purpose of this article to present a few of the salient points about leprosy as a world problem, to describe some of the outstanding clinical features, and to discuss control measures.

WORLD DISTRIBUTION OF LEPROSY

Leprosy is endemic in nearly every country in the world, but it is most prevalent in the tropics and subtropics, in those countries where the sanitary and economic level is low (*1*) (*2*). Prevalence varies from occasional, sporadic cases such as occur in the Baltic States and in our own southern United States, to a high level where more than 5 percent of a population may be afflicted as in some of the Pacific islands and in tropical Africa. There are probably between three and four million affected persons in the world today, only a small fraction of whom are getting adequate care or are segregated.

The disease is widespread in the Western hemisphere, where there are doubtless more than 120,000 cases at the present time. It is estimated that there are 1,000 cases in the United States,

of which less than 400 are segregated at the National Leprosarium at Carville, Louisiana. The endemic zone is practically confined to the Gulf States of Florida, Louisiana, and Texas, but sporadic cases occur elsewhere.

Leprosy is common throughout the West Indies and Central and South America, with a general incidence of about one per thousand population, with 50,000 cases estimated for Brazil, and 20,000 for Columbia. Chile is the only country in the Western Hemisphere in which the presence of the disease is denied.

In Africa the prevalence is moderate to light in the northern and southern parts of the continent and heavy in tropical Africa where more than 5 percent of some groups are said to be infected. In Egypt it is estimated that there are 15,000 cases, in Nigeria 200,000, and in the Union of South Africa there were 7,155 known cases in 1939.

In Europe leprosy was very common from about the twelfth to the eighteenth centuries (*3*) (*4*), but today it is practically restricted to Russia and the Mediterranean countries where it is mildly endemic. There are possibly 10,000 cases on the entire continent.

Asia has been one of the world's great leprosy centers for thousands of years, with India, Burma, Thailand, French Indo-China, Malaya, China, Korea, and Japan showing a high incidence. In the Pacific islands the disease is also very common. In the Netherlands Indies in 1926 there were estimated to be 100,000 cases with a general incidence of two per thousand population. The disease remains one of the major health problems of the Philippines and nearly a third of the entire health budget is used to support more than 10,000 cases in leprosaria. Leprosy is prevalent throughout the Pacific island groups, and is a serious problem in the Solomons, the New Hebrides, and New Guinea.

One can only speculate on the effects of the war on the leprosy problem. It is probably safe to assume that large areas will be impoverished, there will be serious malnutrition, the general sanitary level will be lowered, and control of communicable diseases, including leprosy, will be weakened. In many places segregated lepers may have been set free to mingle with the general population. As a result of all these factors, an increase in prevalence may be anticipated during the next five or ten years. It will be part of our job of rehabilitation, as territory is occupied and in the postwar years, to help the local governments establish a higher level of nutrition and sanitation and to institute humane and logical control of communicable diseases, including leprosy.

Leprosy in servicemen.—What is the extent of the risk in-

curred by our personnel during their foreign service in areas where leprosy is prevalent? It is difficult to assess quantitatively, but doubtless the risk is greater than that incurred by those remaining at home, and we can be sure that the disease will develop in an appreciable number of veterans of World War II during the next 20 years. There is enough accumulated evidence to permit us to draw that conclusion.

Leprosy almost never occurs in the British Isles among those who have not lived in endemic areas. But cases do develop, not infrequently, among British colonials after their return from a period in the colonies.

Recently an analysis was made of patients sent to the United States National Leprosarium at Carville between 1920 and 1940 (*5*). Out of a total of approximately 1,000 admissions during that period there were 85 patients who had served in the armed forces, Army (71 cases), Navy (12 cases), and Marine Corps (2 cases). One group of 32 patients were survivors of the Boxer Rebellion, the Spanish American War or the Philippine Insurrection, and practically all had seen service at some time in leprosy-endemic areas. Among them were 27 native Americans, 8 of whom were living in southern leprosy-endemic areas at the time of enlistment, and the remaining 19 had come from various parts of the northern section of the country, roughly in proportion to the number of enlistments from those areas.

Another group of 51 patients were World War I veterans, of whom 33 had seen service outside the United States, but only 6 had served in leprous areas. Eighteen were born abroad but all the rest had come from southern states. Two men had seen peacetime service after 1918; one was born in the South and had served a year in Texas; the other, also born in the South, had served 3 years in Hawaii.

The numbers are small but probably significant, and suggest that in the majority of instances in native Americans, in the first group infection was contracted abroad in endemic areas, and most of the second group were infected at home in the South. Doubtless many more cases of leprosy occurred in veterans of our Spanish-American War group, cases which were not diagnosed properly, or the patients were not sent to Carville, or they died before 1920.

The 32 cases among Spanish-American War veterans represent a fairly high attack rate, for they are a selected group in whom a positive diagnosis was made and who were sent to Carville from among probably not more than 60,000 to 70,000 survivors of the Spanish-American period, giving a gross ratio of 50 per 100,000. If such reasoning is correct, we may expect, during the next 20

years, the development of 500 cases of leprosy among each million surviving veterans of service in leprosy-endemic areas.

ETIOLOGY

It is generally accepted that leprosy results from infection with an acid-fast organism, the Mycobacterium leprae, first described by Hansen in 1872.

M. leprae is a rod-shaped bacillus, 2 to 6 microns in length, which occurs in tissues of lepromatous leprosy in great numbers, often in bundles or clumps. The organism has never been successfully cultivated in vitro, and it has not been possible to produce the disease in animals. Therefore, it has never been completely proved, in compliance with Koch's postulates, that M. leprae is the cause of leprosy, although the evidence is overwhelming.

There is a constant association between acid-fast bacilli and lepromatous lesions. To cite one case: An infant, exposed to leprosy from birth, was found to have a small, erythematous nodule on one knee. Scrapings showed numerous acid-fast organisms. Death occurred shortly from pneumonia before any further lesions developed. Autopsy showed lepromatous changes in the knee lesion, with many acid-fast bacilli in this location and in the regional lymphatics, but not elsewhere.

The evolution of the disease from such an early stage has been followed many times and organisms are invariably found in new lesions of the lepromatous type. M. leprae are ordinarily not found, however, in skin lesions of neural leprosy, even after careful search through serial sections. The explanation is that they are destroyed rapidly by the immune response of the body and by phagocytic action and are so few in number that they cannot be demonstrated. Patients with neural skin lesions are seen who develop acute exacerbations with edematous swelling and extension of lesions. During this phase M. leprae can often be found in small numbers, although they cannot be demonstrated before and after the acute period.

CLINICAL FINDINGS

Clinically, on the basis of lesions, progression, and bacteriologic findings, the disease may be divided into two main types, the neural and the lepromatous.

Neural leprosy, often called the maculo-anesthetic form, is characterized by lesions of the skin and nerves with a decrease or loss of sensory perception in a few or many areas, with or without

trophic and other secondary changes from which extreme mutilation may result. Neural skin lesions may occur alone without any demonstrable nerve trunk involvement, and may be single or multiple, varying in size from less than a centimeter in diameter to extensive lesions over much of the skin area.

A typical lesion is a pale, flat macule, sharply circumscribed, with diminished pigment, often having a finely granular or papular periphery, and with varying degrees of decrease of sensory perception. Temperature sense may disappear first with subsequent diminution of pain and light touch perception. Frequently macules appear to be spreading peripherally.

A biopsy of the papular border of such a lesion will usually reveal granulomatous changes evidenced by infiltration with round and epithelioid cells, with or without multinucleate giant cells. Such lesions, because of the similarity of the histology to that in tuberculosis, are often described as "minor tuberculoid" or "subtuberculoid." The granulomatous changes frequently involve the peripheral nerve endings and the sweat glands.

A similar pathologic process may involve one or more of the nerve trunks. Smooth or nodular swelling of the nerves may occur with interference of function causing anesthesia of the parts supplied, trophic changes, and an atrophic, flaccid paralysis. Caseous abscesses of peripheral nerves are not an uncommon finding. Any nerve trunk may be involved, but leprous neuritis is most often demonstrated in the ulnar, the peroneal, the facial, the great occipital, and the supraorbital nerves. As a result, claw hand, foot drop, and facial paralysis are well recognized signs of leprosy.

The prognosis of the neural form of leprosy is good as far as elimination of the infection is concerned, but because of the frequent localization of lesions in main nerve trunks, extensive and mutilating deformities often occur. There are, however, many cases in which the signs are minimal, the lesions being limited to one or a few small, anesthetic macules which tend to disappear in a few months or years without leaving any permanent sequelae. The neural form is thought of as leprosy occurring in an individual with a relatively high degree of resistance to the invading organism, which stimulates a marked cellular reaction.

Occasionally, raised, edematous, sharply-demarcated lesions may occur in the form of plaques, rings, or as gyrate borders of former flat macules. These may develop suddenly, within the space of a few days, and they may flatten out as rapidly. This is the so-called "major tuberculoid" form of leprosy. It is usually classed with the neural type because there is nearly always anesthesia of the lesions, the prognosis is usually good, and the histopathology is

qualitatively similar to that seen in the papular borders of simple neural macules.

Acid-fast organisms are rarely found in cases of neural leprosy, either in the lesions of the skin, the nerves, or in the nasal secretions, except in the case of the major tuberculoid type of lesions in which organisms may be demonstrated, ordinarily in small numbers. This is an important point in diagnosis. Neural cases comprise considerably more than half of all cases in an area, as a rule, and if the demonstration of acid-fast bacilli were accepted as a necessary criterion for a diagnosis of leprosy, more than half the actual cases would be missed.

Lepromatous leprosy, often called "nodular leprosy" presents a different clinical and histologic picture. There is usually a nodular thickening of various areas of the skin, although at times the process may show itself as a diffuse induration. The lesions may develop anywhere, but they are commonly seen on the face, chiefly the ear lobes, the forehead, or over the malar prominences. Pigmentary changes are not so striking as in the neural skin lesions, and the nodules often appear darker than the surrounding normal areas.

The histopathology shows, characteristically, an accumulation of large, mononuclear, "foamy" cells, and what are probably large mononuclear cells packed with acid-fast bacilli. On examining a section of a nodule stained for acid-fast organisms, it is seen that much of the mass of the tissue is made up of bacilli. It appears that there is very little reaction produced by the host, that the organisms grow and multiply unhindered within the cells, producing globules of organisms contained within the distended cell walls.

Such lepromatous lesions may occur anywhere in the body, and by their location and number they cause a variety of signs and symptoms through the destruction or displacement of normal tissues, much as in neoplastic growths. Destruction of the eyes with resulting blindness, or of the larynx, with resulting stenosis and dysphagia, are common in lepromatous leprosy. Nerve trunks may be the site of lepromatous changes with clinical signs indistinguishable from those in neural leprosy. Although neural cases rarely develop lepromatous changes and are purely neural, lepromatous cases nearly always develop, sooner or later, neural-type lesions as well. These cases are commonly called the "mixed" type of the disease.

The prognosis in lepromatous leprosy is much graver than in the neural form. Usually the disease progresses steadily over a period of many years with resulting deformities, mutilations and destruction of tissue. However death occurs as a rule from some

intercurrent infection such as tuberculosis or from nephritis, and not primarily because of leprosy.

Acid-fast organisms are found in enormous numbers in skin scrapings from lesions of nodular leprosy, in the nasal secretions if there are lesions in the nasal cavity, and in the blood.

DIAGNOSIS

The most important factor in making a diagnosis is to be leprosy conscious, to think of the possibility of skin or nerve lesions being caused by the disease. It has been the common experience in this country that patients with leprosy have drifted from one clinic to another for years and have reached an advanced stage before the correct diagnosis was made.

There is no single finding which will establish a diagnosis beyond all doubt. There are, however, a few criteria which are of paramount importance, namely, anesthesia, enlargement of nerve trunks, histologic changes, and the presence of acid-fast bacilli. The character of the skin lesions is also important, particularly the pale macules, or nodular or diffuse thickening, but the changes produced are so varied as to simulate many other skin conditions.

The presence of surface anesthesia, with or without skin lesions, in the absence of other obvious causes should suggest the possibility of leprosy. The loss of thermal sense is usually the earliest and frequently the only sign to appear. Anesthesia may occur over a macular lesion or in the absence of demonstrable skin changes, in which case it may follow the distribution of one of the main sensory nerves or one of its branches. The loss of tactile and pain sense may also be found but this usually develops somewhat later and involves a smaller area.

Nerve enlargement is often a striking feature and is associated with signs of loss of function of the nerve with anesthesia and atrophic paralysis. A smooth or nodular enlargement of any of the peripheral nerves should always suggest leprosy as a cause. The nerves most commonly found enlarged have already been listed and are those most accessible to palpation.

Histologic changes are important in the presence of suggestive skin lesions, but they are not pathognomonic, except for the changes which occur in lepromatous lesions with the appearance of typical masses of large, round "foamy" cells, and cells packed with acid-fast bacilli. Leprosy is to be suspected if granulomatous changes, infiltration of round cells, and epithelioid cells with, perhaps, an occasional giant cell, are found in biopsy material from the granular border of a skin lesion.

The demonstration of acid-fast bacilli in skin lesions or in the nasal cavity is helpful but not conclusive. It has already been pointed out that the causative organism is absent from more than half of the actual cases of leprosy. Acid-fast bacilli are found in tuberculosis of the skin, but usually in smaller numbers than in lepromatous leprosy.

Occasionally, small numbers of M. leprae can be demonstrated from skin lesions of major tuberculoid leprosy, but there is also usually demonstrable anesthesia to differentiate it from tuberculous lesions. Tubercle bacilli may be found in the nasal passages in cases of pulmonary tuberculosis. There are many free-living saprophytic acid-fast organisms which might be found on the skin or in the nose. It is clear, then, that one must be very cautious in making a diagnosis of leprosy from the single finding of acid-fast bacilli.

The method of making nasal smears and skin scrapings is of some importance. The nasal cavity should first be inspected for the presence of any obvious lesions. The most favorable location for taking a specimen is the anterior portion of the septum, which may be the site of lepromatous changes. The surface should be cleaned gently with cotton swabs moistened with saline or other bland solution. Then the area should be scraped lightly to obtain actual tissue cells from the mucosa, using a small spoon curette or other instrument. It is advisable to use some local anesthetic.

Material from the skin for bacterioscopic examination can best be obtained in the following manner. A fold of the skin is pinched between the thumb and fingers and an incision is made a few millimeters long into the corium, using a sharp scalpel or razor blade. Care should be taken not to go too deep, to avoid drawing too much blood. The blade should then be turned and the sides of the incision scraped to obtain tissue cells and fluid. The material is smeared on slides, fixed, and stained in the usual way. Skin scrapings should be made from skin thickening or nodules, or from the edges of macular lesions.

The differential diagnosis of leprosy is often difficult, and the disease is frequently mistaken for some other condition. Perhaps the most common error is a mistaken diagnosis of syphilis, especially in advanced lepromatous cases in which serologic tests are frequently positive in the absence of syphilis. However the demonstration of acid-fast bacilli helps, and characteristic anesthesia of the lesions indicates neural leprosy. Skin tuberculosis ordinarily shows neither the great numbers of organisms nor the nodular type of lesions found in lepromatous leprosy, nor is the anesthesia of neural leprosy present.

Neural leprosy may simulate syringomyelia, and it is probable that many cases of "syringomyelia" are actually cases of leprosy. Many other conditions, such as Boeck's sarcoid, fungus infections, and erythema nodosum, to mention but a few, may cause confusion, but no attempt will be made here to present a detailed discussion of the subject.

TREATMENT

Almost all cases of leprosy will show improvement with no treatment except adequate diet, rest, and suitable exercise. There is little more that can be done except to deal with intercurrent infections and to treat symptoms and complications. Volumes have been written on the chemotherapy of leprosy, and nearly everything in and out of the pharmacopoeia has been used at some time. The heavy metals, various dyes, potassium iodide, diphtheria toxoid, fever therapy, and chaulmoogra oil or some of its derivatives have all been tried without any proved specific effect on the disease.

Chaulmoogra preparations have been widely used for many hundreds. if not thousands of years. Although there is a widespread belief among the medical profession that they are valuable specific remedies, many experienced students of leprosy disagree, and some believe that they may actually be harmful (*6*). Sulfonamides may be useful in treating the secondary infections which complicate ulcerative lesions. Vitamin B_1 gives symptomatic relief from the pain of neuritis. Surgical intervention is often necessary in advanced cases to remove necrotic bone, to promote healing of ulcers, and as tracheotomy in cases with laryngeal involvement.

Occupational therapy is an important part of treatment, especially in leprosaria, but unfortunately too little attention is given to it in most places. The majority of patients are reasonably able-bodied, they feel well, and they may be well except for a skin infection which is causing no incapacity. They need a productive occupation to keep bodily functions at the highest possible level of efficiency, and to ward off the despondency which months and years of idleness will produce.

PREVENTION AND CONTROL

Unfortunately, neither the manner of transfer of the causative organism nor the portal of entry into the new host is known. But it is accepted that leprosy results from contact with a leper or

with contaminated articles, and it follows that prevention of infection requires avoidance of such contact.

Personnel serving in areas where leprosy is prevalent should avoid, as far as possible, close association with natives. They should stay out of their homes, especially of those with skin lesions such as white patches, ulcers, or nodules. Sexual contact with native women also should be avoided, particularly prostitutes, for it is probable that leprosy can be transmitted during intercourse. Above all, such contact should be avoided if skin abnormalities are apparent. Personal hygiene and cleanliness are also doubtless important in prevention. Thorough and vigorous bathing with soap and water should be the rule when close contact with possibly infected persons has been necessary.

Control of leprosy is difficult. The objective, of course, is to prevent new infections and thus bring about a continuing decline in prevalence. In theory this should be easy, for it should entail only the separation of the sick from the well. But in practice the results of segregation have been disappointing and there is no indisputable proof that such measures in themselves have resulted in a decline in prevalence.

In the Philippines, where compulsory isolation of lepers was started in about 1906, the incidence had apparently declined but little by 1940, although cases were undoubtedly being detected earlier. In Hawaii, segregation measures were adopted before 1900, and although there was apparently a gradual decrease in incidence, there were still about two cases per thousand population in 1938. In Norway, there was a striking and marked decrease in leprosy from a very high level in 1850 to only a few cases for the entire country in 1940. Some attribute the decline to compulsory segregation which was started soon after the middle of the century, but the number of cases had begun to decrease before isolation was adopted, and many believe that other factors were responsible, chiefly the improvement of hygienic standards.

Segregation, however, has probably never been complete enough to constitute a fair trial. Measures adopted were generally so severe, until the past two decades, that many lepers were driven into hiding and continued to spread their infection. It was customary in the early days of segregation to gather all cases, neural as well as lepromatous, and herd them together in some remote, isolated spot where they abandoned all hope of ever being liberated or of seeing family and friends again. Infectious cases, those with lepromatous lesions, were probably not detected and isolated early enough to prevent them from being the source of numerous secondary cases.

With the development of more humane and liberal policies and case-finding surveys, it is believed that segregation is becoming effective in control. Only those with lepromatous lesions need be isolated. Regional leprosaria are being developed in many places where patients can be kept near their homes and where visits of friends and families are permitted. Parole after a period of negative bacterioscopic tests is now commonplace; in many places home isolation is encouraged when economic and social factors in the patient's environment are suitable. These regulations are doubtless more effective, and the attitude toward the disease is changing slowly, and leprosy is coming to be regarded as an unfortunate infection from which recovery may be expected.

SUMMARY

1. Leprosy is a world problem and the disease is prevalent in most of the tropics and subtropics.

2. Exposure of many of our military personnel is inevitable, and will result in the manifestation of cases of leprosy during the next 20 years.

3. There are two clinical types of leprosy, the lepromatous, or nodular, and the neural, or maculo-anesthetic. Acid-fast bacilli, M. leprae, are consistently present in lesions of the first type, but are usually absent from lesions of the second type.

4. There is no treatment which has been proved specifically curative, but spontaneous improvement and recovery occur.

5. Control must depend upon efforts to raise the sanitary and economic level and on humane rules for early segregation of lepromatous cases.

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INTESTINAL PARASITIC INFECTIONS

IN A NAVAL HOSPITAL IN NEW ZEALAND*

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The series of examinations on which this report is based was made upon approximately equal numbers of Navy and Marine Corps personnel, and a few Army patients, admitted to a Naval Mobile Hospital in New Zealand. The patients were from all parts of the South Pacific area, with widely varying conditions of exposure to parasitic infection, and it was felt that they would provide a valuable index to the degree of parasitism to be expected in personnel in this area.

Less than 20 percent of the patients examined were admitted with gastro-intestinal complaints, and only a small percentage of these with an established diagnosis of intestinal parasitic infection. The rest of those examined comprise a fairly random sampling of the admissions to this hospital, and with few exceptions the stool examinations were ordered routinely, without reference to the condition of the patient.

The direct centrifugal flotation method of Faust (*1*), using zinc sulfate at a specific gravity of 1.18, was employed for the demonstration of ova and protozoan cysts, and in our experience proved greatly superior to any other concentration method. The concentrate was stained with an iodine-potassium iodide mixture prepared according to the rather exacting directions of D'Antoni (*2*); this was found to give a more precise stain than Lugol's, Gram's, or other iodine-potassium iodide solutions. Iron hematoxylin stained fecal films were also made from each feces, using the short staining method given in the Laboratory Guide to Medical Protozoology and Helminthology of the National Naval Medical Center. Cedarwood oil was used as a temporary mounting medium for these slides, so that they could be examined immediately. (This can be removed with xylol from any slides which one desires to retain, and permanent mounts may then be made with the conventional mounting media.)

Wet smears were not employed routinely, but were made on all

* With the technical assistance of Chief Pharmacist's Mate, Marshall R. Wheeler, U.S.N.R.

mushy and liquid stools. Two drops of normal saline were placed one inch apart on a slide, and bits of feces thoroughly mixed with each. To one, a drop of D'Antoni's iodine was added, and coverslips were placed on both. The iodine-stained smear was searched for amebic cysts, and the unstained one for trophic amebae and flagellates. The wet smear was not used more extensively for several reasons. Its main value, when a concentrate is also made, lies in the demonstration of trophic amebae and of flagellates. These occur primarily in stools which contain a high percentage of water, and on such wet smears should be made. Both trophic amebae and cysts, moreover, are more readily identified in the iron hematoxylin stained smear than in the wet preparation, under the conditions which usually obtain in a clinical laboratory.

This series comprises a total of 2,388 stool examinations on 1,371 patients, an average of 1.7 examinations per patient. Intestinal parasites were found in 375, or 28 percent, of these patients. That a single fecal examination often does not reveal the entire parasitic fauna of the patient has long been known. Sawitz and Faust (*3*) have found that the zinc-sulfate technic, combined with iron hematoxylin stained smears, will demonstrate an average of 36 percent of cases of Entamoeba histolytica infection in a single examination; 59 percent with two examinations; and up to 93 percent of infections when six examinations are employed. On this basis approximately 52 percent of E. histolytica infections actually present should have been demonstrated by an average of 1.7 examinations per patient. For the nonpathogenic intestinal amebae the same authors were able to demonstrate 48 percent of infections with one examination; 70 percent with two examinations; 85 percent with three examinations, etc. In the present series approximately 65 percent of the nonpathogenic amebae should have been found. Faust (*4*) states that all cases

Parasite	Demonstrated percent infection	Theoretical percent infection
Hookworm	8.46	
Strongyloides stercoralis	1.38	
Ascaris lumbricoides	0.37	
Trichuris trichiura	2.12	
Enterobius vermicularis	0.07	
Hymenolepis nana	0.07	
Taenia saginata	0.07	
Isospora hominis	0.37	
Giardia lamblia	1.96	
Entamoeba histolytica	8.09	15.6
Entamoeba coli	13.66	21.0
Endolimax nana	22.15	34.0
Iodamoeba williamsi (bütschlii)	3.79	5.8
Dientamoeba fragilis	1.61	2.5
Chilomastix mesnili	0.32	
Enteromonas hominis	0.16	
Trichomonas hominis	0.40	

of hookworm infection in which the adult worms are already established in the intestine, all trichuris infections, and all ascaris infections (except the less than 5 percent of cases of the latter disease in which only male worms are present) should be demonstrated in a single zinc sulfate concentration.

The table on the preceding page gives in the second column the percentage of infection found in this series, and in the third column an estimate of the percentage of patients actually infected with the various amebae, derived from the figures cited previously.

The work which has been done on intestinal parasite infections in the United States, while voluminous, has generally been limited to certain small sections of the population. One of the most representative surveys to date is that of Boeck and Stiles (*5*), who did an average of 1.6 examinations each on a total of 8,029 persons, with the following findings:

Parasite	Demonstrated percent infection	Parasite	Demonstrated percent infection
Hookworm	3.9	Giardia lamblia	6.5
Strongyloides stercoralis	0.1	Entamoeba histolytica	4.1
Ascaris lumbricoides	1.1	Entamoeba coli	19.6
Trichuris trichiura	2.1	Endolimax nana	13.2
Enterobius vermicularis	0.8	Iodamoeba williamsi	5.0
Hymenolepis nana	0.5	Chilomastix mesnili	3.1

A comparison of these two tables shows that the incidence of hookworm and amebiasis in the present series is approximately double that which was found by Boeck and Stiles, and it seems highly probable that a large number of these infections were acquired in the South Pacific area. Hookworm infections were found commonly in men from the northern states, who had had no residence in endemic hookworm areas prior to going overseas.

Isospora hominis, a sporozoan parasite which has been reported in some 200 cases from man, was found five times in this series. The pathogenicity of this parasite has been the subject of considerable debate (*6*), with the available evidence pointing to its being limited, as in the case of giardia. It is also possible that isospora is normally a parasite of some lower animal, and its appearance in man is accidental and therefore usually transitory. Of the five cases which we encountered, four showed no recognizable effects of the parasitism. The fifth had, upon admission, a dysentery of over a month's duration, which in spite of repeated stool examinations and cultures, and a thorough series of laboratory tests, could not be attributed to any other factor. This patient was transferred and his subsequent history is not known.

The scarcity of Giardia lamblia infections in this series would

be quite surprising were it not for the fact that most of the patients admitted to the hospital had been in malarious areas, in which they were on atabrin suppressive treatment. Atabrin, it is now known (*7*), is the therapeutic agent of choice for giardiasis. All cases of giardiasis in this hospital were treated with atabrin (grains 1½, three times daily for five days) and all had negative stools upon repeated examination, after a single course of treatment.

It is very probable that additional cases of pinworm (Enterobius vermicularis) infection would have been recognized if cellophane swabs of the anal region had been taken routinely. However it was felt that the probable incidence of this parasite among men of the age group encountered in the service was too low to justify this procedure. Strongyloidiasis was for the most part diagnosed from the iron hematoxylin stained fecal films, in which the larvae are well stained and easily recognizable under the low power of the microscope. The progress of treatment was followed by Baermann concentrates (*1*) of the feces.

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MAN-DAYS LOST FROM COLDS

The common cold is responsible for more than one-third the total number of days lost in American industry. It causes a productive time loss of 100 million working days each year with an annual cost of one-half to two billion dollars.—Drafts do cause colds. Science News Letter 46: 262, October 21, 1944.

PSYCHOGENIC "MALARIA"

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In a recent article in the BULLETIN Simpson and Sagebiel[2] pointed out that some cases have been encountered at a hospital near the combat area in which a psychosis or psychoneurosis seemed intimately related to an attack of malaria. Several similar incidences in patients originally suspected of having malarial chills have been observed by the author, which on subsequent investigation proved to be anxiety attacks. In each instance benign tertian malaria had been contracted in the South Pacific, and in each case the malaria had run a refractory course with numerous remissions and recurrences. The patients were psychologically attuned to frequent true malarial chills. Curiously enough, the psychologic structure of each person seemed to be nearly identical, both regarding the clinical picture and the personality structure prior to enlistment. The psychodynamics of these cases can be indicated by describing a composite clinical history.

A young Marine enters the hospital confidently telling the medical officer that he has malaria and that he has had a chill. Shortly after admission he has another "chill" which bears a strikingly close resemblance to a malarial episode except that he has no elevation of temperature. He may have a coarse shaking which visibly rocks the bed, chattering teeth, and he may complain of severe generalized malaise, or he may have a fine, rapid instability of tense muscles peculiar to anxiety attacks. The pulse and respirations are rapid, but his perspiration is not as profuse as anticipated. Repeated examinations of the peripheral blood reveal no plasmodia.

On assuring the patient that he is not suffering from malaria, surprising results are encountered. He is not at all thankful for the news that he is in good physical condition. He is merely resentful that no treatment is instituted for his alleged malaria. Attempts to explain to him that it is possible to continue to have the symptoms of a disease when the disease itself no longer exists are met with frank hostility. That is, he presents a type of defense met only in persons whose symptomatology serves a useful psychologic purpose.

During the remainder of his hospital stay a psychologic investigation is maintained, and though he may have only one more "chill" his pathologic

[1] Indebtedness is acknowledged to the chief of the medical service of this hospital, Lieutenant Commander Harold L. Rakov (MC) U.S.N.R., who referred these cases to the psychiatric service and who offered valuable editorial comment.

[2] SIMPSON, W. M., and SAGEBIEL, J. L.: Cerebral malaria; report of 12 cases encountered at U. S. Naval Base Hospital——. U. S. Nav. M. Bull. 41: 1596-1602, November 1943.

personality structure becomes more obvious as he gives up his somatic complaints. These complaints nearly always include one or more of the symptoms encountered in anxiety neurosis, such as headache, dizziness but not true vertigo, tinnitus, blurring of vision, dry mouth, excessive thirst, tightness in the throat, tightness in the chest, palpitation, tachycardia, excessive perspiration, tremor, nausea, frequency of urination, borborygmus, diarrhea or constipation, and apprehension without adequate cause. An entry in his health record is usually found stating that previous treatment of his malaria did not alleviate the symptoms which had been ascribed either to the malaria itself or to one of the drugs employed.

The psychologic history is one of psychopathic behavior from early youth, involving a broken or unstable home environment, hostility to the father with openly expressed resentment of his authority, and severe and frequent temper tantrums which have resulted in his running away from home more than once.

Various other neurotic traits may have been present, but his history of difficulty with his teachers, his superiors at work, and often with the police, leaves one with the unmistakable impression that his outstanding conflict in life, at a superficial level, has centered around his own inability to control his aggressive tendencies even before the intense accentuation of this conflict brought about by fighting and military discipline.

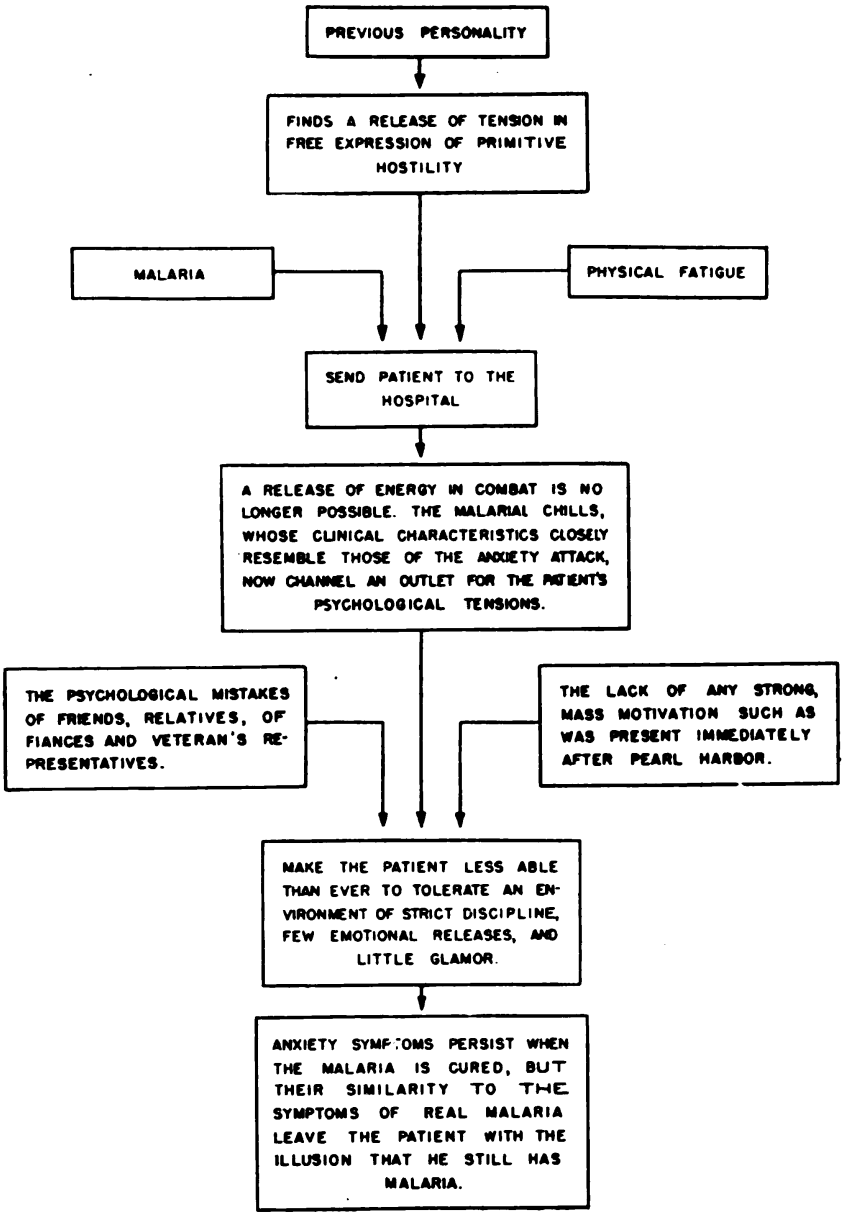
Everyone of these patients had joined the Marines because they believed that this branch of the service offered the best chance of active combat duty. Many of them had enlisted in a hurried fit of rage at the Japanese shortly after Pearl Harbor, and each of them left the implication that they had derived satisfaction from the legalized release of murderous impulses that occurred during their combat experiences. They were unanimously disgruntled with the prospects of doing guard duty in a navy yard, and particularly dissatisfied with having to conform to a rigid type of discipline. This latter they had been allowed to forego under the rough and ready conditions of South Pacific warfare and during the time in the hospital and on convalescent leave.

On returning home many of them had plunged hastily into an unwise love relationship. Their discussions of plans for settling down on a farm with their loved one had a hollow and almost sadistic note and a sexually overdirect content which created strong doubts in the examiner's mind as to the possibility of their making a satisfactory adjustment to the less directly sexual aspects of married life.

That hostility and resentment of regimentation occupied a prominent place in their spontaneous stream of thought is interestingly attested in the story that each told of their experiences on Guadalcanal. The telling of this was accompanied by marked physical and psychologic signs of emotion. In other interviews, such emotion was only encountered in connection with the topic of discipline. They gave further expression to their disdain of group standards by wearing unkempt uniforms and adopting a generally surly attitude.

On admission these men did not present a true syndrome of combat fatigue. Their battle experiences were related without attendant somatic signs of anxiety. When battle dreams were reported they were infrequent and not considered particularly disturbing by the patient. The startle response was not elicited.

A schematic representation of psychology of these cases might be expressed as in the accompanying diagram.



Raines and Kolb[3] have pointed out that the well-meaning but misguided behavior of friends and relatives often has a deleterious effect on psychiatric patients who have had combat experience. No other factor seems to explain adequately the apparently complete lack of guilt-feelings, or the quiet self-righteousness that these patients evinced when saying that they felt that they had done their share in this war and that they wanted to be out of the service. It is also true that these patients were seen at a time when the current mass psychology regarding the war centered around such facetiousness as "The war is all over but the fighting."

[3] RAINES, G. N., and KOLB, L. C.: Combat fatigue and war neurosis. U. S. Nav. M. Bull. 41: 923-936, July; 1299-1309, September 1943.

Another factor was their prolonged hospitalization, a well known cause of difficulty in returning patients to duty. This seems to create a vicious circle. The malaria obscured the psychiatric instability of these patients so that they did not receive psychotherapy at the optimum time, and also it is possible that their nervous tension contributed to the poor response to treatment directed at the malaria.

With a sufficiently slow and tactful approach, sedulously avoiding any implication that conscious factors are at work, and always being alert to the patient's tendency to involve directly the medical officer in his conflicting feelings, these patients can be made to accept the psychogenic nature of their symptoms. The "chills" as such, then disappear. There remains a personality that has difficulty adjusting to the social restraints of civilian life, one which suffered the trauma of combat experiences, and one which has no conscious desire to make further sacrifices for the war effort.

The patient who showed the worst response to psychotherapy was the one who had been least exposed to actually traumatic experiences. This, and other observations, lead to the conclusion that the ultimate prognosis depends more on the severity of the personality defect prior to exposure to battle, than on the severity of the combat experience.

Too few patients have been seen to permit any dogmatic conclusions about their disposition as a group. Two were discharged from the service because of their previously psychopathic history; it is expected that another will also be discharged, the return of two patients to duty is contemplated, and the fate of another is still in doubt.

SUMMARY

1. A psychosomatic syndrome, characterized by the illusion of having malaria, and apparently a result of South Pacific warfare, is described.

2. The psychogenesis of several cases is discussed.

3. The prognosis of these patients seems to depend more on their previous personality organization than on the actual severity of their combat experiences.

4. They have been difficult to work with psychotherapeutically, mainly because the psychogenic factors were so effectively concealed behind the diagnosis of malaria at the time when psychotherapy would have been most effective.

STUDY OF 1,063 NAVAL OFFENDERS

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This study consists of an attempt to evaluate, from a psychologic and psychiatric standpoint, a series of factors which might be associated with the production of the behavior leading to incarceration in a Naval brig. One thousand sixty-three consecutive, unselected, court-martial admissions to a Naval disciplinary barracks were analyzed. The reasons for confinement are listed in table 1. From this table it becomes evident immediately that the problem is almost entirely one of absence over leave, and absence without leave, since 94 percent of the total admissions were for these reasons. The emphasis in this survey, therefore, has been placed on these two principal offenses. The following factors were analyzed:

1. Causes for admission.
2. Length of time A.O.L., A.W.O.L.
3. Previous Naval offenses.
4. Previous civil offenses.
5. Surface reasons for offenses.
6. Education and intelligence.
7. Age of offenders.
8. Marital status.
9. Racial distribution.
10. Nativity of parents.
11. Psychiatric findings.
12. Length of service prior to first offense.
13. School delinquencies.

The seriousness of unauthorized absences from the Navy from the standpoint of manpower is indicated in table 2, which shows the length of time lost to the service. The total time that the 1,000 men under consideration were absent is 32,833 days. The 758 who were absent over leave were away for 25,278 days, and the 242 absent without leave stayed away for a total of 8,555 days. The average length of time for the total group was 33.83 days; for the absent-over-leave cases 33.09 days; and for the absent-without-leave cases 36.25 days.

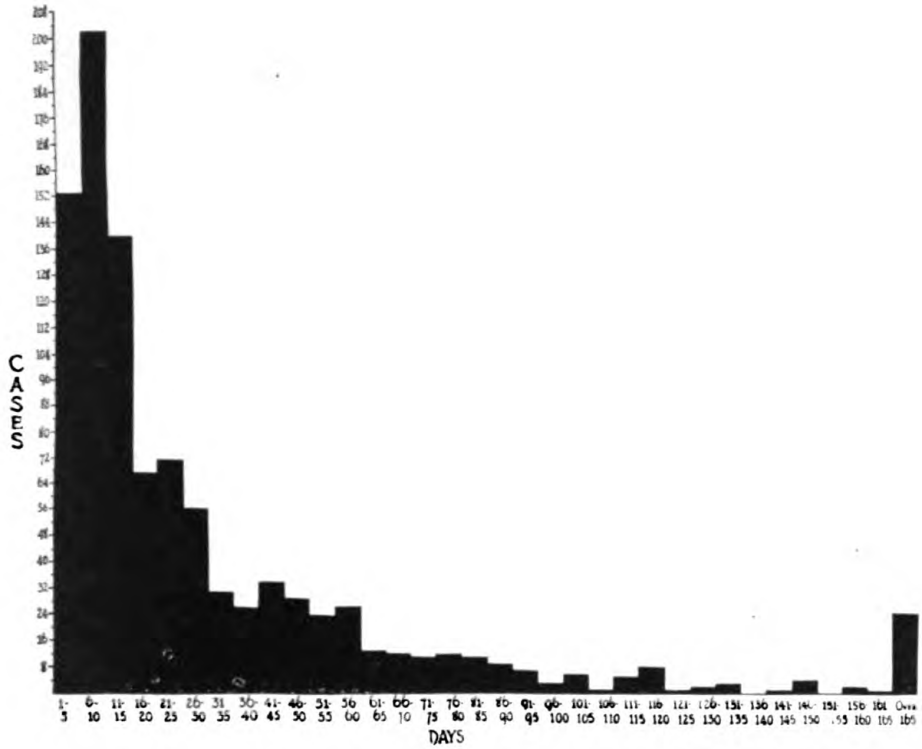
TABLE 1.—*Reasons for admission*

Reason	Number of cases	Reason	Number of cases
Absence over leave	758	Bringing liquor aboard ship	2
Absence without leave	242	Taking a prisoner on liberty	2
Accidental shooting	8	Refusing to work	1
Possession of another man's property	7	Investigation	1
Shirking duty	6	Stealing automobile	1
Theft of government property	5	Material witness—manslaughter	1
Forging and selling liberty cards	4	Held for action of civil authorities	1
Disobedience of orders	4	Scandalous conduct	1
Defrauding Government	3	Violation of censorship regulations	1
Breaking arrest	3	Asleep on watch	1
Insolence to officer	3	Assault of petty officer	1
Tampering with U. S. mails	2	Sodomy	1
Leaving post without being relieved	2		
Drunk and disorderly	2	Total	1,063

TABLE 2.—*Length of time A.O.L. and A.W.O.L.*

Number of days	A.O.L.	A.W.O.L.	Total
1–5	105	48	153
6–10	169	33	202
11–15	109	31	140
16–20	56	12	68
21–25	54	18	72
26–30	39	18	57
31–35	21	10	31
36–40	21	5	26
41–45	29	5	34
46–50	22	7	29
51–55	16	8	24
56–60	13	14	27
61–65	10	3	13
66–70	8	4	12
71–75	10	1	11
76–80	11	1	12
81–85	7	4	11
86–90	6	3	9
91–95	5	2	7
96–100	2	1	3
101–105	3	3	6
106–110	1	0	1
111–115	5	0	5
116–120	7	1	8
121–125	1	0	1
126–130	2	0	2
131–135	3	0	3
136–140	0	0	0
141–145	1	0	1
146–150	3	1	4
151–155	0	0	0
156–160	0	2	2
161–165	0	1	1
166 and over	19	6	25
Total	758	242	1,000

These averages are not a true indication of the central tendency of the groups, however, because they are skewed by the few who stayed away for one or more years. Thus a better idea of the "average" length of time is expressed by the medians; these are 16.23 days for the total group; 15.93 days for the A.O.L. group, and 23.20 for the A.W.O.L. group. These 32,833 days lost to the service are exclusive of the time lost after the apprehension or return of these men. If the length of time that these men were

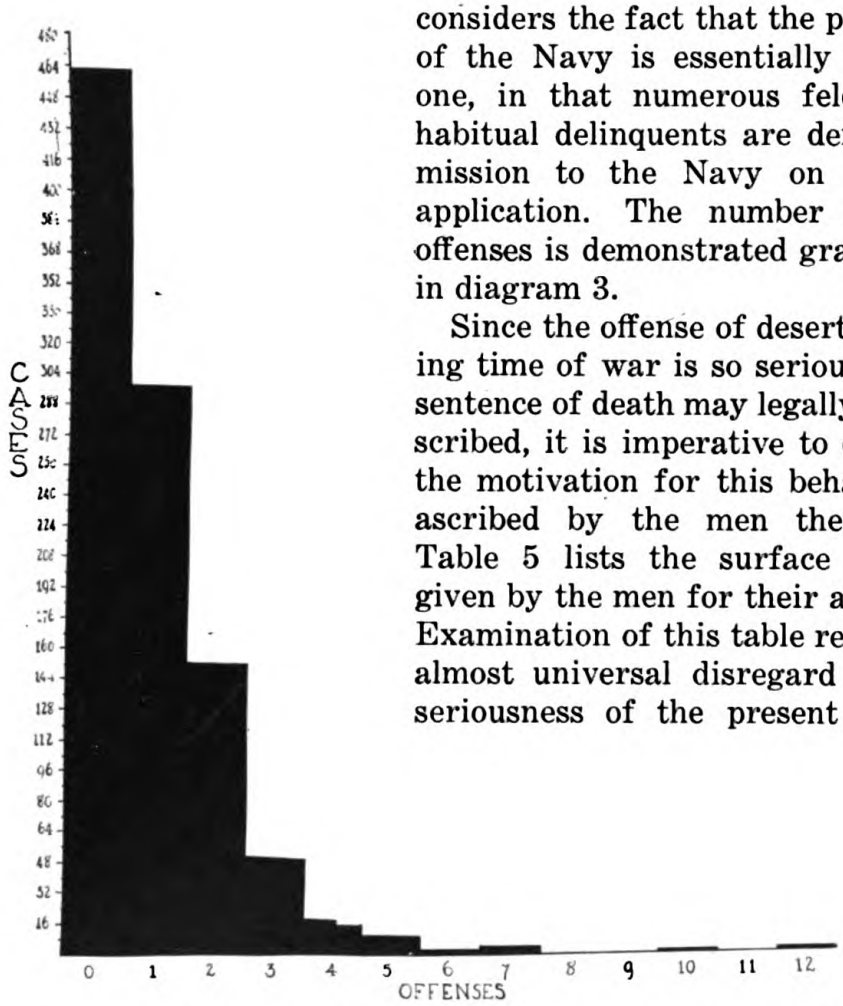


Graph 1.—Length of time A.O.L. or A.W.O.L.

kept from their duties awaiting trial, awaiting sentence, and serving sentence, is added, the totals become truly staggering. When it is further considered that these thousand cases represent approximately 3 months' admission to only one brig, the problem of lost manpower in the Navy approaches a critical point. Graph 1 shows graphically, the number of days lost by the 1,000 men under consideration.

A further feature of the seriousness of this problem is presented in table 3 and graph 2, which show the distribution of Naval courts-martial prior to the immediate offense for the group studied. It shows that 53.8 percent of the group are repeaters, many of them after a period at duty of less than a week. One of the repeaters in this group had had 12 previous courts-martial. This figure must be viewed in the light of the following consideration. From analysis of table 3 it can be assumed that the proportion of repeaters in the Navy will increase as time goes by, since the number of recruits is steadily decreasing proportionately.

Table 4 indicates that 16.7 percent of this group of offenders had come in conflict with civil authorities prior to their entering the Navy. Since the group is essentially a young one, the fact that over 16 percent have already been in trouble in civil life appears to be heavily weighted. This becomes even more evident when one



Graph 2.—Previous Naval offenses—exclusive of captain's mast.

considers the fact that the personnel of the Navy is essentially a select one, in that numerous felons and habitual delinquents are denied admission to the Navy on original application. The number of civil offenses is demonstrated graphically in diagram 3.

Since the offense of desertion during time of war is so serious that a sentence of death may legally be prescribed, it is imperative to examine the motivation for this behavior as ascribed by the men themselves. Table 5 lists the surface reasons given by the men for their absences. Examination of this table reveals an almost universal disregard for the seriousness of the present conflict and a hedonistic, egocentric, and, at times, neurotic attitude on the part of these offenders.

By way of illustration, the greater number of men admitted, upon questioning, that the pressing need to see their families was satisfied in one or two of the fifteen or twenty days A.O.L., the balance of the time being spent in "doing the town." Again, many men who found Naval medical attention "inadequate" for their ailments, did not bother to consult a civilian physician in all the time that they were out, or even during their civilian status prior to entering the Navy. The psychologic basis for the type of rationalizations presented by these men has been described elsewhere[1].

Since it might be assumed that the reason for these delinquencies is largely due to lack of education and intelligence, a record

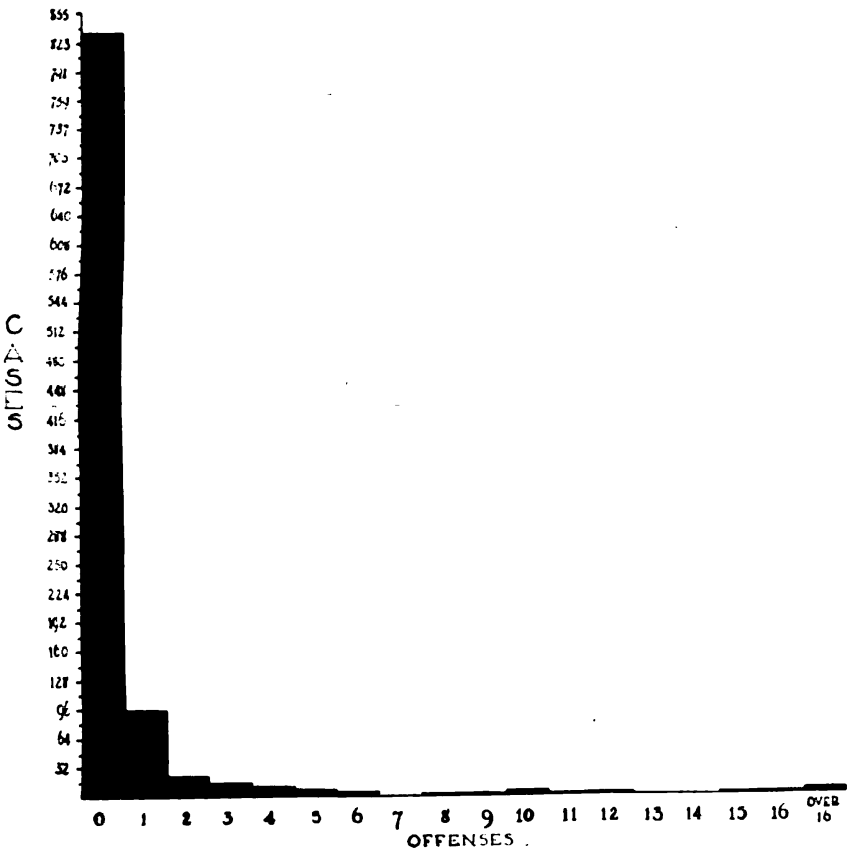
[1] BROMBERG, W.; APUZZO, A. A.; and LOCKE, B.: Study of motivations for desertions and over leaves in the Navy. Read at the Centennial Meeting, American Psychiatric Association, Philadelphia, May 15, 1944.

TABLE 3.—*Distribution of previous Naval offenses exclusive of captain's mast.*

Number of offenses	Number of cases	Number of offenses	Number of cases
0	462	8	0
1	299	9	0
2	152	10	1
3	51	11	0
4	18	12	1
5	10		
6	2	78	1,000
7	4		

TABLE 4.—*Distribution of civil offenses prior to entering Navy*

Number of offenses	Number of cases	Number of offenses	Number of cases
0	833	10	4
1	95	11	1
2	23	12	1
3	15	15	1
4	10	16	1
5	7	25	1
6	4	31	1
7	0	50	1
8	1		
9	1	215	1,000



Graph 3.—Distribution of civil offenses prior to entering Navy.

TABLE 5.—*Stated reasons for going A.O.L. or A.W.O.L.*

Illness:	
1. Became ill while on authorized leave or liberty	20
2. To obtain medical attention (Naval care inadequate)	22
3. Chronic seasickness	27
4. Repeated headaches	20
5. Other illness or disability which interfered with duties	9
6. Nervousness (including fear of sea, gunfire, etc.)	44
7. Homosexual	4
8. Drug addict	2
9. Illness, including death, of parents and siblings	71
10. Illness of wife (including pregnancy)	39
11. Illness of children	7
Total	265
Don't like:	
1. The Navy	26
2. The ship	40
3. Officers on the ship	25
4. Shipmates	10
5. Present duty:	
a. Sea duty	26
b. Shore duty	24
c. Mess attendant	4
d. Armed Guard	2
e. Amphibious	2
f. Engine room	1
Total	160
Went home:	
1. Homesick	45
2. To see:	
a. Parents	26
b. Wife and children	35
c. Siblings	9
d. "Girl friend"	6
e. Friend	2
f. Grandparents	1
3. To be home for holidays	6
Total	130
Leave:	
1. No leave grahted	39
2. Inadequate leave granted	14
Total	53
Drunk	77
Resented restriction (wanted to be free)	35
Felt like staying over (to have a good time)	32
Family trouble:	
1. Personal domestic difficulties	20
2. Parental domestic difficulties	11
Total	31
Marriage:	
1. To be engaged	1
2. To be married	22
3. To marry girl he had impregnated	6
Total	29

"Was late, so I took more time"	24
Would like:	
1. To be transferred	3
2. Overseas duty	3
3. Submarine duty	3
4. Promotion	3
5. Aviation duty	2
6. Amphibious duty	2
7. East coast duty	2
8. More action	2
9. Armed Guard duty	1
Total	21
Needed at home (financial, help on farm, etc.)	15
Wasn't drawing any pay (because of fines for previous offenses)	9
"Got disgusted"	9
Stayed home at mother's request (under age)	6
"Got a crazy spell (my head tells me to do things)"	6
Stayed with a woman	6
Missed train	5
Couldn't find ship	5
"Believed I was on authorized leave or liberty"	3
"They were trying to frame me"	2
To oblige another man who was going A.W.O.L.	2
"Can't keep away from girls"	1
Girl friend pregnant—wanted to find responsible party	1
"To go home and beat a guy up"	1
"Sea bag stolen and I got mad"	1
Total	72

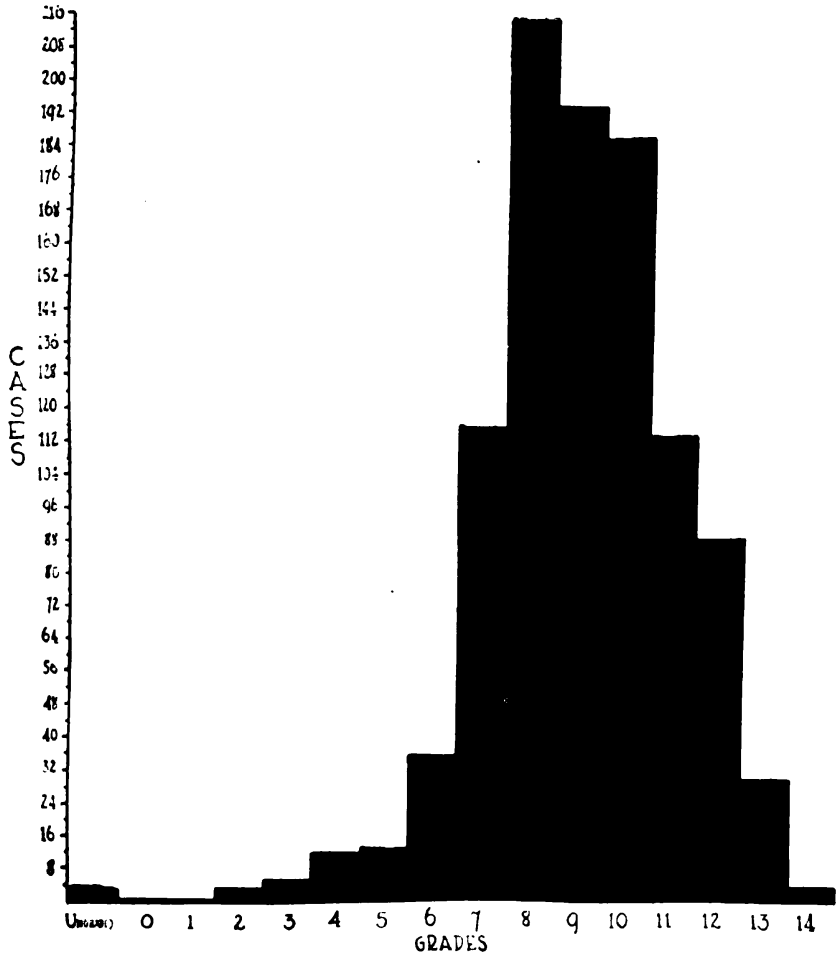
was kept of the replies to the question "What is the highest grade which you completed in school?" These are presented in table 6 and graph 4. The average amount of schooling completed for the entire group is 9.3 grades. Thirty-four of the men had had some college training and 719 had gone beyond grade school. When this is compared with the norms for the general population and with

TABLE 6.—*School grades completed*

Grade	Number of cases	Grade	Number of cases
Ungraded	3	8	216
0	1	9	195
1	1	10	187
2	4	11	114
3	6	12	89
4	12	13	30
5	13	14	4
6	36		
7	116	Total	1,000

those obtained by Locke[2] of 14,812 civil reformatory and prison inmates one finds that the Naval prisoners are slightly better educated than the civil prison group and the general population.

[2] LOCKE, B.: Various factors in a penal population: J. Crim. Law & Criminol. 33: 316-320, November-December 1942.

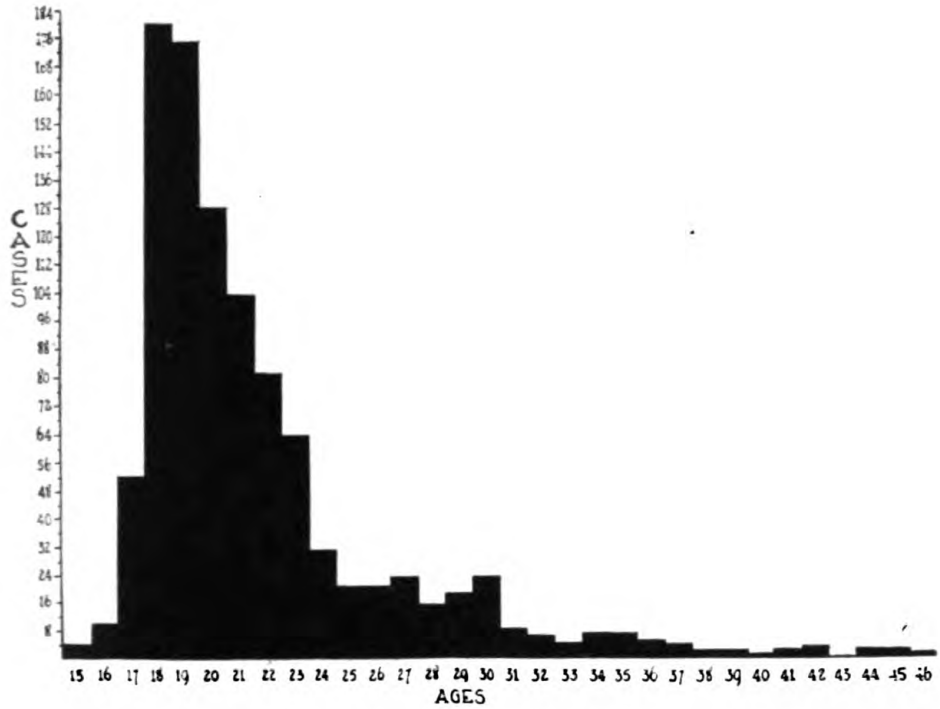


Graph 4.—Academic grades completed.

Since it has been accepted that intelligence and education are closely correlated, it may be assumed that the Naval prisoners under discussion compare favorably in intelligence with the general population from which they come. Table 11 indicates that only 19 individuals were of borderline or deficient intelligence following examination, confirming the conclusion that this group has not become delinquent because of insufficient intellectual endowment.

Table 7 and graph 5 show the distribution of ages of these offenders. The mean age is 21.55 years and the median is 19.64 years. Since 50 percent of the group is roughly 20 or more years old, it would be difficult to ascribe the high incidence of unauthorized absences to "boyish" irresponsibility.

Table 8 indicates marital status. The majority, 70.4 percent, are unmarried; 27.9 percent are married; and 1.7 percent divorced, separated, or have had their marriages annulled.



Graph 5.—Distribution of ages.

TABLE 7.—*Distribution of ages*

Age	Number of cases	Age	Number of cases
15	4	31	8
16	10	32	6
17	52	33	4
18	180	34	7
19	175	35	7
20	126	36	5
21	103	37	4
22	81	38	2
23	63	39	2
24	31	40	1
25	20	41	2
26	20	42	3
27	23	43	0
28	15	44	2
29	18	45	2
30	23	46	1
		Total	1,000

TABLE 8.—*Marital status*

Single	704
Married	279
Divorced, separated, or annulled	17
Total	1,000

Table 9 gives the racial distribution found in this group and table 10 the country of origin of each of the immediate parents of these prisoners. Table 9 appears to indicate that the number of

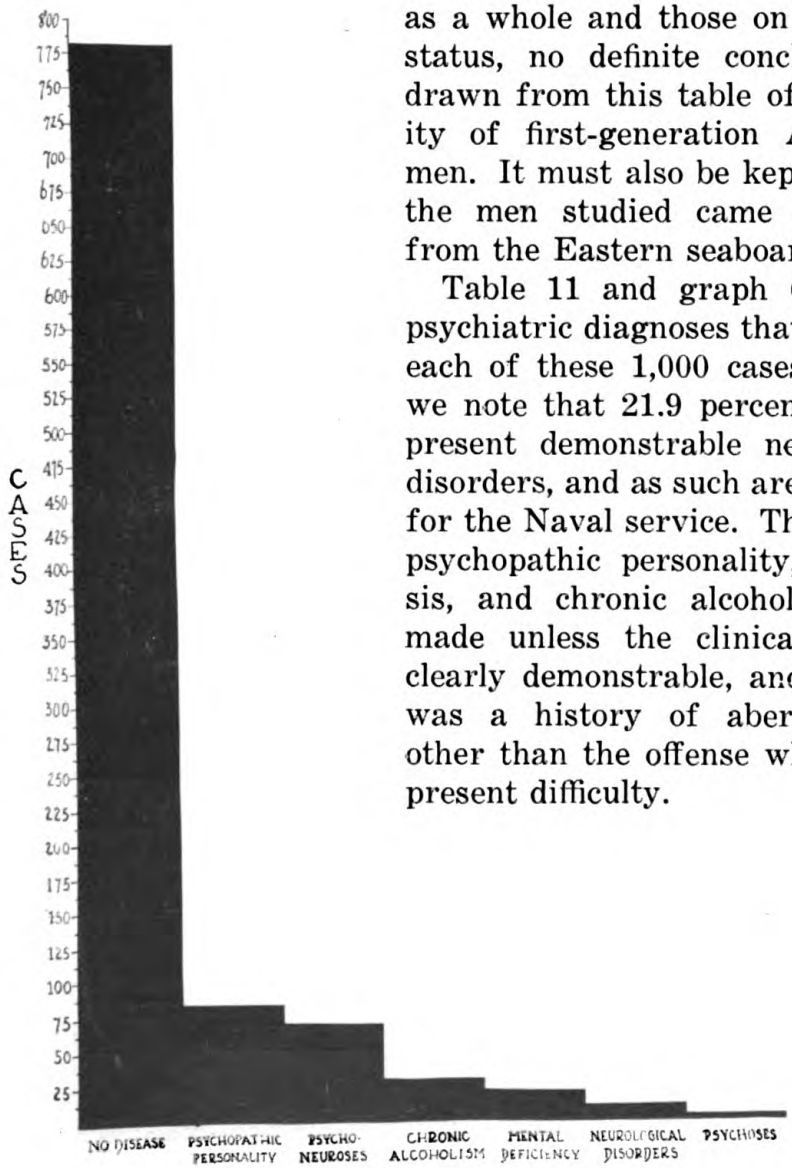
TABLE 9.—*Racial distribution*

White	918
Negro	79
Red (American Indians)	2
Yellow (Chinese)	1
Total	1,000

Negro offenders is proportionately far beyond that which would be expected from their actual number in the Naval service.

The findings in table 10 must be viewed in the light of the proportion of seamen in the Navy, born of foreign-born parents. Without a comparison of the nativity backgrounds in personnel in the Navy as a whole and those on a disciplinary status, no definite conclusion can be drawn from this table of parent nativity of first-generation American seamen. It must also be kept in mind that the men studied came predominantly from the Eastern seaboard.

Table 11 and graph 6 indicate the psychiatric diagnoses that were made in each of these 1,000 cases. From these we note that 21.9 percent of the cases present demonstrable neuropsychiatric disorders, and as such are poor material for the Naval service. The diagnoses of psychopathic personality, psychoneurosis, and chronic alcoholism were not made unless the clinical picture was clearly demonstrable, and, unless there was a history of aberrant behavior other than the offense which led to the present difficulty.

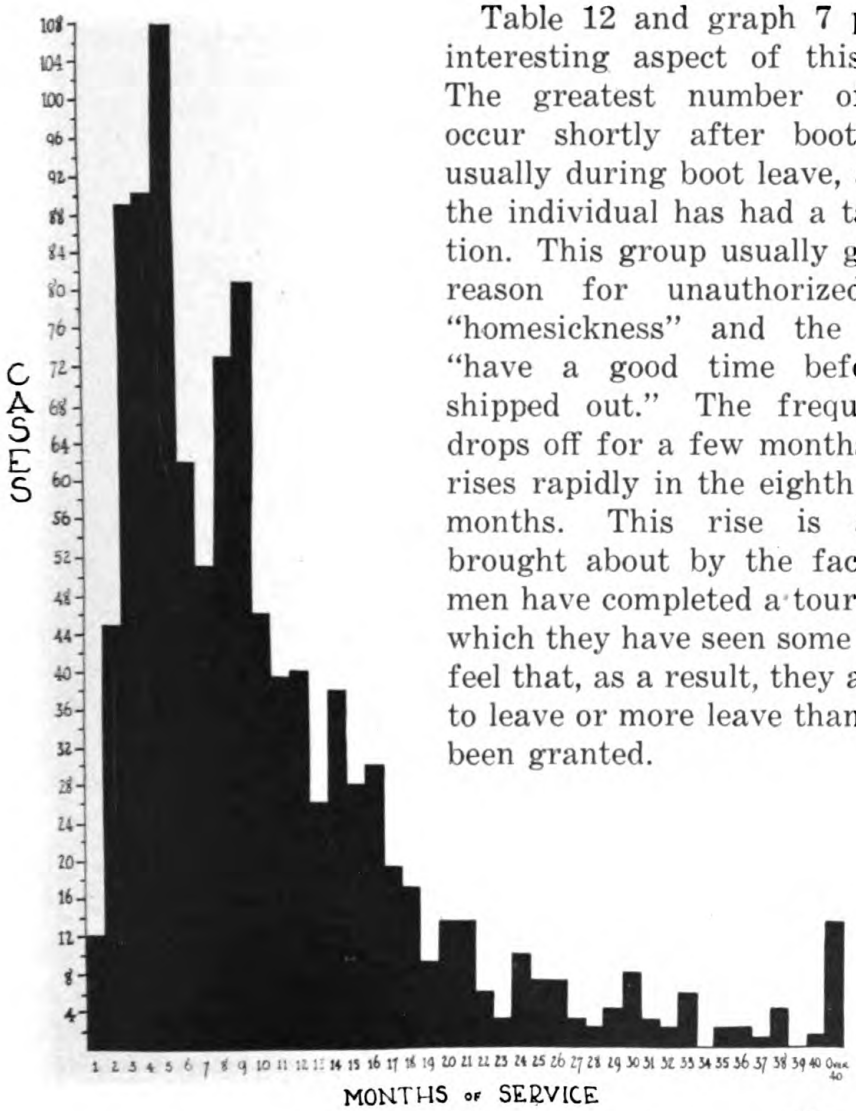


Graph 6.—Psychiatric findings.

TABLE 10.—*Country of origin of parents*

United States	1,350	Norway	7
Italy	176	Hungary	6
Ireland	100	Mexico	5
Poland	66	Sweden	4
Germany	49	Syria	4
Canada	39	British West Indies	4
England	33	Finland	3
Austria	23	Cuba	2
Holland	16	Nova Scotia	2
Czechoslovakia	13	Brazil	2
Scotland	12	Denmark	2
France	11	Armenia	2
Spain	10	Romania	2
Greece	10	Philippine Islands	1
Puerto Rico	10	Turkey	1
Lithuania	9	Newfoundland	1
Portugal	9	Guatemala	1
Russia	8		
Yugoslavia	7	Total	2,000

Table 12 and graph 7 present an interesting aspect of this problem. The greatest number of offenses occur shortly after boot training, usually during boot leave, and before the individual has had a taste of action. This group usually gives as its reason for unauthorized absence "homesickness" and the desire to "have a good time before I get shipped out." The frequency then drops off for a few months and then rises rapidly in the eighth and ninth months. This rise is apparently brought about by the fact that the men have completed a tour of duty in which they have seen some action and feel that, as a result, they are entitled to leave or more leave than they have been granted.



Graph 7.—Length of Naval service prior to first court martial.

Table 13 throws an interesting light on this group. Thirty-two percent of these men admitted to truancy while in school; 6.4 percent had been expelled from school one or more times; 2.2 percent had been suspended at least once, and 1.4 percent had spent some

TABLE 11.—*Psychiatric diagnoses*

Diagnosis	Cases
No disease	781
Psychopathic personality	82
Psychoneuroses	72
Chronic alcoholism	29
Mental deficiency	19
Neurologic disorders	12
Psychoses	5
Total	1,000

TABLE 12.—*Length of service prior to first offense exclusive of captain's mast*

Months	Cases	Months	Cases	Months	Cases	Months	Cases
1	12	13	26	25	7	38	4
2	45	14	38	26	7	40	1
3	89	15	28	27	3	41	1
4	90	16	30	28	2	47	2
5	108	17	19	29	4	51	1
6	62	18	17	30	8	52	1
7	51	19	9	31	3	56	2
8	73	20	13	32	2	58	1
9	81	21	13	33	5	65	1
10	46	22	6	35	2	73	1
11	39	23	3	36	2	144	1
12	40	24	10	37	1	165	1
						252	1
						Total	1,000

TABLE 13.—*Academic delinquencies*

Truancy:		
Occasional	139	
Frequent	181	320
Expulsions:		
One	49	
Two	7	
Three	6	
Four	2	64
Suspensions:		
One	13	
Two	5	
Three	4	22
Admissions to truant schools	14	14
Total		420

time in truant or reform schools. Since the type of behavior involved in truancy parallels that found in unauthorized absences from the Navy, it is interesting to note the high incidence of truancy in the sample studied. It tends to indicate that the activities of many of these men conform to patterns of behavior established long before any contact with service life.

SUMMARY AND CONCLUSIONS

A series of factors has been studied in an attempt to determine the extent to which they might be involved in producing unauthorized absences from the Naval service.

1. The seriousness of the problem was demonstrated by the fact that in the 1,000 cases studied in detail the Navy lost 90 man-years of service through absences, apart from the time lost while these men were in a disciplinary status.

2. Repeaters comprised 53.8 percent of the number of admissions and the indication is that this proportion will become larger as enlistments in the Navy (voluntary or by selection) decrease.

3. It was found that 16.7 percent of the men had histories of civilian arrests prior to entering the Navy. It is felt that this percentage is relatively high because of the fact that many habitual offenders are not permitted to enter the Navy.

4. The reasons given by the men for their A.O.L. or A.W.O.L. status varied greatly from the true psychologic activation. The stated motivations were the desire to aid or be with the family, particularly in times of illness, personal illness, and the need for a rest after seeing action. The psychologic drives were the desire for pleasure; aggression against authority; and frequently neurotic or immature factors.

5. The men studied were found not to be inferior in intelligence or education from the population from which they derived.

6. Records revealed that 42 percent of the group had been in trouble in school because of frequent truancies, suspensions and expulsions.

7. The mean age for the group was 21.55 years and the median 19.64. This indicates that chronologically at least, if nothing more, the men were old enough to appreciate the seriousness of their offenses.

8. Approximately 30 percent were or had been married. The balance had never been married.

9. The group included 79 Negroes. Since this was 7.9 percent of the total group, it appears to be far out of keeping with their total representation in the Navy. However, this is purely an impression and must be checked against their actual number in the service.

10. Definite neuropsychiatric disorders were found in 21.9 percent of the cases. These individuals are not suitable Navy material and should be discharged eventually because they are a continual source of trouble, not only because of their own inability to adjust,

but also because of the difficulties which they cause among their shipmates in the integral unit of a fighting ship.

11. Absences were found to come most frequently after the completion of boot training and after the first tour of active duty.

12. The general conclusion indicated that a longer period of training, screening after the first test of duty, and a program of reeducation to develop maturity, might reduce unauthorized absences from the Navy.

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MASKING TAPE AS AN ADHESIVE

The following facts were found in favor of Scotch masking tape over adhesive tape under tropical conditions:

1. Equal or better adhesion. Under tropical conditions a moist skin surface is the rule; adhesive plaster "sheds" very quickly, while the paper tape, if it loosens, can be refastened.

2. Less irritation of the skin. The skin of lesions requiring repeated dressings has been found to break down very rapidly with stripping of the outer cornified epithelium and development of a red, highly sensitive, weepy surface and the appearance of numerous furuncles and pustules. I have encountered no case of sensitivity to Scotch tape.

3. Water- and sweatproof.

4. Dark color (gray, black) of the tape and poor absorbent surface prevent rapid soiling and fouling common to ordinary plaster.

5. No residual adhesive gum left on skin after removal.

6. Deterioration of adhesive qualities after exposure to approximately 1 year of tropical climate is much less than in the case of adhesive plaster.

Disadvantages of the paper tape include:

1. Durability of dressing is not over 2 days.

2. It is unsuitable for strapping ankles and back.

3. Slightly slower to use. The tape tears irregularly and must be cut; it is more inclined to wrinkle. However with practice this becomes a minor factor.

After 6 months' experience, in part using both plaster and tape and subsequently using the latter only, the author has found paper masking tape well worth including in medical supplies for equatorial areas.—POLAND, W. M., Lieutenant (MC) U.S.N.R.

TREATMENT OF INTESTINAL OBSTRUCTION IN THE FIELD AND ABOARD SHIP

JAMES S. HIBBARD
Lieutenant Commander (MC) U.S.N.R.

Despite interest in surgical methods and technics for care of combat casualties, little attention has been shown to the usual case of so-called "State Side Surgery" which occurs in our armed forces. Intestinal obstruction falls into this category and must not be overlooked when encountered in the field and on board ship. Although its comparative frequency is definitely much less, enough patients are encountered so that if improperly or inadequately treated, a high mortality and an unnecessary loss of manpower will ensue.

Failure to employ the well-established scientific principles laid down for the treatment of obstruction is unjustifiable. This fact is evident when one considers the medical advances of the present war, which fortunately include not only well-organized and splendidly equipped medical units adequately distributed in the field and on all larger ships, but also the advantages of air transportation for the rapid transfer of patients.

Wangensteen (*1*), McKittrick and Sarris (*2*), and others have shown that during the last thirteen years there has been a decided decline in the mortality rate of intestinal obstruction. Wangensteen attributes the improvement to a better understanding of the effects of obstruction from the adoption of the mechanical conception of the ill effects and to the introduction of transnasal duodenal suction in relieving intestinal distention. Mainly through this teaching, the mortality in most clinics has decreased from 6 to 12 percent.

McKittrick (*3*), after studying a large controlled series of cases over a long period of time at the Massachusetts General Hospital, advocates early operation in all cases of less than 24 hours, after instituting suction and relieving dehydration and dechlorination. Possibly in expert hands this treatment in time may prove to be the one of choice. Nevertheless it is felt that the principles advocated by Wangensteen of suction in all cases of simple mechanical obstruction are far more acceptable, especially for those untrained in the management of obstruction problems.

The average medical officer, moreover, is thoroughly schooled in the differential diagnosis of obstructions and in the understanding of suction treatment. In cases detailed to his care, the setting up of improvised apparatus and supervising treatment are readily accomplished.

All those, however, who are expected to handle suction apparatus should be familiar with the commercial machines listed for mobile and Naval hospitals, and in addition, they should be able to construct a simple apparatus from odd parts secured in first-aid stations in the field and on board ship. Training in suction therapy moreover should include knowledge of the important factors of fluid intake and output, the dangers of dehydration, dechlorination and deproteinization, and the understanding of proper replacement therapy during use of the suction apparatus.

The signs and symptoms that identify the presence of a bowel obstruction are familiar to all medical officers. However it is felt that strongly suspected cases should also be given suction therapy especially when x-ray verification is unobtainable. In fact one should not hesitate in making a diagnosis of "Diagnosis Undetermined (obstruction, intestinal)" while in the field or on board ship but at the same time arrange immediately for definitive treatment or emergency treatment and transfer.

After determining the presence of obstruction, the distinction between simple mechanical obstruction, strangulation obstruction, and large bowel obstruction, is imperative. It must be remembered that in the case of strangulation, immediate operation is life saving, whereas in large bowel obstruction, suction is of no benefit except as a pre- and postoperative measure.

Although hours of procrastination in diagnosing large bowel obstruction are relatively unimportant, the criteria necessary to recognize strangulating obstruction early must be decisive. The signs of localized tenderness, rigidity, rebound tenderness, and palpation of an intraperitoneal mass through the abdominal wall or by rectum, must be considered indicative of strangulation. However these signs are not absolutely characteristic, but if followed, they materially reduce the chances of grave error.

The diagnosis of large bowel obstruction is based essentially on the usual clinical findings confirmed by x-ray. This group shows no impairment of the blood supply, and hence is not considered an emergency. They are, moreover, generally seen by the medical officer in the early stages of the disease when ample time is available for transfer to a well-equipped unit. A complete work-up and proper evaluation can consequently be accomplished without fear of overdistention of the bowel and perforation.

The importance of the roentgenologic examination in intestinal obstruction is well-established and not only throws light on the diagnosis but also reveals the character and degree of distention of the bowel during treatment. Some surgeons moreover advocate that treatment in all cases of intestinal obstruction should not be instituted until flat films of the abdomen are obtained. But considering the diagnosis a clinical problem, and the x-ray films only evidence of intestinal stasis and its character, there seems to be no contraindication in establishing treatment primarily, in the few cases for which adequate facilities are unavailable. Certainly little time will be lost in transferring these patients to shore units or ships with well-equipped laboratories and sickbays.

In the group which must be transferred, the nasal tube should be left in place, although suction may safely be discontinued for periods of three to four hours. If longer periods of transfer are contemplated, it is advisable to set up a simple suction apparatus which can be supervised by the attendant accompanying the patient.

Although the long, balloon-tipped Miller-Abbott tube is preferable in the well-supervised hospitals, the short, black, weighted-tip duodenal tube with multiple perforations is best suited for use in the smaller units. It has the advantage of permitting quick insertion, requires little time and energy for passing it into the duodenum, and on transfer of patient, care of the tube is less difficult.

In the field and on board ship, McKittrick's teaching of early operation in cases of less than 24 hours, or immediate surgery in all cases of simple obstruction regardless of a time element, is considered the correct course of procedure by many surgeons. Numerous patients, however, will be operated upon unnecessarily, some when the diagnosis has not been confirmed by x-ray, and others when spontaneous recovery will follow the use of transnasal suction. Moreover the simplicity of the suction treatment is far more desirable than the difficulties of immediate surgery. These demand a well-equipped surgical unit manned by personnel of expert ability if the problems of marked bowel distention and the dangers of releasing adhesive bands without the benefits of previous decompression by the use of suction are encountered.

Although the conservative suction plan is recommended in the majority of cases of obstruction, there remain two important factors which deserve special consideration, i.e., strangulation obstruction, and persistent bowel distention unrelieved by suction. Wangensteen emphasizes these two factors as being largely responsible for the failure in the entire group.

Strangulation obstruction has always been considered a difficult surgical problem, and heretofore has been discussed only in respect to its differential diagnosis and to the necessity of its prompt surgical relief. The second factor, however, according to Wangensteen is largely attributable to the shortcomings of the current suction treatment. Indiscriminate prolonged use of suction should be guarded against in all cases showing no relief of distention and in which an operative intervention is indicated.

Wangensteen now successfully employs a direct surgical attack upon the distention factor occurring in these two comparatively infrequent but important groups. The procedure, which largely replaces the use of blind enterostomy, is patterned somewhat after the principles of the Monks' operation, and is based upon an aseptic suction evacuation of the proximal distended bowel through an enterotomy opening. This preliminary maneuver not only insures the safe handling of the obstructive mechanism in uncomplicated obstruction but also curbs the dangers of resection with primary anastomosis when indicated by the presence of nonviable strangulation of the bowel. The writer, having experienced a comparable degree of success, contends that this method approaches the ideal in handling these difficult problems in the field and on board ship.

Wangensteen's procedure requires an ordinary evacuating trochar for which a five-inch segment of copper or glass tubing, beveled at the end, may be satisfactorily substituted. In addition, a long rectal tube with multiple perforations at the tip which slides easily through the trochar, and an equal length of Penrose drain are required. This latter sheathes the rectal tube and is tightly secured at one end to the catheter entrance of the trochar. At the other end it is fastened to the distal end of the rectal tube. Hence the rectal tube can be gently inserted or withdrawn into the bowel through the trochar by reefing the Penrose drain upon it without fear of contamination. Suction can be applied to the rectal tube through a simple two-bottle apparatus, or as used in this hospital, through a water suction pump. It is desirable to be able to make or break the suction by the insertion of a three-way glass connector into the circuit, in order to prevent too great a suction on isolated areas of the intestinal mucosa.

To prevent spillage at operation, the selected segment of bowel is primarily aspirated between rubber-covered clamps. A transverse incision is placed down to the mucosa, through which the trochar is plunged after first inserting a purse-string suture loosely around its edges. The purse-string suture is then drawn taut, preferably in a circular groove incorporated in the trochar

which checks the trochar from slipping out of the bowel opening during aspiration. Trauma and any unnecessary manipulations of the distended segments of intestine are absolutely contraindicated.

SUMMARY

1. The present day nasal suction plan of management for intestinal obstruction is recommended for use in the field and on board ship.

2. Routine instruction in the use of suction, emphasizing the important factors of fluid balance and the dangers of dehydration, dechlorination, and deproteinization is advocated.

3. The differential diagnosis of obstructions is stressed with a warning against the attempted use of suction in strangulating obstruction and in large bowel obstruction.

4. The indiscriminate prolonged use of suction without evidence of decompression has been shown to be contraindicated.

5. Wangensteen's procedure of aseptic decompressive enterotomy has been advocated for use in dealing with the distention factor occurring in persistent marked bowel distention unrelieved by suction.

6. This procedure has also been recommended for routine use in dealing with strangulating obstruction as a preliminary step to resection and primary anastomosis.

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MEDICAL PROBLEMS ON AN ATTACK TRANSPORT

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In view of the amphibious nature of the Pacific operations, it seems appropriate at this time to present problems encountered and lessons learned by the medical staff of an attack transport, which participated in actions at Kiska, Tarawa, Kwajalein Atoll, and elsewhere, and to consider wherein the activities of a medical department on this type of vessel differ from those of hospital ships, shore stations, cargo carriers, and warships. It is realized that the practices discussed here might have been modified under other circumstances and that some generalizations made here may apply only to a ship of this type and then only under unusual circumstances of climate, the need for haste, and availability of facilities. However, since these conclusions are based on actual experience, it is felt that they may be of aid to other medical organizations facing these problems for the first time.

On this ship the operating room is well equipped for all except brain surgery, the x-ray facilities consist of a portable machine and a darkroom, and the laboratory-pharmacy is adequately equipped except for complicated blood chemistry. There are three battle dressing stations and additional operating rooms may be set up in wardrooms and cabins as necessary.

PREPARATIONS BETWEEN BATTLE ACTIONS

Applying the leisure time of the hospital division to the most profitable end in the periods between actions is a task which taxes the resources of the medical officers, but which pays dividends. It is during these weeks and months of relative inactivity that the battle efficiency of the department suffers. Since hospital corpsmen are limited by regulation in the types of work they may do in servicing the ship, they lose out in activity which keeps the men of the other divisions in good physical condition.

Regular, supervised exercise is the only sure method of averting this difficulty.

After the ship leaves port, it is our practice to integrate with the medical department of the ship all medical facilities and personnel of the troops being carried. Medical personnel who are scheduled to go to the beach during the battle often either remain on the ship or are returned shortly because, except for first aid, medical treatment cannot be given on shore until the entire island has been secured. Officers and corpsmen of the troop medical organizations are assigned to battle stations and familiarized with the equipment and facilities available throughout the ship. Conferences of troop and ship's medical personnel are held to get acquainted, to learn the special skills of the men available and so appropriately assign them, and to prepare plans for handling casualties.

Ten days preceding the day designated for an offensive landing, the usual activities of the hospital division are amplified. Crews and officers of the landing boats, gun crews, and others are taken in small groups for an hour's review of first aid, with lectures by the medical department officers and demonstrations by the corpsmen. Lectures and demonstrations are given to the corpsmen on the types of injuries they may expect, and what measures they will carry out in conjunction with the medical officers. Also, those procedures are reviewed which they must be able to carry out by themselves if no medical officer is available, what they can do and what they must not do.

Dummy operations are set up in the operating rooms, and, using sterile technic, every member of the medical department goes through the steps of the operations to be expected, from the senior medical officer to the hospital apprentice, until each man is qualified to play any part on the operating or first-aid teams. Corpsmen are drilled in the technic of administering intravenous therapy. All spend time with those skilled in laboratory technics until hematologic procedures have been mastered. Blood counts, hemoglobin estimations, and cross matchings for transfusions are stressed. Each corpsman is also required to go through the steps of exposing, developing, and recording x-ray films.

ORGANIZATION DURING BATTLE

In the care of wounded during battle, methods must be adjusted to the physical characteristics of the ship, the medical personnel available, the rapidity and numbers in which the casualties arrive, the type of injuries, and many other variable factors.

On this ship, casualties are raised on litters over the fantail by block and tackle, and carried into the spacious troop mess space which has previously been cleared of tables. If only ten arrive at one time, all can be cared for in the sickbay and surgery, but if fifty or a hundred arrive simultaneously, as is usually the case, there must be preliminary segregation. Those with wounds requiring immediate surgery are allocated to the main and temporary operating rooms set up throughout the ship, resuscitative measures being started before the patients are moved. Patients who can await treatment or be treated without anesthesia are cared for by the medical officers and corpsmen at the battle dressing stations. Those in critical condition postoperatively, are nursed in the sickbay or in officers' cabins.

OPPORTUNITIES AVAILABLE TO MEDICAL STAFFS

Frequent trips between the scene of battle and mid-Pacific or continental base hospitals afford the medical staff of an attack transport unique opportunities to evaluate the effects of the treatment used under battle conditions. It has been our good fortune repeatedly to see and follow those patients to whom we had given definitive surgical treatment within sight and sound of the beaches on which combat was taking place, first to these mid-Pacific base hospitals and later to activities in the United States coastal ports, for periods of months after they were first wounded.

Another useful source of information has been found in watching the arrival at mid-Pacific hospitals of casualties coming directly from other attack transports, after transportation from atolls and islands where fighting was in progress. Nowhere is the general condition and travel comfort of apparatus so apparent as when the men are being moved for the first time, one or two weeks after their injuries. Here are emphasized the dangers of certain forms of plaster-of-paris or metal immobilization. The importance of the travel tag, which is attached to each patient before he leaves his ship, and of the shipboard x-rays and records, in expediting the segregation of the various types of injuries is apparent when large numbers of patients arrive simultaneously.

ADMINISTRATIVE PROBLEMS DURING COMBAT

The question whether to accept, reject, or transfer casualties when close to the line of battle is one that the senior medical officer may find difficult to decide. Although under ideal circumstances the medical facilities of the ship should not be intentionally overburdened with casualties, such circumstances seldom exist. The

general medical plan for the campaign may provide for the number of wounded to be carried by each ship, but it cannot always be arranged that they shall not all arrive at one time. And the ships designated to accept these casualties are not always immediately accessible to the beach where the wounded accumulate. Since hospital ships do not usually appear until the battle has been secured, the transports which have brought in the combat troops must administer the original definitive surgery to the casualties.

The presence on a transport of more wounded requiring emergency surgery than the surgical teams can attend to within the most desirable period, renders difficult the decision whether to accept or reject successive boatloads of wounded. The line of least effort is to tell the coxswain to take his boatload to another ship. We have had patients who have been carried about in Higgins boats among the ships of the invasion fleet in the transport area for hours before a ship was found which would or could accept them.

The coxswain's job of finding the ship to which his casualties are consigned is not always easy. Such ships lie from 1 to 5 miles offshore and may be surrounded by forty or more vessels. Perhaps the coxswain is turned away from the ship intended to receive his load. Or he cannot find it. The ships in the transport area are in motion; their positions are constantly changing. In the heat of battle the coxswain may not remember or recognize those ships which are intended to receive casualties and consequently goes from one to another trying to unload his injured. The fact that he has just been under fire and has perhaps lost some of his crew or cargo does not make his problem any easier.

The solution of this problem lies not in the hands of any individual or ship, but can be attained only by teamwork, by every unit making a regular practice of stretching its capacity to the very utmost. If the senior medical officer of the ship applied to cannot care for these patients himself, he will simplify the solution if he learns by blinker or other communication which nearest ship can accept this load, and then identifies that ship for the coxswain before allowing him to shove off. And if no such facility can be identified, he should accept the patients. They are better off lying on the deck of the transport than on the beach or on the deck of the Higgins boat.

The transferring of postoperative patients, particularly those who have had abdominal surgery, from one ship to another shortly after operation, should be reduced to a minimum. Patients who have had laparotomies, colostomies, and similarly extensive abdominal interventions, do not survive moving (*1*). Patients of this

type should be retained on board until the 10-day critical period has passed. Perhaps after several days of action the ship bearing these cases is ordered to proceed to another phase of the action. The presence of the few patients in this category in the sickbay will not preclude adequate care for the patients received later, and their chances of survival would be compromised by early transportation. Being moved involves transportation up steep ladders and through narrow corridors, being dropped by a block and tackle over the side of the ship and into a bucking Higgins boat, being again hoisted over the side of a ship, and carried though the ship in the same manner.

This problem is a recurrent one, as hospital ships usually arrive to take over the casualties after the beach has been secured. The thought that there is now available a floating hospital with superior facilities for therapy is always tempting, but it should be remembered that the desperate need of these patients at this time is for absolute rest.

OBSERVATIONS ON PROCEDURES AND APPARATUS

The use of plaster of paris for immobilization of battle wounds differs somewhat from its use in civilian life or in hospitals.

Plaster-of-paris bandages are made up on this ship from crinoline and orthopedic plaster by the corpsmen, one thousand rolls wrapped in oiled paper being kept ready for emergencies. Applied in the hot, humid atmosphere of the lower decks of the ship, particularly in tropical areas, plaster casts differ in their behavior from those applied in better ventilated surroundings and on patients who are thereafter nursed in cool, dry, airy wards. The former fail to dry. Hip-spica casts applied in the humid compartments of a ship in tropical waters, have been found still moist when removed 6 weeks later.

Consequently plaster casts applied under these conditions should be made thicker than customary, or reinforced. Hip-spica casts are reinforced across the hip joint with thin strips of wood to give support during the first 2 weeks, when the plaster is still insufficiently dried to resist the strains consequent upon the manipulations of transportation.

No unpadded plaster casts are applied to battle wounds on this ship. The early removal of casts, which is so frequently unavoidable in caring for war wounds, is excruciatingly painful if no padding has been interposed between hairy skin and the plaster. Many unpadded casts we have seen arrive at base hospitals bear holes cut through to bony prominences to relieve painful pressure.

Some of them concealed pressure ulcers.

Under the tension of combat conditions, it is difficult to avoid errors in the technic of the application of unpadded casts on fresh injuries. A circular plaster-of-paris cast should be split to the skin immediately following application if that cast is applied within 10 days after injury, regardless of whether such procedure will cause loss of position of the fracture fragments. Permanent and irreparable damage has been seen again and again through failure to observe this precaution. Trueta's (*2*) admonition, "Without proper excision no recent wound should be inclosed in plaster. . ." should not be forgotten. Although a circular, unsplit, unpadded cast gives reasonably safe support when applied after the first 2 weeks following injury, all casts applied soon after injury should be split to accommodate this hemorrhagic and edematous swelling.

The hanging cast for the transportation of fractures of the humerus has been found inferior to the use of a light shoulder spica. Patients in the latter travel more comfortably, arrive at their destination in better general condition, and suffer no damage to the fracture site. A half-inch distraction at the fracture site has been seen repeatedly in compound fractures immobilized in a hanging cast. Among these have been cases in which the extent of the compounded wound has been minimal.

The theoretic advantage that the hanging cast on shipboard permits the patient to become ambulatory earlier, fails to materialize because the patient's discomfort in this form of support seldom permits him to leave his bunk during the one or two weeks on board ship. A light spica holding the elbow 5 inches from the costal margin is as convenient as an arm cast for traversing hatches, ladders, and corridors. These patients are invariably transported from the ship on litters. Fine degrees of reduction of the fracture are unimportant because the immobilizing plaster is changed as soon as the patient arrives at the hospital.

Fixed traction for fractures of the femur is desirable, the pin being imbedded in a bilateral, long-leg plaster spica and penetrating the os calcis, tibial crest, or the supracondylar region, countertraction being supplied by pressure of the plaster against the sole of the foot of the uninjured leg. Adhesive plaster skin traction, incorporated into the plaster, slips because the skin is usually moist when the adhesive is applied. Skeletal fixation by transfixing pins in other regions is provocative of trouble, especially if the limb is not covered with a cast to prevent motion of the skin against the pin. Profuse drainage about pins has been observed in cases in which the joints proximal to the pin have not been immobilized. Adequate facilities and competent judgment for removal of the

pin may not be at hand when there is evidence of infection of the pinhole.

The practice of drawing a diagram of the fracture on the cast at the time the plaster is applied, with a few words of explanation, is helpful. Shipboard x-rays and records require considerable time to reach their destination, and for this reason and because the patients complain about their wounds when they arrive at a new activity, many casts are unnecessarily removed at each organization through which the patient passes on his way back to a base hospital. Each surgeon lacks sufficient information to justify leaving the cast undisturbed.

No ship should be without some simple saddle arrangement for the application of plaster-of-paris hip-spica cast, regardless how unlikely it may seem that one will ever be needed. The sight and sound of the arrival at a base hospital of a patient with fractures of both femurs, carried on another ship and not immobilized in a plaster spica, emphasized for us beyond forgetting the importance of this apparatus.

Numerous complications from the use of the so-called Thomas arm splint have been observed. Every case of fracture of the upper extremity brought onto this ship in this splint was the worse for its use. Passageways, ladders, and hatches on board ship are too narrow to permit transportation of these casualties with the arm abducted from the side. Consequently the arm is adducted, and the presence of the splint ring in the axilla hampers circulation and widely angulates the fragments of the humerus at the site of the fracture, further compounding the wound and lacerating or contusing the neurovascular bundle. Countertraction in these cases is unnecessary; muscle pull in the upper extremity in the presence of a compound fracture is negligible.

Even simple fractures, which are rarely seen in amphibious warfare, can be satisfactorily immobilized on one or two pairs of yucca board splints. A fractured arm which is immobilized at the patient's side, or with the elbow flexed to allow the forearm to rest across the chest, supported by a sling and strapped to these board splints, can come to no harm, is easy to transport, and is most comfortable for the patient, regardless of the type or location of the fracture.

Enough patients have been observed on arrival on the ship with their wounds covered by a puddle of pus surrounded by a crater of rock-hard coagulum of sulfonamide crystals, to prove that the local application of this drug does not prevent infection (*3*). Debridement of extensive wounds in many cases is complicated and prolonged by the fact that the surgeon must remove all these fine

white particles from the wound surface, and must often do a complete excision of the wound surface, as he has no way of knowing which of this material is coral sand and which is sulfonamide.

The widespread, enthusiastic, and usually inadequately supervised oral administration of sulfonamide drugs by hospital corpsmen in combat areas has many dangers. Untoward effects of the drugs cannot be watched for when great numbers of patients need attention. Temperature curves, furthermore, are profoundly modified by their use. This is a serious disadvantage, because on shipboard the medical officer caring for many casualties may have no time to check clinical features on the noncritical cases other than the temperature curves, nor can he adequately investigate the cause of every fever when the wound is not the responsible agent.

Sulfonamides have been applied locally at the time of debriding compound fractures in less than half the patients we have followed here. It is believed that occurrence or absence of infection in these cases has had no relation to the use of sulfonamides, but has depended on other factors, such as the extent of the devitalization of tissues at the time of the original injury, the length of time supervening between reception of the wound and the debridement or excision, the completeness of debridement permitted, and facilities available at the time of operation. Only one case was observed in which there was even a suggestion of the "spreading infection" (4) which is possibly benefited by sulfonamides.

Excepting laparotomies, when drop ether was necessary for relaxation, and in eye injuries, all operations on this ship have been carried out under sodium pentothal anesthesia. There have been no deaths or other serious complications due to its use, in spite of the fact that its administration has usually been in the hands of inexperienced men.

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HEARING TESTS[1]

AN EVALUATION

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The present study was undertaken in an effort to determine the true significance and value of the common clinical tests of hearing. These include the Spoken Voice, the Whispered Voice, the Coin Click, and the Watch Tick tests. Inasmuch as the custom is standard throughout the Navy of reporting hearing ability in terms of these particular tests, it is apparent that a thoroughgoing study of their measurement properties is needed.

As these clinical tests are designedly tests of auditory acuity, the technic was adopted of comparing the results on the clinical tests with results from the same population on the most reliable laboratory test of auditory acuity, the audiogram. The audiogram provides an accurate analysis of the range of the frequency spectrum to which an ear is sensitive, and the peak or peaks of maximum sensitivity, as well as a detection of any abnormalities such as diplacusis, lacunae, or tonal islands. This sort of information can be only crudely gathered with the use of clinical examination.

Specifically, it was hoped that by this method the following information on the clinician's tools could be secured:

1. Whether any one of the clinical tests serves as a good indicator of ability to hear specific frequencies (differential sensitivity).

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[1] This is the fifth and final report on an audiometric study which was done during 1939-1942. The first part was reported in the U. S. NAVAL MEDICAL BULLETIN of January 1942, under the general title of "Auditory Acuity in Submarine Personnel," and concerned hearing loss due to Diesel engine noise. The second part appeared in the April 1942 issue and discussed "Hearing Loss due to Exposure to Radio under Service Conditions." Part Three appeared in July 1942, and was divided into two sections: One concerned "Aero-Otitis Media in Submarine Escape Training" and the other, "Hearing Loss due to Exposure to Increased Air Pressure." The fourth part appeared in October 1942, and discussed "Hearing Loss due to Exposure to Gunfire."

2. Whether any combination of clinical tests can be colligated to produce a battery which might substitute satisfactorily for an audiogram.

In addition to the hearing tests administered, a number of other sorts of data were secured—chronologic age, Navy rate, and years of submarine service. On the basis of an otoscopic examination each ear was rated on a four-point scale from 0 (normal) through 3 (cases of acute infection, perforation of the drumskin, etc.). Finally, a check was made as to whether any disability was due to middle ear or to cochlear dysfunction (Weber and Rinne tests). While not related directly to the major problem, a number of significant facts have appeared from this data, and will be reported here.

TABLE 1.—*Distribution of subjects by age*

Age						
<20	21–25	26–30	31–35	36–40	41–45	>45
91	97	61	70	87	57	37 = 500

The clinical acuity tests used were, with the exception of the Spoken Voice test, administered in conformity with directions given by the Manual of the Medical Department, 1939. Our use of the Spoken Voice test corresponds closely in design to the Whispered Voice test, with the obvious differences in articulation and amplitude. The audiometric examination was conducted with the Western Electric 2A and 6B audiometers (results on the two instruments were demonstrated interchangeable). Tests were conducted under partially sound-deadened conditions. A standard psychophysical procedure was adopted, a modification of the Method of Limits, the Method of Serial Groups. Subjects were given one or more ascending series, in steps of five decibels; the threshold was taken as that lowest setting where the subject consistently reported the tone.

Of more than 2,000 men examined, a total of 500 cases was selected at random for study. Table 1 shows the distribution of this population with respect to age. The group included 231 engine room ratings, and 269 deck ratings. Table 2 summarizes the condition of the auditory systems as revealed by the Weber and Rinne tests. It would seem that there is sufficient heterogeneity on a variety of criteria to assure a wide range of scores on any tests of auditory function. Consequently, interpretation will not need to be restricted to a small band of the true range of ability.

TABLE 2.—*Classification of auditory apparatus of subjects by tests of Weber and Rinne*

Weber	Rinne R	Rinne L	Interpretation	Number
1	1	1	Both ears normal	401
0	0	1	Middle ear dysfunction	0
2	1	0		4
1	0	0		5
0	1	1	Inner ear dysfunction	54
2	1	1		22
0	1	0	Not interpretable	7
1	1	0		3
0	0	0		2
2	0	0		1
2	0	1		1

Weber—0: Sound localized in R ear
1: Sound localized in median plane
2: Sound localized in L ear

Rinne—0: Middle ear dysfunction
1: Ear normal

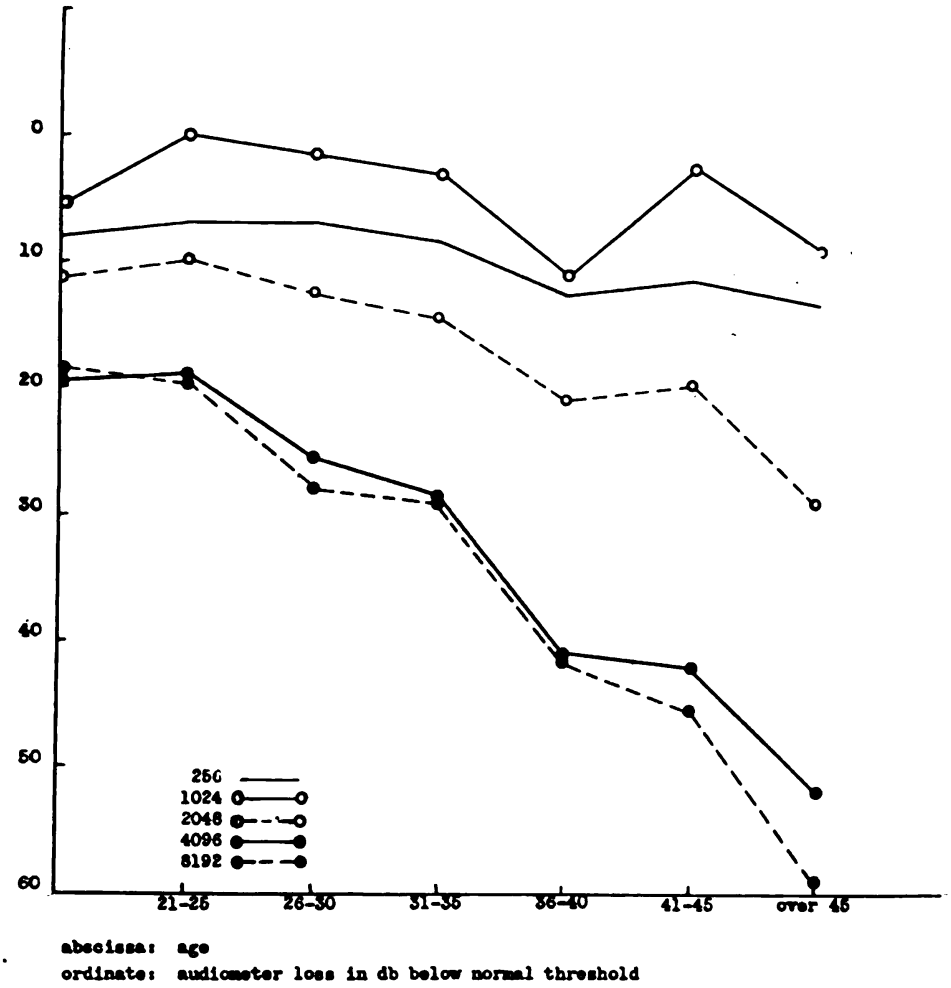
The audiogram, regarded as the criterion, will be used as the point of departure for discussing other data.

1. *The audiogram and the otoscopic examination.*—It will be seen on an inspection of table 3 that a direct relationship exists between the rating given an ear by the otologist, and the audiogram for that ear. The average loss of the whole range progresses regularly from 13.2 decibels at 0 (normal) rating to a loss of 41.2 decibels at rating 3. The usual result in studies of this kind is seen in table 3, where loss is not only progressive from rating 0 to 3, but is also progressively more severe in general as one passes from low to high frequencies.

It might be thought that these results may possibly be an artifact of a relationship between otologic condition and age, on the ground that with increased age the otoscopic rating is likely to be lower. It seems, however, that such is not altogether the case, since the correlation for all 1,000 ears between age and otoscopic

TABLE 3.—*Otoscopic rating*

Loss in decibels	Average loss in hearing			
Cycles per sec.	0	1	2	3
256	6.9	11.2	19.9	32.4
1,024	.7	4.7	15.9	28.0
2,048	11.2	14.8	23.3	35.5
4,096	23.3	34.6	36.5	55.2
8,192	24.2	38.4	55.9	55.2
Average	13.2	20.7	30.3	41.2
Number	528	420	43	9



1. Relation of audiogram to age.

rating is only $r = +.30 \pm .02$. Such a relationship, while indicating that the connection between age and ear condition is by no means negligible, is probably not of such magnitude as to account for the results summarized in table 3.

2. *The audiogram and Navy rate.*—In view of the known fact that certain occupations are more instrumental than others in producing loss of acuity, it was thought necessary to analyze the 1,000 audiograms with respect to the variable of Navy rate. In this matter, however, it is important to control the factor of age. Analysis of the data revealed little difference in acuity between any two categories of rate. Between machinists and deck hands no statistically significant difference was present; moreover, the differences were by no means always in the expected direction.

3. *The audiogram and chronologic age.*—The relation between age and acuity is summarized in figure 1. As is universally re-

ported, here too, increased age entails loss. Only two or three points need to be emphasized with these data. One is the rather remarkable fact that in the men over 40, many of whom had served a decade or more in submarine service, hearing throughout the speaking range (2,048 cycles per second and lower) is impaired relatively little. With these men, only the oldest group (over 45) was depressed as much as 20 decibels, and then only at 2,048 c.p.s. Evidently the average submariner, even the veteran, enjoys normal or only slightly depressed hearing for the spoken voice.

With the higher frequencies, the effect of age is somewhat more severe, such that men over 35 are appreciably affected. It is important to observe that the effect of age on hearing at 8,192 c.p.s. is statistically indistinguishable from that at 4,096 c.p.s.

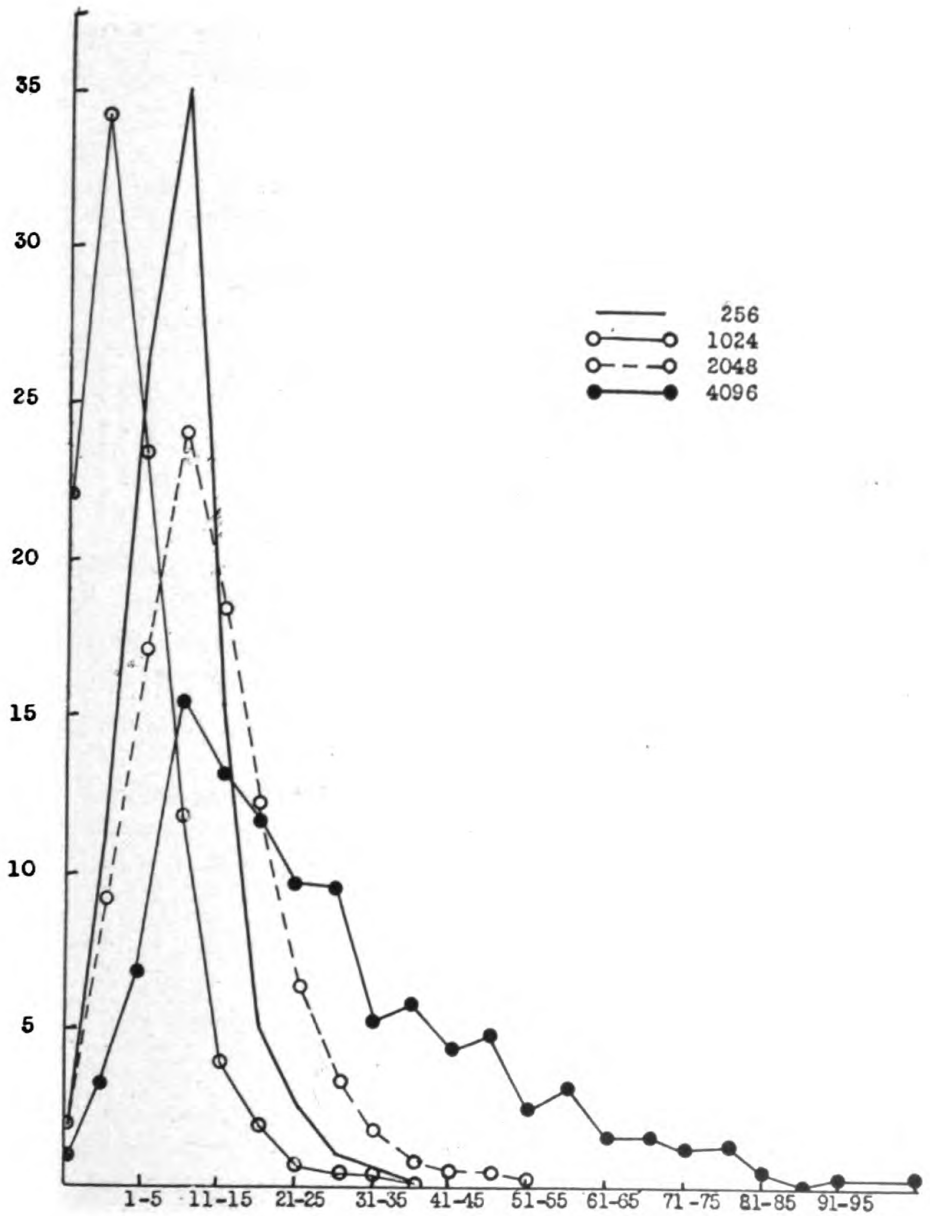
4. *The audiogram and the Spoken Voice test.*—On the basis of our results the Spoken Voice test may be summarily dismissed as of no diagnostic value. Of 1,000 ears, only 38 were reported as being anything but perfectly normal by this sign; whereas we know from other tests that many more ears were seriously defective. It is true that of the 38 ears most—not all—were defective by audiometer test; and that at the high frequencies these same ears *all* tested below 25 decibels. Yet it cannot be concluded that the spoken voice picks out those ears with high tone loss, since it classed as "normal" 87 ears which were, at 8,192 c.p.s., depressed some 90 decibels. Without burdening the reader with further data, we may be permitted on these grounds alone to view the test askance.

5. *The audiogram and the Whispered Voice test.*—The picture is more encouraging in the case of the Whispered Voice test. Here, 137 ears were characterized as in some degree below normal. Such a figure agrees somewhat more closely with the audiometer's findings.

The first point to be considered is the relation between the category "normal", and audiometry. Figure 2 shows the percentage of "normals" distributed against audiometric loss. (Data for frequencies 512 and 8,192 almost exactly coincide with those for 256 and 4,096 respectively, and are omitted so as not to burden the graph unduly.) For the four lower frequencies the relation is quite good—that is, the whispered voice did not indicate as "normal" any appreciable number who had serious low tone loss. For the two high frequencies the screening was hardly satisfactory. Of those whose high tone hearing had dropped even as far as 50 decibels below normal, a good percentage is reported "normal" by whispered voice. In cumulating the number of ears

which dropped below 25 decibels on the high tones, we find that more than a third of the cases are represented; yet these ears are passed as normal.

We conclude that if an ear is found normal by whispered voice, there is a very good chance indeed that at 2,048 c.p.s. and below, that ear will be functioning well; but that nothing can be said with confidence about possible loss at higher frequencies.



2. Whispered Voice test category "normal" as related to the audiogram.

Without presenting graphs similar to figure 2 for every other category of Whispered Voice test, we can quickly get an idea from table 4 as to the relation in question. Let us take a provisional figure of 25 decibels loss, below which is said to be "failing". Then from table 4 it will be seen that if an ear is rated less than "normal"—even though falling into the adjacent (12–14/15) category, the chances become *practically certain* that a high tone deficiency occurs. We take this table to mean that if the Whispered Voice test score is 12–14/15, high tone hearing is almost certainly affected; but as the score deteriorates from 12–14 through 0–2/15, there is greater and greater likelihood that low tones are also lost.

TABLE 4.—*Rating on Whispered Voice test. (Percentage of those who "failed" (i.e., fell more than 25 decibels below normal) on audiogram at any frequency, as related to score on Whispered Voice test)*

Cycles per sec.	(Normal) 15/15	12–14/15	9–11/15	6–8/15	3–5/15	(Deaf) 0–2/15
256	2.3	7.1	33.3	45.4	50.0	48.0
512	3.5	14.2	50.0	45.4	42.8	51.0
1,024	1.6	21.3	33.3	27.2	21.3	44.0
2,048	8.6	50.0	83.3	81.8	85.7	100.0
4,096	46.5	100.0	100.0	100.0	100.0	100.0
8,192	37.4	92.8	100.0	90.9	100.0	100.0

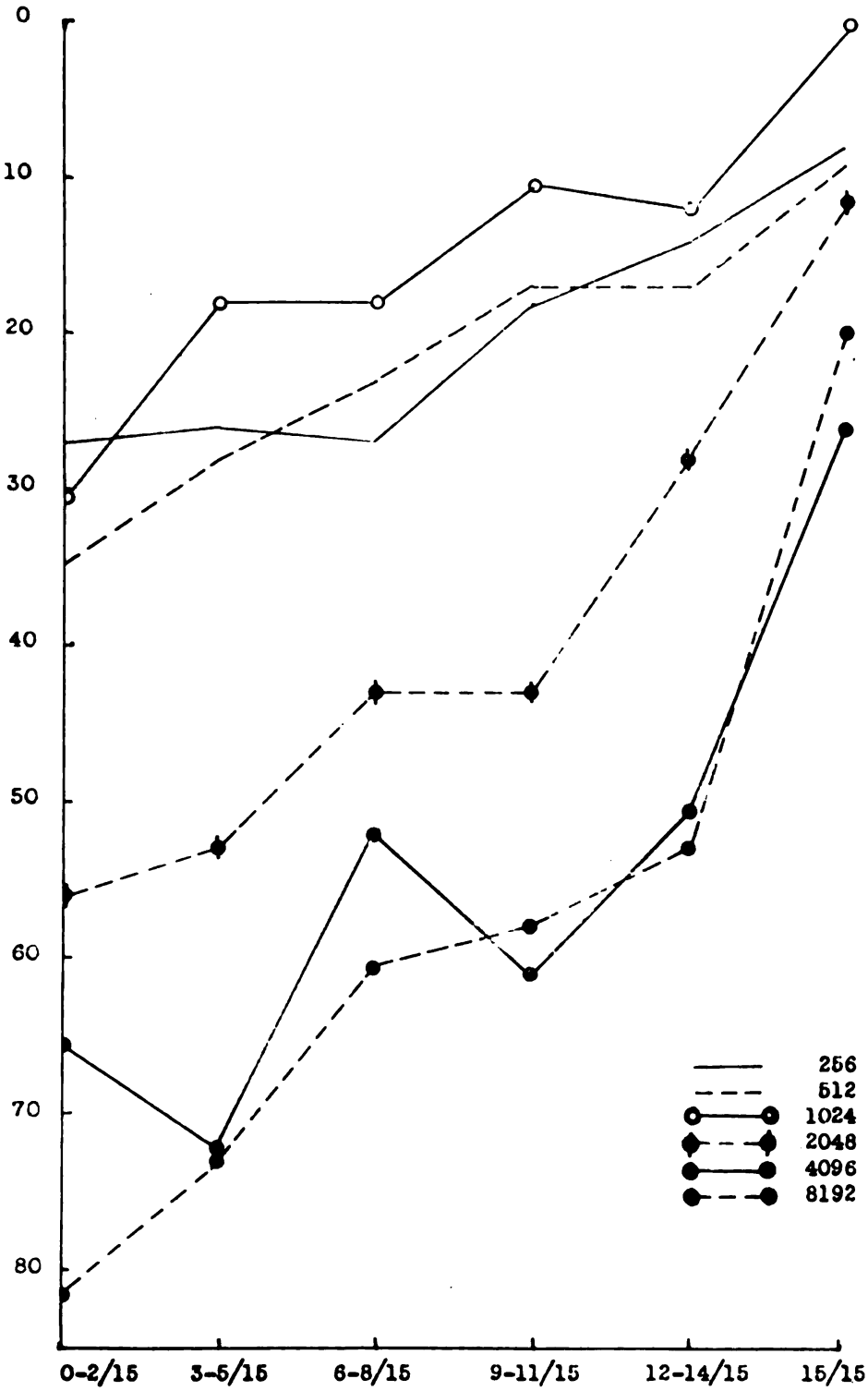
A more precise demonstration of the relation between the whispered voice and audiometry is contained in figure 3. Here is plotted, for each frequency, the mean audiometer loss for each category of Whispered Voice test score. The plots describe a regular, fairly straight-line relationship. The sizes of the standard

TABLE 5.—*Interrelationships among clinical tests and audiometer test*

Cycles per sec.	256	512	1024	2048	4096	8192	C.C.	W.T.
W.V.	+.30	.32	.30	.60	.35	.37	.82	.60
	±.05	.05	.06	.04	.06	.05	.005	.01
C.C.	+.19	.29	.13	.39	.27	.21	.....	.56
	±.07	.06	.09	.07	.07	.07	.....	.01
W.T.	+.25	.25	.29	.41	.57	.46	.....	.....
	±.03	.03	.03	.02	.02	.02	.....	.....

Pearson product-moment correlation plus or minus 1 standard error.
W.V.: Whispered Voice test
C.C.: Coin Click test
W.T.: Watch Tick test
c.p.s.: Cycles per second

errors permit us to say that the general shape of these curves is statistically reliable. Figure 3 bears out our earlier statements as to the differential effect on high and low frequencies. Here, too, if we provisionally take any loss greater than 25 decibels as "fail" on the audiogram, figure 3 shows that as the Whispered



abscissa: Whispered voice test score.

ordinate: Audiometer loss in decibels below normal threshold.

3. Whispered Voice test score as related to the audiogram.

Voice test score gets lower, the chances of "failing" the audiogram become progressively greater.

Furthermore it can be shown that the correlation between the audiogram and the Whispered Voice test is at all frequencies greater than chance (see table 5).

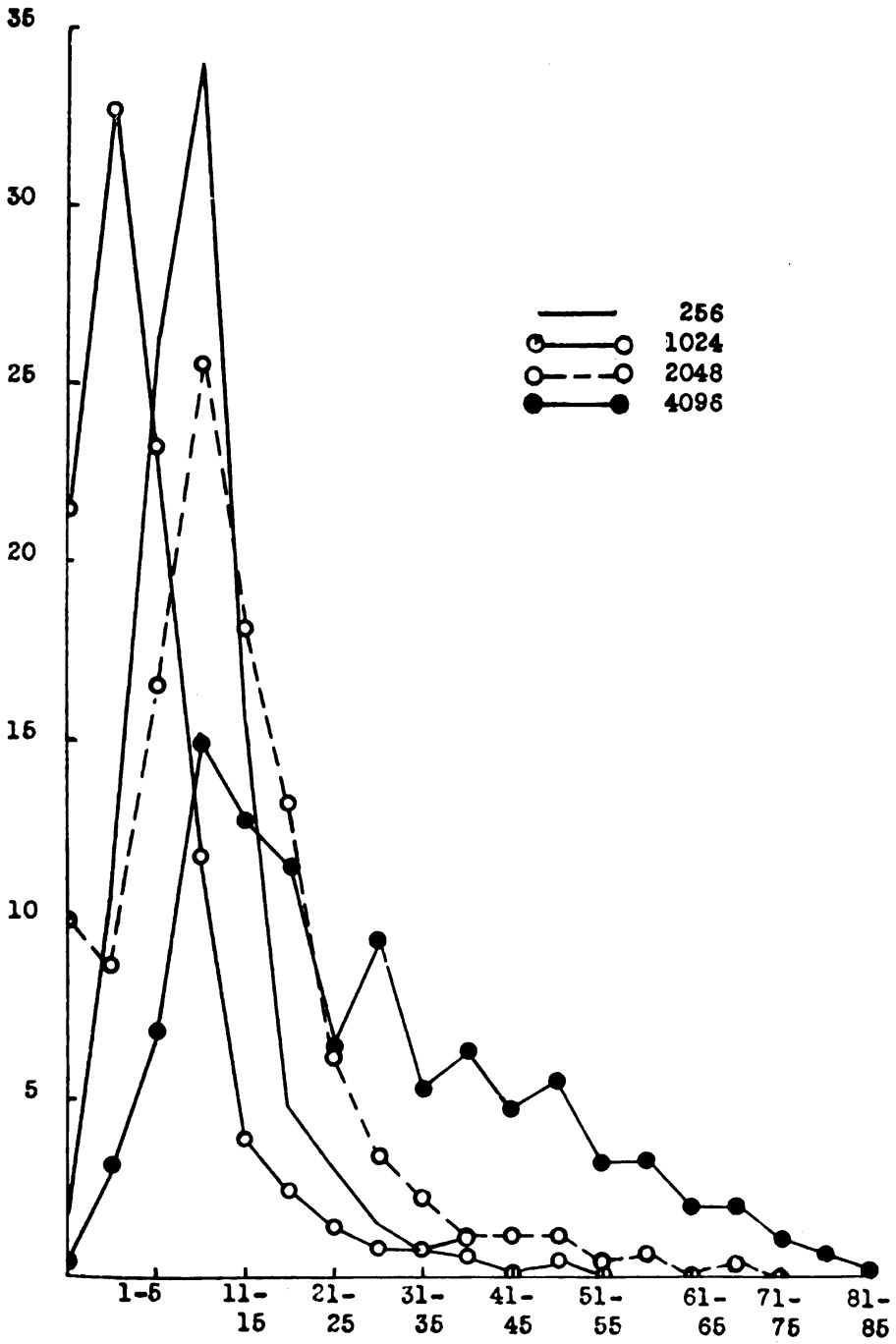
Evidently a definite relationship exists between each and every audiometer frequency and Whispered Voice test. Would it not then be justified to dispense with the audiometer test since the whispered voice is so much easier and cheaper to use? The negative answer is two-fold: (1) The Whispered Voice test is not a delicate enough instrument to pick out all deficient ears, and (2) when it does detect a deficient ear it provides no real cue as to the frequency-composition of the deficiency and only a rough approximation of its extent. The percentages with which one is forced to work in the interpretation of this test are much too gross to permit usable analysis of individual ears.

Nevertheless the results of this test are not obfuscated by unreliable or contradictory data; several important statements can be made about auditory acuity on the basis of whispered voice examination. The fact that as it stands it is not a good test of *differential* frequency loss, does not impair its other qualities nor prevent it from being elaborated or used in possible combination with other tests.

6. *The audiogram and the Coin Click test.*—The results of the Coin Click test can be presented in exactly the same manner as those of the preceding test. Figure 4 shows what discriminative value the "normal" category possesses; again it is seen that while the Coin Click rates as "normal" very few ears which show more than a mild loss for low tones, yet an appreciable number of ears seriously defective for high tones are not picked out.

The discriminative value of the other categories may be ascertained by a glance at tables 5 and 6, and at figure 5. The low positive correlations of table 5 indicate that a tendency does indeed exist for a low score on the Coin Click test to be paralleled by a depressed audiogram. Table 6 reveals (1) that any falling off of the coin click score from "normal" is a sure sign of high tone deficiency, and (2) that with lower and lower scores the presumption of low tone deficiency becomes more nearly a certainty. The results are graphically depicted in figure 5, where the mean audiometer loss at any coin click category is plotted. The differential discriminative value for different frequency bands is clear.

7. *The Whispered Voice and the Coin Click tests.*—Every line of evidence that we are able to muster from the original data points to the same conclusion, namely, that the Whispered Voice



4. Coin Click test category "normal" as related to the audiogram.

and the Coin Click tests are almost exactly alike in that they both test the same auditory functions, and produce almost identical results. When, for example, figures 2 and 4 (whose axes are com-

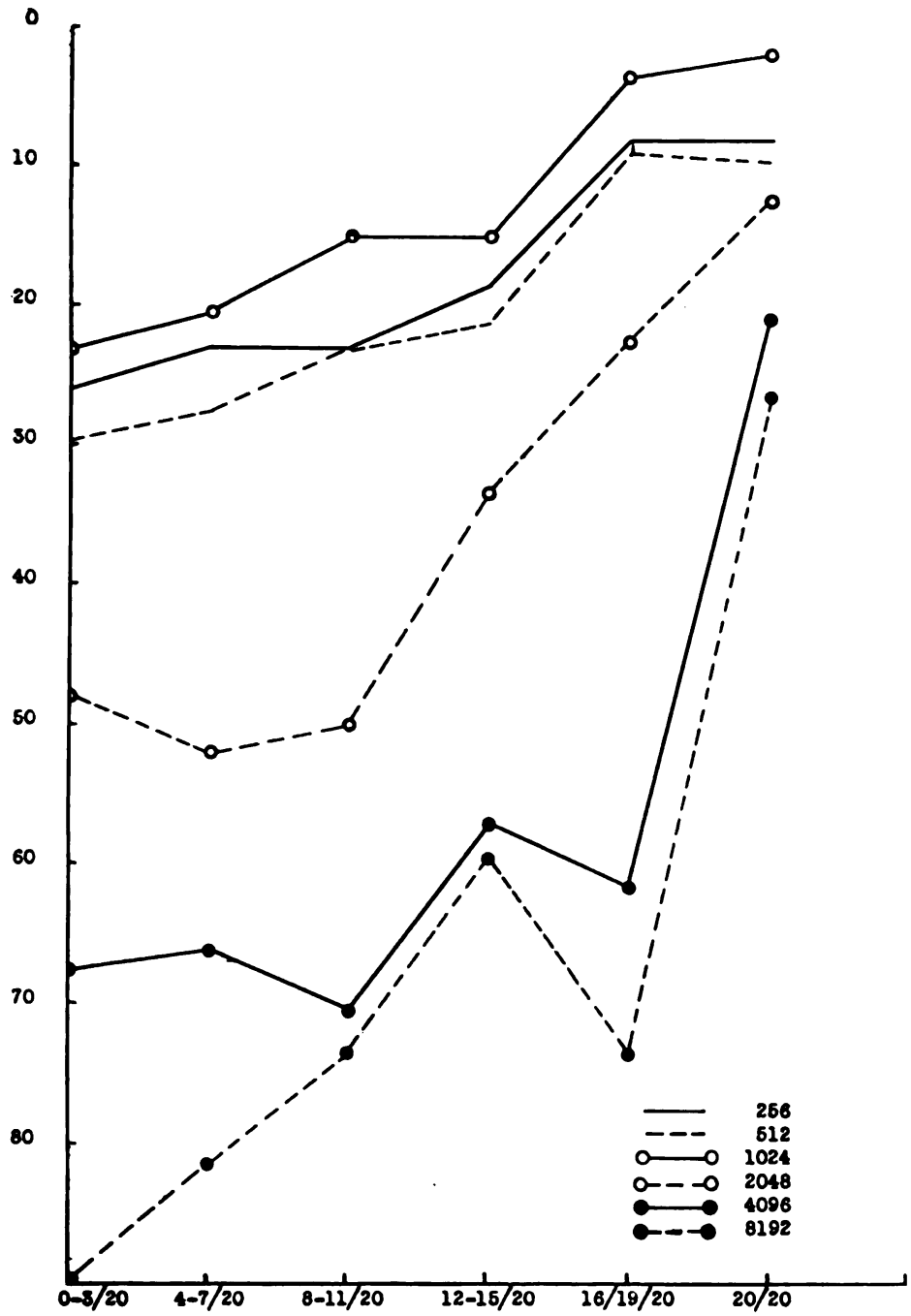
parable in every way) are drawn on semi-transparent paper and superimposed one on the other, the lines are seen to coincide with startling fidelity. Quite evidently the audiometric interpretation of the "normal" category of both tests is identical. Again, similar inspection of figures 3 and 5 reveals this duplicative phenomenon. Furthermore the correlation between the tests ($r = +.82 \pm .005$, table 5) shows that both tests place individual ears in almost exactly the same category. This is so consistent that, as inspection of the original data reveals, there were only 25 of the 892 ears called "normal" by coin clicks which the whispered voice did not also call "normal".

Even though the predictive value of either of these tests on the other is so high as to make them almost interchangeable when administered as we did, there are nevertheless definite reasons for preferring the Whispered Voice over the Coin Click test: (1) The former screens out a few more defective ears (137 reported below "normal" as against only 108 by coin click); (2) the correlations with the audiometer data (table 5) are uniformly higher and more reliable; and (3) whereas the Whispered Voice test caught all but 25 of the ears which were screened out by coin clicks, the latter missed 50 ears screened out by whispered voice.

TABLE 6.—*Rating on Coin Click test. (Percentage of those who "failed" (i.e., fell more than 25 decibels below normal) on audiogram at any frequency, as related to score on Coin Click test)*

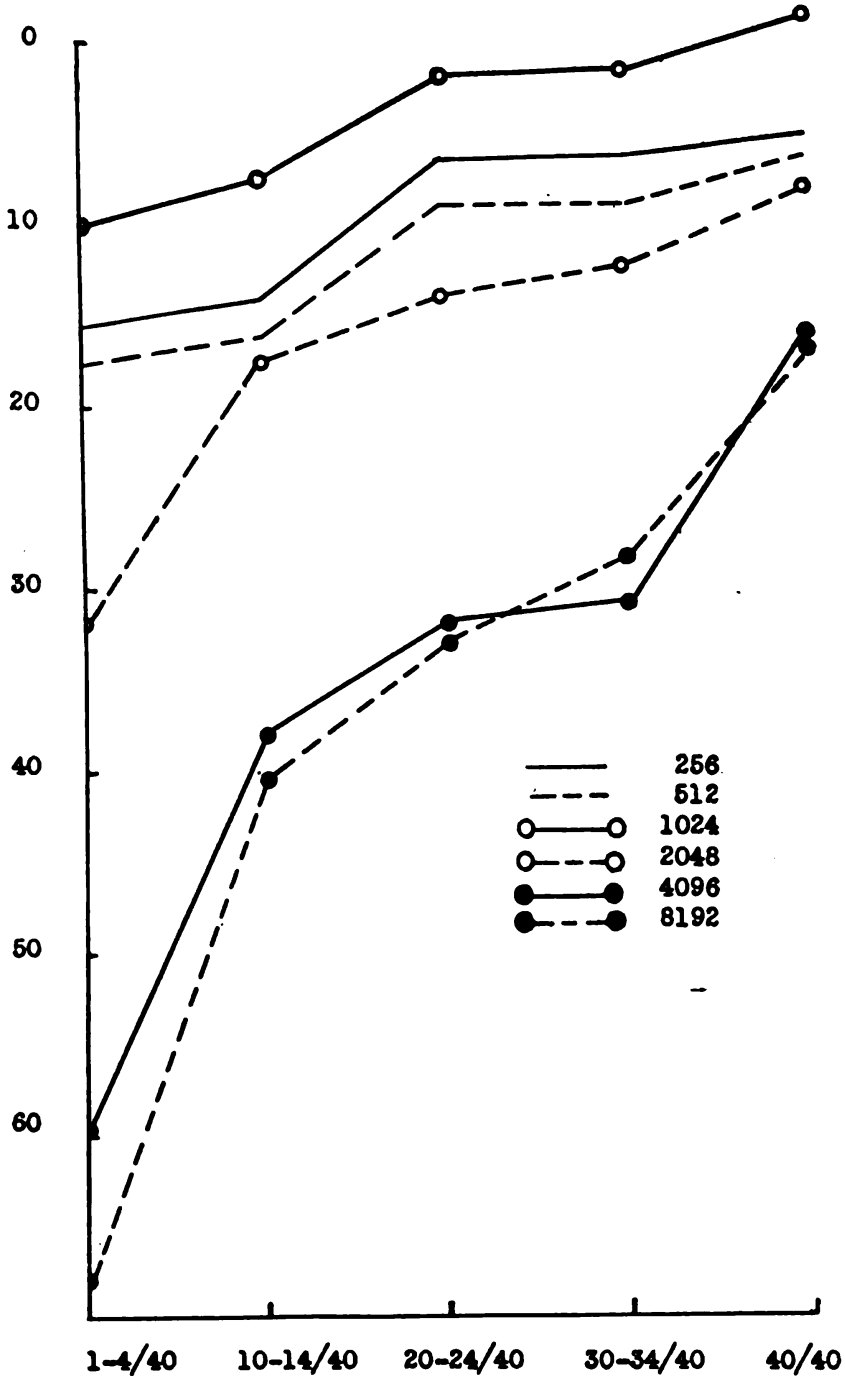
Cycles per sec.	(Normal) 20/20	16–19/20	12–15/20	8 11/15	4 7/15	(Deaf) 0–3/20
256	4.5	0.0	20.0	33.3	36.3	42.3
512	5.4	0.0	40.0	33.3	45.4	46.1
1,024	3.3	0.0	20.0	33.3	36.3	38.4
2,048	11.7	33.3	20.0	100.0	100.0	84.6
4,096	48.0	100.0	100.0	100.0	100.0	100.0
8,192	39.0	88.8	100.0	100.0	100.0	100.0

8. *The audiogram and the Watch Tick test.*—Inspection of figure 6 will reveal a slightly different relation with the audiogram than was true of the other tests; with progressively lower score it is not nearly so probable that low tones are affected. Even when the watch acoumeter has to be brought within 1 to 4 inches of the head, low tone impairment is not necessarily severe. While table 7 shows that the Watch Tick and the audiogram are not unrelated at low frequencies, the magnitude of this relationship is approximately doubled in the higher frequency bands. It seems justified to say that the Watch Tick test is one measuring primarily high tone deficiency.



5. Coin Click test score as related to the audiogram.

9. *The Watch Tick and other clinical tests.*—With regard to the practical question of how well a clinical test of hearing can screen out defective ears, figure 7 exhibits the value of the Watch Tick test. Not only does this test succeed in labeling correctly those



6. Watch Tick test score as related to the audiogram.

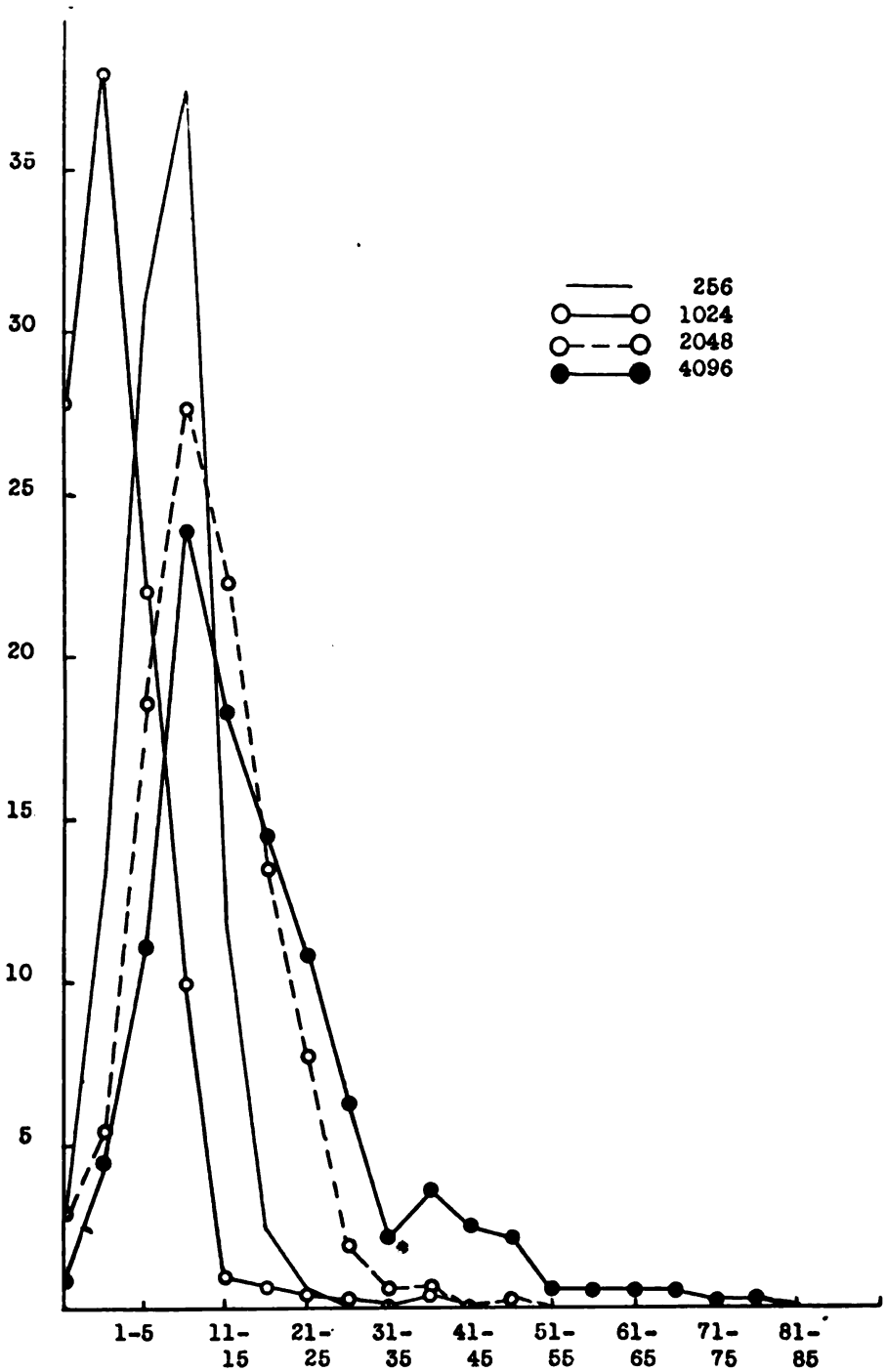
ears which are normally effective for low tones, but for high tones as well it is discriminative, in that only a few ears with important high tone loss are called "normal". (For categories below "normal" this argument is pursued in table 7.)

TABLE 7.—*Rating on Watch Tick test. (Percentage of those who "failed" (i.e., fell more than 25 decibels below normal) on audiogram at any frequency, as related to score on Watch Tick test)*

Cycles per sec.	(Normal) 40/40	30-34/40	20-24/40	10-14/40	(Deaf) 1-4/40
256	0.4	0.0	1.9	16.8	14.8
512	0.6	1.7	5.8	18.3	20.9
1,024	0.2	1.7	1.9	9.8	13.5
2,048	3.2	8.4	15.6	18.3	55.5
4,096	14.5	61.0	56.8	34.5	100.0
8,192	15.4	44.0	56.8	78.8	98.7

Again with provisional designation of a loss greater than 25 decibels as "fail," table 7 shows that at the category "normal" the watch tick did *not* detect 14.5 and 15.4 percent of high tone defectives (at 4,096 and 8,192 c.p.s. respectively). These figures showing errors in screening are not satisfactory; nevertheless they are much better than the 37.4 to 48.0 percent of high tone defectives which the whispered voice and coin clicks passed as "normal" (see again tables 4 and 6). As one glances over table 7 from "normal" to "deaf," it becomes plain that the extent of low tone involvement is slight; but herein lies the practical value of the Watch Tick test—that a low score is that much more closely correlated with high tone loss. It will be remembered from tables 4 and 6 that any dropping off from "normal" with whispered voice or coin click meant that immediately a severe high tone loss could be predicted with some confidence; but the severity was unknown, while the extent of low tone involvement was uncertain. With the Watch Tick test, on the other hand, there is more ground for a statement about the severity of high tone loss, and this statement is not so much complicated by the possibility that low tone loss contributes to the Watch Tick test score.

The general fact underlying the preceding discussion on the dissimilarity of the Watch Tick and other tests is, that the watch tick tends to screen out a deficiency which the others do not. Whereas the whispered voice and the coin clicks tend to screen out those ears with severe high tone loss *accompanied by more or less severe low tone loss,* the watch tick detects these and, *in addition,* those ears which are *normal* for low tones but which have a more or less severe high tone loss. Two or three items connected with this statement should be emphasized. In the first place the watch tick picks out many more ears as defective (533 as against 137 for the whispered voice; it is of great importance to note that of these 137, the watch tick did not fail to detect a single one). In the second place, that the two types of test measure somewhat different abilities may be supposed from the only moderate cor-



7. Watch Tick test category "normal" as related to the audiogram.

relations between them (see table 5 on this relationship).

We may presume that the watch tick is a fair instrument for measuring high tone deficiency; the question arises whether it would be possible to use it in combination with other clinical tests to describe adequately a broad frequency range. To do so it would only be necessary to devise a clinical test which measures low tone loss independently.

In the clinical tests as we have been using them, no tendency to measure low tones independently is seen. The whispered voice appears, however, quite capable of being adapted for this purpose. It is highly possible that by the proper selection of words used, the working range of the whispered voice could be lowered by octaves. The proper use of gutterals, linguals, and nasals, for example, might materially change the picture.

Another possibility appears, namely, that one might devise an administration of the Coin Click test so that its undesirable features are obviated. In the present study there were obviously strong low tone components in the coin click itself. Yet it may be possible well-nigh to eliminate these by a suitable technic of suspending or balancing the coin instead of grasping it or placing it in the palm. Other variables include the denomination of the coin, the distance from the center at which it is struck, etc. It may be possible to standardize a coin click test which would, for example, more nearly approach the Watch Tick than the Whispered Voice test.

It is the hope of this laboratory to explore further a number of such leads with a view to establishing, if possible, a small battery of easily accessible tests which might serve as more than a crude substitute for the complete audiometric survey.

SUMMARY

1. Data has been presented from 1,000 ears relating the 6-octave audiogram to the Spoken Voice, Whispered Voice, Coin Click, and Watch Tick tests.

2. The Spoken Voice test was shown to be practically worthless as an index of acuity.

3. The Whispered Voice test was shown to be very effective in screening out that type of ear seriously defective for high tones and concomitantly more or less defective for low tones; the correlation between extent of low tone audiometric loss and whispered voice score was significant but not high ($r = +.30$).

4. The Coin Click test as used here produced results very similar to those of the Whispered Voice test, but for several reasons the latter is to be preferred.

5. The Watch Tick test differs from the preceding tests in that low tones are involved only very slightly. The Watch Tick test is fairly satisfactory as a differential test of high tone hearing.

6. None of the clinical tests used showed any tendency to measure low tone hearing independently from high tone hearing.

7. In the conduct of this experiment it was found absolutely essential to standardize the technic of giving the various tests. Further study on the effect of variation in the administration of whispered voice and coin clicks is projected.

8. It is the intention of this laboratory to continue to explore the problem of clinical tests of hearing with a view to determining whether any clinical test can be devised which will screen ears with low tone, but not high tone, loss. If one should be successful in this, there could be made available a small battery of clinical tests which would provide information as to differential loss of acuity, and so serve as an effective substitute for an audiogram.

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PENICILLIN IN TREATMENT OF VINCENT'S ANGINA

The recent experimental work concerning the use of penicillin in various spirochete and spirillum diseases led to the view that this substance might be useful in the treatment of two patients suffering with Vincent's angina.

The two cases were extremely similar. There was "sore throat" of 24-hour duration, hyperemia and passive congestion of the pharyngeal mucous membranes and an oval shaped, yellow-gray pseudomembrane about 1.5 cm. by 2 cm. on the right tonsil of one patient and on the left of the other. This membrane, when removed, revealed a bleeding, raw ulcer. There was pain on pressure with a tongue blade and the breath was foul. The temperatures were 99.8° and 102.2° F. respectively. Smears from both lesions showed a great predominance of the spirilla and fusiform Vincent's bacilli.

The treatment consisted of intravenous injection of 100,000 units of penicillin, divided into five injections at 2-hour intervals. No untoward reactions were observed. No other measures of any type were employed. The usual sanitary precautions regarding individual utensils, etc., were observed.

Twenty-four hours after completion of treatment the patients had no complaints and temperatures had returned to and remained normal. At this time the pseudomembranes had disappeared; the ulcers were "clean" looking and did not bleed. After 48 hours there was a definite appearance of healthy granulation tissue and at the end of 96 hours both ulcers had healed completely. No further complaints or symptoms have been noted.—COLEMAN, R. M., Lieutenant (MC) U.S.N.R.

HEARING AIDS

JOHN C. HOWARD, JR.
Lieutenant (MC) U.S.N.R.

Reports of aural casualties for the first 2½ years of the war have begun to make their appearance in the literature, and the picture painted by several of the authors is not a pretty one. Hughson[1] estimates that World War II will see a quarter of a million men leave the service with some degree of hearing impairment. He arrives at this figure by pointing to the estimated forty thousand aural casualties in World War I, which involved only a fraction of the number of men in service in World War II.

Although this figure seems high, it has been pointed out in a previous publication[2] that in a group of service personnel, picked at random from ground and sea forces (air and submarine personnel were purposely excluded) a definite discrepancy was shown in the auditory acuity of a significant percentage of the group as compared with audiograms of civilians taken from the same age group a few years before the war. Impaired hearing will definitely become a postwar problem from the standpoint of both compensation and job placement.

A hearing aid, as its name implies, is nothing more than a hearing aid. It has no effect on the underlying pathologic change that brought about the auditory impairment. Its purpose is that of amplification. The amplifying characteristics of one instrument may differ greatly from those of another. However the essential parts of a hearing aid consist of a microphone and amplifier or transmitter, with two or three miniature vacuum tubes, condensors, and resistances; a receiver which is connected to a carefully fitted earpiece; and a battery pack consisting of a 1½-volt A battery, and a B battery pack ranging from 20 to 50 volts.

The amplification should be in frequencies involved principally in the speech range, which is generally considered to lie between 256 and 4,096 cycles. The aid should be equipped with a volume

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[1] HUGHSON, W.: Hearing aids. Tr. Am. Acad. Ophth. 48: 180-190, January-February 1944; also HUGHSON, W., and THOMPSON, E.: Arch. Otolaryng. 39: 245-249, March 1944.

[2] HOWARD, J. C., JR.: Hearing—post-war problem. Ann. Otol., Rhin. & Laryng. 52: 843-849, December 1943.

control which will allow gradations in the amount of sound transmitted. The instrument should be so constructed as to place special emphasis on those frequencies in which the auditory acuity is impaired. The hearing aid may be of the air-conduction type, with a fitted earpiece in the external auditory canal, or of the bone-conduction type, with the earpiece fitted over the mastoid portion of the temporal bone.

In general it may be said that air conduction is much more efficient than bone conduction because under optimum conditions bone conduction is 30 decibels below normal air conduction in performance. Bone conduction at the present time has a frequency range limit of less than 3,000 cycles. However in the presence of a suppurating middle ear, bone conduction is frequently indicated.

Before a hearing aid is advised, a thorough otologic examination should be made by a physician to determine the underlying pathologic condition. The external canal, tympanic membrane, and middle ear should be examined. Eustachian tube patency should be tested, the pharyngeal orifice inspected, and any treatment that may augment the auditory acuity instituted before a hearing aid is prescribed. This can be done only by a physician, not by a representative of a hearing aid firm.

After it has been established that the individual can probably be benefited by a hearing aid, a thorough audiometric examination should be carried out and the loss plotted. Hearing losses are of three general types: First, uniform loss in all frequencies; second, high tone loss with relatively normal hearing up to 1,024 cycles (very common in nerve impairment due to gunfire); and third and least common, low tone loss. A hearing aid should be selected that will increase the amplification in this range. A snug-fitting earpiece should be molded with the greatest of care to prevent feedback squeal and other noises. Special attention should be paid to the residual hearing.

A complete audiometric check should be made by a physician not only before but after a hearing aid is prescribed, as the aural mechanism should be "refracted" as carefully as the eyes—from a financial standpoint, more so—as the average glasses cost but a fraction of the lowest-priced hearing aid.

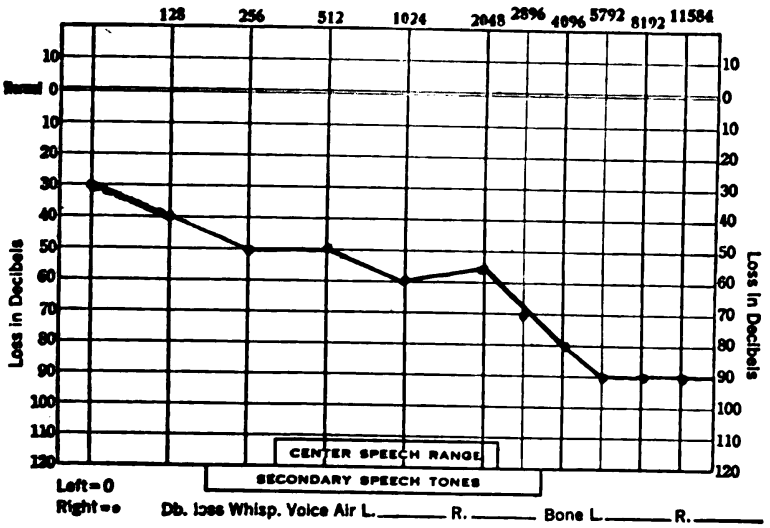
The ordinary speaking voice varies in intensity from 35 to 45 decibels at the usual conversational distance. The average shout is about 60 to 65 decibels. Perception of vowels lies between 500 and 2,500 cycles and voiced consonants between 1,000 and 3,000 cycles. The unvoiced consonants range between 2,250 and 8,000 cycles. A child perceives high tones up to 16,000 cycles, and a dog can catch tones up to 25,000 cycles which is too high for the human

ear to hear. As a person grows older there is a progressive decrease in auditory acuity for the high tones due to degeneration of the auditory nerve that comes with age.

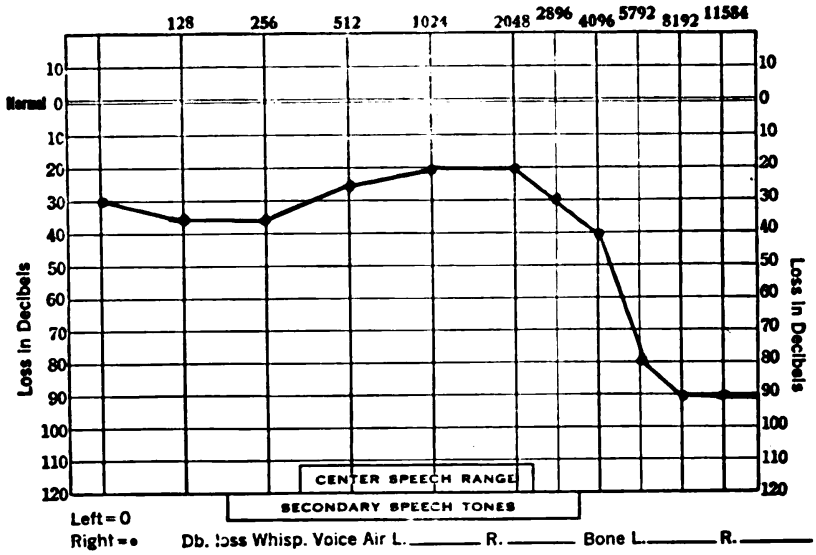
Thus it may be said that for practical purposes the problem is to bring the hearing up to the usual speaking-voice level in the 256 to 4,096 cycle range. Impairment of the higher tones in the 6,000 to 11,000 range may cause the individual to miss bird calls or the higher tones at a concert, but it will not affect his perception of ordinary conversation and the conventional noises in everyday life. The exclusion of these sounds which lie in the higher tone ranges are in general so gradual that the individual is unaware of their absence.

With these facts in mind, the question arises as to who can wear a hearing aid and be benefited by it. In general it may be said that a person with a hearing loss in both ears of 40 decibels or more in the speech frequency range can benefit from a hearing aid. If the loss in each ear is above 75 decibels, the impairment is usually considered too great to be benefited by a hearing aid. An aid should give the wearer a gain of 30 decibels in speech reception regardless of the unaided hearing. Further, in the candidate for a hearing aid the unaided hearing in both ears should be balanced. If one ear has normal or nearly normal hearing, that will ordinarily suffice for the usual occupation.

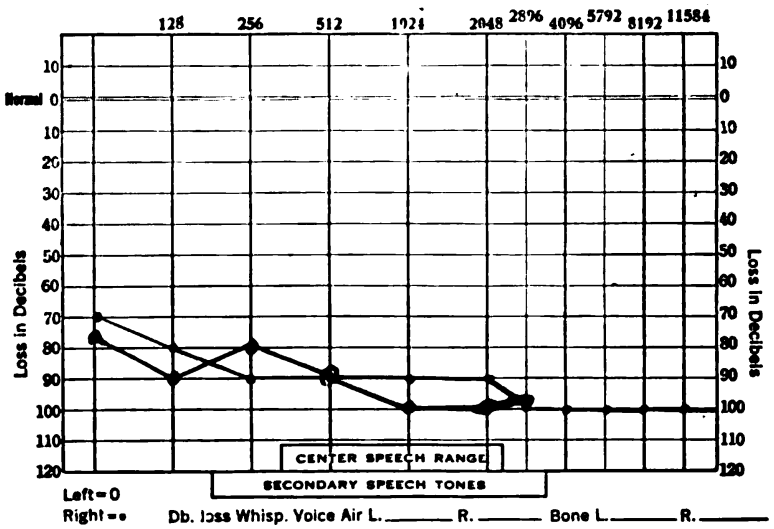
A case picked at random is illustrated, with the effect of a hearing aid on the auditory acuity shown by the audiograms.



1. In this audiogram the tympanic membrane is normal. Tuning forks show impaired bone conduction in the right ear. This man had trouble understanding ordinary conversation, which made it difficult to carry out routine orders.



2. Audiogram of the same ear after the patient had been fitted with a hearing aid of the air-conduction type.



3. Loss in both ears is such that a hearing aid would not help and is not indicated. Patient referred for instruction in lip reading.

The choice of the make of the hearing aid should be left to the patient. The American Medical Association has at the present time accepted 25 hearing aids. The patient-dealer relationship should be pleasant and convenient, as like any other electrical device the hearing aid is subject to breakdowns, and servicing of the instrument is important.

A SIMPLIFIED TECHNIC FOR ACRYLIC JACKETS

LLOYD H. DAHL[1]
Lieutenant (DC) U.S.N.R.

A simplified procedure for constructing an acrylic jacket crown is presented in which the wax pattern is made directly from the tooth. This eliminates the amalgam die, upper and lower impressions, taking the bite, and mounting the case on the articulator. The possibility of error is thus reduced and there is a significant saving in time.

1. The tooth (fig. 1) is prepared with the proper shoulder, and a celluloid tooth form is selected. The most popular form is the long tapering type. This type can be shortened and festooned, so that the gingival fit is slightly extended beyond the shoulder of the preparation in order to carry the wax beyond the shoulder of the tooth. The celluloid form is tried on the tooth and the patient is asked to close the jaws to determine the proper bite before loading the wax (fig. 2).

2. While the wax is somewhat soft, the patient closes the teeth and the bite is again checked. The celluloid form and the wax are burnished around the gingiva with a warm spatula.

3. The wax pattern is removed from the tooth, and excess wax is applied to the mesial and distal surfaces to insure proper contact points. The incisal edges are lengthened to provide for trimming and polishing the crown after processing.

4. The laboratory procedure consists of vibrating plaster (stone if available) to the inside of the wax pattern, and while the plaster is still soft a three-fourths inch wood screw with a flat head is worked into the plaster, the head being left exposed. With this accomplished the pattern is set down until the plaster has set.

5. The plaster is poured into the lower half of the flask (fig. 3). It is necessary to have an excess of plaster about the edges of the flask, so that on investing the pattern, it will be at the top of the convexity when the plaster is finally trimmed.

6. When the pattern is inserted into the plaster, it should be placed at a 45-degree angle, inner side down, to facilitate manipulation of the acrylic material (fig. 4).

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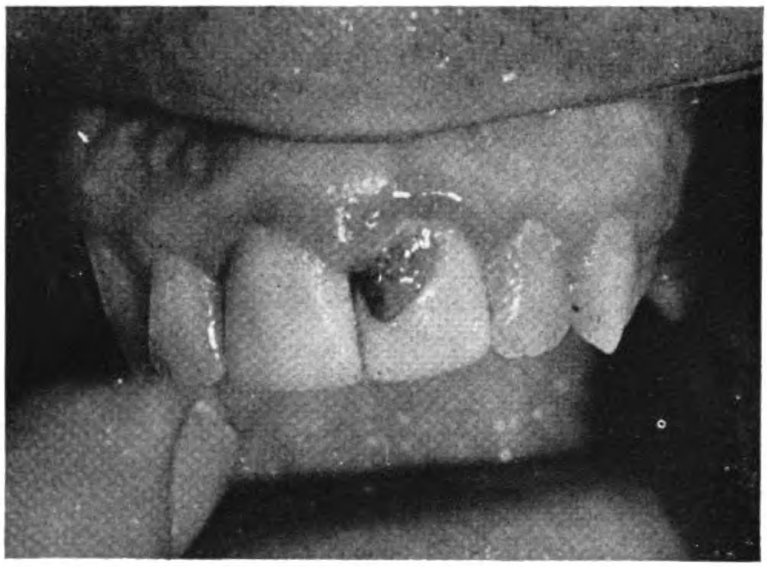
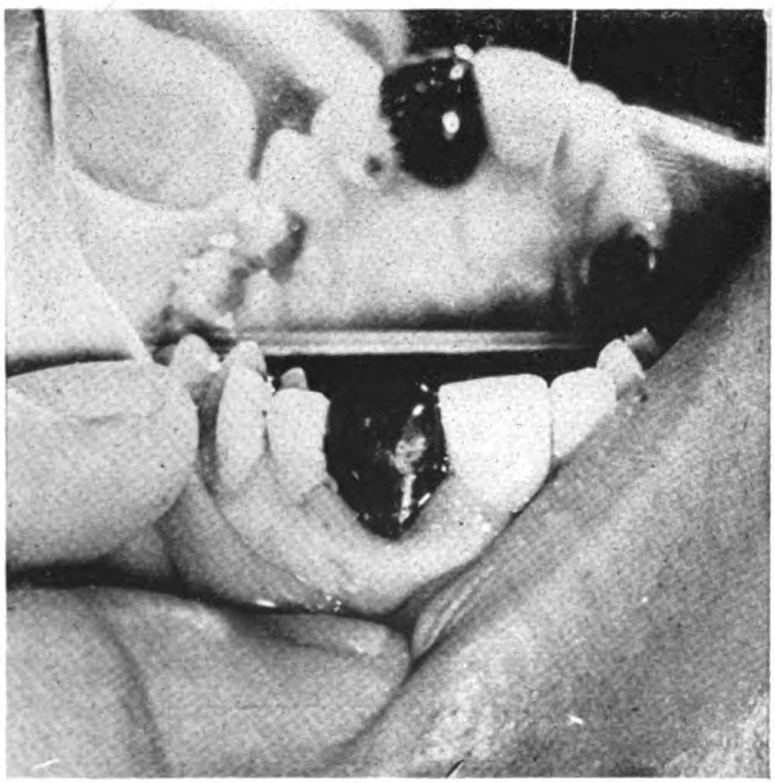
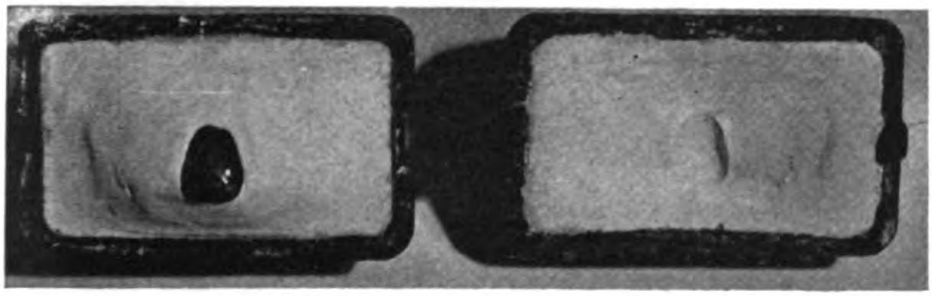
[1] Assisted by B. Johnston (dental technician, prosthetic) and M. Hawkins, Pharmacist's Mates, first class, U.S.N.R.



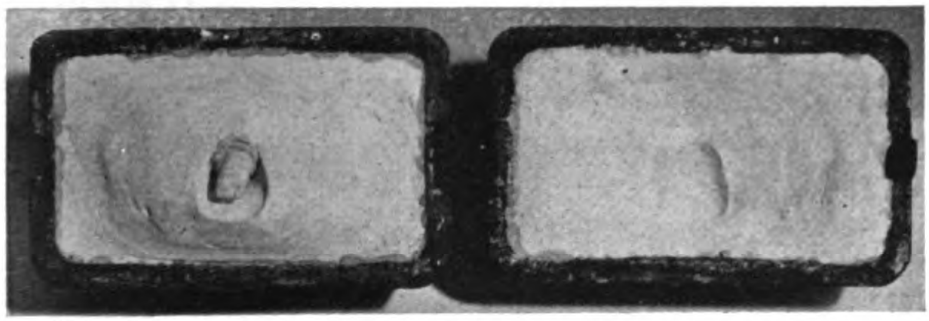
1. Tooth before treatment, showing a defective porcelain jacket.



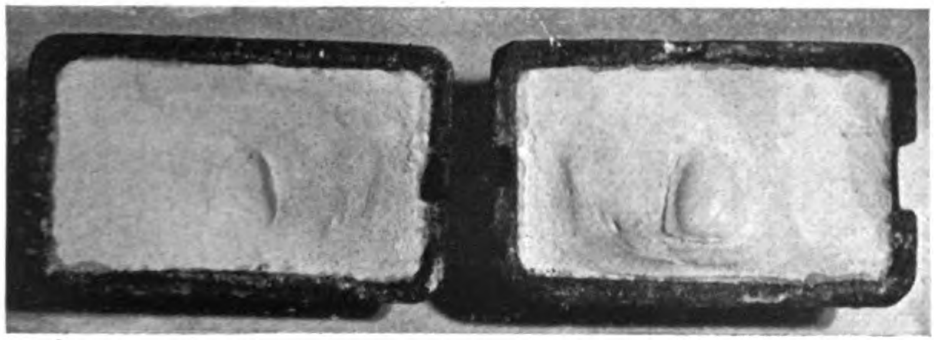
2. Celluloid form loaded with wax and placed on tooth. External and internal surfaces of wax pattern are mirrored.



3. Pattern invested in flask.



4. Wax boiled out. Note angle of tooth model.

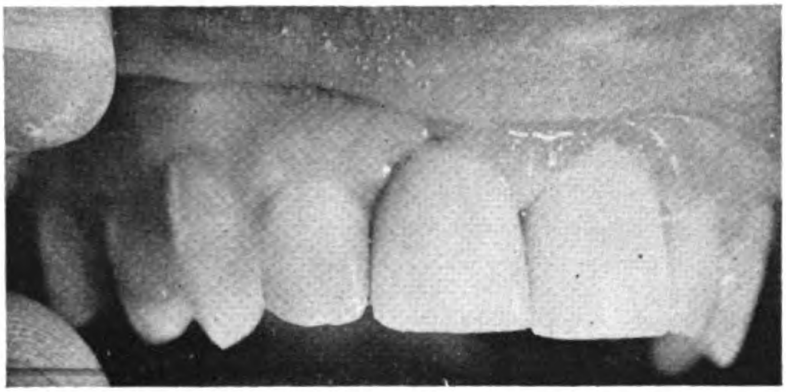


5. Excess acrylic trimmed away.

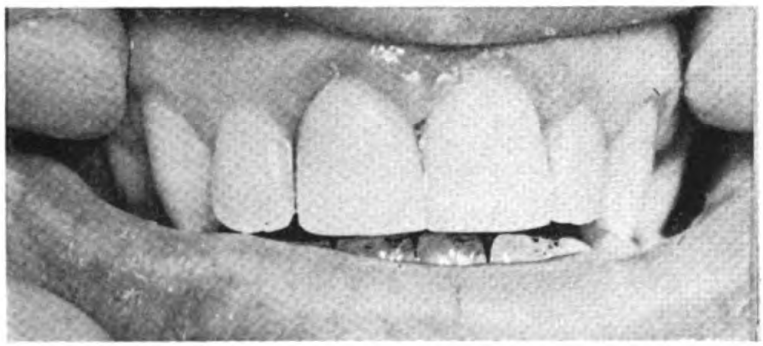
7. The celluloid form when heated in boiling water for approximately 5 minutes readily becomes soft and is removed from the flask.

8. The acrylic powder and liquid are mixed thoroughly and allowed to set before packing until a consistency similar to that of heavy bread dough is attained. (A cold mixing jar retards and a warm mixing jar accelerates the setting time.)

9. The case is trial-packed; a sheet of cellophane is placed between the upper and lower halves of the flask to insure easy separation after pressing. With only a moderate amount of pressure, the flask is closed completely, after which the flask is opened and the excess acrylic is trimmed away (fig. 5).



6. Rough crown trimmed and tried in place. Crown is longer than the incisors to allow for polishing.



7. Jacket polished and cemented to place with kryptex.

10. The case is ready to be cured. A new piece of cellophane is placed between the upper and lower halves of the flask. The flask is closed completely in a bench press as in trial-packing. The case is placed in water at 140° F. for 10 minutes, after which the heat is increased to boiling and held for 20 minutes. The flask and press are removed from the boiling water and exposed to the air for 10 minutes, when the case may be immersed in cold water for 15 minutes and then opened.

11. When a translucent incisal tip is indicated, the already cured acrylic is removed from the outer surface by a flame-shaped vulcanite bur. The translucent acrylic is applied to this area and the case again cured. If other shades are desired in the incisal third of the crown, they may be added in the same manner.

12. After processing has been accomplished the crown is removed from the flask and trimmed to approximate size.

13. If it is necessary to polish the crown after cementation, tripoli, fine pumice, tin oxide or precipitated chalk may be used on a fine brush wheel.

BIOSTATISTICS IN MEDICAL RESEARCH[1]

II. PROBABILITIES IN SMALL SAMPLES

H. M. C. LUYKX
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In medical research one is frequently faced with the problem of drawing conclusions from data based on a small number of observations. For example, let us say that rabbits inoculated with a given compound are known to die within 24 hours in 60 percent of cases. A group of 12 rabbits so inoculated subsequently receives treatment, and it is observed that only 4 of them die within 24 hours. Was the treatment responsible for reducing the effect of the inoculation?

To answer this question it is necessary to know whether such a result could reasonably be expected due to chance alone. If so there is no evidence that the treatment was effective. If not then something must have reduced the fatality rate. If the group of twelve rabbits was comparable in all respects except treatment with the population of rabbits on which the 60-percent fatality was based, then that treatment may be assumed to have been the causative factor. It is necessary, therefore, to test whether 33 percent (4 out of 12) in this case is significantly different from 60 percent.

A group of twelve rabbits is too small a sample to permit use of a simple significance test, such as calculating x/σ, as described in the first paper in this series. The general principle, however, is the same. The probability of obtaining a result such as this due to chance alone may be calculated, and, with this knowledge, the research worker decides how to interpret his findings. As mentioned in the earlier paper, a clear understanding of the meaning of "significant," as used in the statistical sense, is necessary, as well as a realization that the statistical analysis does not add to the quality of the observations, but merely provides the analyst with the means of making his decisions with greater confidence.

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[1] The first article in this series on biostatistics in medical research, I. Significant Differences, appeared in the December BULLETIN. A third and concluding article, III. Samples which are 100-Percent Positive, will appear in the February issue.

TABLE 2

$$C = \frac{n!}{x!\,(n-x)!}$$

n / x	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	n / x
0																			1	0
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	20	1
2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	190	2
3	1	1	4	10	15	21	28	36	45	55	66	78	91	105	120	136	153	171	1,140	3
4			1	5	15	35	56	84	120	165	220	286	364	455	560	680	816	969	4,845	4
5				1	6	21	28	36	45	55	66	78	91	105	120	136	153	171	15,504	5
6					1	7	8	9	10	11	12	13	14	15	16	17	18	19	38,760	6
7						1	1	1	1	1	1	1	1	1	1	1	1	1	77,520	7
8																			125,970	8
9																			167,960	9
10																			184,756	10
11																			167,960	11
12																			125,970	12
13																			77,520	13
14																			38,760	14
15																			15,504	15
16																			4,845	16
17																			1,140	17
18																			190	18
19																			20	19
20																			1	20

THE BINOMIAL DISTRIBUTION

The problem states that the average probability of an inoculated rabbit dying is 0.60. The question is how often, due to chance alone, one may expect to find as few as 4 rabbits dying in a group of 12 (assuming for the moment that the treatment had no effect at all).

According to the theory of probability it is possible, in a group of 12, to find none, 1, 2, or any number up to 12 rabbits dead, even though the probability is 0.60. The most likely number to die is that which is closest to 60 percent of 12, or seven. But it is obvious that in successive groups of 12 there would not be just seven dead rabbits each time. Quite often there would be 6 or 8 deaths. A little less often there would be 5 deaths, or 9 deaths. The chances of having 12 deaths, or 1, or no deaths, are very small, but they do exist.

TABLE 1.—*Binomial distribution when p = 0.60 and n = 12*

x	C	Q×R	P
		($q^n = 0.0000167772$)	
0	1	0.000017	(less than 0.00005)
1	12	0.000025	0.0003
2	66	0.000038	0.0025
3	220	0.000057	0.0125
4	495	0.000085	0.0421
5	792	0.000127	0.1006
6	924	0.000191	0.1765
7	792	0.000287	0.2273
8	495	0.000430	0.2128
9	220	0.000645	0.1419
10	66	0.000967	0.0638
11	12	0.001451	0.0174
12	1	0.002177	0.0022
		Total.....	0.9999

p = probability of one event being positive
n = number of subjects in the sample
x = number of positive events (subjects) which may be observed in one sample
C = coefficient of each term in the binomial expansion
$Q = q^n = (1-p)^n$
$R = (p/q)^x = \left(\frac{p}{1-p}\right)^x$
P = probability of observing x positive events in any sample

The binomial distribution in table 1 shows the probability of finding each of the possible number of deaths, from 0 to 12, in samples of 12, when the probability of dying is 0.60. This distribution is derived entirely from the values of p (= 0.60) and n (= 12), and depends on them only. For the sake of reference, the formula of the distribution may be described as the expansion of the expression:

$$(p + q)^n$$

where:

p = the probability of an event occurring
q = 1–p = the probability of that event not occurring, and
n = the size of the sample.

The reader need not be concerned with the algebra of this expansion, nor with the algebraic expression for any given term. The completed distribution is in terms of x, the possible number of deaths, and shows the value of P for each x. P is the probability of finding x dead rabbits in a sample of twelve. The table is filled in by simply applying the following formula for each value of x:

$$C \times Q \times R = P$$

The values of the three factors are found in tables C, Q and R respectively. The steps are as follows:

Step 1.—The possible values of x are listed from o to n, in this case from 0 to 12.

Step 2.—The values for C are copied directly from table 2, using the column for the proper n.

Step 3.—Next, in table 3, Q is located in the proper row and column for the values of p and n (0.6 and 12). This number is the same for each line of the distribution and is used as a constant multiplier only.

Step 4.—Using the successive values of R, from table 4, in the column for the proper p (= 0.6), and reading from x = 0 to x = n(= 12), Q is set up as a constant multiplier, and the product Q × R is entered on each line.

Step 5.—To obtain each value of P, C is multiplied by Q × R.

Step 6.—The column of P values thus calculated is then summated. The result should be very close to 1.0 to indicate that no error was made in the arithmetic.

TABLES FOR CALCULATION OF THE BINOMIAL DISTRIBUTION

n = total number of observations (sample size).

p = the probability of any observation being positive, where all observations are either positive or negative.

x = a given number of positive observations (may be any value from 0, no positive observations, to n, all observations positive).

P = the probability of finding x positive observations in a given sample, due to chance alone.

$$P = \overbrace{\frac{n!}{x!\,(n-x)!}}^{C} \times \overbrace{(1-p)^n}^{Q} \times \overbrace{\left(\frac{p}{1-p}\right)^x}^{R} = \frac{n!}{x!\,(n-x)!}\,p^x\,(1-p)^{n-x}$$

Note: n ! = factorial n x ! = factorial x

C, Q and R are taken from the tables, depending on the specific values of x, n and p as the case may require.

Note: In tables 3 and 4, the figure in parentheses following a given value signifies the number of zeros to be inserted between the digits as written and the decimal point. Where the figure is minus, the decimal point in front of the number is moved to the left. Where the figure has no minus sign, the zeros follow to the right of the digits.

Examples:

(1) $p = .6, n = 20$
$Q = .109951\ (-7) = .000\ 000\ 010\ 995\ 1$

(2) $p = .9, x = 17$
$R = 166{,}772\ (11) = 16{,}677{,}200{,}000{,}000{,}000$

In the latter case the ciphers should not actually be zeros. Whatever digits they represent, however, are of no consequence because the first six significant digits provide all the accuracy needed.

When multiplying two numbers taken from the table, they are used just as written, retaining six significant digits in the result. If there is a figure in parentheses following either number, that figure is written after the result. If both factors are followed by parentheses, the parenthetic figures are added algebraically and written after the result.

Examples:

(1) $p = .35, n = 14, x = 12$
$C \times Q \times R = 91 \times .240318\ (-2) \times .594095\ (-3) = 12.9923\ (-5)$
(moving the decimal 5 places to the left)
$= .000\ 129\ 923$, or $.000\ 130$

(2) $p = .85, n = 17, x = 15$
$C \times Q \times R = 136 \times .985261\ (-14) \times 199{,}487\ (6) = 26{,}730{,}256\ (-8)$
$= .267\ 302\ 56$, or $.267\ 303$

(3) $p = .6, n = 20, x = 5$
$C \times Q \times R = 15{,}504 \times .109951\ (-7) \times 7.59375 = 12{,}944.9\ (-7)$
$= .001\ 294\ 49$, or $.001\ 294$

According to table 1, the probability of having no deaths is too small to utilize four decimal places (actually less than two in one hundred thousand). The probability of having one death is about three in ten thousand; of having two deaths over two in one thousand, and so on. The chances of having four deaths or less are given by the sum of the P values from $x = 0$ through $x = 4$. Thus:

0.0000 (less than 0.00005)
0.0003
0.0025
0.0125
0.0421
0.0574

The probability of having four deaths or less, when $p = 0.60$, is therefore 0.057, or a little less than six in one hundred[2]. This is generally considered not sufficiently unlikely to permit us to call it good evidence. In other words, on this evidence alone we do not feel justified in saying the treatment was effective in reducing

[2] If the probability of finding four deaths or less is the only information desired, table 1 need not be completed beyond $x = 4$.

TABLE 3

$$Q = (1 - p)^n$$

n \ p	.01	.02	.03	.04	.05	.1	.15	.2	.25	p / n
2	.980 1	.960 4	.940 9	.921 6	.902 5	.81	.722 5	.64	.562 5	2
3	.970 299	.941 192	.912 673	.884 736	.857 375	.729	.614 125	.512	.421 875	3
4	.960 596	.922 368	.885 293	.849 347	814 506	.656 1	.522 006	.409 6	.316 406	4
5	.950 990	.903 921	.858 734	.815 373	.773 781	.590 49	.443 705	.327 68	.237 305	5
6	.941 480	.885 842	.832 972	.782 758	.735 092	.531 441	.377 150	.262 144	.177 979	6
7	.932 065	.868 126	.807 983	.751 447	.698 337	.478 297	.320 577	.209 715	.133 484	7
8	.922 745	.850 763	.783 743	.721 390	.663 420	.430 467	.272 491	.167 772	.100 113	8
9	.913 517	.833 748	.760 231	.692 534	.630 249	.387 420	.231 617	.134 218	.750 847(−1)	9
10	.904 382	.817 073	.737 424	.664 833	.598 737	.348 678	.196 874	.107 374	.563 135(−1)	10
11	.895 338	.800 731	.715 301	.638 239	.568 800	.313 811	.167 343	.858 993(−1)	.422 351(−1)	11
12	.886 385	.784 717	.693 842	.612 710	.540 360	.282 430	.142 242	.687 195(−1)	.316 764(−1)	12
13	.877 521	.769 022	.673 027	.588 201	.513 342	.254 187	.120 905	.549 756(−1)	.237 573(−1)	13
14	.868 746	.753 642	.652 836	.564 673	.487 675	.228 768	.102 770	.439 805(−1)	.178 179(−1)	14
15	.860 058	.738 569	.633 251	.542 086	.463 291	.205 891	.873 542(−1)	.351 844(−1)	.133 635(−1)	15
16	.851 458	.723 798	.614 254	.520 403	.440 127	.185 302	.742 511(−1)	.281 475(−1)	.100 226(−1)	16
17	.842 943	.709 322	.595 826	.499 587	.418 120	.166 772	.631 134(−1)	.225 180(−1)	.751 695(−2)	17
18	.834 514	.695 135	.577 951	.479 603	.397 214	.150 095	.536 464(−1)	.180 144(−1)	.563 771(−2)	18
19	.826 169	.681 233	.560 613	.460 419	.377 354	.135 085	.455 994(−1)	.144 115(−1)	.422 828(−2)	19
20	.817 907	.667 608	.543 794	.442 002	.358 486	.121 577	.387 595(−1)	.115 292(−1)	.317 121(−2)	20

n \ p	.3	.35	.4	.45	.5	.55	.6	p / n
2	.49	.422 5	.36	.302 5	.25	.202 5	.16	2
3	.343	.274 625	.216	.166 375	.125	.091 125	.064	3
4	.240 1	.178 506	.129 6	.915 062(−1)	.062 5	.410 062(−1)	.025 6	4
5	.168 07	.116 029	.077 76	.503 284(−1)	.031 25	.194 528(−1)	.010 24	5
6	.117 649	.754 189(−1)	.046 656	.276 806(−1)	.015 625	.830 377(−2)	.004 096	6
7	.823 543(−1)	.490 223(−1)	.279 936(−1)	.152 244(−1)	.781 25 (−2)	.373 669(−2)	.163 84 (−2)	7
8	.576 480(−1)	.318 645(−1)	.167 962(−1)	.837 339(−2)	.390 625(−2)	.168 151(−2)	.655 36 (−3)	8
9	.403 536(−1)	.207 119(−1)	.100 777(−1)	.460 537(−2)	.195 312(−2)	.756 681(−3)	.262 144(−3)	9
10	.282 475(−1)	.134 627(−1)	.604 662(−2)	.253 295(−2)	.976 562(−3)	.340 506(−3)	.104 858(−3)	10
11	.197 733(−1)	.875 078(−2)	.362 797(−2)	.139 312(−2)	.488 281(−3)	.153 228(−3)	.419 430(−4)	11
12	.138 413(−1)	.568 801(−2)	.217 678(−2)	.766 218(−3)	.244 141(−3)	.689 525(−4)	.167 772(−4)	12
13	.968 890(−2)	.369 721(−2)	.130 607(−2)	.421 420(−3)	.122 070(−3)	.310 286(−4)	.671 089(−5)	13
14	.678 223(−2)	.240 318(−2)	.783 642(−3)	.231 781(−3)	.610 352(−4)	.139 629(−4)	.268 435(−5)	14
15	.474 756(−2)	.156 207(−2)	.470 185(−3)	.127 479(−3)	.305 176(−4)	.628 330(−5)	.107 374(−5)	15
16	.332 329(−2)	.101 535(−2)	.282 111(−3)	.701 137(−4)	.152 588(−4)	.282 748(−5)	.429 497(−6)	16
17	.232 630(−2)	.659 974(−3)	.169 266(−3)	.385 625(−4)	.762 939(−5)	.127 237(−5)	.171 799(−6)	17
18	.162 841(−2)	.428 983(−3)	.101 560(−3)	.212 094(−4)	.381 470(−5)	.572 566(−6)	.687 195(−7)	18
19	.113 989(−2)	.278 839(−3)	.609 360(−4)	.116 652(−4)	.190 735(−5)	.257 655(−6)	.274 878(−7)	19
20	.797 923(−3)	.181 245(−3)	.365 616(−4)	.641 584(−5)	.953 674(−6)	.115 945(−6)	.109 951(−7)	20

fatality, because the results observed could have occurred due to chance.

If, on the other hand, a given experiment in this example had produced 2 dead rabbits in a group of 12, this would be called significant evidence regarding the effectiveness of the treatment. Two deaths or less, out of 12, could occur due to chance only 0.0028 of the time, or less than 3 times in a thousand such experiments.

This method of determining the probability of obtaining a given result due to chance alone, in small samples, involves application

TABLE 3 (Continued)

$$Q = (1 - p)^n$$

n \ p	.65	.7	.75	.8	.85	.9	n \ p
2	.122 5	.09	.062 5	.04	.022 5	.01	2
3	.042 875	.027	.015 625	.008	.003 375	.001	3
4	.150 062(−1)	.008 1	.390 625(−2)	.001 6	.506 25 (−3)	.000 1	4
5	.525 219(−2)	.002 43	.976 562(−3)	.000 32	.759 375(−4)	.000 01	5
6	.183 827(−2)	.000 729	.244 141(−3)	.000 064	.113 906(−4)	.000 001	6
7	.643 393(−3)	.218 7 (−3)	.610 352(−4)	.128 (−4)	.170 859(−5)	.1 (−6)	7
8	.225 188(−3)	.656 1 (−4)	.152 588(−4)	.256 (−5)	.256 289(−6)	.1 (−7)	8
9	.788 156(−4)	.196 83 (−4)	.381 470(−5)	.512 (−6)	.384 434(−7)	.1 (−8)	9
10	.275 855(−4)	.590 49 (−5)	.953 674(−6)	.102 4 (−6)	.576 650(−8)	.1 (−9)	10
11	.965 492(−5)	.177 147(−5)	.238 419(−6)	.204 8 (−7)	.864 976(−9)	.1 (−10)	11
12	.337 922(−5)	.531 441(−6)	.596 046(−7)	.409 6 (−8)	.129 746(−9)	.1 (−11)	12
13	.118 273(−5)	.159 432(−6)	.149 012(−7)	.819 2 (−9)	.194 620(−10)	.1 (−12)	13
14	.413 955(−6)	.478 297(−7)	.372 529(−8)	.163 84 (−9)	.291 929(−11)	.1 (−13)	14
15	.144 884(−6)	.143 489(−7)	.931 323(−9)	.327 68 (−10)	.437 894(−12)	.1 (−14)	15
16	.507 094(−7)	.430 467(−8)	.232 831(−9)	.655 36 (−11)	.656 841(−13)	.1 (−15)	16
17	.177 483(−7)	.129 140(−8)	.582 077(−10)	.131 072(−11)	.985 261(−14)	.1 (−16)	17
18	.621 190(−8)	.387 420(−9)	.145 519(−10)	.262 144(−12)	.147 789(−14)	.1 (−17)	18
19	.217 417(−8)	.116 226(−9)	.363 798(−11)	.524 288(−13)	.221 684(−15)	.1 (−18)	19
20	.760 958(−9)	.348 678(−10)	.909 495(−12)	.104 858(−13)	.332 526(−16)	.1 (−19)	20

n \ p	.95	.96	.97	.98	.99	n \ p
2	.002 5	.001 6	.000 9	.000 4	.001	2
3	.000 125	.000 064	.000 027	.000 008	.000 001	3
4	.625 (−5)	.256 (−5)	.81 (−6)	.16 (−6)	.1 (−7)	4
5	.312 5 (−6)	.102 4 (−6)	.243 (−7)	.32 (−8)	.1 (−9)	5
6	.156 25 (−7)	.409 6 (−8)	.729 (−9)	.64 (−10)	.1 (−11)	6
7	.781 25 (−9)	.163 84 (−9)	.218 7 (−10)	.128 (−11)	.1 (−13)	7
8	.390 625(−10)	.655 36 (−11)	.656 1 (−12)	.256 (−13)	.1 (−15)	8
9	.195 312(−11)	.262 144(−12)	.196 83 (−13)	.512 (−15)	.1 (−17)	9
10	.976 562(−13)	.104 858(−13)	.590 49 (−15)	.102 4 (−16)	.1 (−19)	10
11	.488 281(−14)	.419 430(−15)	.177 147(−16)	.204 8 (−18)	.1 (−21)	11
12	.244 141(−15)	.167 772(−16)	.531 441(−18)	.409 6 (−20)	.1 (−23)	12
13	.122 070(−16)	.671 089(−18)	.159 432(−19)	.819 2 (−22)	.1 (−25)	13
14	.610 352(−18)	.268 435(−19)	.478 297(−21)	.163 84 (−23)	.1 (−27)	14
15	.305 176(−19)	.107 374(−20)	.143 489(−22)	.327 68 (−25)	.1 (−29)	15
16	.152 588(−20)	.429 497(−22)	.430 467(−24)	.655 36 (−27)	.1 (−31)	16
17	.762 939(−22)	.171 799(−23)	.129 140(−25)	.131 072(−28)	.1 (−33)	17
18	.381 470(−23)	.687 195(−25)	.387 420(−27)	.262 144(−30)	.1 (−35)	18
19	.190 735(−24)	.274 878(−26)	.116 226(−28)	.524 288(−32)	.1 (−37)	19
20	.953 674(−26)	.109 951(−27)	.348 678(−30)	.104 858(−33)	.1 (−39)	20

of the binomial theorem. This theorem is the basis of the x/σ test referred to earlier, the latter being an approximation. In large samples the approximation is sufficiently close to be adequate in practically all cases. In small samples the results of this approximation may vary widely from those obtained by direct application of the binomial theorem. Because this theorem involves some more or less complex and laborious mathematics, a number of special tests have been devised which will approximate it more closely than the x/σ test. By means of the accompanying tables, however,

TABLE 4

$$R = \left(\frac{p}{1-p}\right)^x$$

p / x	.01	.02	.03	.04	.05	.1	.15	p / x
0	1	1	1	1	1	1	1	0
1	.101 010(−1)	.204 082(−1)	.309 278(−1)	.416 667(−1)	.526 316(−1)	.111 111	.176 471	1
2	.102 030(−3)	.416 493(−3)	.956 531(−3)	.173 611(−2)	.277 008(−2)	.123 457(−1)	.311 419(−1)	2
3	.103 061(−5)	.849 986(−5)	.295 834(−4)	.723 380(−4)	.145 794(−3)	.137 174(−2)	.549 562(−2)	3
4	.104 102(−7)	.173 467(−6)	.914 952(−6)	.301 408(−5)	.767 336(−5)	.152 416(−3)	.969 816(−3)	4
5	.105 154(−9)	.354 013(−8)	.282 975(−7)	.125 587(−6)	.403 861(−6)	.169 351(−4)	.171 144(−3)	5
6	.106 216(−11)	.722 476(−10)	.875 179(−9)	.523 278(−8)	.212 558(−7)	.188 168(−5)	.302 019(−4)	6
7	.107 289(−13)	.147 444(−11)	.270 674(−10)	.218 033(−9)	.111 873(−8)	.209 075(−6)	.532 974(−5)	7
8	.108 372(−15)	.300 906(−13)	.837 136(−12)	.908 469(−11)	.588 805(−10)	.232 306(−7)	.940 543(−6)	8
9	.109 467(−17)	.614 095(−15)	.258 908(−13)	.378 529(−12)	.309 897(−11)	.258 117(−8)	.165 978(−6)	9
10	.110 573(−19)	.125 325(−16)	.800 747(−15)	.157 720(−13)	.163 104(−12)	.286 797(−9)	.292 903(−7)	10
11	.111 690(−21)	.255 766(−18)	.247 654(−16)	.657 168(−15)	.858 441(−14)	.318 664(−10)	.516 887(−8)	11
12	.112 818(−23)	.521 972(−20)	.765 939(−18)	.273 820(−16)	.451 811(−15)	.354 071(−11)	.912 154(−9)	12
13	.113 957(−25)	.106 525(−21)	.236 888(−19)	114 092(−17)	.237 795(−16)	.393 412(−12)	.160 968(−9)	13
14	.115 108(−27)	.217 398(−23)	.732 644(−21)	.475 382(−19)	.125 155(−17)	.437 124(−13)	.284 062(−10)	14
15	.116 271(−29)	.443 669(−25)	.226 591(−22)	.198 076(−20)	.658 713(−19)	.485 694(−14)	.501 285(−11)	15
16	.117 446(−31)	.905 446(−27)	.700 797(−24)	.825 316(−22)	.346 691(−20)	.539 660(−15)	.884 621(−12)	16
17	.118 632(−33)	184 785(−28)	.216 741(−25)	.343 882(−23)	.182 469(−21)	.599 622(−16)	.156 110(−12)	17
18	.119 830(−35)	.377 112(−30)	.670 334(−27)	.143 284(−24)	.960 362(−23)	.666 246(−17)	.275 488(−13)	18
19	.121 041(−37)	.769 617(−32)	.207 320(−28)	.597 017(−26)	.505 454(−24)	.740 274(−18)	.486 155(−14)	19
20	.122 263(−39)	.157 065(−33)	.641 195(−30)	.248 757(−27)	.266 028(−25)	.822 526(−19)	.857 920(−15)	20

p / x	.2	.25	.3	.35	.4	.45	.5	.55	p / x
0	1	1	1	1	1	1	1	1	0
1	.25	.333 333	.428 571	.538 462	.666 667	.818 182	1	1.222 22	1
2	.062 5	.111 111	.183 673	.289 941	.444 444	.669 421	1	1.493 83	2
3	.015 625	.370 370(−1)	.787 172(−1)	.156 122	.296 296	.547 708	1	1.825 79	3
4	.390 625(−2)	.123 457(−1)	.337 359(−1)	.840 657(−1)	.197 531	.448 125	1	2.231 52	4
5	.976 562(−3)	.411 523(−2)	.144 583(−1)	.452 661(−1)	.131 687	.366 648	1	2.727 41	5
6	.244 141(−3)	.137 174(−2)	.619 640(−2)	.243 741(−1)	.877 915(−1)	.299 985	1	3.333 50	6
7	.610 352(−4)	.457 247(−3)	.265 560(−2)	.131 245(−1)	.585 277(−1)	.245 442	1	4.074 28	7
8	.152 588(−4)	.152 416(−3)	.113 811(−2)	.706 704(−2)	.390 184(−1)	.200 816	1	4.979 68	8
9	.381 470(−5)	.508 053(−4)	.487 763(−3)	.380 533(−2)	.260 123(−1)	.164 304	1	6.086 28	9
10	.953 674(−6)	.169 351(−4)	.209 041(−4)	.204 902(−2)	.173 415(−1)	.134 431	1	7.438 78	10
11	.238 419(−6)	.564 503(−5)	.895 891(−4)	.110 332(−2)	.115 610(−1)	.109 989	1	9.091 84	11
12	.596 046(−7)	.188 168(−5)	.383 953(−4)	.594 095(−3)	.770 735(−2)	.899 908(−1)	1	11.112 3	12
13	.149 012(−7)	.627 225(−6)	.164 551(−4)	.319 898(−3)	.513 823(−2)	.736 288(−1)	1	13.581 6	13
14	.372 529(−8)	.209 075(−6)	.705 221(−5)	.172 253(−3)	.342 549(−2)	.602 417(−1)	1	16.599 8	14
15	.931 323(−9)	.696 917(−7)	302 237(−5)	.927 514(−4)	.228 366(−2)	.492 887(−1)	1	20.288 6	15
16	.232 831(−9)	.232 306(−7)	.129 530(−5)	.499 430(−4)	.152 244(−2)	.403 271(−1)	1	24.797 2	16
17	.582 077(−10)	.774 352(−8)	.555 130(−6)	.268 924(−4)	.101 496(−2)	.329 949(−1)	1	30.307 7	17
18	.145 519(−10)	.258 117(−8)	.237 913(−6)	.144 805(−4)	.676 639(−3)	.269 958(−1)	1	37.042 7	18
19	.363 798(−11)	.860 392(−9)	101 963(−6)	.779 721(−5)	.451 093(−3)	.220 875(−1)	1	45.274 5	19
20	.909 495(−12)	.286 797(−9)	.436 983(−7)	.419 850(−5)	.300 729(−3)	.180 716(−1)	1	55.335 5	20

the calculation of a binomial distribution is reduced to its maximum simplicity. Research workers may thus be encouraged to make an accurate statement of probabilities instead of depending on formulas, the limitations of which are not always clearly understood.

It must be remembered, as pointed out previously, that the

TABLE 4 (Continued)

$$\mathbf{R} = \left(\frac{p}{1-p}\right)^x$$

x \ p	.6	.65	.7	.75	.8	.85	.9	p / x
0	1	1	1	1	1	1	1	0
1	1.5	1.857 14	2.333 33	3	4	5.666 67	9	1
2	2.25	3.448 98	5.444 44	9	16	32.111 1	81	2
3	3.375	6.405 25	12.703 7	27	64	181.963	729	3
4	5.062 5	11.895 5	29.642 0	81	256	1 031.12	6 561	4
5	7.593 75	22.091 6	69.164 6	243	1 024	5 843.03	59 049	5
6	11.390 6	41.027 2	161.384	729	4 096	33 110.5	531 441	6
7	17.085 9	76.193 4	376.563	2 187	16 384	187 626	478 297(1)	7
8	25.628 9	141.502	878.647	6 561	65 536	106 322(1)	430 467(2)	8
9	38.443 4	262.789	2 050.18	19 683	262 144	602 489(1)	387 420(3)	9
10	57.665 0	488.037	4 783.74	59 049	104 858(1)	341 410(2)	348 678(4)	10
11	86.497 6	906.355	11 162.1	177 147	419 430(1)	193 465(3)	313 811(5)	11
12	129.746	1 683.23	26 044.8	531 441	167 772(2)	109 631(4)	282 430(6)	12
13	194.620	3 126.00	60 771.3	159 432(1)	671 089(2)	621 240(4)	254 187(7)	13
14	291.929	5 805.43	141 800	478 297(1)	268 435(3)	352 036(5)	228 768(8)	14
15	437.894	10 781.5	330 866	143 489(2)	107 374(4)	199 487(6)	205 891(9)	15
16	656.841	20 022.8	772 020	430 467(2)	429 497(4)	113 043(7)	185 302(10)	16
17	985.261	37 185.2	180 138(1)	129 140(3)	171 799(5)	640 576(7)	166 772(11)	17
18	1 477.89	69 058.3	420 322(1)	387 420(3)	687 195(5)	362 993(8)	150 095(12)	18
19	2 216.84	128 251	980 751(1)	116 226(4)	274 878(6)	205 696(9)	135 085(13)	19
20	3 325.26	238 181	228 842(2)	348 678(4)	109 951(7)	116 561(10)	121 577(14)	20

x \ p	.95	.96	.97	.98	.99	p / x
0	1	1	1	1	1	0
1	19	24	32.333 3	49	99	1
2	361	576	1 045.44	2 401	9 801	2
3	6 859	13 824	33 802.7	117 649	970 299	3
4	130 321	331 776	109 295(1)	576 480(1)	960 596(2)	4
5	247 610(1)	796 262(1)	353 388(2)	282 475(3)	950 990(4)	5
6	470 459(2)	191 103(3)	114 262(4)	138 413(5)	941 480(6)	6
7	893 872(3)	458 647(4)	369 448(5)	678 223(6)	932 065(8)	7
8	169 836(5)	110 075(6)	119 455(7)	332 329(8)	922 745(10)	8
9	322 688(6)	264 181(7)	386 237(8)	162 841(10)	913 517(12)	9
10	613 107(7)	634 034(8)	124 883(10)	797 923(11)	904 382(14)	10
11	116 490(9)	152 168(10)	403 790(11)	390 982(13)	895 338(16)	11
12	221 331(10)	365 203(11)	130 559(13)	191 581(15)	886 385(18)	12
13	420 530(11)	876 488(12)	422 140(14)	938 748(16)	877 521(20)	13
14	799 007(12)	210 357(14)	136 492(16)	459 987(18)	868 746(22)	14
15	151 811(14)	504 857(15)	441 324(17)	225 393(20)	860 058(24)	15
16	288 441(15)	121 166(17)	142 695(19)	110 443(22)	851 458(26)	16
17	548 039(16)	290 798(18)	461 379(20)	541 170(23)	842 943(28)	17
18	104 127(18)	697 915(19)	149 179(22)	265 173(25)	834 514(30)	18
19	197 842(19)	167 500(21)	482 346(23)	129 935(27)	826 169(32)	19
20	375 900(20)	401 999(22)	155 959(25)	636 681(28)	817 907(34)	20

discussion here is concerned only with determining what could happen due to chance, and evaluating the observed results in that light.

The statistical treatment says nothing about the degree of effectiveness of the remedy, or about the cause of the differences in percentages observed.

KODACHROME PHOTOMICROGRAPHY IN MALARIA

RAPID METHOD OF INSTRUCTION

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As the present war has partly confined itself to malarial areas, there has been a great need for malaria microscopists. The teaching of malaria microscopy as it is done today is slow and laborious at best. There are many reasons for this. One of the most important is that a good source of well stained positive smears is lacking. Smears fade over a period of a few weeks, even those that are mounted carefully, so that to maintain a good slide library is nearly impossible unless one has a continuous inflow of new material.

Because color values are lost on old slides, the students are under the impression that the malaria parasite is not easily seen, whereas in fresh positive smears it is easily seen and of excellent color. For the beginner there are also other time consumers such as adjustment, lighting, oil immersion technic and the time used searching for parasites. It seemed necessary therefore to find an improved method of group instruction.

At this activity laboratory technicians (qualified assistants) are trained for field hospitals serving with the Marine Corps. Medical officers also are trained in clinical methods and in the laboratory diagnosis of malaria. Our source of positive smears is the reservoir of relapsing cases in personnel who return at irregular intervals from the South Pacific area.

Smears are hastily stained for the trained malaria microscopists; they are for the most part thick smears and are often faded within a 3-week period and unfit for the instruction of beginners. Not enough microscopes are available for instruction of a large group.

These factors, together with the fact that the majority of the corpsman candidates had never seen a microscope, led to experimentation with photomicrography of malaria plasmodia. If the

plasmodia could be photographed in their natural color, here was a method for the permanent recording of all stages of development of the organism, as well as for the condensation of the teaching wealth of many slides in their normal original colors. Technical difficulties could be eliminated for the beginner. A study of the microscopy of malaria could be made with a minimum of equipment and a wealth of nonperishable material.

After a period of trial and error, excellent natural color reproductions of all the stages of development of the Plasmodium vivax were produced. Later a series of reproductions of P. falciparum was also made. These reproductions consist of 35 mm. kodachrome transparencies mounted between glass covers. They are projected with any standard slide projector on a glass bead screen and must be viewed from a distance of at least 15 feet. They constitute a permanent reproduction of the parasite in the colors as it appears on a freshly stained slide. They were produced with equipment from Field Medical Unit No. 39 which includes a Bausch & Lomb microscope and its standard illumination source. The only additions were a Leica camera and magenta stock filter solutions (*1*). The technic of making these kodachrome transparencies is relatively simple and easily within the ability of any good amateur photographer.

METHOD OF INSTRUCTION

With these transparencies of slides projected on a screen before a class of students, many features of the malaria parasite may be pointed out by the instructor while the students are all simultaneously viewing exactly what they would see through the microscope.

As the microscopic diagnosis of malaria is taught here, on the first day the disease is discussed and the cycle of the parasite in man is drawn on the blackboard with colored chalk. In these drawings certain of the colored transparencies are imitated. Diagrammatic representation as found in textbooks is often confusing because it is more ideal than what is actually seen. The anatomy of the parasite is discussed and demonstrated on the kodachrome projections. After the asexual cycle is presented, the students are told that they will be required to learn the terminology of the various stages, and that they must all be capable of redepicting the cycle as it has been presented.

On the second day slides are projected in the normal sequence of development of the parasite in the blood cell. The vivax parasite is used because all stages are easily seen. Later the other

types may be taught by their variance from vivax. The development of the trophozoite is shown first, then schizogony to maturity. At all stages care is taken to imitate the intimate parts of the anatomy of the parasite. This is not possible with the older methods of teaching. Among the more important features are vacuoles, pseudopodia, hemozoin pigment, the Burgundy red color of the chromatin granule, division of nuclear substance, and the changes that take place in the red blood cell.

After one showing, the entire group is presented again and this time the students are able to make sight diagnoses of the various stages. Blood platelets and artifacts are shown concomitantly with the parasites and a direct comparison can be made. It is necessary for the students to realize that stages of development may take protean forms; this is adequately illustrated by the variations of the kodachrome photomicrographs.

It is gratifying to note the accuracy with which the students will now make a diagnosis when given slides to view under the microscope. Most of them are able to make a differential diagnosis from thin smears by the third day. It is noteworthy that they ignore for the most part artifacts, platelets, and leukocytes. They seldom try to construct a parasite out of an artifact, a fault common to beginners.

After they have mastered the reading of thin smears a review of the technic of thick smears and the principles of staining is presented, and is supplemented by projections of many reproductions of thick-smear slides. The changes in the parasite in the thick smear as compared with that of the thin smear are demonstrated by having the students view thin- and thick-smear projections alternately. Such major changes as condensation and distortion may readily be seen. Weeks were sometimes involved in the former method of instruction; by the use of these photomicrographs men are trained in 7 days of continuous instruction.

PHOTOMICROGRAPHIC METHOD

As stated previously, the equipment consists of a microscope and a standard Burton light source, a camera, and Eastman Kodachrome film, 35 mm., in rolls of 18 exposures. This should be of the artificial light, type A, indoor. An exposure meter is not necessary as test exposures can be made (*2*). Filters for color correction will be discussed later. A review of the literature would lead one to believe that this procedure would be extremely difficult without highly technical equipment, lighting sources, and many filters, but very satisfactory results can be attained with the equipment listed.

The literature on hand does not reveal any report on kodachrome photomicrography of the malaria plasmodium. Personal communication with other sources indicates that it has not been attempted or was not practical. Perhaps this is because the parasite is a very poor subject for color photography. To remedy this situation we have altered the Giemsa stain (Bethesda) slightly in order to intensify the staining of the cytoplasm and to produce a more marked color contrast.

SMEARS AND STAINS

It is advisable to photograph thin smears first in order to check the technic. Wright's stain is almost always unsatisfactory because it contains eosin which is not very well reproduced in a kodachrome photomicrograph. Because of its very narrow absorption band as well as its peculiar position in the spectrum, this stain usually appears green (*2*) when the color is actually red or pink. An attempt should be made to keep the thin smears at about the same density. They should be stained *constantly* as follows:

Materials required:	Giemsa stain (Bethesda). Giemsa buffer solution. 0.5 percent solution of aqueous methylene blue.
Stain mixture:	Giemsa stain..... 1 part Giemsa buffer solution..... 10 parts Methylene blue (1:10,000)..... ⅝ part
Directions:	Immerse fixed thin smears for 40 minutes, rinse quickly in buffer solution, and allow to dry; do not blot.

This technic will reveal the red cells as a blue-gray, and the parasites in their normal colors of blue and Burgundy red. The cytoplasm will be contrasty and the background of the film should have a slightly bluish cast. Pigment will retain its normal color.

Thick smears should be stained in the same manner except that the stain-buffer dilution is 1:50. The methylene blue should be added in a ratio of 2 cc. to a total staining mixture of 50 cubic centimeters. Staining time is 45 minutes and buffer time 3 minutes. Direct sunlight must not strike the slides.

Figure 1 shows the photomicrographic assembly. This is divided into the camera-microscope box, the Burton illuminator, the Bausch & Lomb microscope, the bellows assembly, the camera board and the Leica camera. The bellows assembly may be made of two folds of black paper.

The box is easily constructed of soft pine. Its width and depth

are 32 cm.; its height from the floor to the top of the camera board is 49 cm. The lateral ports admit the hands for microscope adjustments.

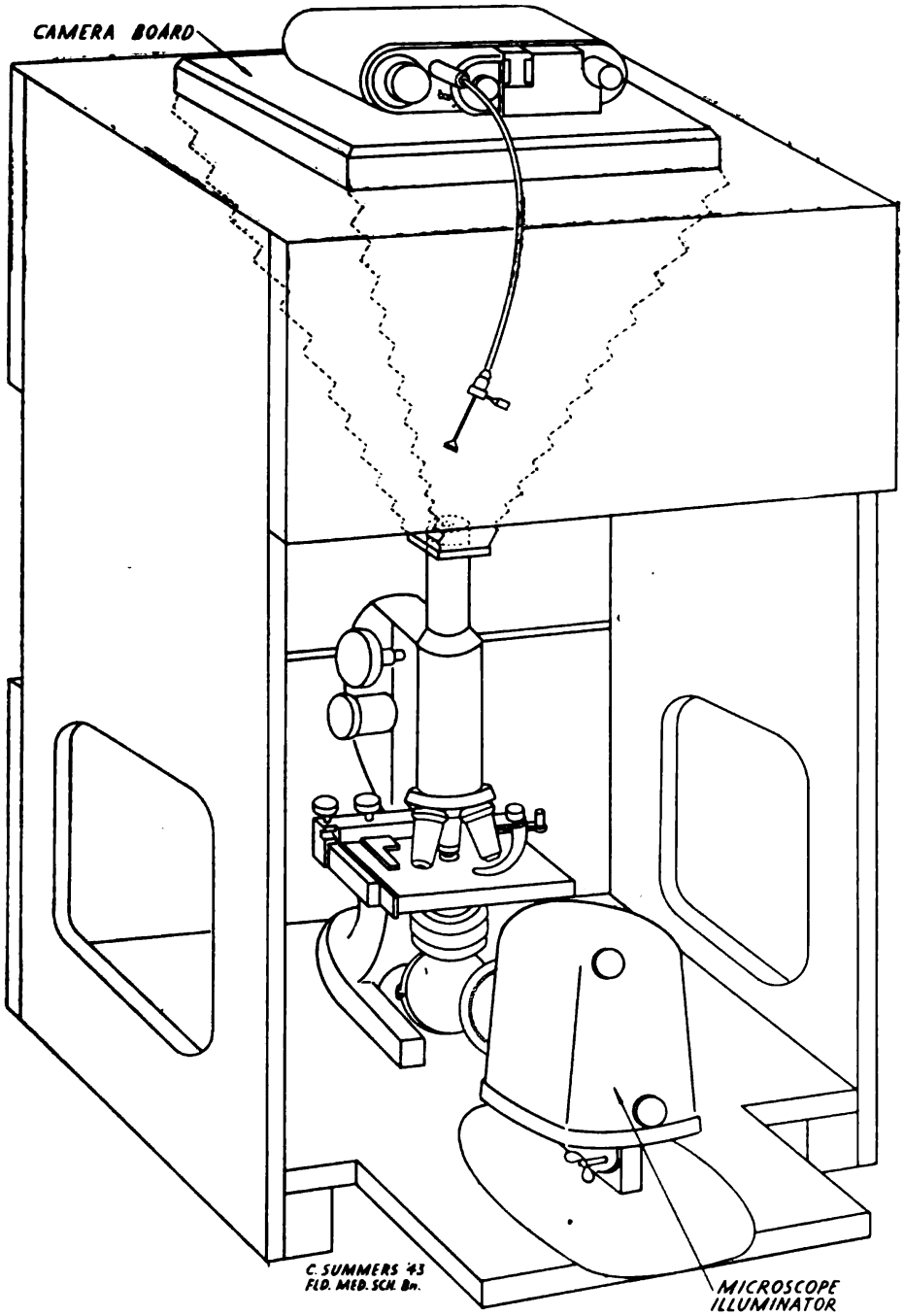
The camera board is shown in figure 3. It is 22 cm. square and 1.5 cm. thick. Its center opening admits snugly the protruding mechanism of the camera with lens removed. If the fit is accurate it will be lightproof. The top side of the camera board is faced with cardboard to protect the camera and to facilitate a snug fit with the camera front.

The microscope is placed within the box as shown in figure 1, and the paper bellows is attached securely to the barrel of the microscope below the eyepiece by a piece of cotton tape. This is so arranged that the distance from the ocular top to the film plane is 20 cm. The microscope illuminator is placed on the projected floor of the box with its extended barrel pointing toward the center of the concave mirror from a distance of 8.5 cm. (rim of barrel to mirror) as shown in figure 3.

The Burton illuminator contains a 100-watt bayonet base projection bulb. This light source is sufficient. The green heat-absorbing light condenser is replaced by a white one. The beam from the illuminator on the concave mirror is centered and reflected vertically through the substage condenser. With the 5-power eyepiece in place the projected spot is about 0.5 cm. in excess of the camera opening of the camera board. This spot must be centered exactly in the camera opening. This can be done by placing a large rhinoscopic mirror through the camera opening and viewing the centering of the spot on the underside. When its overlap is equal around the periphery, the spot is centered. This procedure will insure maximum light intensity. The 10-power eyepiece is then substituted for the 5-power one. The projected spot is now much larger but its exact center will be represented on the film when the camera is placed later. Spherical aberration will now be less apparent (*8*).

Figure 2 shows the details of the alinement of the optical system. Even though the angle of incidence of the light is seemingly in error, it is actually found that this arrangement produces a more intense subject illumination with this equipment than a seemingly more correct 90-degree angle. A more intense illumination facilitates focusing.

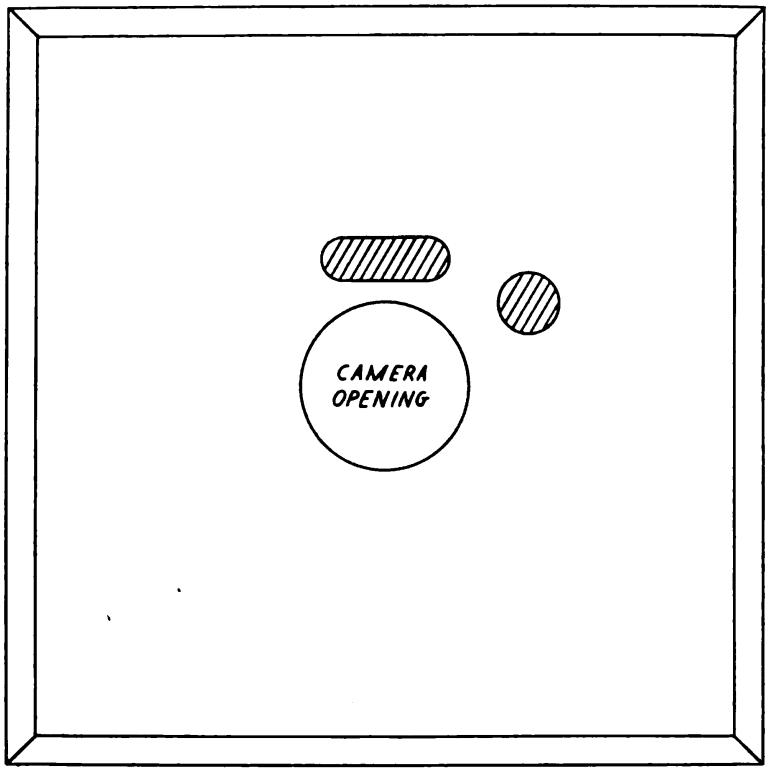
The microscopic slide to be photographed is placed on the mechanical stage and the oil immersion lens is adjusted with clear liquid petrolatum. A fine ground glass plate is placed over the camera opening of the camera board to receive the projected image, and the image to be photographed is brought into sharp



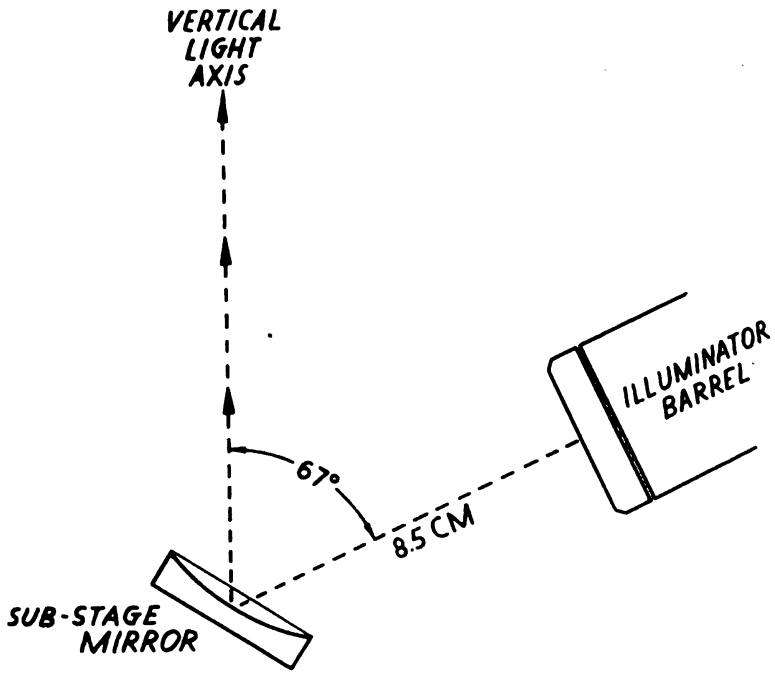
1. Assembly complete with camera inserted.

focus. At least 30 seconds is allowed for the oil to assume its most static position, and then the image is refocused.

Critical focus of the projected image may now be obtained by using the inverted 5-power ocular as a magnifier. The substage condenser is adjusted to give maximum light with its diaphragm widely opened. The ground glass plate is removed, the Leica



2. Camera board (top view) showing camera accommodation.



3. Lower optical alinement.

camera (lens removed) is placed in position, and the exposure is made with the aid of a cable release. The camera is removed and the focus rechecked on the ground glass plate. If the focus was not held, another exposure may be made after readjustment. A generous depth of focus will permit the variation in the level between the film plane and the plane of the ground glass.

Construction and assembly of the apparatus must be such that there will be no movement at any time. The entire optical system must be scrupulously cleansed of dust or other material to insure clear images.

Exposure duration must be exact with kodachrome film. We have found that one-fourth to one-second exposures will usually include any of the variables in smear density and staining discrepancies that may be present.

A compensating filter has been found to be helpful in eliminating the greenish cast in the transparency (*1*) (*2*). A workable filter can be made as follows. A set of their liquid compensating filters (magenta and blue stock solutions) is obtained from the Eastman Kodak Company. A solution is made by dissolving Knox's gelatin in 400 cc. of distilled water. To this is added 4 cc. of the magenta stock solution and the whole is mixed thoroughly. Several 5-cm. square mounting glasses are prepared by sealing their edges with waterproof cellulose tape. The magenta-gelatin mixture is then poured on the glasses to a depth of 1 mm., solidified in a cool place, and allowed to dry thoroughly. Another mounting glass may be bound to this prepared slide to protect the surface as one would mount a transparency. This filter is slipped into the clip on the barrel of the Burton illuminator.

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CLINICAL NOTES

CONGENITAL HEMIHYPERTROPHY

REPORT OF CASE

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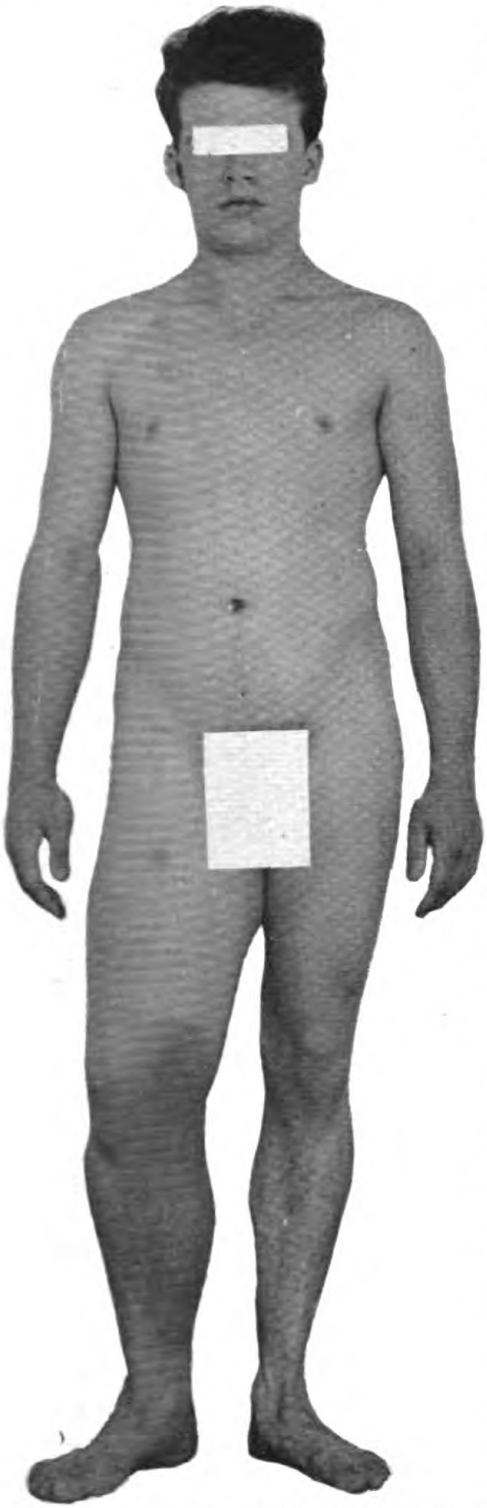
Congenital hemihypertrophy can be defined as an enlargement or overdevelopment of the skin, subcutaneous tissues, muscles and bones on one side of the body producing gross asymmetry of the body contour. This enlargement may involve an entire half of the body, or only a part of one side.

Normally there are discernible variations in the size of the two sides of the body, but these inequalities are not readily recognizable. It is only when the normal limits of variation between the two sides have been passed, that the individual can be considered to be the subject of congenital hemihypertrophy. The term "congenital" recognizes that the condition is inherent in the structural development of the individual, and that it is not the result or sequel of any accident or disease occurring after birth.

Cases of congenital hemihypertrophy are not frequently encountered. Many clinicians who have had long and varied experience admit that they have never personally seen a case. Several well known medical textbooks fail to mention this condition. Cecil only briefly refers to the subject with a few lines on facial hemihypertrophy, which is noted as a rare anomaly. The total number of cases reported to date is comparatively small. Some of the reported cases have been classified as partial hemihypertrophy, whereas others have been complete examples of this condition.

There has been doubt expressed by some authors who reported their cases as to whether the condition was essentially a hemihypertrophy of the larger parts or a hemiatrophy of the corresponding opposite parts. The essential point to be considered is whether the larger parts are larger than normal, or whether the opposite smaller parts are smaller than normal. The distinction



—*Official U. S. Navy Photo.*

The massive size of the right lower extremity is apparent. Note also the greater distance of the right nipple from the midline. The face appears symmetrical and the upper extremities are equal and normal in size. The patient stands with the right knee slightly flexed on account of the greater length of the right lower extremity.

between hemihypertrophy and hemiatrophy will depend upon the decision as to which side is considered normal.

The cause of hemihypertrophy is not known. It has been ascribed to vascular changes, and it is believed that the blood vessels on the enlarged side are usually larger than those on the normal side. It is, however, quite probable that the larger blood vessels are a part of the general enlargement of the part, rather than the causal factor. The most plausible theory of the causation of hemihypertrophy is that the process is a morphogenetic anomaly resulting from a deviation in the normal process of twinning of the embryonic ovum cells.

In the cases reported, males and females were involved in about equal ratio, and the right side was more frequently involved than the left. The hemihypertrophy shows more markedly in the limbs, and there is lengthening as well as an increase in bulk of the affected extremity. The face and head are not infrequently spared. In the female, the breast may be considerably larger on the affected side. The skin may show vasomotor changes which most commonly take the form of a

bluish white marbling on the affected side. X-ray studies usually show that the bones are to some degree involved in the process. Gessell's studies showed that the condition is occasionally associated with feeblemindedness.

DIFFERENTIAL DIAGNOSIS

As a rule, cases of congenital hemihypertrophy will be readily recognized. There are, however, several other conditions which are characterized by an enlargement of an extremity, which may somewhat resemble congenital hemihypertrophy. None of these other conditions, except congenital arteriovenous aneurysm, is present at birth, and most of them develop in adult life. This fact will at once distinguish it from congenital hemihypertrophy.

1. Meige's disease or Milroy's hereditary lymphedema is a chronic edema of one or both legs, which affects women much more frequently than men and which appears after puberty. There is considerable swelling of the extremities involved, and the skin is thickened with nearly complete absence of pitting upon pressure. It is a familial disease, and can frequently be seen in several members of the family.

2. Filariasis of long duration will frequently produce a chronic lymphedema of an extremity. It is found in many parts of the world but most frequently among the natives of the Samoan Islands in the South Pacific. In the present world war many American soldiers and sailors who were stationed in Samoa have been infected with filariasis, and some of these men may develop a lymphedema of an extremity. The lymphedema is the result of the lodgment in the main lymphatics of adult male and female filaria worms.

3. Obstruction of the deep veins of an extremity as a result of thrombophlebitis, phlebothrombosis, new growths, etc., will result in swelling and associated vascular changes of an extremity. It may be difficult to differentiate this condition from hemihypertrophy, especially if this swelling occurs in early childhood.

4. A congenital arteriovenous aneurysm involving an extremity will cause a congestion in the venous circulation and produce a swelling and lengthening of a limb. However there are associated superficial varicosities and an increase in the temperature of the skin usually present on the affected side. Arteriography may assist in the recognition of this rare condition.

5. Angioneurotic edema may produce a temporary swelling of an entire extremity. This is usually associated with other symptoms of urticaria, and should therefore be readily recognized.

6. Atypical poliomyelitis may sometimes produce a muscular

atrophy of an extremity, which by contrast may cause the corresponding normal part to appear hypertrophied. The normal extremity contrasted with the atrophied fellow may rarely simulate hemihypertrophy.

7. Progressive lipodystrophy is a rare disorder of the subcutaneous fat in which there is atrophy above the waistline and hypertrophy below it. There is an accumulation of fat in large masses over the buttocks, inguinal regions, and inner aspects of the knees and legs. The disease usually commences in the second or third decade of life and progresses very slowly for a period of years. The changes are bilateral.

Case report.—A white male, born in Youngstown, Ohio, on 10 July 1926, was inducted into the U. S. Naval Reserve as an apprentice seaman on 6 December 1943.

His father and mother have always been in good health and have no physical abnormalities. He has one older brother and one younger sister, who have always been in good health and have no physical abnormalities. No members of his father's or mother's families have been known to have any developmental physical anomalies.

The patient had measles and chickenpox, and does not remember having had any other of the usual childhood diseases. He specifically denied that he had infantile paralysis. He stated that his mother told him that she first became aware that his right lower extremity was larger than the left while he was an infant. Nothing was done about this until 1937 when he was examined by a physician who referred him to the Lakeside Hospital, Cleveland, Ohio, for further study of his developmental defect. The patient stated that no operation or other corrective treatment was advised. The right lower extremity continued to grow larger than the left throughout his growing period, and during the past few years he also observed that the right side of his chest was somewhat larger than the left side.

He has had a pronounced limp since early childhood, and he was unable to run well or participate in athletics or active games on that account. He stated that he had a tendency to fall whenever he tried to walk fast or when he did any heavy lifting. In the summer of 1939 he fell and injured his right knee, which was painful and swollen for about three weeks. He was obliged to use a crutch to help him get around. His right knee troubled him frequently after that, and caused an aggravation of his previous limp. He slipped and fell on the icy street in the winter of 1939, and again injured the right knee. He next injured the right knee in the summer of 1940, and again in the summer of 1942.

Two weeks after his induction in the U. S. Navy, he fell in the gymnasium and again injured his right knee. He was confined to the sickbay for 9 days. On 24 February 1944, he again fell and injured his right knee while bowling. His knee was treated at the dispensary for one week, but he continued to complain of pain and inability to walk, so he was transferred to this hospital for further treatment.

The examination on admission showed a well developed, well nourished young adult who was confined to bed on account of pain in the right knee region.

The striking thing observed about this patient was the marked asymmetry

TABLE 1.—*Measurements comparing the sizes of the right and left sides of the trunk and lower extremities*

Part measured	Right in inches	Left in inches
Chest—semicircumference at level of nipples	19 7/8	18 1/2
Distance of nipples from midline of sternum	4 1/2	3 1/2
Abdomen—semicircumference at level of umbilicus	17	16
Pelvis—circumference from symphysis pubis to midsacrum	19 3/8	18 3/8
Thigh—circumference at level of upper third	27	23
Thigh—length from anterior-superior spine of ilium to lower edge of medial condyle	19 7/8	19 1/8
Knee—circumference over patella	18 1/2	14 1/2
Leg—length from internal condyle of tibia to tip of internal malleolus	16	16
Leg—circumference at middle portion	17 1/2	15
Ankle—circumference at malleoli	10 3/4	10
Foot—width across base of metatarsals	4 1/8	3 7/8
Foot—length from heel to great toe	9 1/4	8 3/4

of his body, mainly on account of the inequality in the size of the lower extremities. The right buttock and the entire right lower extremity were considerably larger than the corresponding left side. The patient was able to stand most comfortably when his right foot was advanced six inches ahead of his left foot.

The right half of the trunk was noticeably larger than the left half. This was confirmed by measurements from the anterior midline to the posterior midline at various body levels (see table 1). The head, neck and the upper extremities showed no abnormalities in size, shape or contour (see table 2).

TABLE 2.—*Measurements of the head and upper extremities*

Part measured	Right in inches	Left in inches
Arms—circumference at level of upper third	12 1/2	12 1/2
Elbows—circumference	10 1/2	10 1/2
Wrists—circumference	6 7/8	6 3/4
Hand—circumference at level of midpart of metacarpals	10	10
Upper extremities—length from acromioclavicular joint to tip of middle finger	32 1/4	32 1/4
Head—semicircumference from middle of bridge of nose to midocciput	11	11
Head—semicircumference from middle of upper lip to tip of 4th cervical vertebra	9 3/4	9 3/4
Head—center of pupil to center of bridge of nose	1 3/8	1 3/8
Ears—greatest length of auricle	2 3/8	2 3/8

Careful examination of the right knee showed that it was not swollen, and there was no evidence of free fluid in the knee joint cavity. There was moderate limitation of motion of the right knee, and he complained of pain in this knee on the extremes of motion. He was unable to rest his full weight on the right foot because of this pain and walked with a decided limp. Consultation with the orthopedic department established the fact that the patient had a tear of the internal semilunar cartilage of the right knee. The rest of the physical examination showed normal findings, as did the laboratory procedures.

X-ray studies were made to determine the relative size of the bones on each side. The heart was normal in size and position, and the lung fields were clear throughout. The ribs appeared to be normal in size and contour, and

it was impossible to establish definitely any differences in the two sides of the thoracic cage.

The anteroposterior view of the lumbosacral spine and pelvis showed a slight scoliosis but no other bony abnormalities, and it was not possible to establish any difference in the size of the two innominate bones.

The anteroposterior and lateral views of both thighs, knees, and legs showed no bony abnormalities, and no difference in the diameters of the bones in question was noted.

On 2 May 1944, an arthrotomy was performed under spinal anesthesia and one third of the semilunar cartilage and part of the fat pad of the right knee joint was excised. A few weeks after the operation, physiotherapy was commenced for the restoration of the function of this knee. He improved nicely and he does not complain now of pain in the knee. The patient still walks with a limp, and he has the same peculiar stance he had prior to the operation.

SUMMARY

A case of congenital hemihypertrophy involving the right side of the trunk and the entire right lower extremity is described.

The head was symmetrical and normal in shape. Both upper extremities were equal in size, shape, and contour.

There is no history of any similar anomalous maldevelopment in any other member of his family.

The patient has been walking with a limp since childhood, as the result of the unequal size of his lower extremities.

In the past several years he has frequently fallen and injured his right knee. These falls caused a tear of the internal semilunar cartilage of the right knee joint.

An arthrotomy of the right knee joint was recently performed and the broken semilunar cartilage removed. He now has no pain in the right knee, but still walks with a limp.

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CAJANDOL

Cajandol is a new soothing analgesic and antiseptic for the genito-urinary system. It is composed of 5-percent cajeput oil in peanut oil with 0.1-percent propylparahydroxy-benzoate added as a preservative. The therapeutic effect of the preparation is due to the essential oil in cajeput and the oil-soluble propyl ester of parahydroxy-benzoic acid. Cajeput oil is an essential oil extracted by distillation from the fresh leaves and twigs of plants of the Myrtaceae family, particularly the species Melaleuca, which are commonly found in the East Indies.—BURKLAND, C. E.: Cajandol. Am. J. Surg. 66: 86-87, October 1944.

MADELUNG'S DEFORMITY

CASE REPORT

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and
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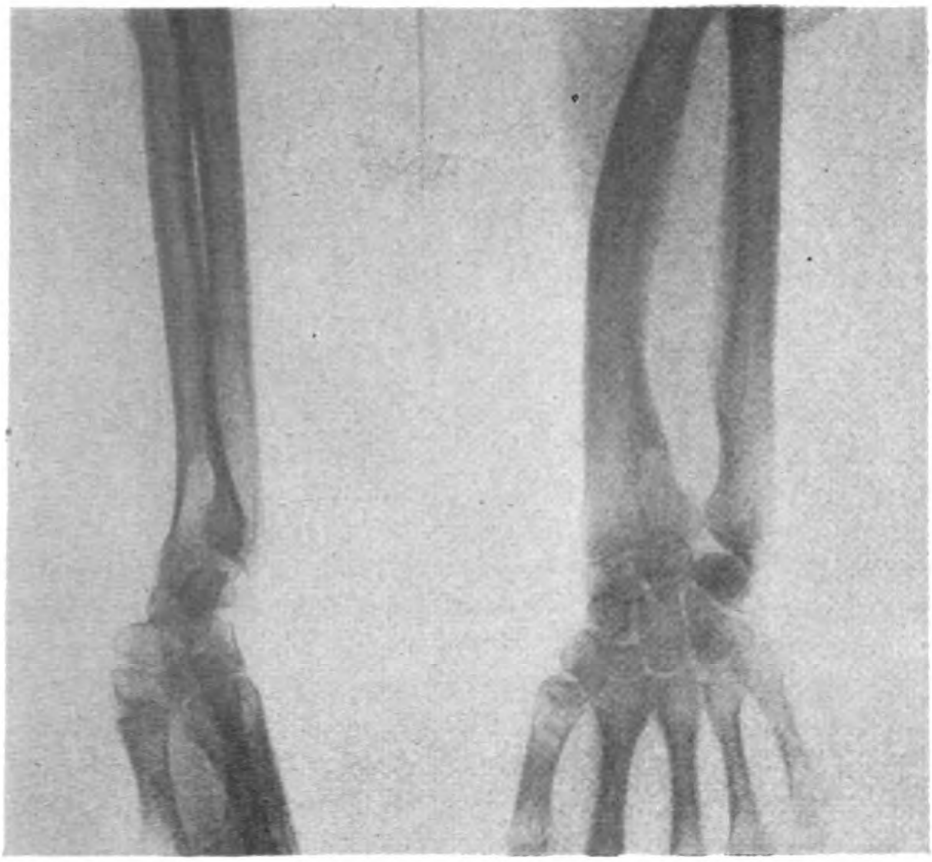
The deformity involving the distal end of the radius and the wrist, which is commonly associated with the name of Madelung who described it in 1878, is considered of sufficient rarity and importance to warrant calling attention to it through the medium of the following case report.

Case report.—The patient, a 13-year-old girl, had always been in good health and without noticeable deformity until 3 weeks prior to examination. At this time an unusual prominence along the lateral aspect of the distal part of both forearms was noted by her mother. There had been no discomfort noted in the upper extremities. At first the patient stated that she had noted no limitation of motion or other functional disturbance of the forearms, wrists or hands. However, following examination and further specific questioning it developed that she had noted an inability to execute completely the movement of supination with either forearm for some time previously, although she was unable to state for how long a period she had noted this functional disturbance. Otherwise there were no subjective complaints.

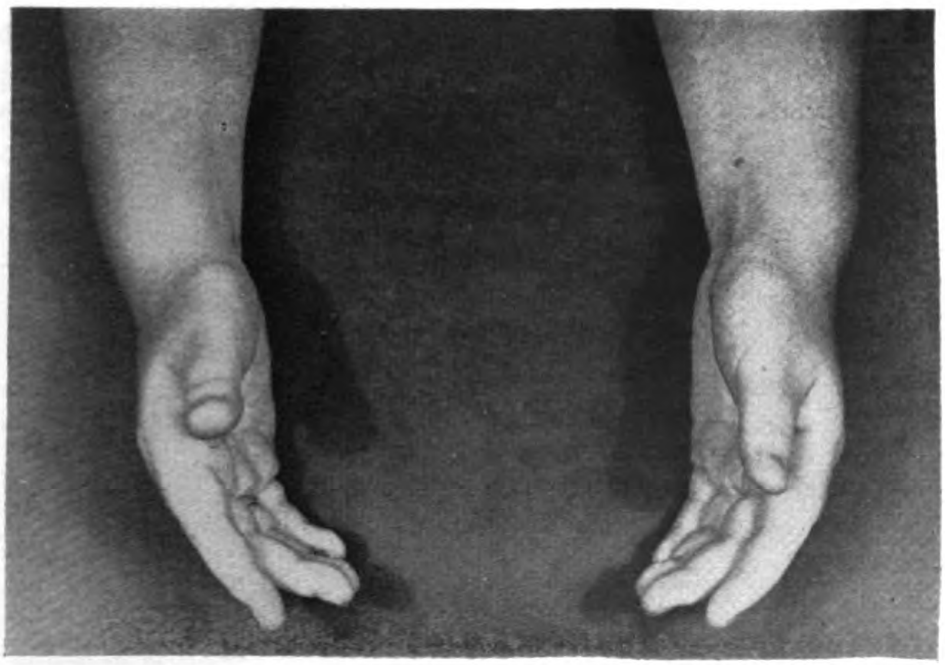
There was no history of familial bony deformity or congenital anomaly elicited.

The points of interest in the examination were confined to the upper extremities. There was noted a rather exaggerated carrying angle bilaterally. There was a convex prominence noted along the lateral aspect of the distal one-third of the radius bilaterally. There was no ulnar deviation of the hands, but there was a slight appearance of subluxation of the hands to the volar sides of the forearms. It was also observed that the patient was able to supinate through only one-half the normal arc with either forearm (fig. 1).

Roentgenographic examination of both forearms and wrists revealed moderate lateral bowing of the radius bilaterally. There was some anterior angulation of both radii at their distal ends, and the articular surfaces of these bones were directed medially to a moderate degree. The position of the distal end of each ulna was noted to be somewhat posteriorly located as compared with that of the radius. There was also noted an acute-angled arrangement of the proximal carpal row bilaterally with the semilunar bone projecting upward between the distal ends of the radius and ulna (fig. 2). X-ray examination of the elbows revealed no abnormalities.



1. Lateral and antero posterior views of right forearm and wrist.
—Official U. S. Navy Photo.



2. Wrist and hand in full supination. The deformity of the radii and the limited motion are shown.
—Official U. S. Navy Photo.

COMMENT

This patient presents in a mild degree the growth deformity at the distal end of the radius which is commonly referred to as Madelung's deformity. It has also been known under such names, among others, as radius brevior, congenital dysmorphosis of the wrist, radius curvus and inferior radiocubital chondrodysplasia (*1*).

According to Thompson and Kalayjian (*1*) the typical deformity is curvature of the distal half of the radius in a combined volar and ulnar direction, shortening of the forearm, prominence of the distal end of the ulna and an appearance of volar subluxation of the hand at the wrist. Premature closure of the radial epiphyseal growth line and an inverted arrangement of the proximal carpal row of bones are characteristic.

The cause is unknown. It is commonly believed, however, that the deformity results from a growth disturbance in the distal radial epiphyseal cartilage. The deformity has been ascribed to a variety of causes including fractures, specific disease involving the distal radial epiphysis, congenital dislocation, arthritis, rickets, osteochondritis, osteofibroma and traumatic separation of the epiphysis. The condition is said to occur much more frequently in females than in males, to be bilateral in approximately two-thirds of the cases, and a hereditary factor has been reported. In our case as far as could be determined there was no evidence of infection, trauma, rickets or other obvious causative factor. Hence, this case is considered to fall within the group originally described by Madelung without evidence of trauma or infection.

The symptoms almost always appear in adolescence. Pain and limited motion of the carpus and distal radio-ulnar articulations are the early symptoms. Pain usually is the symptom for which the patient seeks therapy. It is of interest to note that our patient was conscious of no symptoms until it was pointed out to her that she was unable to supinate fully either hand.

In some of the milder cases of this type of deformity, no treatment is necessary owing to the absence or minimal nature of the subjective disturbance. However, in the more advanced cases, corrective measures are in order. Various types of surgical procedures have been recommended. Phemister (*2*) first advocated epiphyseal arrest at the distal end of the ulna to retard its growth. Other procedures recommended have been resection of the juxta-epiphyseal disc with simultaneous linear osteotomy of the radius before termination of growth in this bone (*3*), and excision of the distal end of the ulna. Schnek (*4*) has used cor-

rective osteotomy of the radius alone in cases in which the disproportion in the length of the bones was not a major factor in the deformity. Thompson and Kalayjian state that resection of a portion of the diaphysis of the ulna near the wrist joint is the most effective means of relieving the pain as it corrects the distortion of the joints. They state further that corrective osteotomies at the points of greatest curvature, after growth is completed in both bones, will reduce the deformity and increase the function of the wrist and hand.

In our case, in view of the lack of subjective symptoms and the minimal deformity, it was decided that surgery was not indicated at the time of examination.

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MORPHINE IN BURNS

Morphine increases the 24-hour mortality (up to 100 percent) in severe experimental burns, particularly when given in large doses and with nembutal. Practically no 24-hour mortality occurred when ether alone was employed. It is inferred that large doses of morphine, when used in the absence of pain, may increase the early mortality in severe human burns.—ELMAN, R.: Influence of ether, morphine and nembutal on mortality in experimental burns. Ann. Surg. 120: 211-213, August 1944.

RUPTURED ANEURYSM OF SPLENIC ARTERY

REPORT OF A CASE

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The following case is reported because the anatomic location of this aneurysm constitutes an interesting pathologic oddity. Sacculated aneurysms occurring in the subclavian, carotid, submaxillary, popliteal, femoral, and iliac arteries are probably much more common than those of the splenic artery, despite the latter's tortuosity.

Case report.—A Naval officer, 36 years old, was found prone on the deck of his stateroom in shock. His skin was cold, pallid and clammy. The radial pulse was very rapid and feeble, and the heart action was rapid, forceful and regular. The blood pressure was 75/60. Except for a slight ptosis of the right eyelid, there were no neurologic signs. A slight amount of mucoid saliva exuded from the mouth. The abdomen was moderately distended and there was tenderness to palpation in the epigastrium.

Shock therapy was instituted and the patient aroused sufficiently to complain of severe indigestion occurring 8 hours previously while he was motoring in a jeep. This distress subsided promptly but left him feeling weak. Upon retiring 2 hours later he had felt fairly well except for this weakness. Indigestion, with abdominal cramps, recurred just prior to the loss of consciousness 6 hours later. There was no history of dietary or alcoholic indiscretion, nor of trauma, and the patient asserted that his previous health had been excellent.

During the ensuing 3 hours the patient's clinical condition seemed to improve slightly, but he remained in severe shock. He then became extremely restless and complained of increased severity of the upper abdominal pain. The abdomen was now diffusely tender to palpation. No blood pressure reading could be obtained and the pulse was racing weakly. A Miller-Abbott tube was introduced and the stomach contents, approximately 70 cc. of normal gastric juice, withdrawn. Subsequently the patient's condition became rapidly worse, culminating in deep coma with Cheyne-Stokes respiration and clonic and tonic convulsions, and finally death.

At autopsy the abdominal cavity was found to contain approximately 2,600 cc. of blood, and in the left upper quadrant there was a large blood clot overlying the omentum. Numerous small blood clots were adherent to the omental surface. On the main trunk of the splenic artery, just proximal to its left gastro-epiploic branch, there was a very thin-walled, circumscribed aneurysm measuring about 3 cm. in diameter, and bearing upon its superior surface a 3-mm. rough-edged perforation through which blood could be expelled on light pressure. There was no thrombus within the aneurysmal sac. The spleen weighed 140 gm. and appeared normal. The stomach and intestines presented no abnormality. There were no other aneurysms, nor was there evidence of

vascular dilatation, weakness or disease, except for mild atheromatosis of the aorta, and a very few tiny areas of atherosclerosis in the aneurysm wall. Except for minimal congestion of the lungs there was no chest or mediastinal pathosis. The heart and coronary arteries were normal. The pathologic diagnosis was ruptured aneurysm of the splenic artery.

COMMENT

It was postulated that perforation had occurred concomitantly with the initial symptoms 8 hours before the patient was seen by the medical officer, and that this minute perforation was sealed off by a blood clot. If this was the case the patient lived more than 11 hours following rupture. The pathologic appearance of the defect, however, would not seem to support this assumption. There was no thrombus within its wall, and the intima and adventitia were ragged around the site of perforation as from a sudden, forceful rupture.

Some pathologists feel that in approximately 50 percent of sacculated aneurysms of the abdominal aorta and its branches the medial injury may be due to infectious diseases or to local infection, the remainder being syphilitic in origin. Syphilis appears to be the most important single factor concerned in the formation of aneurysms, wherever their location. In this case there was little clue as to a probable cause. Atheromatous plaques were neither large nor widespread. The patient was a man of good habits and apparent good health. There was no evidence or history of trauma, and clinical and serologic findings were negative for syphilis. The health record contributed nothing of merit. The current annual physical examination had revealed a healthy individual without evidence of cardiovascular or other disease.

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PRECIPITIN REACTION TEST FOR W. BANCROFTI

A test antigen has been prepared from the dried pulverized microfilariae of Wuchereria bancrofti. This material gave a positive precipitin reaction in 2 of 26 serums from patients with circulating microfilariae but without clinical symptoms, and 3 positive tests from 14 patients with clinical filariasis but negative for parasites in the blood. In 10 control serums tested with the antigen from microfilariae all the tests were negative. No positive reactions were observed in any of the serums tested with the dried pulverized leukocytes.—OLIVER-GONZALEZ, J., and BERCOVITZ, Z. T.: Precipitin reactions with antigen prepared from microfilariae of Wuchereria bancrofti; preliminary report. Am. J. Trop. Med. 24: 315-316, September 1944.

EPIDERMOLYSIS BULLOSA

REPORT OF SEVEN CASES

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Epidermolysis bullosa is a comparatively rare hereditary dermatosis characterized by the development of various size bullae in the skin following a minimal amount of trauma. The lesions develop chiefly upon the extensor surfaces of the joints and other areas exposed to trauma. In some individuals the lesions may be limited to the feet. The condition manifests itself early in life and is explained by hereditary deficiencies in the elastic fibers of the skin, with a resulting increased vulnerability.

The increasing frequency with which this disease is being seen by physicians in military service is shown by recent reports of cases from both the Army (*1*) (*2*) (*3*) and the Navy (*4*). However, it is of interest primarily to medical officers on duty at recruit training centers, since it is very unlikely that individuals so affected would ever go beyond the first few weeks of military training. The disease is obviously disqualifying for military service.

During the past 9 months, 7 patients with epidermolysis bullosa, 5 of whom had lesions limited to the feet, were seen in this hospital.

CASE REPORTS

Case 1.—A Marine recruit, 18 years of age, gave a history of having had blisters on both feet since the age of 5. The condition necessitated the substitution of moccasins for shoes. His feet have never been completely free of lesions except when he was at absolute rest in bed. The disease is much more severe during the summer months and is aggravated by wearing shoes. Many new lesions appear after a normal amount of walking. Following rest in bed the lesions subside completely but recur after wearing shoes for 1 day. This sequence was observed on three successive occasions during hospitalization. No other area of the skin has been similarly affected. One brother, 21 years old, was discharged from the Army because of the same condition.

Examination revealed skin lesions limited to the feet, consisting of a number of discrete, tense bullae varying in size from 0.5 to 2.0 cm. and scattered

over the soles, heels, and dorsa of the feet, over the Achilles tendons, and over the sides and dorsa of the toes. No scars were seen.

Case 2.—A second Marine recruit, also 18 years of age, gave a history of having had blisters on both feet since early childhood. Although he had never been entirely free of lesions, the disease was much worse during the summer months. He wore moccasins rather than shoes during the summer. A normal amount of walking caused new lesions to form. Following rest in bed the lesions completely subside, but recur after wearing shoes for 1 day. Except for an occasional blister on the fingers, no other area of his skin has been affected. One sister, one brother and his mother have this same condition.

Examination revealed skin lesions limited to both feet, and consisting of various size, discrete, tense bullae scattered over the plantar surfaces, sides, and dorsa of both feet. There were also a number of pigmented scars over the dorsa of the feet and ankles.

Case 3.—A Marine private, 25 years old, gave a history of having had blisters on both feet since early life, and occasionally similar lesions on the elbows and hands. The condition is worse during the summer months at which time he wears moccasins rather than shoes.

The patient is 1 of 15 children, 10 boys and 5 girls. Six of the 9 boys living, 1 of the 3 girls living, and the patient's father, 68 years of age, are similarly affected.

Examination revealed skin lesions limited to the feet, consisting of many discrete, tense bullae varying in size from 1.0 to 3.5 cm. and scattered over the plantar surfaces and dorsa of both feet. There were also a few similar lesions over both ankles. No scars were present.

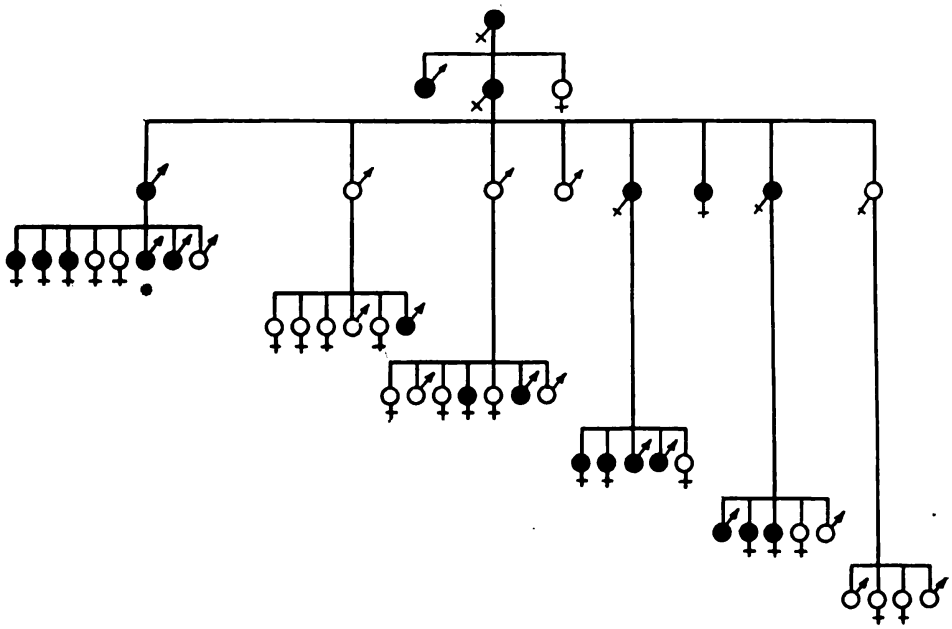
Case 4.—The fourth patient, 24 years old, also gave a history of having had the condition since early childhood. Although he has never been entirely free of lesions, the dermatosis is much worse during the summer. Blisters develop over the elbows, hands, knees, legs and ankles following a minimal amount of trauma, and usually heal with scarring after a week or 10 days. His feet have never been involved except for an occasional blister.

The patient's mother, only brother, only sister, two maternal uncles, seven cousins, and his maternal grandmother are similarly affected. Two maternal aunts are his only known relatives not affected. The patient has never seen his father and knows nothing about his father's family.

Examination revealed skin lesions limited to the elbows, hands, knees, legs, and ankles. The feet were not involved. The elbows and knees showed no active lesions but the skin over these areas was thin and atrophic. Over the dorsa of both hands and fingers were many atrophic scars and a number of clear bullae. The palmar surfaces of both hands and all fingers showed many small keratotic areas and a few scars. The anterior surfaces of the lower legs and lateral aspects of the ankles presented extensive atrophic scarring and a few active bullae. The fingernails and toenails showed extensive dystrophic changes and were very small.

Case 5.—The fifth recruit, also a Marine, 28 years of age, stated that he had had blisters on both feet since the age of 3. Although he has never been free of lesions, the condition is worse during the summer months. He wears house slippers rather than shoes.

Twenty-two of the patient's 47 paternal relatives are similarly affected (fig. 1).



1. Incidence of epidermolysis bullosa in family of the patient cited in case 5. The black circles indicate affected members of the family; the asterisk indicates the patient.

Examination revealed skin lesions limited to the feet consisting of a number of discrete, tense, gray bullae varying in size from 1 to 4 cm. in diameter and scattered over the plantar surfaces and sides of both feet. No scars were present (fig. 2).

Case 6.—The sixth patient in this series, a Marine recruit, 31 years old, gave a history of having had blisters on both feet since early life. He wears specially constructed house slippers rather than shoes. He has found that by limiting his activities he can get along fairly well in civilian life except during the summer months when the condition is much worse.

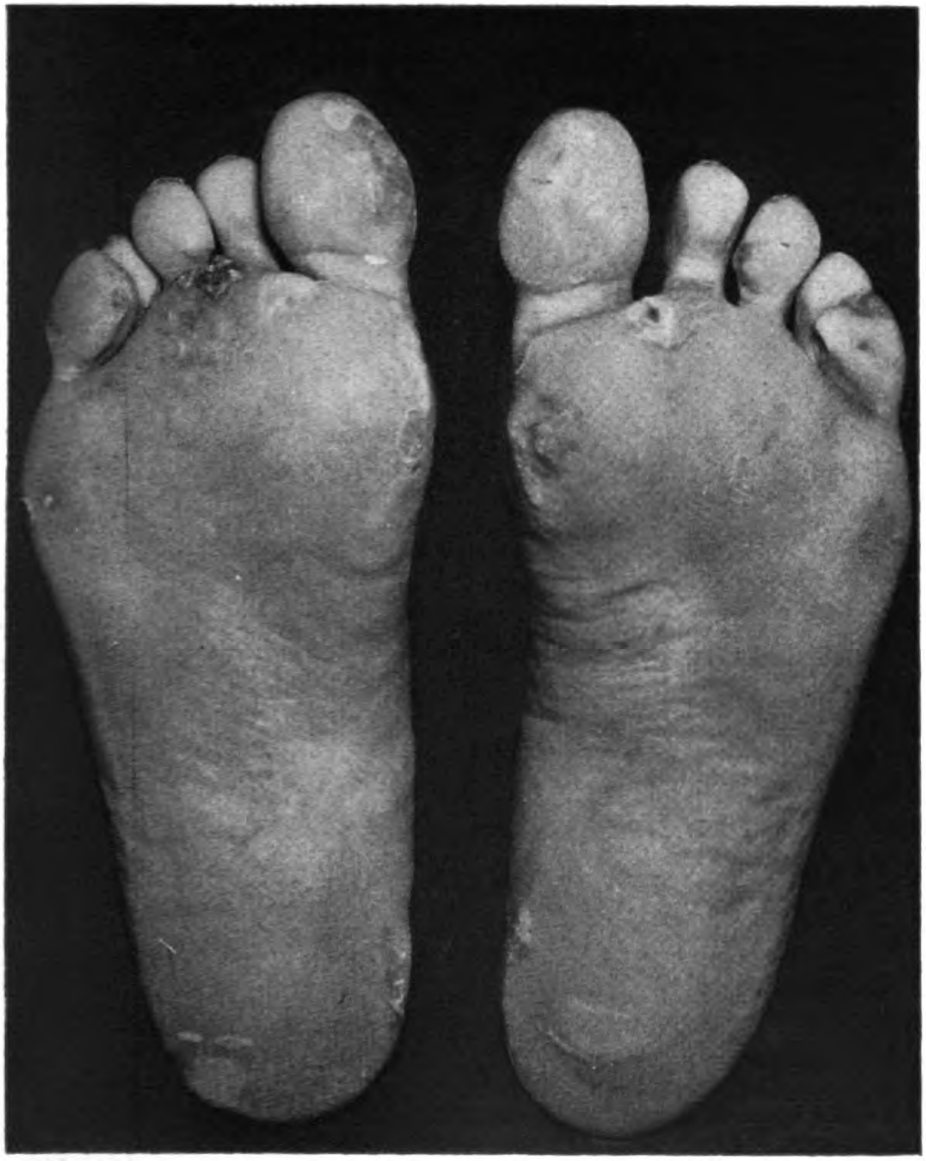
The patient is one of 6 children of whom 1 girl and 3 boys are similarly affected. His father, paternal uncle, paternal aunt and 10 cousins are affected. The patient has 2 children, neither of whom is affected.

Examination revealed skin lesions limited to the feet, consisting of a number of clear, tense, discrete bullae from 0.5 to 4.5 cm. in diameter and distributed over the sides and plantar surfaces of both feet and toes. No scars were present.

Case 7.—The final patient in this series, 25 years of age, gave a history of having had blisters on both feet since early life. The patient's son, 18 months old, as well as the patient's father, one uncle, and one aunt are similarly affected. The patient presents skin lesions limited to the feet and consisting of various size bullae. There are no scars. No other area of the skin is affected.

COMMENT

The seven reported patients had similar experiences in recruit camp. They were admitted to the hospital after 2 or 3 training



2. (Case 5.) Showing many small bullae which developed after walking with shoes for 1 hour.

days. During the first training day they developed a number of bullae, some of which ruptured, and became infected and painful, necessitating hospitalization of the patients.

Following rest in bed the lesions subsided completely within a week or ten days, but recurred after the patients had walked about, wearing their shoes, for 1 day. This sequence was observed in each patient on 3 successive occasions during his hospital stay.

Since these patients are usually admitted to the surgical service as having "infected blisters," it is desirable that medical officers in surgical wards know of this disease and recognize it. As a matter of fact, in five of our seven patients the condition was

correctly diagnosed in the surgical wards, and in one in the post dispensary before admission of the patient to the hospital. In all but one of the seven cases, therefore, the correct diagnosis was made before admission to the dermatologic service.

The past history, that is, lifetime duration, and development of new lesions following a minimal amount of trauma, together with the familial occurrence, aid in differentiating the condition from other vesicular dermatoses.

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FLUORINE IN PREVENTION OF DENTAL CARIES

Two methods of use have been suggested and are being tried —the addition of sodium fluoride to the amount of 1 part per million to the potable water, and the topical application of solutions of the same chemical to the enamel surfaces of the teeth.

It has been reported that in areas where the fluorine content of the drinking water was 1 part per million or more there were six times as many caries-immune children, a 60-percent reduction in the caries experience rate, a 75-percent decrease in first molar loss, and a 95-percent decrease in caries of the upper incisors.

Since fluorine seems to act not by chemical union, but by adsorption to the enamel, thereby rendering the tissue soluble in acids, it seemed logic to experiment with the topical application of solutions of sodium fluoride. Clinical reports previously cited support the value of this method. The strength of solution and frequency of application necessary to obtain maximum results are yet to be worked out.

The question of the toxicity of fluorine naturally occurs. More than a million people in the United States safely use water supplies containing several times the 1 part per million required for the prevention of dental caries. As for the therapeutic application of sodium fluoride solutions to the teeth, it has been shown that it can be carried out without appreciable systemic absorption.—FARFEL, I., Lieutenant (DC) U.S.N.R.

PLASMA TREATMENT OF MUMPS ORCHITIS

REPORT OF FIVE CASES

ROBERT G. SMITH
Lieutenant (MC) U.S.N.R.

During the past month there occurred an outbreak of forty cases of mumps aboard ship. To the present, five patients have developed orchitis. After reading a recent article on pooled plasma treatment of mumps orchitis[1] it was decided to try this form of therapy on all five patients. Five hundred cubic centimeters of reactivated dried pooled plasma was administered intravenously as the initial dose. Results obtained might be described as excellent to dramatic. Four of the patients volunteered the information that the plasma gave them very quick relief. Not enough time has elapsed to determine if any patients will develop atrophy of the testicle. The 5 cases are briefly summarized as follows:

CASE REPORTS

Case 1.—This patient, 22 years old, had not had mumps before. He developed bilateral mumps, then a left orchitis on the seventh day, with his temperature reaching 103.4° F. He was given 500 cc. of plasma on the ninth day. All pain disappeared overnight, the temperature became normal, and swelling of the testicle was practically gone on the eleventh day.

Case 2.—The second patient, 22 years old, also had had no previous attack of mumps. He developed bilateral mumps and then orchitis on the right side, and a temperature of 102.8° F. on the ninth day of the disease. He received 500 cc. of plasma the same day. The pain had disappeared within 24 hours and his temperature was normal on the fourteenth day although there was still some swelling of the testicle.

Case 3.—This man, 22 years of age, had been under treatment for gonococcal urethritis for several weeks when he developed an epididymitis on the right side and a temperature of 100.5° F., and was admitted to the sickbay. The next day he had a right orchitis and a temperature of 103° F. The following day he developed a left orchitis and a temperature of 104° F. The following day (3 days after admission) he had bilateral mumps and his temperature was 104.2° F. He was given 500 cc. of plasma, and 4 days after the mumps developed, all swelling was gone from the parotid glands and the temperature remained normal. Three days later, or 9 days after onset of

[1] RAMBAR, A. C.: Pooled plasma treatment of mumps orchitis. U. S. Nav. M. Bull. 42: 871-873, April 1944.

the orchitis, all swelling had disappeared from the testicles. A urethral smear was still positive for gonorrhea so he was transferred to a Naval hospital for penicillin therapy.

Case 4.—A young man, 19 years old, who had not previously had mumps developed bilateral mumps. After 8 days all swelling and tenderness had subsided and his temperature was normal, so he was returned to duty. Six days later, however, he developed a right orchitis and a temperature of 103° F. He was immediately given plasma. Within 24 hours his temperature was normal, all pain had disappeared, and it was difficult to keep him in bed. Swelling of the testicle subsided within 3 days.

Case 5.—The fifth patient in this series, 19 years old, also had not had mumps before. He developed bilateral mumps, followed on the fourth day of the disease by a right orchitis and a temperature of 100.5° F. Five hundred cubic centimeters of plasma was administered immediately and 4 days later the swelling had subsided more than half, but the patient still complained of pain and tenderness of the testicle, and his temperature had risen to 102.2° F. An additional 500 cc. of plasma was administered and 30 minutes later he had a chill and his temperature rose to 103.4° F.

The following morning he felt much better and his temperature was normal. However during the next 36 hours he felt worse, was delirious, vomited several times and his temperature rose to 102° F. He was given 1,000 cc. of 5-percent dextrose in saline and within 12 hours his temperature was normal and remained normal thereafter. All swelling and tenderness of the parotid glands and the testicle had subsided on the tenth day of the disease. On the fifth, sixth, seventh, and eighth days of the disease this man had complained of severe headache. There was never any stiffness of the neck but he was delirious and vomited several times on the seventh and eighth days. No spinal fluid examination was made but it is very probable that he had a meningeal involvement.

CONCLUSIONS

1. Five, or 12.5 percent of 40 patients with mumps aboard this ship developed orchitis.
2. All patients with orchitis received 500 cc. of reactivated dried pooled plasma intravenously as an initial dose.
3. Results obtained were excellent and dramatic.
4. One patient received a second 500 cc. of plasma when meningitic signs and symptoms appeared.

MEDICAL AND SURGICAL DEVICES

APPLICATION OF THE EVE ROCKING METHOD OF RESUSCITATION ON SHIPBOARD

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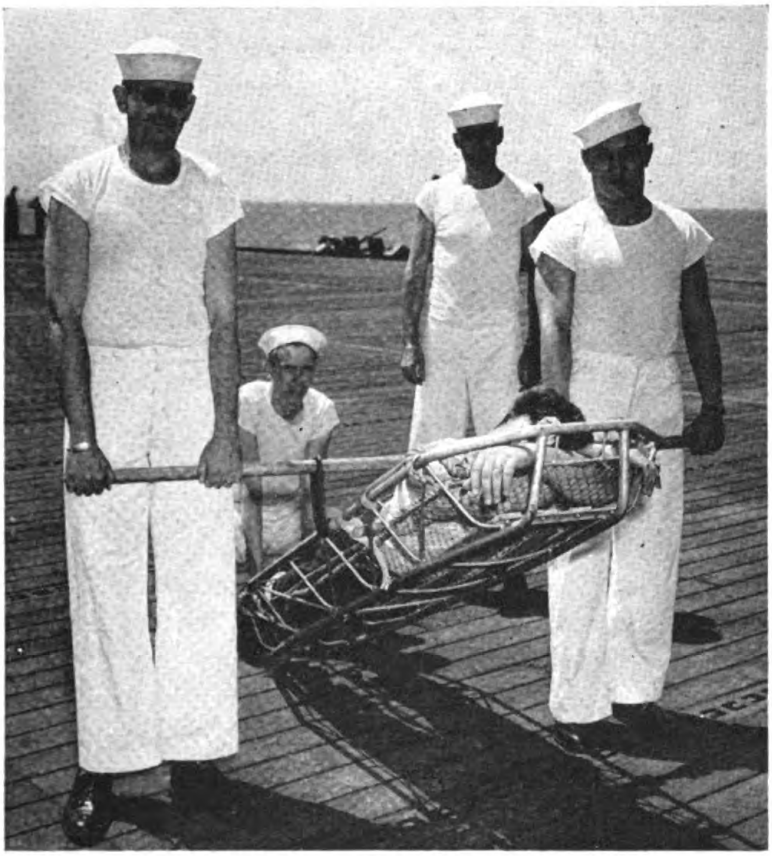
The principal objectives to be attained in resuscitation of the asphyxiated are adequate pulmonary ventilation, sufficient circulatory stimulation, and usually conservation of body heat. Schaefer's method, the most popular in the past, has been shown to be inadequate even in the most expert hands. Resort to the Silvester technic when indicated, does not have much more to offer. Both ideas are based upon the principle of altering the size of the rib cage to effect an exchange of alveolar with outside air.

Of the two main factors in respiration, movement of the ribs, and position of the diaphragm, only the latter is subject to control in an unconscious subject. Without active use of the serrati muscles, expansion of the rib cage is not practicable. Forced compression of the thorax, as in the Schaefer method, puts the pulmonary spaces through only a limited phase of their normal variation. The elasticity of the ribs and their cartilages merely return the cage to its resting size, there being no effective enlargement produced without action by the serrati muscles to alter the thoracic area. The serratus posterior superior muscle elevates the ribs, and the serratus posterior inferior elongates the thorax by drawing the lower ribs downward and backward, and also fixes the lower ribs to facilitate diaphragmatic action. The intercostals, when active, merely serve as support. Hence any attempt to expand the thorax aside from active motion by the victim's own muscles is futile.

On the other hand, the position of the diaphragm may be controlled by gravity even when in a flaccid state. Its elevation is determined normally by (1) lung tissue elasticity which pulls the diaphragm upward, (2) pressure of abdominal viscera which may be positive or negative according to body position, and (3) intra-abdominal tension, ordinarily due to muscle action. It may be seen



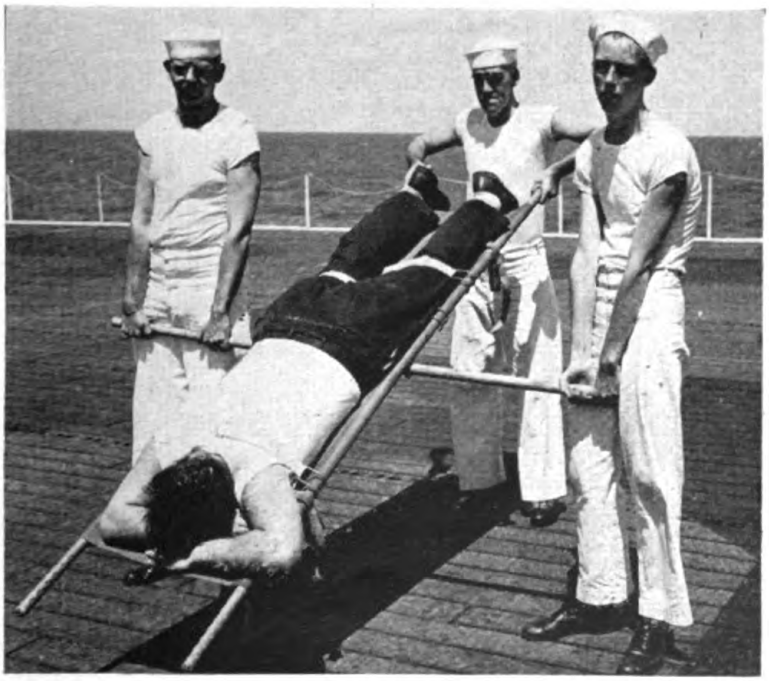
1. Rocking method with Stokes litter in use. Pipe may either be held or placed on supports.

that even in the warm cadaver, lung tissue elasticity and pressure of abdominal viscera may be utilized in altering thoracic volume. The third factor, intra-abdominal tension, functions only when muscles are active; otherwise it passively contributes to the pressure factor.

According to Dally (*1*) the absolute diaphragmatic range between deep inspiration and expiration is 30 mm. on the right and 28 mm. on the left. The movement in quiet respiration averages 12.5 mm. on the right, and 12 mm. on the left. The diaphragm is highest when the body is horizontal and supine. When the subject is erect, the diaphragmatic dome falls. It descends lowest when a sitting position is assumed. Inasmuch as this is principally an effect of positive and negative pressure upon the diaphragm produced by gravitation of abdominal viscera, one would expect an even more pronounced result when muscle tone is lacking. These principles have been stressed by Eve (*2*).

In order to effect the most efficient artificial exchange of alveolar and atmospheric air in an unconscious individual, therefore, it is obvious that former methods of attempting to change

2. Showing eye to accommodate 1-inch pipe welded to frame of Army-type litter.



3. Army-type litter rocked to head-down position.

the rib cage area must be abandoned and attention directed to any technic producing rhythmic alterations of the diaphragmatic posi-

tion. This principle has been consistently advocated by Eve (*3*).

This method changes the subject alternately from a partial upright to a partial inverted position by vertical movement of a litter (or any rigid object at hand) on a central fulcrum. The weight of the stretcher, to which the subject is strapped, face downward, is borne by supports, leaving the operator free to produce the necessary movement, that is, a position of head down, feet up to a 45° angle, alternated with head up, feet down to 45°. After a few minutes the arc is diminished to 30°. Obviously this procedure may be continued indefinitely with a minimum of effort. A face-down position is recommended to facilitate drainage of water from the respiratory system, and also to forestall glossoptosis.

In the absence of a litter, it would seem advantageous alternately to raise the patient to a sitting position from the supine, rather than to attempt pulmonary ventilation by compression and release of the thoracic cage. However some type of rigid support such as a board or oar is usually available, and the rocking motion can be produced with the patient lashed face downward to such a brace. It has been accomplished by simply rocking the patient on the outstretched arms or knees over a thwart or any other convenient object.

Furthermore the technic described by Eve meets the requirements of facilitating circulatory adequacy, and allowing conservation of body heat by means of blankets. This is reasoned as follows: When the body is tilted head down a pressure is produced by the blood column which tends to close the aortic valves and perfuse arterial blood through heart muscle by way of the coronaries. In addition, the rhythmic gravitation of blood to cerebral centers will be stimulating when circulation is weak or failing. As the patient is tilted feet down, blood drains from the pulmonary system through open valves in the left side of the heart to the arterial circulation.

Eve cites Hill's experiments which demonstrate that cerebral circulation may be maintained by alternate head-up and head-down positions. Medication to stimulate cardiac and respiratory activity is a helpful adjunct. The use of carbon dioxide-oxygen mixtures in the severely asphyxiated has been questioned, being considered by some a dangerous depressant of the nerve cells of a person near death.

The conservation of body heat may be accomplished by the use of blankets without interference with the rocking movement. External heat has been shown by Blalock (*4*) to be detrimental where circulation to vital centers is impaired, and is therefore not advised in cases of anoxia. Heat increases oxygen consumption

by raising the metabolic rate and stimulating systemic circulation.

The method of resuscitation described by Eve may be facilitated on United States Naval vessels by minor alterations to two types of litters available.

The popular Stokes litter may be fitted for this type of treatment by having eyes to accommodate a length of one-inch pipe welded to each side of the uppermost bar at the center of gravity, arranged so that they may be turned down when the litters are stowed. Upon being put to use, the uprights are turned into position, the length of pipe is inserted through the two eyes, and the litter suspended. With the extremities of the pipe supported on boxes or lifeboat gunwales, or even held by stretcher-bearers, resuscitation may be undertaken at once by rocking the litter. A rigid support such as a length of pipe is desirable; however lacking this, cable, line, or wire may be used (figs. 1, 2, and 3).

The Army-type litter may be adapted to the use of this method by having two eyes welded to the center of each shaft on the underside to accommodate the length of pipe. The shafts should be reinforced at this point. This is a modification of the rocker devised by Surgeon Commander G. H. Gibbens, R.N.V.R. Figures 4, 5, and 6 illustrate the principle applied to the Stokes litter.

Aside from the physiologic advantages, this method of resuscitation requires no trained personnel and is not tiresome. It may be begun at the scene of the accident and continued during transportation, two or more stretcher-bearers being assigned to the supporting pipe and one delegated to rock the litter.

Eve warns that so efficient is this method, care must be taken to restrict the motion to 10 double rocks a minute lest acapnia supervene.

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SIMPLE METHOD FOR TAKING STEREOSCOPIC CHEST FILMS

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and
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Pharmacist's Mate, second class, U.S.N.R.

Many small medical activities throughout the Navy have some type of x-ray equipment suitable for limited use. It is the purpose of this article to present a simple and inexpensive method for satisfactorily taking stereoscopic films, particularly of the chest, thereby making greater use of this type of equipment.

In many cases, there is a need for stereoscopic examinations of the chest when an expensive mechanical plate changer is not available. This is particularly important in injuries and penetrating wounds of the chest wall, lungs, and mediastinal structures where the advantage of depth is desired. Stereoscopic examinations of the chest may be made wherever a wall-mounted vertical cassette holder is in use and the x-ray tube can be shifted into the vertical position. A stereoscopic viewing apparatus is also necessary.

Satisfactory stereoscopic films are taken at this activity by the following method.

The General Electric combination radiographic and fluoroscopic equipment with tilting table in use in this dispensary is so situated that the wall-type vertical cassette holder could not be mounted on the bulkhead at the proper distance and position from the x-ray tube. A portable wooden stand was constructed of 2-inch by 4-inch material for the vertical cassette holder. This portable mounted holder is placed in position at the end of the x-ray table at a distance of 72 inches from the x-ray tube. It is then adjusted for the proper height of the patient.

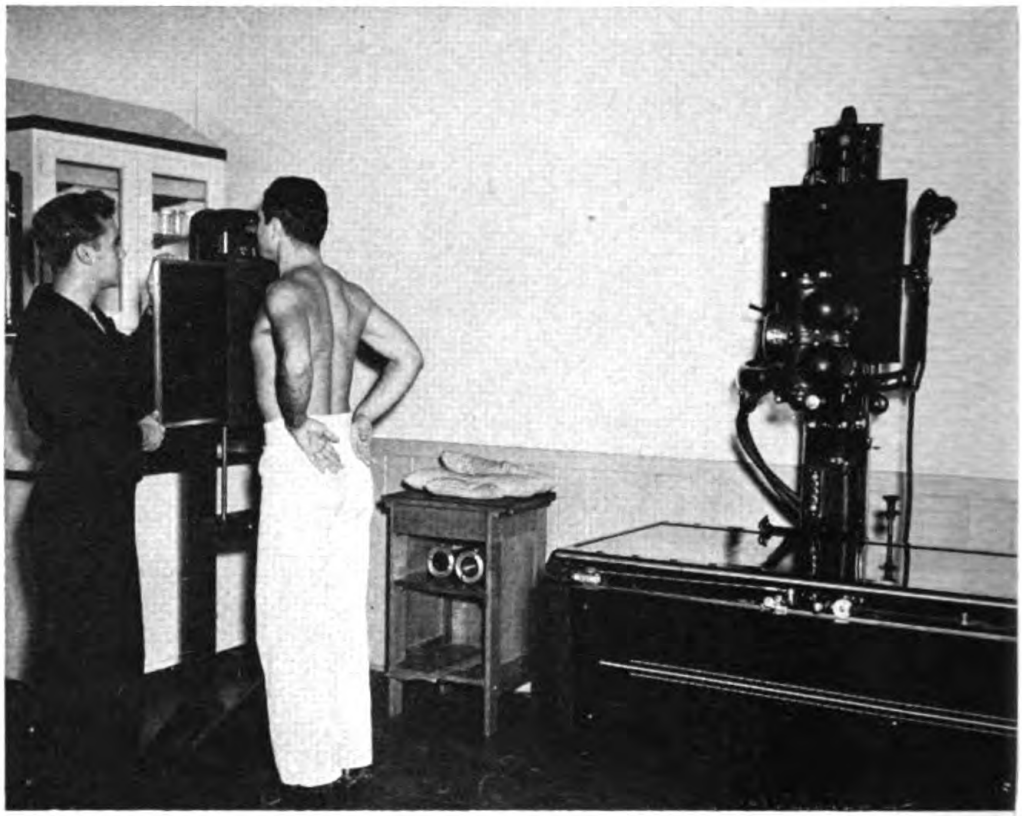
Considerable difficulty was experienced in taking the stereoscopic films of the chest with only this equipment, because after one chest film had been exposed, the patient had to be moved out of position in order to remove the exposed film and insert the unexposed film. It is not possible for the patient to get into the exact original position for the exposure of the second film; this

1. Masonite board to be attached to the vertical cassette holder.

shifting of the patient between films therefore did not give the desired stereoscopic effect, and the following method was devised to obviate this difficulty.

Experiments were carried out to find suitable radio-transparent material to be placed over the front of the vertical cassette holder to act as a board for the patient to lean against during the exposure of the stereoscopic films. Test exposures, to determine x-ray transparency, were made on the materials available at the time, and Masonite board, ⅛ inch thick, and three-ply plyboard, ¼ inch thick, were considered satisfactory. The Masonite board was selected because it gave more strength and rigidity than the plywood and it would not warp or bend.

A piece of Masonite board ⅛ inch thick, 19½ inches long and 15 inches wide was selected. This completely covered the 14- by 17-inch cassette in the vertical cassette holder. Two heavy metal paper clips at the top of the board held the vertical cassette holder, and a right-angle aluminum strip attached to the right



2. Masonite board on vertical cassette holder, patient in position, with cassette being inserted behind the board.

border of the board gave it support and acted as a stop for the cassettes so that they might be inserted in the exact position each time they were changed (fig. 1). The bottom part of the board extended over the bottom of the vertical cassette holder so that if smaller cassettes were used, the holder could be adjusted to fit the size of the cassette used. In this manner only one board is used to fit over any size cassette.

The portable vertical cassette holder is placed into position 72 inches from the x-ray tube, and the cassette holder adjusted to the height of the patient. The x-ray tube is then centered on a level with the center of the cassette holder. The board is next placed in position and secured to the vertical cassette holder by means of the metal paper clips at the top. A 14- by 17-inch loaded cassette is inserted behind the board in the tunnels of the vertical cassette holder (fig. 2), and the patient is placed in the usual position.

A final adjustment of the film and cassette holder is then made for height of the patient and the x-ray tube is centered to the cassette. The patient is given specific instructions that the film will be exposed at deep inspiration, and after this exposure is

made he may exhale quietly while the exposed film is being replaced with the unexposed film. He is then to take another deep breath of the same depth as the first, and after the x-ray tube is shifted, the second exposure is made.

The success of the procedure depends upon two chest films being exposed with the patient in the same position, the only positional change being the shifting of the x-ray tube. A main source of error is that the patient will shift out of position or the chest will not be in a similar position of inspiration for exposure of the second film. To overcome this difficulty the patient is in position at deep inspiration, the x-ray technician is at the controls with the controls properly set for the exposure, and an assistant is ready to change the cassettes immediately following the first exposure. With two persons working in this manner the x-ray tube can be shifted by the x-ray technician and the cassette changed at the same time by the assistant with the patient holding the same breath. This procedure should not take longer than 15 seconds.

The results of stereoscopic chest films taken by this method are satisfactory for practical purposes. The films are not as technically perfect as those taken with a mechanical plate changer but the inexpensiveness and simplicity of the equipment necessary and the practicability of the method make it a valuable adjunct to the ordinary x-ray procedures. This method is also satisfactory for taking stereoscopic films of the skull, cervical and thoracic spine, clavicle, ribs, sternum, and shoulder joint area in the vertical position.

PATHOLOGIC CHANGES OF SUBACUTE BACTERIAL ENDOCARDITIS

It becomes apparent when the pathologic changes of subacute bacterial endocarditis are subjected to analysis that four cardinal conditions occur, the first directly determining the others: (1) The development of bacterial vegetations on previously damaged valves or on congenital cardiac defects; (2) the dissemination of minute bacterial emboli into either the systemic arterial or the pulmonary circulation, or both, the emboli finding ultimate lodgment in various organs and tissues of the body; (3) the transportation, at times, of massive emboli and gross infarction of various organs; and (4) varying inflammatory tissue changes depending on the characteristic response of the organ or tissue concerned.—WILLIUS, F. A.: Cardiac clinics. CVIII. Subacute bacterial endocarditis: Pathology. Proc. Staff Meet., Mayo Clin. 19: 497-503, October 4, 1944.

X-RAY TECHNIC FOR DIAGNOSTIC FILMS

WITH THE WEBER DENTAL MACHINE MODEL-5

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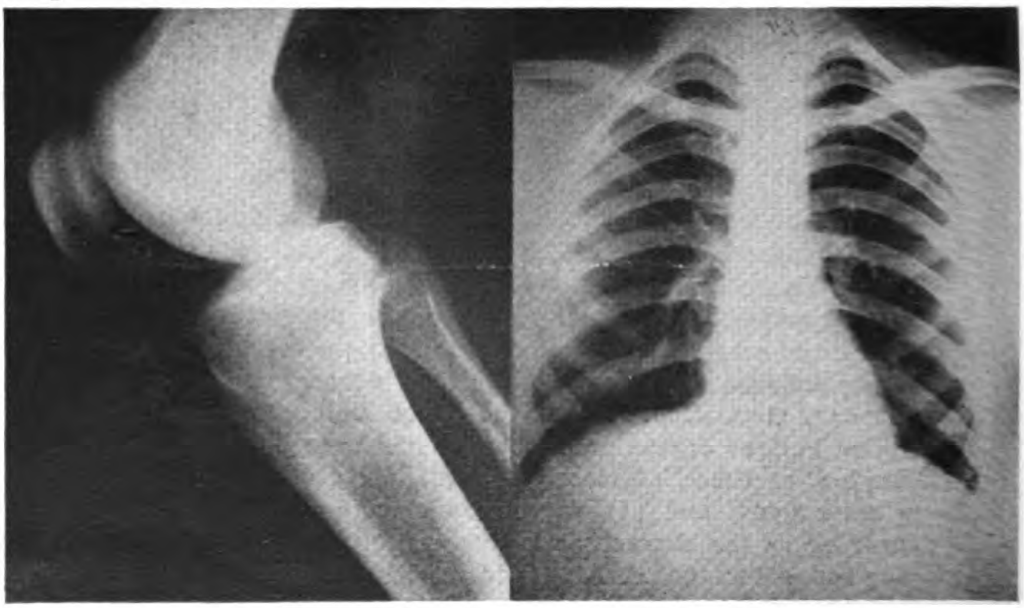
and
DOUGLAS W. WHITE
Lieutenant (DC) U.S.N.R.

The following technic has been used for taking very fine quality x-ray films of the head, chest, spine and extremities at the Naval Training School (Radio), Indianapolis, Indiana. This technic applies only to the Weber Dental X-ray Machine, Model-5, with which it is possible to lower and raise the peak kilo-voltage by dial from 32,000 to 45,000 volts and the milliamperes from 10 to 13.

Double intensifying screens have been used in all these pictures, with Eastman Blue Band Box film. The final results with pictures of the pelvis, thorax, shoulders, lumbar vertebrae, and frontal maxillary sinus (the most difficult areas of the body on which to get diagnostic pictures, especially with a dental machine), are



These roentgenograms were taken with the described technic. The chest picture was on the regular 14 x 17 x-ray film. Osgood-Schlatter disease at left.

excellent. This information is offered because most of the Navy dental x-ray machines are the Weber Model-5.

X-ray procedure with Weber dental unit No. 5

Region	Distance inches	Thickness inches	Kv.	Ma.	Volts	Seconds exposed
Pelvis	24	8	45,000	13	110	2
Lumbar vertebrae	24	8	45,000	13	110	2
Femur head	24	8	45,000	13	110	2
Chest, ribs	36	6–8½	32,000	10	110	1½
Bronchial tree	36	10	45,000	13	110	2
Shoulder	18	6–7	45,000	13	110	¾
Knee	24	5–7	39,000	10	110	2
Head, frontal sinus	7	7	45,000	13	110	2
Head, lateral	18	7½	45,000	13	110	1
Foot	24	4½	32,000	10	110	1
Elbow	21	3–4½	32,000	10	110	1
Hand, forearm, finger	21	2	32,000	10	110	¾

Note: (1) All solutions were 68° F. (2) Developing time 4½ minutes. (3) Double intensifying screens used.

Theoretically this technic should apply to any machine which can control kv. between 32,000 and 45,000 and ma. from 10 to 13. The exposure times given in the Weber manual were more than twice what was required and the pictures turned out too dark to be of diagnostic aid. Each x-ray machine has minor variations which can only be corrected by calibration, by taking pictures and keeping a record of the results, such as satisfactory, too light, too dark, too much detail, or too little contrast. This was the method used to establish the technic outlined in the accompanying table.

ARM BOARD FOR NAVY OPERATING TABLE

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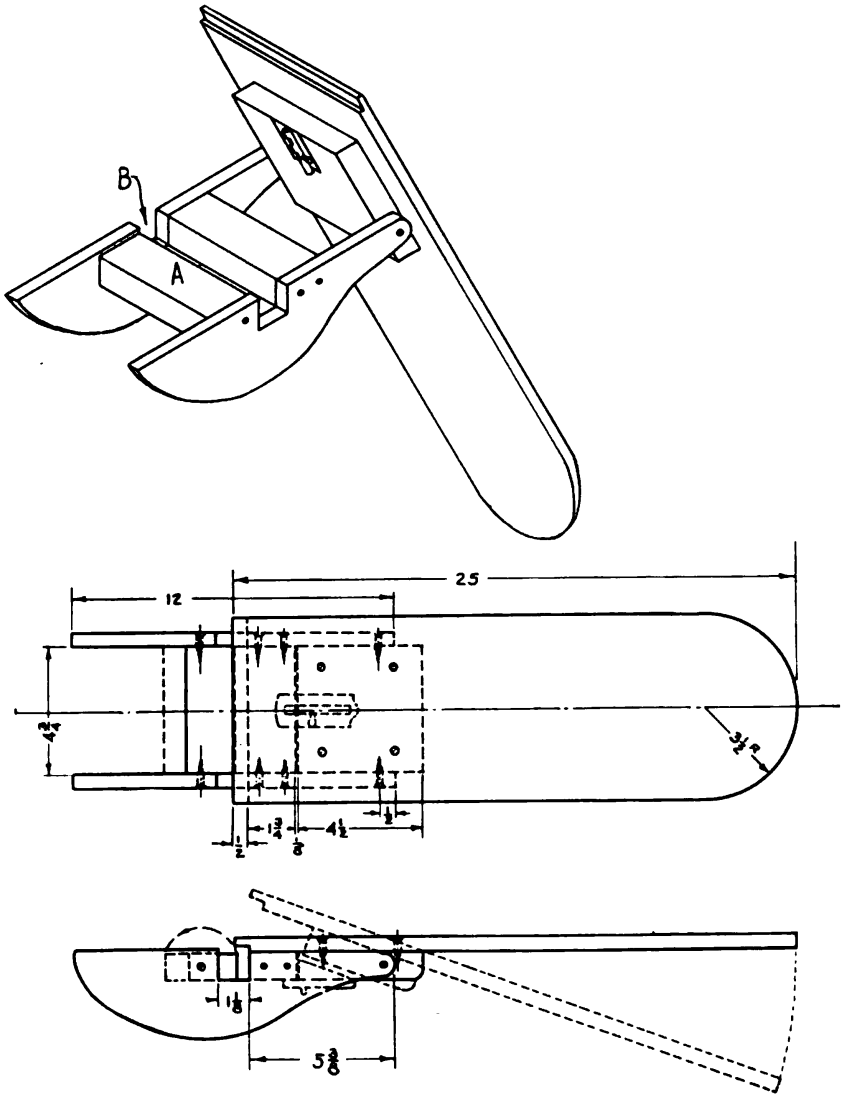
and
J. D. HUMBERD
Carpenter's Mate, first class, U.S.N.R.

Operative procedure frequently requires the securing of the abducted arm while the patient is on the operating table. The indications for this position are evident and numerous. It is often expedient to fix an arm in this position so that the blood pressure cuff is accessible and whole blood, plasma, or fluids can be administered without disturbing the operative team or the draping. This position is of advantage to the surgeon in performing operations on the arm and hand.



Most ships in the United States Navy are furnished with one or both of two operating tables; the small folding operating table (No. 3-885) and the large operating room table (No. 3-880). The former can be set up in any convenient part of the ship, while the latter is usually secured to the deck in the operating room.

It has often been necessary to rely on improvised boards or instrument stands to support the abducted arm. If a large number of casualties are being handled, instrument stands have other and more important uses.

Faced with the need for an arm board that could be used interchangeably on either type table, the junior author constructed the one illustrated. By turning block "A" the slot "B" can be changed in width to fit the edge of either table.

ARRANGEMENT OF QUONSET HUTS FOR MESS HALL UNITS

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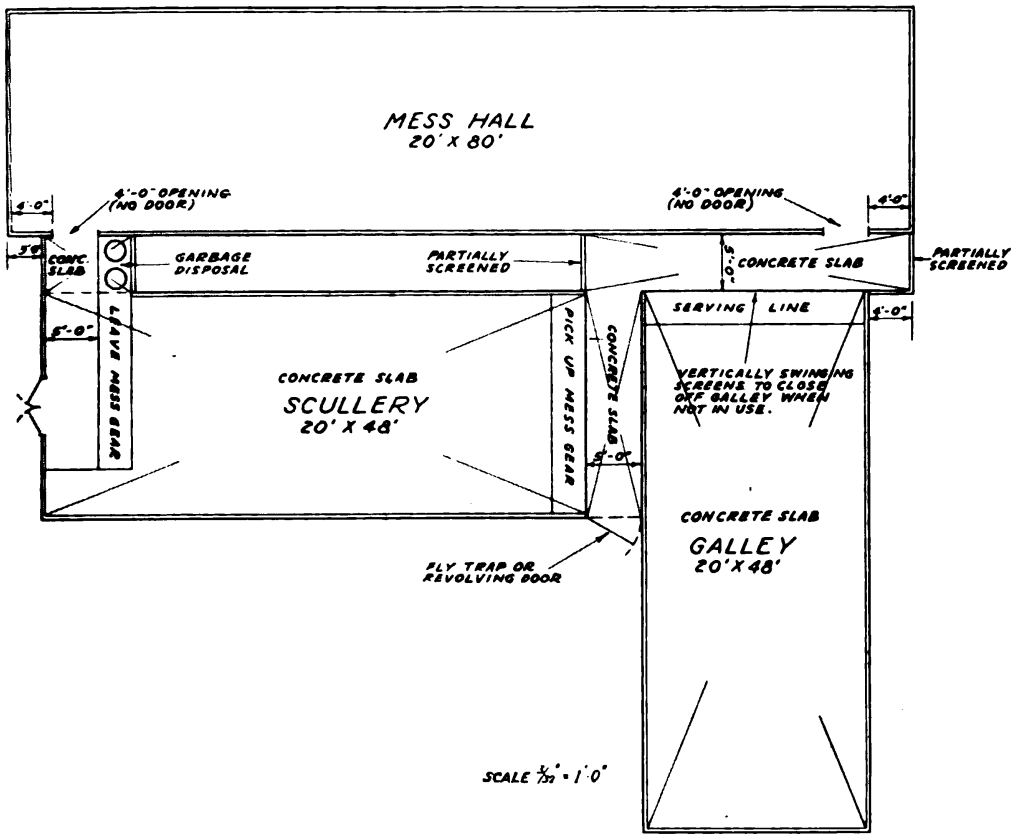
Lieutenant (MC) U.S.N.R.

To control the fly hazard in mess hall units made of Quonset huts, the arrangement of the huts is all-important. Experience soon teaches that the fewer doors possible, the better the protection.

In conjunction with the chief commissary steward and the Seabee officer in charge, the layout shown here was designed. The mess procedure was visualized as a "one-line production" system, i.e., pick up mess gear, obtain food, eat food, clear trays, and finally wash trays. The season in which this unit was constructed forced us to give the fly hazard considerable thought. This year, at another shore base as well as at a hospital unit and two other



installations with which I am familiar, all camps composed of Quonset huts, the problem of fly control was tremendous. It is a mistake to utilize one very large hut as the mess hut as there is (1) a great loss of space, and (2) spraying to be effective would require prodigious amounts.

The regular Quonset hut, 20 feet by 48 feet, is entirely adequate for all galley, scullery, and dining purposes. The present manner of setting up these huts is to place them in rows, with the huts parallel to each other. The problem in screening that such an arrangement presents can readily be visualized. The amount of screening required is great, the result unsatisfactory.

The plan shown here presents an arrangement of these huts which largely avoids the cited disadvantages. Four ends, with their doors, were saved; this material is almost enough to complete the construction. Other buildings, such as the officers' mess hut, butcher shop, bakery, and perhaps a garbage enclosure (with a screen door swung from hinges at the top so as to close by gravity) could be added to the arrangement as shown in the illustration. Changes would have to be made in the scullery according to the type of dishwashing and ware employed.

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CRINOLINE BACKING AS FLEXIBLE CASTS

The crinoline backing, after the adhesive tape has been removed makes an excellent casting material. The sizing on the crinoline, along with the small amount of adhesive substance that attaches to it, combine on wetting to provide immobilization, similar to that of a light plaster cast.

The crinoline is torn into strips of desired widths along its entire length and rolled. Lightly moistened it is applied as any roller bandage, smoothly without tension. As the crinoline dries, it shrinks slightly, adding support and firmness to the dressing. When completely dry, the end of the roll may be sealed down with collodion or a small piece of adhesive tape. Bony prominences need no protection, but several turns of ordinary gauze at the end of the cast prevent chafing.

If kept dry, these casts are effective from four to seven days; with daily showering, from two to four days. They may be made more impervious to wetting by the addition of a small amount of plaster of paris.

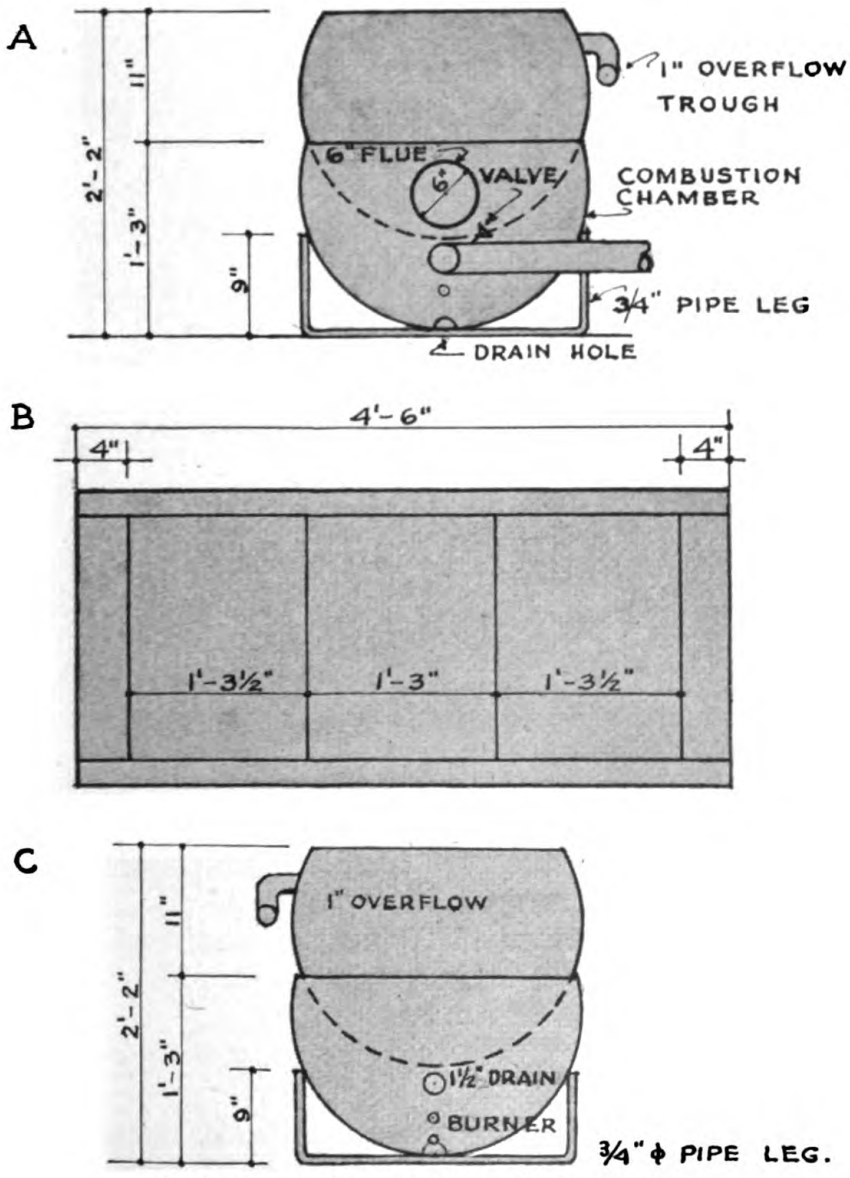
These crinoline casts are particularly valuable in foot and ankle conditions as they are worn with complete comfort within the shoe. They may be used effectively on wrist sprains and certain knee conditions.—BRAUN, G. S., Lieutenant, junior grade H(S) U.S.N.R.

MESS GEAR STERILIZING UNIT

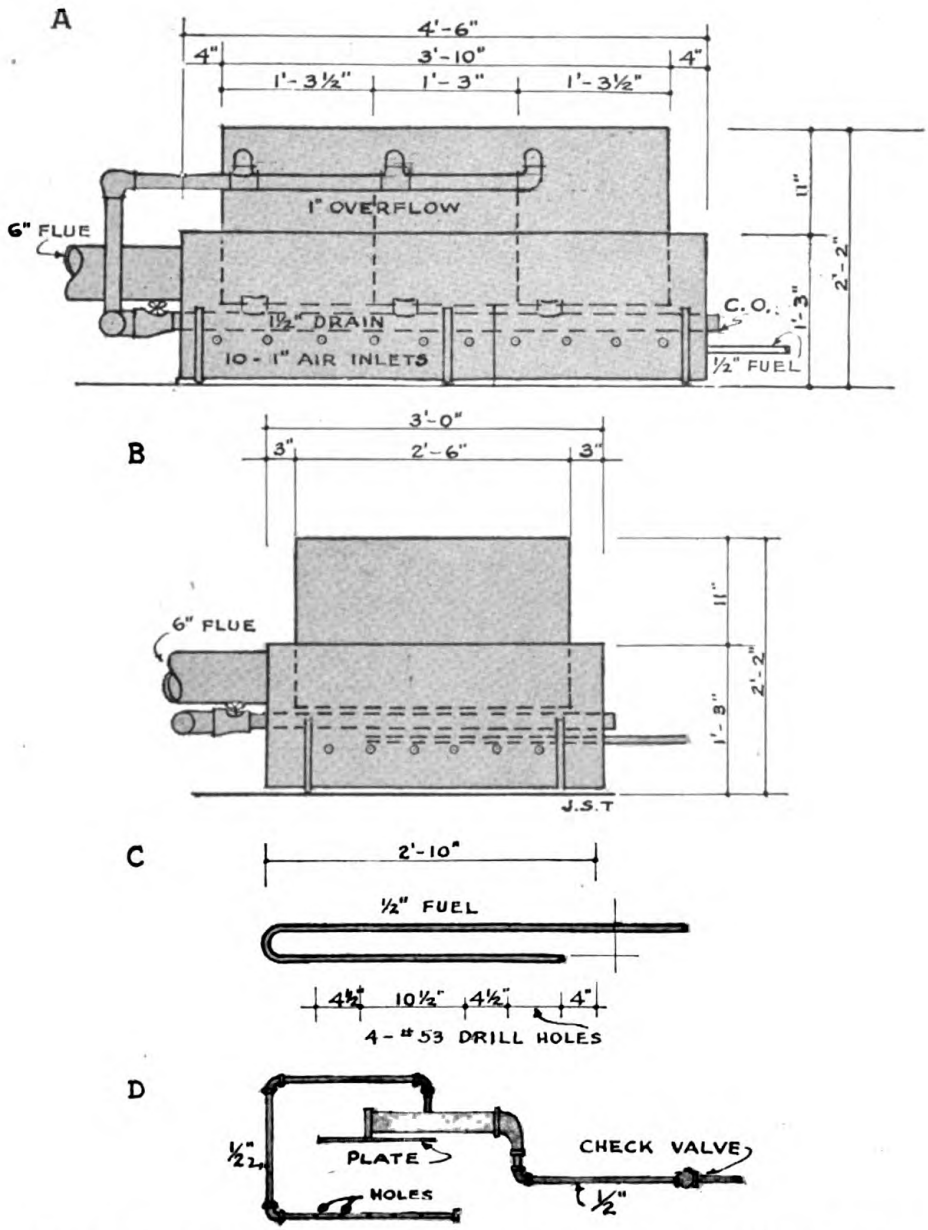
FOR LAND BASED NAVAL UNITS

DAYTON O'DONNELL
Lieutenant Commander (MC) U.S.N.R.

Many sanitation functions are important to the health of a land based Naval unit, such as proper protection from flies, cleanliness



1. A. Rear view. B. Plan. C. Front view.



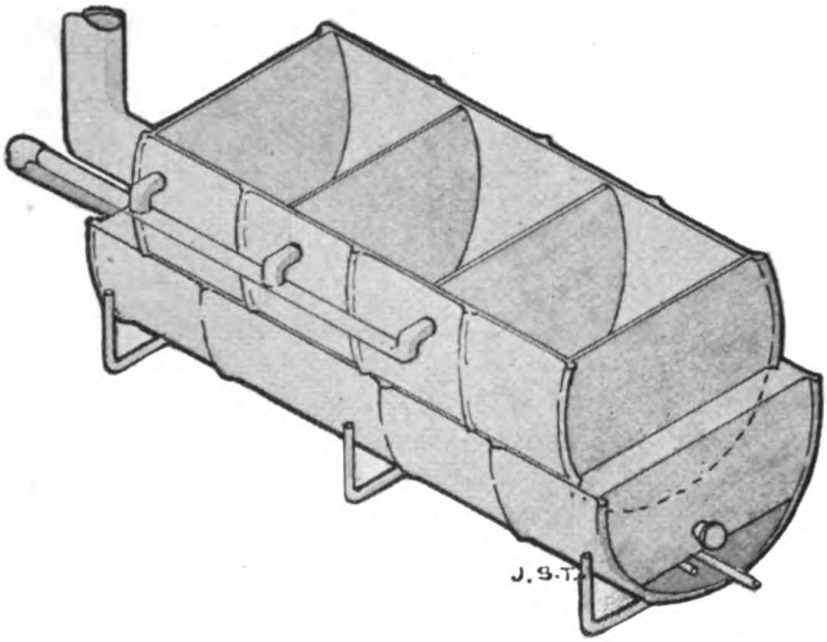
2. A. Side view of three-section unit. **B.** Side view single unit. **C.** Burner pipe. **D.** Alternate burner.

of the galley, health of the food handlers and many other particulars.

On bases that are located in tropical or semitropical climates the sterilization of mess gear just prior to messing is one of the most important measures of sanitation.

Usually this is accomplished by immersing the gear into boiling water just before use.

It is this problem of boiling water that is the responsibility of the Sanitation Department, and serving a meal should not be allowed until the mess gear sterilizing water is boiling.



3. General view of sterilizer made from salvaged oil drums. Fuel used was Diesel oil 75 percent, 80-octane gasoline 25 percent.

Many methods are in use to provide heat for this purpose; however it is safe to say that the majority of amphibious groups have experimented with several units before being satisfied.

The 93d Naval Construction Battalion made many experiments and trials with the usual disappointments before finally adopting the present sterilizing unit, which works satisfactorily, is economical and has good capacity for generating heat.

The accompanying illustrations show the improvised sterilizer and heat unit.

The heat unit works on the principle of converting oil into a combustible vapor by preheating. This process takes place in the U-shaped burner and the vapors ignite in the combustion chamber.

It is necessary to remove and clean the holes in the burner daily.

This unit is simple to make, easy to operate and dependable even in the heavy rains of the tropics.

EDITORIALS

TSUTSUGAMUSHI DISEASE

As the Pacific war backtracks and the island trek liberates conquered territories, new medical problems arise. In sequence, malaria, filariasis and now tsutsugamushi disease test alike the ingenuity of epidemiologist and medical officer.

Logue's[1] description of a scrub typhus epidemic on one of the islands in the Southwest Pacific emphasizes the seriousness of this rickettsial infection. As other reports both from Army and Navy sources appear in the literature, there is revealed a disease problem of a magnitude equaling any thus far encountered.

A disease with a potential mortality of 10 percent and whose therapeusis is restricted at best to relief of symptoms, requires vigorous measures. Unfortunately up to the present there is no known specific therapy, and drugs are not as effective as in other familiar tropical diseases.

The control of tsutsugamushi disease must consequently rely primarily upon preventive methods. These again unfortunately have not been as effective as are procedures for the control of malaria or filariasis. The expansive breeding environs and the exigencies of warfare have hampered epidemiologic control. The sporadic unpredictable character of the infective vectors, moreover, makes mandatory the clearing of all areas where the habitation of vectors is possible. Lack of knowledge, however, of the vector involved and consequently its habits, seasonal periodicity, life history and the like, as well as dearth of information concerning the natural reservoir hosts of both the mite and the rickettsiae in most infectious regions, seriously handicap specific control activity.

Considering the dense vegetation of these areas, the kunai grass, the adjacent shrubbery, leaves and rubbish, epidemiologic measures must necessarily be restricted to the immediate camp site, walks and roadways. Protected spots therefore appear as

[1] Logue, J. B.: Scrub typhus; report of epidemic in Southwest Pacific. U. S. Nav. M. Bull 43: 645-649, October 1944.

islands in a sea of potential infestation. With the presence of tropical rodents in and about these areas, spread of infection into the safety zones is ever imminent and requires continuous, vigorous action.

Evidence is that as Japan is approached the disease is likely to increase, if not in numerical incidence, at least in severity. Most authorities comment on the high mortality of the infection in Japan. Whether this is due to a more virulent form of the disease or to the health status of persons infected in Japan is speculative. Recent experience, however, has shown that mortality is highest in victims over 35 years of age and in persons whose physical condition is depleted, particularly by complicating diseases such as dengue, malaria and dysentery.

The protracted morbidity, moreover, makes the disease of primary military importance. Besides an enforced lengthy convalescence the probability of myocardial sequelae writes off the patient for future military participation.

Furthermore from Farner and Katsampes' report[2] in a recent issue of the BULLETIN it is seen that the incidence of the disease is more widespread than is revealed by current literature. Confusion in terminology has brought about confusion in statistical recording. Such names as rural, scrub, or bush typhus, tropical typhus, coastal fever, Mossman fever, endemic glandular fever, pseudotyphus of sugar cane cutters, river fever, Japanese river fever and tsutsugamushi fever are all terms identifying a single disease entity.

Nor has the naming of the causative organism helped toward clarifying the confusion. Hayashi in his original description of Rickettsia tsutsugamushi emphasized the pleomorphic character of the organism. Ten years later Nagayo, reinvestigating the causative agent of tsutsugamushi, isolated a rickettsia which was monomorphic and which he called R. orientalis. He contended moreover that Hayashi's studies centered around a group of organisms composed of a variety of rickettsiae erroneously considered pleomorphic strains of a single species.

Despite these assertions, pleomorphism in R. tsutsugamushi enjoys an almost general acceptance. The evidence, it must be conceded however, is for the most part of a presumptive character, being based upon proved pleomorphism in rickettsia of true typhus.

Except for the term R. tsutsugamushi all others therefore are of such controversial character, according to Farner, that their

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[2] FARNER, D. S., and KATSAMPES, C. P.: Tsutsugamushi disease. U. S. Nav. M. Bull. 43: 800-836, October 1944.

use had better await further experimental evidence on the relationship of isolated strains. Restriction of the nomenclature of the disease to tsutsugamushi disease, and that of the causative agent to Rickettsia tsutsugamushi, consequently is not only timely but is necessary if uniformity in reporting vital statistics is to be furthered.

FILARIASIS

Among the tropical diseases that the present conflict has projected upon modern medicine, none has a more exotic character than filariasis. Paramount among its clinical manifestations is the disfigurement strikingly apparent among the native population of endemic areas. It has been estimated that as many as 85 percent of the people of some villages are visibly crippled. Recently Rome and Fogel[1] have directed attention to the mental anguish and apprehension this spectacle produces in white troops infected with the disease.

The assertion that these are late clinical manifestations incident to repeated infections over years of living in infested areas has little import in reassuring the unhappy victim that the likelihood of this aspect of the disease occurring in his own particular instance is remote. Moreover the recurrent lymphangitis and lymphadenitis, the pain, swelling, medical manipulation and questioning by the examining physician, the jesting by associates, tend little to relieve his fears. The results of this psychologic inoculation are apparent.

Renewed careful investigation, however, has shown that these clinical entities are out of proportion to the seriousness of the disease, and the prognosis of complete recovery without important residual is good once the patient is removed from the endemic area.

Until recently association of lymphangitis and lymphadenitis with filariasis was thought of only in terms of gross elephantiasis. This impression is gained from textbooks on tropical diseases. Nothing is further, however, from the real aspect of the disease as it is commonly seen in service personnel. It is now generally conceded that elephantiasis is the result of numerous repeated infections over years of habitation in endemic centers.

The local manifestations of the nature described are so pathognomonic of the disease and impressive to the patient that the pro-

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[1] ROME, H. P., and FOGEL, R. H.: Psychosomatic manifestations of filariasis. J.A.M.A. 123: 944-946, December 11, 1943.

tean character of filariasis frequently is overlooked. Subjective complaints of headache, drowsiness, blurring of vision, backache, fatigability and allergic skin reactions disclose a disease that is equally systemic. A hyperproteinemia and a pulmonic phase manifested by the prevalent morning cough so conspicuous in natives of endemic areas, which leads to a suspicion of widespread tuberculosis, confirm clinically this aspect of the disease. Zuckerman and Hibbard's description, however (p. 27 of this issue), of the marked reticulo-endothelial response in the lymphatic system of the filariasis patient, places the constitutional character of the disease on a sound pathologic basis. The generalized reaction is intelligible whether it is explained as a simple allergic manifestation or as a toxic one in response to metabolic products of the worm or to its disintegration in the lymph node.

Other departures from textbook descriptions of filariasis are apparent from the variegated objective and subjective findings discussed by Glauser, p. 21 of this BULLETIN.

The evidence of one patient manifesting the disease after only 2 months in an endemic area casts new light upon the incubation period and introduces the probability of early infection with a latent manifestation that requires on an average of 9 months' residence before apparent onset of symptoms.

Even as the clinical picture of the disease assumes new form its entomologic component has been subjected to a more careful investigation.

Elsewhere in this BULLETIN, p. 1, are described the distribution, habits and characteristics of filarial vectors, and in serial developmental stages the larval cycle of Wuchereria bancrofti is portrayed.

The evidence in support of Aëdes pseudoscutellaris as the principal filarial vector, at least in the Samoan area, is more than circumstantial and places a new epidemiologic aspect on the disease. Following Buxton's pioneering work, the dim-light biting Culex quinquefasciatus was considered the outstanding responsible vector. With the findings of Byrd and his associates and subsequently from the studies of Farner and Bohart, p. 37, the daytime biter Aëdes pseudoscutellaris is positively incriminated. The reclassification of a pseudoscutellaris and the coincident distribution of autochthonous nonperiodic filariasis with the geographic distribution of A. pseudoscutellaris makes a revision of thinking regarding the spread of the disease not only imperative but necessitates a new approach to its control.

Outstanding among Byrd's findings is that pertaining to mosquito flight. Up to the present it was thought advisable that

1 mile or more should intervene between native village and camp site. Byrd has shown that as the distance from the village increases the mosquito population progressively decreases until at 50 yards the recovery of Aëdes pseudoscutellaris is in the nature of a chance capture. The military importance of this information is apparent and broadens the selection of camp sites materially.

Although the life cycle of Wuchereria bancrofti is well known, its portrayal in serial photographs has never before been published. The remarkable illustrations accompanying this article give an added importance to its timeliness and purpose.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

HOMICIDE INVESTIGATION, Practical Information For Coroners, Police Officers, and Other Investigators, by *LeMoyne Snyder, Medicolegal Director, Michigan State Police, Member of the American Medical Association, Member of the American Bar Association;* with chapters by *Captain Harold Mulbar, Chief of the Identification Bureau of the Michigan State Police; Charles M. Wilson, Director, Chicago Police Scientific Crime Detection Laboratory;* and *C. W. Muehlberger, Director, Michigan Crime Detection Laboratory.* 287 pages; illustrated. Charles C Thomas, Springfield, Ill., publishers, 1944. Price $5.

To some, murder is only a morbid subject; to others an essential ingredient of a mystery story; but to investigators of crime it is an acutely practical problem. The possibility of culpable causation enters into the differential diagnosis of every case of unexplained or sudden death. It is estimated that one death in five in the United States falls into this category and so requires official investigation. Under existing conditions lay police officers perform all or a substantial part of the initial search for clues and it is they who must be indoctrinated in acquiring and preserving medical evidence and saving materials for the scientific crime detection laboratory.

The old saw that "murder will out" regularly and automatically is unfair to the memory of Sherlock Holmes but, more important, it is also a myth inimical to the proper pursuit of justice. Dr. LeMoyne Snyder, medicolegal director of the Michigan State Police, has had a unique opportunity to see how uninformed investigations of suspected homicide can destroy the precious scien-

tific clues which might lead to proof of murder. He undertook to prepare a basic manual for the guidance of lay coroners, police officers, and general practitioners because no one else had done so. He did not endeavor to make his volume a treatise for the professional forensic, pathologic, or medical examiner. Instead he sought to give lay investigators vital information concerning acquisition, preservation, and interpretation of evidence in respect to death caused by any one of the several violent means customarily employed.

Though he had modestly confined his claims to these objectives, this reviewer thinks that the author has gone further and made a substantial contribution to the field of scientific proof. His manual will prove indispensable to the lay audience he had in mind but it will prove helpful also to every attorney who practices criminal law and to courts which must weigh medical evidence in the trial of homicide cases. The special legal value of the study arises from the author's awareness that he is dealing with a problem of proof which is likely to become crucial in court proceedings. His exposition is primarily concerned with the acquisition and perpetuation of perishable evidence in respect to homicide. His presentation is a terse, applied treatise on scientific evidence in homicide cases.

Exposition is based upon a pragmatic functional approach. He projects himself into the position of the investigating officer and shows exactly what steps should be taken in succession and why. The author has a keen sense of primary values and does not overburden the text with secondary minutiae. As he carries the investigator along, discussing the problems common to all homicide inquiries, Dr. Snyder is careful to avoid long technical discourses upon the reasons for postmortem phenomena. He gives a sufficient general explanation of these changes but discreetly confines himself primarily to what the investigator should look for and why. He takes pains to point out what a particular finding may reveal in respect to the time, place, or cause of death.

In his initial pages Dr. Snyder deals with more pervasive problems, such as the desirable procedure to follow at the scene of a homicide, the routine data to be recorded systematically, the photographing of the body and its environment, and the making of various vital observations. He then carries the reader into more specialized chapters devoted to such subjects as "Homicide Due to Gunshot Wounds," "Homicide Due to Cutting and Stabbing Wounds," "Deaths Due to Asphyxia," "Drowning and Bodies Found Dead in the Water," "Examination of Burned Bodies," "Deaths Due to Poisoning," "Effect and Detection of Alcohol,"

"The Investigation of Deaths Due to Highway Accidents," "Deaths Due to Criminal Abortion," and "Examination for Suspected Sexual Assault." In one of his concluding chapters Dr. Snyder discusses "Popular Fallacies in Homicide Investigation."

As each mode of death has its evidentiary peculiarities, Dr. Snyder has followed a simple and logical plan in considering these as distinct special problems. Naturally there are obscure cases of sudden or unexplained death where the cause will only appear after a carefully conducted postmortem examination. The investigator is made aware of the necessity for such examinations, but Dr. Snyder addresses himself in main to schooling the investigator in the making of vital observations within his own range as a layman.

The book is compact, practical, informative, and interesting. It carries a considerable number of illustrations. In 42 of our states the investigation of sudden death is conducted under the general jurisdiction of lay coroners. To these public officials and to all investigators of homicide who need to know what sort of tales "dead men may tell," Dr. Snyder has made an exceptionally valuable contribution.

ONE HUNDRED YEARS OF AMERICAN PSYCHIATRY, by an editorial board headed by *J. K. Hall, M.D., General Editor*. 649 pages. Published for The American Psychiatric Association by Columbia University Press, New York, 1944. Price $6.

It is fitting that each special phase of the Art of Medicine periodically assess its progress, take its bearings as it were, in an attempt to define its purpose, practices, and precepts. Particularly, when aims and goals are enormously comprehensive, does it seem wise to pause, and with the searching light of history, peer into the past to establish true value and gain. Such economics of medical profit can be understood best in terms of the universal specie of suffering and unhappiness.

Man is so constituted that his relationships with his fellowmen and with himself have always been the major cause of his strife and discontentment. Because conflicts constantly press for resolution, these relationships have acted as a source of continued mystery, speculation, and curiosity. It was to be expected, therefore, that there should have been formed a branch of medicine, since it is the discipline which attends the ills of mankind, which sought to explain these imponderables with the hope, that by so doing, man's lot could be made easier.

The signs of a progressive culture are the kind of measures which are taken to direct its interpersonal relationships, mold its attitudes, and instruct the young. Those who undertake these

problems as their profession, have an unenviable job; that they stumble, seem awkward, fall short of completing the work they set for themselves is not so much a basis for criticism, as it is a testament to the magnitude of the task they cut out for themselves.

The editorial board of the American Psychiatric Association has achieved a rare combination in the production of this book—it reaffirms psychiatry's position as a contributor to medical progress and by so doing, pays tribute to its pioneer members who too often have labored as prophets without honor.

The centenary volume is one of those fortunate productions which has not only valuable scientific and historical worth, but is also a literary work of singular merit. The Centenary Emblem, which appears on the title page, sets the tone of the whole volume; with fine craftsmanship, it depicts the veil of scientific isolationism being lifted from the face of social problems and public issues. Surely at this time in our national history, there is no greater or more pressing need, than to order properly our future with every resource we can command.

The volume gains academic stature by its subtle appraisal of psychiatry's role as a growing cultural force. Rather than present a reporter's account of past performances by means of endless lists of names, dates, and events, it surveys one hundred years' progress synoptically and by so doing, achieves its object. Even without benefit of formal recognition, it must be admitted that psychiatric thinking has permeated every aspect of our civilized living, healthy and diseased. Lest in looking at what remains yet to be done we lose heart and feel that we are pursuing a chimeric pseudoscience, we need only pause sufficiently long to read of the herculean labors of such humanitarians as Isaac Ray and Dorothea Lynde Dix. Volumes such as this should be a source of pride in the accomplishments of American Medicine.

THE ROMANCE OF MEDICINE, The Story of the Evolution of Medicine From Occult Practices and Primitive Times, by *Benjamin Lee Gordon, M.D., Member American Association of the History of Medicine; Attending Ophthalmologist to the Shore Memorial Hospital, Somers Point, New Jersey, and to Atlantic County Hospital for Tuberculosis, Northfield, New Jersey.* 624 pages; illustrated. F. A. Davis Co., Philadelphia, Pa., publishers, 1944. Price $5.

This is a different book to review, inasmuch as it discusses everything from the Primitive Conceptions of Fecundation, through Biologic Products in Occult Healing, to the Speculative Modern Concepts of Immortality. It is more or less a compendium and everything is grist that comes into the author's mill. In the introduction and early chapters, he traces the forerunners of medi-

cine in ancient times—the spirits and demons, etc. His intention is to give personal interpretations of certain practices and customs which to the modern mind seem unintelligible. He warns that his approach must be dogmatic in spots but feels that it is novel and hopes his work will serve to stimulate others.

In the chapter on the various ideas of fecundation and the supposed influences of lunar periodicity upon the menses, he reminds us of the fact that the French peasant women speak of menses as "le moment de la lune," and points out the fact that Aristotle and Galen thought that the moon controlled the menstrual cycle in women. In the chapter on man's knowledge of his physical self, he discusses the various opinions on anatomy, physiology, etc., mentioning such interesting speculation as Plato's belief that "the intestines are long and tortuous in order to permit food to remain there for a long time so that the mind may not be disturbed in its contemplation by the desire for nutriment." The discussion of Galenic and post-Galenic concepts of physiology and the search for the vital principal is interesting.

Needless to say that not everyone will agree with the author's interpretations of various phenomena, particularly when he strays into the philosophic and theologic fields. One also wonders about the correctness of the statement on page 191 that masturbation is a cause of hysteria. Modern psychiatric thought tends to believe that it is more in the nature of an effect of underlying emotional unrest rather than a cause.

It is difficult to read the book because it is so crammed full of facts. Fortunately, however, it is well annotated and would serve as an excellent source book. There are a few minor errors, such as the title of Messmer's thesis (page 499) which should be The Influence of the Planets upon Man rather than Plants upon Man. These errors do not detract from the authenticity of the work, however, and can easily be corrected.

FUNCTIONAL DISORDERS OF THE FOOT, Their Diagnosis and Treatment, by *Frank D. Dickson, M.D., F.A.C.S., Associate Professor of Clinical Surgery, Medical School, University of Kansas; and Rex L. Diveley, A.B., M.D., F.A.C.S., Colonel, Medical Corps, Army of the United States.* 2d edition. 352 pages; 202 illustrations. J. B. Lippincott Company, Philadelphia, Pa., publishers, 1944. Price $5.

The first two chapters on the evolution and anatomy of the human foot are not noteworthy.

However in chapters three and four the author clearly and reasonably presents an excellently coordinated picture of the human foot performing its normal functions and being affected by certain adverse conditions.

He analyzes the various actions and purposes of foot muscles, ligaments and bones and explains how variations of bony structure alter the stresses on supporting ligaments. He describes the different factors which predispose to and which induce altered or disturbed foot physiology and discusses the progression of such conditions from their inception to the terminal painful stage.

In chapter eleven the subject of hallux valgus is treated in the same way. Lucidly and understandably he describes the forces and conditions leading up to and producing bunion formation. He divides bunion operations into three general groups and presents very practical indications for the choice of operation in each stage of the deformity.

These three chapters are extremely well done and should be considered indispensable for those who are interested in feet.

Chapters five through ten present the method of examination, and the findings and symptoms of abnormal feet from infancy through adult life. The treatment for each condition is adequately described and illustrated with diagrams and photographs.

The discussions on toenails, the skin, tarsal and metatarsal disorders and affections of the heel, although clearly and simply written, present nothing new. This is likewise true of the last three chapters which discuss constitutional diseases of feet, strapping and foot exercises.

Chapter sixteen on the military aspects of foot disabilities gives a good, general, brief and practical discussion of those foot conditions which are not compatable with military service and those few which are amenable to treatment in the service. He notes that arch supports, while satisfactory in civilian life, do not seem to have any therapeutic place in military service. His advice to the military surgeon is very sound when he says, "Bunions or hallux valgus, calcaneal spurs and rigid first toes practically never can be operated upon and the soldier returned to duty, and operations on these conditions should not be advised in military service."

MANUAL OF HUMAN PROTOZOA, With Special Reference to Their Detection and Identification, by *Richard R. Kudo, D.Sc., Associate Professor of Zoology, The University of Illinois.* 125 pages; illustrated. Charles C Thomas, Springfield, Ill., publisher, 1944. Price $2.

This book appears to be, on the whole, a brief of standard text without critical deletion of the concepts of yesterday which recent knowledge has proved to be in error; and without, as far as the reviewer can see, any contribution of original ideas by the author.

The title page states that the manual was written "With Special Reference to Their (human protozoa) Detection and Identification." It is helpful but no more so than other manuals on human

protozoa and in some instances, less so. A few misleading statements might be mentioned:

On page 10 it is stated that the "trophozoites of E. histolytica vary in diameter from 15 to 35 microns," when actually the lower limit is well known to reach 8 microns. On page 13 when evaluating Lugol's solution as a stain for cysts, the author states that the nuclei are easily recognized. This is true only for the large race; the nuclei of the small race are almost impossible to see even when the cysts are stained with iodine. The author fails to mention that there are two races of E. histolytica, which is a fundamental fact, not only in the understanding of the clinical manifestations of E. histolytica infections, but also in the identification of the E. histolytica cysts and their differentiation from the cysts of other intestinal amebae.

In his discussion of Dientamoeba fragilis, Kudo makes no reference to a most convenient method of its identification, namely, the use of aqueous smears. He also gives such misinformation as "this active amoeba undergoes (sic) progressive movement." The reviewer is convinced that D. fragilis is not capable of progressive movement in smears which can be examined microscopically. There are other errors and omissions and not a few typographic mistakes.

BACTERIAL INFECTION, With Special Reference to Dental Practice, by *J. L. T. Appleton, B.S., D.D.S., Sc.D., Professor of Bacteriopathology and Dean, The Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania.* 3d edition, thoroughly revised. 498 pages; illustrated with 86 engravings and 5 plates. Lea & Febiger, Philadelphia, Pa., publishers, 1944. Price $7.

This edition fulfills in every way the primary purpose of the book, which states it is to aid the reader to form a comprehensive concept of infection. The style of writing is simple, well constructed and concisely digested, yet adequate. The liberal use of references should inspire the student to additional reading wherever his interest is most marked. For this reason the book is not only of value to the undergraduate but to the busy practicing dentist as well. It could be used as a ready reference book for the clinical investigation of any problem relative to bacteriology that might be presented.

The text is divided into three parts, Bacteriology, Infection, and Special Infections of the Oral Cavity. The first part on Bacteriology begins with the description of the morphology and the effects of environmental factors of bacteria together with the relation of bacterial growth to oxygen supply. The antibacterial action of chemicals, surgical antisepsis and asepsis, pure culture study of

bacteria and the filtrable viruses are also discussed.

The second part on Infection is most complete, beginning with a study of the nature of infection and general concept, followed by three chapters on how bacteria produce disease. These include the conception of Koch's postulates, the conditions determining infection, the virulence of a parasite and invasiveness, mechanical damage, toxicity and allergy. The natural defenses of the skin, eye, respiratory tract, mouth, stomach, intestine, genito-urinary and central nervous systems, the lymphoid tissue, humoral defenses, the process of phagocytosis, excretion of bacteria, antibiosis, the bacteriophage and use of maggots are clearly outlined. An entire chapter each is given on the humoral defenses, the cellular defenses, inflammation, resistance or immunity, artificial active immunization, characteristics of infection, the factors affecting susceptibility to infection, the dissemination and transmission of infectious agents and carriers and the minimizing of infectious disease. Two chapters are devoted to the types of infection.

Almost one fourth of the book is used for special infections of the oral cavity, which enhances its usefulness so that it could be used for a clinical handbook. The chapters in this section include the ecology of the microorganisms of the oral cavity, the streptococcus–pneumococcus group, spirochetes of the mouth, dental caries, bacteriology of the dental pulp and of the apical and periapical region, the control and management of the pulpless tooth, periodontal disease and infection, focal infection, Vincent's infection, actinomycosis, osteomyelitis, oral manifestations of extraoral infections, gonococcal and syphilitic infections, tuberculosis and the bacteriologic aspects of oral hygiene.

The chapter on dental caries is in the opinion of this reviewer the most complete and up-to-date description of the complex process that has been written. It discloses the unbiased viewpoint of the author and gives a conservative interpretation of the many researches in this field, together with numerous references and suggestions for clinical application. Dr. Appleton's concise summary has laid a sound foundation upon which a possible method for the clinical control of dental caries may be formulated in the future.

This book has consistently adhered throughout its contents to sound bacteriologic principles. It is enthusiastically recommended to dentists and students as the most practical, well briefed, and authoritative work on bacterial infection in its relation to dental practice that may be obtained at this time.

PRACTICAL MALARIA CONTROL, A Handbook for Field Workers, by *Carl E. M. Gunther, M.D., B.S., D.T.M. (Sydney), Field Medical Officer, Bulolo Gold Dredging Limited, Territory of New Guinea, at present with the Australian Medical Corps;* with a foreword by *Prof. Harvey Sutton, O.B.E., M.D., F.R.A.C.P., B.Sc., D.P.H., F.R.San.I.* 91 pages. Philosophical Library, New York, publishers, 1944. Price $2.50.

One cannot help but feel that if the author, now a prisoner in the hands of the Japs, could be acquainted with the recent advances in the control of malaria, he would be the first to deny the book's worthiness for publication. Certainly the small volume contains little of information to medical officers or civilian practitioners which might not be more profitably obtained from almost any of the standard texts on the subject.

MEDICAL DIAGNOSIS, Applied Physical Diagnosis, edited by *Roscoe L. Pullen, A.B., M.D., Instructor in Medicine, Tulane University of Louisiana School of Medicine;* with a foreword by *John H. Musser, B.S., M.D., F.A.C.P., Professor of Medicine, Tulane University of Louisiana School of Medicine.* 1106 pages; 584 illustrations and 12 colored plates. W. B. Saunders Co., Philadelphia, Pa., publishers, 1944. Price $10.

This book differs radically from other texts on physical diagnosis. First, it is a compendium by 26 authors, similar to the plan in popular texts on medicine and surgery. A second difference is that proportionally much less space is given to examination of the heart and lungs than in other texts; in this case only 109 of the 1,014 pages. Third, there is included for the student methods for special examinations such as the electrocardiograph, electroencephalograph, proctoscope, neurologic and psychiatric examinations.

Considering the book as a whole it may be said that it is well written by men who apparently know their subject, these men chiefly belonging to younger groups. The illustrations are plentiful and well chosen. The index is carefully arranged both as to symptoms and signs and as to diseases. And, as a distinct credit to Dr. Pullen, the editor and one of the chief contributors, there is little or no repetition in the different chapters.

The reviewer, a teacher of physical diagnosis before entering the service, thinks the chapters on the rectum, skin, mouth, breasts, and extremities are excellent, and all the more appreciated because these are often barely touched on in most texts, the usual plan being to get the student over the hurdles, heart and lungs, to the neglect of the remainder of the examination. The reviewer, however, feels that in Dr. Pullen's book the 109 pages given to examination of the heart and lungs is too brief.

It would appear also that the text attempts to be too all inclusive, too far reaching. For example, 156 pages are given to the

following: "Neurological Examinations", "Practical Mental Measurement", "Differential Diagnosis of Neurosis and Psychosis", "Clinical Electroencephalography", "Electrocardiographic Diagnosis" and "Psychiatric Approach." The reviewer has never understood the rationale of including electrocardiography in a textbook on physical diagnosis, for certainly it has no part in a physical examination.

It will be interesting to see how this work is accepted. As the reviewer sees it, it will likely serve better as a reference than as a text. The many good chapters on subjects usually receiving scant attention in other works may offset the superfluous chapters that have no place in such a work.

TEXTBOOK OF GENERAL SURGERY, by *Warren H. Cole, M.D., F.A.C.S., Professor and Head of the Department of Surgery, University of Illinois College of Medicine;* and *Robert Elman, M.D., Associate Professor of Clinical Surgery, Washington University School of Medicine.* 4th edition. 1118 pages; illustrated. D. Appleton-Century Co., Inc., New York, publishers, 1944. Price $10.

The authors have condensed in one volume an excellent coverage of general surgery. By omission of detailed operations, a wealth of material in the general principles of surgery is included. This is especially good as it stresses time proven principles of surgery along with the important role now played by chemotherapy, penicillin, water and electrolyte balance, vitamins and protein nourishment.

Included in this book are many excellent drawings, photographs and x-rays which are most helpful not only in illustrating the various points brought out by the authors but in clarifying diagnosis.

A great deal of emphasis is given traumatic surgery. Details such as nonunion of fractures, infection of wounds, delayed wound healing, general principles in treatment of burns, shock, head injuries, etc., are well covered and will be appreciated by those doing war surgery.

TUBERCULOSIS OF THE EAR, NOSE, AND THROAT: Including The Larynx; The Trachea, and The Bronchi, by *Mervin C. Myerson, M.D., New York City.* 291 pages; illustrated. Charles C Thomas, Springfield, Ill., publisher, 1944. Price $5.50.

The author has devoted fully one-half of this book to the subject of tuberculosis of the larynx, which is very well written, concise, and easily read. He includes on this subject (1) the general considerations, (2) pathology, (3) symptomatology, diagnosis, and prognosis, (4) treatment, (5) tracheotomy in relation to tuberculosis, (6) nontuberculous lesions of the larynx among the tuberculous patients. The latter half of the book deals with tuber-

culosis of the nose, oral cavity, tongue, pharynx, tonsils, esophagus, trachea and bronchi, with a brief chapter on the technic of bronchoscopy in tuberculosis.

In tuberculosis of the larynx age is a definite factor. The greatest frequency is 20-40 years of age and it is rarely seen in advanced age. The author is of the opinion that the larynx becomes involved by the way of the blood stream and not by contact with large quantities of sputum which pass through the larynx. With regard to pathology there are three main types increasing in severity, namely, (1) exudative, (2) productive, and (3) destructive. The regions most likely to be encountered are (1) arytenoids, (2) the interarytenoid space, and (3) the vocal cords. The symptoms encountered are those which interfere with function, as well as those caused by affection of the sensory nerves. The symptoms most likely to be encountered in order of decreasing frequency are (1) hoarseness to aphonia, (2) pain, (3) dysphagia and odynophagia, (4) dryness, (5) soreness, and (6) pain (no hoarseness). The therapeutic measures that are used are (1) cautery, (2) oils, (3) light therapy, (4) x-ray, and (5) injection and resection of the nerves.

Usually therapeutic measures are employed if the disease is inactive; if active it is managed by inactive measures. Even if the larynx is healed after tuberculous involvement it cannot be considered cured; it may be considered healed, arrested, latent or apparently cured. Cutting instruments should never be employed in this condition, as the use of curettes and forceps cause bleeding and create new avenues for the spread of the disease.

The most common nontuberculous condition of the larynx among the tuberculous patients is chronic laryngitis, which is usually the result of excess cough, postnasal drip, and smoking, and is characterized by generalized thickening and dull redness of all structures of the larynx.

The author's chapter on tuberculosis of the tonsils is interesting. Because of their location, they are more likely to become infected than any other part of the respiratory tract. With rare exception, infection of the tonsil is secondary to disease elsewhere. There are two types encountered: (1) Manifest (divided into two forms (a) ulcerative and (b) miliary), and (2) latent, showing no external evidence of the disease. There are tubercles which form in the subepithelial tissues of the surface or crypts, which later coalesce and extend into the tonsillar substance. The frequency of tonsillar tuberculosis makes it important that a complete physical examination be performed before all tonsillectomies. The author cites several cases wherein routine tonsillectomies

were performed without the doctor suspecting tuberculosis; the patients died, within six weeks following the operation, with generalized tuberculosis.

The remainder of the book deals with rarer manifestations of tuberculosis. It is well written, with a good bibliography, and numerous case histories at the end of each chapter.

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FIELD HANDLING OF COMPOUND FRACTURES

Patients coming into this hospital lead one to the conclusion that two details of the so-called closed plaster treatment technic for compound fractures are not widely known or observed—the use of vaseline packs and immobilization of soft parts.

Almost every patient with this type of injury coming to the hospital has under the cast vaseline gauze tightly plugging the wound. As a result the wound is expanded and the overlying dressing holding the vaseline pack snugly in the wound dams up all secretions. Frequently the plug causes retention of large amounts of pus. The necessity of adequate drainage, and lightly packing so as to fill but not enlarge the wound, has repeatedly been stressed. The wound moreover should be surgically extended if necessary to permit free drainage. Furthermore the covering dressing should be such as to permit the vaseline pack to extrude from the wound as healing takes place. This principle has been almost uniformly violated in the cases coming to this hospital.

Through-and-through wounds have invariably had through-and-through vaseline packs. These wounds should be lightly packed from both ends but not through-and-through.

Most frequently the adequate immobilization of soft parts and bone is neglected in the treatment of upper arm and thigh fractures. Nothing less than a spica cast furnishes adequate immobilization for these wounds. Several fractures have arrived with no cast, or with a simple leg cast, and 3 to 5 inches of overriding is not unusual in the femur. There is no mechanical advantage in placing a pin in the distal fragment with its incorporation in the cast. Immobilization is the important factor, alinement secondary.

Padding of casts over bony prominences, especially the heel and the dorsum of the foot, should be done to avoid pressure sores.—McKEEVER, D. C., Commander (MC) U.S.N.R.

PREVENTIVE MEDICINE

Captain T. J. Carter, Medical Corps, United States Navy, in Charge

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TOXIC EFFECTS OF ARSENICAL COMPOUNDS

AS EMPLOYED IN THE TREATMENT OF DISEASES IN THE UNITED STATES NAVY, 1943

T. J. CARTER
Captain (MC) U.S.N.

WESLEY M. CHAMBERS
Lieutenant, junior grade (HC) U.S.N.
and
LAURA T. ANDERSON

From November 1924 until August 1942, medical officers of the Navy have been required to make monthly reports of the number of doses of arsenicals administered and a separate report of each case in which ill effects are noted. Since August 1942 reports have been made quarterly, except from submarines. During the 19 years, 1925 to 1943, in which this information has been compiled, 2,159,850 doses of arsenicals have been administered and 1,201 untoward reactions have been reported.

Previous articles dealing with the information obtained from these reports have been published in the following issues of this BULLETIN:

September 1925	October 1934	January 1938	October 1941
January 1927	January 1935	October 1938	January 1942
January 1929	October 1935	January 1939	October 1942
July 1930	January 1936	October 1939	January 1943
October 1931	October 1936	January 1940	November 1943
October 1932	January 1937	October 1940	January 1944
October 1933	October 1937	January 1941	October 1944

Cases of arsenical dermatitis occurring during the year 1943 were reported in the October 1944 issue of the BULLETIN.

The present article includes all cases, except those of arsenical dermatitis, which were reported during the year 1943. Comparative figures from the experience of previous years are also presented.

TABLE 1.—*Arsenical reactions, 1943*

Classification	Mapharsen and neoarsphenamine			
	Mild	Severe	Fatal	Total
Arsenical dermatitis*	13	13	0	26
Liver damage	0	10	0	10
Reactions of minor importance	6	0	0	6
Vasomotor phenomena	3	0	0	3
Jarisch-Herxheimer	2	0	0	2
Hemorrhagic encephalitis†	0	0	1	1
Total	24	23	1	48

*Case histories were published in the October 1944 issue of the BULLETIN. Twenty-nine of the above reactions (13 mild and 16 severe) were caused by mapharsen.

†The fatal reaction was caused by neoarsphenamine.

TABLE 2.—*Arsenicals administered during the year 1943 for all diseases*

Drug	Doses (grams)				Total
	0.9 to 3	0.9	0.6 to 0.9	Less than 0.6	
Bismarsen:					
Navy	0	0	0	187	187
All others	0	0	0	79	79
Mapharsen:					
Navy	0	0	0	215,925	215,925
All others	0	0	0	11,871	11,871
Neoarsphenamine:					
Navy	0	998	9,923	4,162	15,083
All others	0	14	422	107	543
Sulfarsphenamine:					
Navy	0	0	4	0	4
All others	0	0	0	28	28
Tryparsamide:					
Navy	1,178	0	0	0	1,178
All others	433	0	0	0	433
Total	1,611	1,012	10,349	232,359	245,331

TABLE 3.—*Arsenicals administered during the 12-year period, 1932–43, for all diseases*

Drug	Doses (grams)				Total
	0.9 to 3	0.9	0.6 to 0.9	Less than 0.6	
Acetarsone:					
Navy	0	0	0	166	166
All others	0	0	76	771	847
Arsphenamine:					
Navy	0	0	149	10,297	10,446
All others	0	0	7	706	713
Bismarsen:					
Navy	0	0	0	2,668	2,668
All others	0	0	1	1,895	1,896
Mapharsen:*					
Navy	0	0	0	575,782	575,782
All others	0	0	0	49,693	49,693
Neoarsphenamine:					
Navy	0	6,779	313,296	387,088	707,163
All others	0	859	39,792	137,080	177,731
Silver arsphenamine:					
Navy	0	0	0	355	355
All others	0	0	0	204	204

*First administered in 1935.

TABLE 3.—*Arsenicals administered during the 12-year period, 1932-43, for all diseases (Continued)*

Drug	Doses (grams)				Total
	0.9 to 3	0.9	0.6 to 0.9	Less than 0.6	
Sulfarsphenamine:					
Navy	0	18	401	7,472	7,891
All others	0	8	404	13,511	13,923
Tryparsamide:					
Navy	37,501	0	0	13	37,514
All others	17,928	0	2	8	17,938
Total	55,429	7,664	354,128	1,187,709	1,604,930

TABLE 4.—*Deaths and severe reactions following the administration of 1,380,440 doses of neoarsphenamine, 1925–43; ratio of deaths and severe reactions to doses*

Classification	Deaths		Severe reactions		Deaths and severe reactions	
	Number	Ratio to doses, 1 to –	Number	Ratio to doses, 1 to –	Number	Ratio to doses 1 to –
Hemorrhagic encephalitis	17	81,202	1	1,380,440	18	76,691
Arsenical dermatitis	13	106,188	209	6,605	222	6,218
Vasomotor phenomena	6	230,073	57	24,218	63	21,912
Blood dyscrasia	8	172,555	20	69,022	28	49,301
Acute renal damage	2	690,220	5	276,088	7	197,206
Acute yellow atrophy of the liver	2	690,220	0	.....	2	690,220
Vascular damage (probable renal hemorrhage)	1	1,380,440	0	.....	1	1,380,440
Liver damage	1	1,380,440	27	51,127	28	49,301
Jarisch-Herxheimer	0	.....	2	690,220	2	690,220
Gastro-intestinal	0	.....	5	276,088	5	276,088
Polyneuritis	0	.....	1	1,380,440	1	1,380,440
Borderline hemorrhagic encephalitis	0	.....	1	1,380,440	1	1,380,440
Arsenical neuritis	0	.....	1	1,380,440	1	1,380,440
Optic neuritis	0	.....	1	1,380,440	1	1,380,440
Classification undetermined	1	1,380,440	0	.....	1	1,380,440
Total	51	27,067	330	4,183	381	3,623

TABLE 5.—*Deaths and severe reactions following the administration of 625,476 doses of mapharsen, 1935–43; ratio of deaths and severe reactions to doses*

Classification	Deaths		Severe reactions		Deaths and severe reactions	
	Number	Ratio to doses, 1 to –	Number	Ratio to doses, 1 to –	Number	Ratio to doses, 1 to –
Arsenical dermatitis	0	.....	26	24,057	26	24,057
Blood dyscrasia	0	.....	1	625,476	1	625,476
Hemorrhagic encephalitis	1	625,476	0	.....	1	625,476
Liver damage	0	.....	10	62,548	10	62,548
Polyneuritis	0	.....	1	625,476	1	625,476
Vasomotor phenomena	0	.....	1	625,476	1	625,476
Total	1	625,476	39	16,038	40	15,637

TABLE 6.—*Deaths following administration of arsenical compounds, 1919–43*

Year	Arsphenamine	Neoarsphenamine	Silver arsphenamine	Mapharsen	Total	Year	Arsphenamine	Neoarsphenamine	Silver arsphenamine	Mapharsen	Total
1919	3	0	0	0	3	1932	0	4	0	0	4
1920	1	1	0	0	2	1933	0	7	0	0	7
1921	3	1	0	0	4	1934	0	3	0	0	3
1922	0	4	0	0	4	1935	0	2	0	0	2
1923	0	1	0	0	1	1936	0	3	0	0	3
1924	1	2	0	0	3	1937	0	1	0	0	1
1925	0	2	0	0	2	1938	0	3	0	0	3
1926	0	4	0	0	4	1939	0	4	0	0	4
1927	1	4	0	0	5	1940	0	1	0	0	1
1928	0	6	0	0	6	1941	0	0	0	1	1
1929	0	3	0	0	3	1942	0	0	1	0	1
1930	0	3	0	0	3	1943	0	1	0	0	1
1931	0	0	0	0	0						
							9	60	1	1	71

NUMBER OF PERSONS TREATED FOR SYPHILIS AND OTHER DISEASES

Annually, on 31 December, each activity reports to the Bureau of Medicine and Surgery, on NAVMED-Form A, the number of persons in that command who have a history of syphilis, and the number receiving any antisyphilitic treatment during the year. A report of the number of persons who were treated during the year with an arsenical compound for a disease other than syphilis is also required. This census does not take into account individuals who left the service during the year.

In table 7 treatment data are listed separately for "active service personnel" and "all others." The term "all others" includes Veterans' Administration patients, dependents of Naval personnel, and native populations of insular possessions.

In table 7 it will be noted that 3,951 persons in the Navy and Marine Corps were treated with arsenical compounds during the year 1943 for diseases other than syphilis. These diseases were: Angina, Vincent's 2,969; gingivitis 19; gingivitis, Vincent's 475; malaria 300; spirochetosis, unclassified 98; paradentosis 8; yaws 5; and other diseases and conditions seventy-seven.

Of the persons in the group "all others" treated for diseases other than syphilis, 65 were treated for angina, Vincent's; 82 for yaws; and 1 for pyelitis.

VASOMOTOR PHENOMENA

MAPHARSEN

Case 27–1943.—After exposure to infection in April 1943, this patient developed a small sore on the shaft of the penis. Repeated darkfield examinations yielded negative results. The Kahn blood reaction on 18 August was 2-plus.

Arsenical treatment consisted of 0.06-gm. injections of mapharsen on 17,

TABLE 7.—*Syphilis and arsenicals, U. S. Navy, 1943*

Item	Persons		
	Navy and Marine Corps	All others	Total
Syphilis census, Dec. 31, 1943	20,421*	.....	20,421
Number of persons treated for syphilis with—			
Arsenicals:			
Bismarsen	59	2	61
Mapharsen	8,244	864	9,108
Neoarsphenamine	1,027	69	1,096
Sulfarsphenamine	0	4	4
Tryparsamide	93	10	103
Total persons treated with arsenicals	9,423	949	10,372
Heavy metal compounds:			
Bismuth	8,059	655	8,714
Mercury	24	14	38
Mixed treatment (specific mixture, etc.)	2	0	2
Potassium iodide	36	0	36
Total persons treated with heavy metal compounds	8,121	669	8,790
Number of persons treated for diseases other than syphilis with—			
Arsenicals:			
Bismarsen	2	0	2
Mapharsen	2,069	132	2,201
Neoarsphenamine	1,808	16	1,824
Fowler's solution	72	0	72
Total persons treated with arsenicals	3,951	148	4,099
Heavy metal compounds:			
Bismuth	37	74	111

*Incomplete data.

19, 21, and 24 August. Two hours after the last injection the patient complained of severe headache, severe generalized aching, and continuous vomiting. Examination revealed a fever of 102° F., the skin was red and warm, there was slight edema of the eyelids, and the conjunctivae were injected. On the following day the temperature rose to 105° F., and a blood count revealed 3,750,000 erythrocytes, 16,350 leukocytes, 38 band forms, 47 segmented cells, 36 lymphocytes, and 1 monocyte. Smears were negative for Treponema pallidum.

Treatment consisted of bed rest, abundant fluids, and alcohol sponge baths. Recovery ensued in 11 days.

Case 28–1943.—After exposure to infection on 25 December 1942, this patient developed a penile lesion. A darkfield examination was positive for Treponema pallidum.

Arsenical treatment began with a 0.9-gm. injection of neoarsphenamine on 30 December and was followed by 0.06-gm. injections of mapharsen on 2 and 7 January 1943. Five minutes after the last injection the patient experienced dizziness and general malaise, followed by mild chills, fever, and vomiting. These symptoms continued and the next morning he noticed severe itching and prickling of the skin. Examination showed moderate, generalized cutaneous hyperemia. The other symptoms were relieved, but the skin reaction persisted, with decreasing severity, until the following morning. No history of allergic diseases or previous drug idiosyncrasy was elicited. Bed rest and abundant fluids were given. Recovery from this reaction occurred in 48 hours.

Intramuscular injections of bismuth subsalicylate were administered on 14 and 21 January. A second reaction, manifested by dizziness, chills, fever, vomiting, and hyperemia, occurred 5 minutes after a 0.06-gm. injection of mapharsen on 28 January. Again treatment consisted of rest and abundant fluids, and recovery was complete in 3 days.

Case 29–1943.—One month after exposure to infection on 20 December 1942, this patient developed a penile lesion. Darkfield examination was positive for Treponema pallidum.

Arsenical treatment began with a 0.3-gm. injection of stabilarsan on 22 January 1943 and was followed by 0.65-gm. injections of neoarsphenamine on 27 January and 3 February, a 0.04-gm. injection of mapharsen on 6 February, and a 0.02-gm. injection on 17 February. Five hours after the last injection the patient became nauseated and vomited. The temperature was 100.6° F., and there was sensory anesthesia of the hands and feet extending to the wrists and ankles. Daily urinalyses from 18 February to 2 March were positive for bile. Treatment for the reaction was bed rest, abundant fluids, and a soft bland diet. Recovery took place in 14 days.

JARISCH-HERXHEIMER REACTION

MAPHARSEN

Case 30–1943.—This patient was hospitalized for acute catarrhal fever, and on 16 July examination of the genitalia revealed a penile lesion on the dorsal shaft, shotty inguinal nodes and enlarged epitrochlear glands.

Darkfield examinations and Kahn blood tests were negative until 19 and 20 August when the Kahn reaction was 4-plus. The diagnosis was changed to syphilis on 20 August and arsenical treatment was instituted with a 0.04-gm. injection of mapharsen. A rose-colored rash appeared following the injection, and 3 hours later the patient developed a headache, muscular aches, and a fever of 102.8° F. The pulse rate was 110 per minute. Two hours later the temperature rose to 104° F. and the pulse rate to 140. Treatment consisted of codeine sulfate, ½ grain, and 800 cc. of 5-percent dextrose in saline solution intravenously 7 hours after injection.

The following day the temperature was normal, the roseola had faded, and the penile lesion was not activated. Abundant fluids, and thiamine chloride, 10 mg. three times a day, was given and recovery was complete in 24 hours.

NEOARSPHENAMINE

Case 31–1943.—This patient was exposed to infection on 1 June and a diagnosis of syphilis was established by darkfield examination of a specimen from a penile lesion.

Arsenical treatment, began with a 0.045-gm. injection of mapharsen on 2 July, was followed by 0.06-gm. injections on 4, 6, 8, 10, and 12 July. A Kahn blood reaction was 2-plus on 13 July.

The patient had a reaction to mapharsen after the last injection, manifested by chills, fever, and itching of the skin. This condition cleared on cessation of the drug. Therapy was resumed with a 0.3-gm. injection of neoarsphenamine on 3 September. Four hours after this injection the patient developed chills, fever, and generalized itching. The temperature was 102.3° F., pulse rate 120, and respirations 28. There was a moderate swelling of the lips and

periorbital tissue. The patient was confined to bed and given abundant fluids, and alcohol and water sponge baths. Recovery was complete in 3 days.

LIVER DAMAGE

MAPHARSEN

Case 32–1943.—After exposure to infection on 1 October 1943, this patient developed a penile lesion, darkfield examination of which was negative for Treponema pallidum. However an additional penile lesion developed 1 month later and darkfield examination at this time was positive for the Treponema pallidum.

From 5 November to 14 December the patient received 12 injections of mapharsen, a total of 0.63 gm. On the day following the last injection the patient became jaundiced and all antisyphilitic therapy was terminated. His liver was slightly enlarged and tender at the time, but he did not feel ill. On 30 December the icterus index was 150.

The patient was given a high-carbohydrate, high-protein diet. Calcium gluconate was given intravenously daily for 3 days, and sodium thiosulfate intravenously daily for 13 days. Recovery ensued in 45 days.

Case 33–1943.—One month after exposure to infection on 12 December 1942, this patient developed a penile lesion which was proved positive for Treponema pallidum.

Arsenical treatment began with a 0.03-gm. injection of mapharsen on 23 December and was followed by 0.06-gm. injections on 27 and 30 December 1942 and 6 January 1943.

During the course of the last injections the patient stated that he had experienced considerable dizziness, nausea, and vomiting after the injection on 30 December, and the injection then under process was discontinued after about 1 cc. (0.006 gm.) had been given. Three hours later the patient developed a temperature elevation to 104.6° F., which remained at that level for 12 hours, falling by lysis 24 hours after onset. He experienced severe nausea and pronounced vertigo and 48 hours later developed a slight jaundice.

The nausea continued for several days and the patient had difficulty in retaining any food. He subsequently lost about 15 pounds in weight. There was no opportunity for determining the type of jaundice or for liver function tests. Examination showed a heavy icteric coloration of the sclerae.

Treatment consisted of bed rest and a high-vitamin diet. The jaundice disappeared completely in 15 days, and 2 weeks later, about 5 weeks after onset of the reaction, the patient had apparently recovered completely.

Case 34–1943.—Two days after exposure to infection on 28 October 1942, this patient developed a gonococcal infection of the urethra. This was treated with sulfadiazine and sulfathiazole for 3 weeks. The discharge persisted and he was then treated for 1 month with intra-urethral protargol instillations. The discharge ceased in about 2 weeks. During the third week in November he developed a sore throat, headache, and a skin rash over the trunk and legs. The rash lasted 5 days. The diagnosis of syphilis was established by Kahn blood tests. There was no history of any penile lesion.

From 13 February to 23 March 1943, the patient received 10 injections of bismuth subsalicylate, a total of 1.3 gm., and from 31 March to 12 May he received 7 injections of mapharsen, a total of 0.39 gm. Twenty-four hours

after the last injection of mapharsen the patient became icteric. The icterus index was 50 on 15 March. He had had no constitutional symptoms but had noticed a dark color to his urine during the previous 5 days.

Physical examination showed nothing pertinent to the case except for a definite icteric tinge to the sclerae.

Treatment given for the reaction was 1 gm. of sodium thiosulfate, intravenously, daily for 5 days, a low-fat, high-carbohydrate diet, and 100 gm. of glucose orally each day during hospitalization. The patient was completely recovered in 24 days.

Case 35–1943.—A diagnosis of syphilis was made in this case on 10 August after a darkfield examination of a penile lesion specimen was found to be positive for Treponema pallidum. The Kahn blood test was negative.

Arsenical treatment began with a 0.06-gm. injection of mapharsen and was followed by 0.06-gm. injection on 11, 12, 13, 14, 16, and 18 August.

Two hours after the last injection the patient experienced general malaise and nausea, and 4 hours later the temperature had reached 104° F. Fever was accompanied by nausea and some vomiting. Within 4 days there was an icteric tinge to the conjunctivae. Examination of the urine showed it to be deep amber in color, with a specific gravity of 1.024, 1-plus alumbin, no sugar, and containing bilirubin. There were a few erythrocytes and no casts. No specific treatment was given for the reaction other than bed rest, abundant fluids, and a high-carbohydrate intake in the form of sugars. The patient recovered in 24 days.

Case 36–1943.—After exposure to infection on 7 July 1943, this patient developed a penile lesion which was positive for Treponema pallidum. A Kahn blood test reaction was negative. Arsenical treatment began with a 0.03-gm. injection of mapharsen on 20 August followed by a 0.04-gm. injection on 23 August and 0.06-gm. injections on 27 and 30 August.

Four hours after the fourth injection the patient developed a chill and nausea. The temperature was 102.6° F. The next day he felt well and had no complaints. A fifth injection of 0.04 gm. of mapharsen was administered on 3 September, and at 1600 the patient began to have chills and complained of headache. The temperature was 103.8° F., pulse rate 104 and respirations 26 per minute. Intravenous administration of dextrose solution was started but discontinued because the patient complained of pain in the arm after receiving 600 cc. At 2100 the temperature was 104° F., pulse rate 109, and respirations 24. The temperature fell by lysis and became normal on 6 September but the following day the patient was jaundiced. He was placed on a low-fat, high-carbohydrate, high-protein, high-vitamin diet. By 18 September the jaundice had diminished considerably, and recovery was complete in 15 days.

Case 37–1943.—After exposure to infection on 1 March this patient developed a primary penile lesion. A darkfield examination was positive for Treponema pallidum, and a blood Kahn reaction was 4-plus.

From 16 April to 9 May the patient received 7 injections of mapharsen, a total of 0.42 gm. Eighteen days after the last injection the sclerae became yellow. At this time the temperature, pulse rate, respirations, and blood pressure were lowered. The patient did not appear ill, but there was a striking yellowness of the sclerae and of the skin over the entire body. There was no nausea, vomiting, pain, or clay-colored stools. On 8 June examination

of the blood showed the icterus index to be 45.3; the hemoglobin content was 14 gm., and the erythrocytes numbered 14,750, with a differential of 8 band forms, 50 segmented cells, 38 lymphocytes, 3 eosinophils and 1 monocyte.

The patient was placed on a low-fat, high-carbohydrate diet, and later a fat-free diet. Intravenous calcium gluconate was administered daily, and bismuth subsalicylate as antisyphilitic therapy weekly. By 15 July the icterus index was normal, but there were clinical manifestations of jaundice. Recovery occurred 48 days after onset of the reaction.

Case 38–1943.—This patient was exposed to infection on 1 July and developed a primary lesion on the scrotum on 20 July. Darkfield examination was positive for Treponema pallidum and the blood Kahn reaction was 4-plus.

Arsenical treatment was instituted with a 0.03-gm. injection of mapharsen on 23 August, and 4 hours later the patient exhibited a Herxheimer reaction accompanied by a marked maculopapular secondary reaction which cleared in 48 hours. Treatment was resumed with a 0.04-gm. injection of mapharsen on 27 August and 0.06-gm. injections on 30 August and 3 September.

Three hours after the last injection the patient experienced a severe chill which was accompanied by slight headache and nausea. The temperature was 102° F. at 1330. At 1430 the patient vomited profusely and seemed to feel better, was comfortable and did not complain of pain. At 1545 he became very flushed and complained of fever. He seemed to be slightly delirious. At this time the temperature was 104.2° F., pulse rate 106 and respirations 24 per minute. Twitching of the forearms and fingers of both hands was also noted. At 1600 an intravenous infusion of 5-percent dextrose in normal saline solution was started, following which he quieted down.

At 1730, after 600 cc. of the fluid had been injected, he developed a severe chill, with a temperature of 104° F., pulse rate 136 and respirations 30 per minute. The pulse was very rapid, thready, and weak, and the fingernails and lips were markedly cyanotic. The patient seemed to be in circulatory shock. The intravenous infusion was discontinued, and warm blankets and hot water bottles were applied. There were no involuntary movements. Morphine sulfate ⅙ grain with atropine sulfate 1/500 grain, was administered. At 1900 the patient felt better, was rational, but anxious and apprehensive, and complained of low back pain. The pulse rate at this time was 124 beats per minute. At 2300 the temperature was 104.6° F., pulse rate 100 and respirations 28 per minute. The patient had a comfortable night, with profuse perspiration requiring changes in bed linen and clothing. The total fluid intake was 840 cc. and the total output 875 cubic centimeters.

By 5 September the patient was much improved but complained of weakness, headache, and some perspiration. The temperature ranged from 99° to 101° F., the blood pressure was 108/55.

On 6 September because of loss of fluids, the patient was given an intravenous infusion of 5-percent dextrose in saline solution, but after 800 cc. had been injected he developed a severe chill followed by an elevation of temperature and pulse rate, the latter becoming normal after about 2 hours. On 9 September, the patient began to show signs of clinical jaundice, and had anorexia and slight nausea. The temperature was normal. He was placed on a low-fat, high-carbohydrate, high-protein, high-vitamin diet, and on 18 September the jaundice was very much decreased. The time of recovery was not reported.

Case 39–1943.—This patient was exposed to infection on 15 August. A diagnosis of syphilis was established by darkfield examination. A typical motile Treponema pallidum was revealed in the exudate from a primary penile lesion. Antisyphilitic treatment began with a 0.04-gm. injection of mapharsen on 30 August and was followed by 0.06-gm. injections on 2, 6, 9, and 12 September and a 0.03-gm. injection on 16 September.

Four days after the last injection the patient complained of headache, pain in the abdomen, nausea, and vomiting. There were no skin lesions. On 20 September the patient was admitted to the sick list. Examination showed the temperature to be 99° F., pulse rate 84, and respirations 20. The conjunctivae were markedly injected. The abdomen was somewhat distended with maximal tenderness and involuntary spasm over the right hypochondrium. The patient complained of severe pain radiating to the right scapular region. Blood count showed 4,650,000 erythrocytes and 9,400 leukocytes, with a differential of 64 segmented cells, 27 lymphocytes, 5 eosinophils and 4 monocytes. The urine was amber, clear, and acid; specific gravity was 1.017, and there was an occasional pus cell, and round- and squamous-cell epithelium.

On the following afternoon the temperature was 101° F. Pain was relieved by enema, and 1 grain of codeine by mouth every 4 hours as necessary. The next day there was marked jaundice of the conjunctivae and generalized jaundice of the entire body. The patient was placed on a high-carbohydrate diet. Twenty-four hours later the pain had disappeared and the muscle spasm was almost completely gone, but there was tenderness on deep pressure over the liver, and the jaundice was more marked. The urine showed high concentration of bile salts. The temperature, pulse rate, respirations, and blood count were within normal limits.

On 27 September the patient had no complaints, and antisyphilitic treatment was discontinued. He was still taking large amounts of glucose by mouth and jaundice was marked. By 6 October he was still markedly jaundiced although he was symptom free. He was discharged from the sick list after 16 sick days. Five days later he was still jaundiced but felt well and had a good appetite. Stools were clay-colored and the urine was positive for bile salts. A saturated solution of potassium iodide, 10 minims, three times daily was administered. From then on the blood count was within normal limits, the blood Kahn reaction negative, and the jaundice gradually cleared. The patient had no complaints. By 11 November he was symptom free, felt fine, had a good appetite, and was well in all respects. Antisyphilitic treatment with bismuth subsalicylate in oil was started and potassium iodide therapy was continued. Recovery was complete in 51 days.

NEOARSPHENAMINE

Case 40–1943.—After exposure to infection on 3 March, this patient developed a chancre, a scraping of which was positive for Treponema pallidum on darkfield examination.

Arsenical treatment was begun with a 0.03-gm. injection of mapharsen on 15 May followed by 0.06-gm. injections on 17, 20, 24, and 27 May, and a 0.45-gm. injection of neoarsphenamine on 31 May. About six hours after each injection of mapharsen and after the injection of neoarsphenamine, the temperature rose to 105° F. On the day following the injection of neoarsphenamine the sclerae were jaundiced and the urine showed bile. The icterus index on 9 June was 52. The patient was given a high-carbohydrate, fat-free diet,

and calcium levulinate intravenously until 28 June, at which time there were no clinical manifestations of jaundice, and the icterus index was within normal limits. Recovery was complete in 27 days.

Case 41–1943.—After exposure to infection on 8 October 1943, this patient developed a lesion on the dorsal side of the prepuce. A darkfield examination on 20 October, was positive for Treponema pallidum. The Kahn blood reaction was negative.

Antisyphilitic treatment was begun with a 0.9-gm. injection of neoarsphenamine on 20 October and was followed by 0.6-gm. injections on 26 October and 2 November. Five minutes after the last injection the patient became nauseated and vomited. Six hours later he developed mild edema of the face and a fever of 103° F. Urinalysis showed 2-plus albumin and many red blood cells and cellular and granular casts.

On 5 November the patient was admitted to the hospital complaining of back pain and numbness of the hands and feet. Physical examination revealed deep icterus of the sclerae and mucous membranes; the liver was palpated 3 fingers breadth below the costal margin and was tender. By 11 November the temperature, pulse rate, and respirations were normal. The icterus index was 93 and examination of the eyes revealed only a conjunctivitis. The patient was placed on a regimen of intravenous dextrose and a high-carbohydrate, low-fat, diet.

On 17 January 1944 bismuth therapy was started. The patient complained of periodic low back pain and some diarrhea, but stool examinations and cultures and x-rays of the spine yielded negative results. On 3 February the icterus index was 22, complete blood count, urinalysis and stool examinations were within normal limits, and on 7 February the patient was returned to duty with the recommendation that future antiluetic therapy be given with extreme caution following the current bismuth therapy. Recovery ensued in 97 days.

FATAL REACTION

NEOARSPHENAMINE

Case 42–1943.—This patient was exposed on 14 April. Syphilis was diagnosed by the clinical appearance of an indurated, slightly painful erosion on the upper surface of the foreskin, associated with painless, nontender, inguinal adenitis on the left side. A darkfield examination on 22 May was positive for Treponema pallidum. Arsenical treatment was instituted with 0.6-gm. injections of neoarsphenamine on 24, 27 and 31 May.

At 0200 on 2 June (8 days after the first injection and 40 hours after the last), the patient was discovered in a convulsive state. Examination showed him to be comatose, with dilated pupils, sonorous breathing, and general clonic contractions, particularly of the hands, arms, and feet. Sodium amytal, grains 3¾ by intramuscular injection, appeared to quiet him for about 5 hours, but at 0900 he had more severe spasms, hypertension, and a temperature rise. Caffeine sodium benzoate was administered intramuscularly. Breathing ceased at 0940, and artificial respiration was given but the patient expired.

Postmortem spinal fluid tap showed 2,400 erythrocytes. The urine was cloudy with amorphous phosphate crystals and erythrocytes. Necropsy findings were slight cerebral edema, with increased intracranial pressure; subendocardial hemorrhage of the left ventricle; and bilateral pyelitis from clinical gonorrheal urethritis and syphilis.

REACTIONS OF MINOR IMPORTANCE

MAPHARSEN

Case 43–1943.—After this patient's exposure to infection on 1 March, a diagnosis of syphilis was established by clinical appearance and a positive blood Kahn reaction. From 5 May to 23 May, he received eight injections of mapharsen and a second course was begun with a 0.06-gm. injection of the drug on 25 June. Three hours later the patient developed malaise, injection of the ocular conjunctivae, myalgia, fever, and a rapid pulse. No specific treatment was administered, and complete recovery occurred in 48 hours.

Case 44–1943.—After exposure to infection on 1 December, this patient noticed a penile chancre with typical satellite bubo in the left inguinal region. Darkfield examinations on 20 and 30 December were positive for the Treponema pallidum. The Kahn blood reaction was negative.

Arsenical treatment was begun with a 0.06-gm. injection of mapharsen, and 1½ hours later the patient returned to the sickbay complaining of chilly sensations, nausea, fever, and severe headache. The temperature was 102° F. Fever and the other symptoms subsided in about 4 hours, and the next morning the patient had no further complaints and was returned to duty.

NEOARSPHENAMINE

Case 45–1943.—The patient was exposed to infection on 1 July, and a diagnosis of syphilis was subsequently made because of positive findings on darkfield examination. Arsenical treatment was given by means of 0.6-gm. injections of neoarsphenamine on 7, 14, and 20 August. Seven hours after the last injection the patient developed general malaise, dizziness, and fever of 101° F. Urinalysis showed 2-plus albumin and the presence of bilirubin (determined by foam test and color). No specific treatment was given and the patient recovered in 5 days.

Case 46–1943.—In this case the patient was being treated with neoarsphenamine for Vincent's angina; no syphilitic infection was present. From 31 December 1942 to 1 March 1943, he received 15 oral topical applications of neoarsphenamine in 10-percent glycerin. On 4 March he was given a 0.2-gm. injection of neoarsphenamine, and 30 hours later he developed a reaction manifested by marked dizziness and weakness, moderate chills, and nausea. Recovery was complete in 4 days.

Case 47–1943.—This patient was exposed to infection in May of 1942. A diagnosis of syphilis was made on the basis of positive serologic tests. From 15 August 1942 to 7 April 1943, he received 3 courses of arsenical treatment which consisted of 1.32 gm. of mapharsen (number of doses not reported).

The fourth course of arsenical treatment began with a 0.3-gm. injection of neoarsphenamine on 23 May and a 0.6-gm. injection on 30 May. Three hours after the last injection the patient developed chills with a temperature of 103° F. Examination revealed no jaundice or skin eruption. Tenderness was present over the liver.

Treatment consisted of bed rest, abundant fluids, and concentrated glucose solution by mouth. Recovery was complete in 24 hours. *Note*: This appeared to be an individual idiosyncrasy and not a true toxic reaction. The same lot of neoarsphenamine was used on 2 other luetic patients without reaction.

Case 48–1943.—This patient was exposed to infection on 26 March. A diagnosis of syphilis was subsequently established by darkfield examination of material from a small penile ulcer.

Arsenical treatment began with a 0.3-gm. injection of neoarsphenamine on 1 May and was followed by a 0.45-gm. injection on 6 May and a 0.6-gm. injection on 11 May. Three hours after the last injection the patient developed chills, fever, headache, and generalized aches and pains. The blood count and urine were within normal limits. Treatment for the reaction was bed rest, codeine sulfate, ½ grain, and aspirin, 10 grains. Recovery was complete in 48 hours.

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FOREIGN PROTEIN REACTION FROM PENICILLIN

The following case suggests the possibility of penicillin foreign protein reaction resembling serum sickness.

An 18-year-old seaman was given five intramuscular injections of penicillin at 3-hour intervals totaling 100,000 units, for a gonococcal urethritis. On the next day the urethral discharge had entirely ceased.

The patient remained apparently well until the twelfth day after the injection when an itching rash appeared about his elbows and abdomen. Later during the day his ankles, knees, and wrists became stiff and swollen.

He had received no previous penicillin and had had no other parenteral injection for months previously. There was no familial or personal history of allergic disorders.

Examination on admission aboard this hospital ship revealed a generalized urticaria with wheals of various sizes. The ankles and wrists were visibly swollen, tender, and painful. The lymph nodes were palpable but not tender. The patent's temperature ranged from 99° to 102° F. Therapy to control his symptoms was without success and his discomfort remained for 7 days before the eruption subsided. Joint stiffness persisted, although the swelling had subsided. After 2 weeks the patient was considered well and was discharged to duty.

The consensus of the medical officers who saw this patient placed the blame on penicillin or some impurity of the preparation despite the lack of confirmation of a skin test.

Preliminary studies have produced accounts of very few toxic effects from penicillin. Mindful of similar early reports on the sulfonamides, this case is submitted for the attention of those using penicillin.—HAILEY, H. E., Lieutenant Commander (MC) U.S.N.R., and MILLARD, E. B., Lieutenant (MC) U.S.N.R.

RODENT CONTROL AT A SOUTH PACIFIC BASE

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Rat control is of considerable importance at military bases where rodent-carried diseases are endemic. On the South Pacific islands, lack of natural predatory enemies and an excellent habitat are conducive to large rodent populations, and, in turn, to rodent-borne epidemic diseases such as plague, murine typhus, tsutsugamushi disease and Weil's disease. The endemicity of plague and the possible occurrence or introduction of other rodent-borne related diseases, coupled with a high population density of rats, at this South Pacific base made organized rodent control necessary.

This base, at one time, was composed of over two hundred distinct military organizations ranging in size from small activities to large supply depots and infantry units; the base functions around a large, busy harbor and an island city of over nine thousand inhabitants. The buildings in the more congested areas of the city are very poorly constructed compared with United States standards; and with a population more or less accustomed to an indifferent degree of prosperity, these are not well maintained. Open sewers, indiscriminate disposal of waste and trash, together with congested oriental sections scattered throughout the city, contribute to the maintenance of heavy rat populations and periodic outbreaks of epidemic diseases.

Cases of plague and one or two deaths have been reported on the island every three or four years since the last epidemic in 1913, when over fifty deaths were reported. Feral rats, found in every environment from the coastal plains to the dry mountainsides and the rain forests in the mountain valleys, are a constant source of breeding stock, which continually invade the city and military installations.

When American forces established this base there were relatively high rodent populations and these increased as ration dumps and supply depots were hastily established with little time or material to make provisions for rat control. Considerable supplies

were lost to invading rats, and although there were no outbreaks of rodent-borne epidemic disease, the disease potential was great.

Data secured through interviews and a recently conducted survey of all military units on the island, indicate that the total rodent population in and around military units and the city mentioned above, has been reduced by a very large percentage since the establishment of a rodent control unit. Considering that most of the results have been obtained through poisoning, the 5,000 or more rats and mice, trapped or otherwise taken by unit personnel for investigative purposes, are indicative of the success obtained. At the present time the rodent control problem has been reduced to one of monthly checking of units, control of small reinvaded areas, and pest problems (mostly mice). The epidemic disease potential is considered to have been reduced to a minimum.

ORGANIZATION AND TRANSPORTATION

Organization of the rodent control unit was complicated by many problems, such as the procurement of transportation, personnel and supplies, and the proper methods of approach and technics to be used. After eight months' experience and considerable evolution of ideas and technics, it is felt that satisfactory solutions have been achieved.

Sufficient transportation is absolutely essential to a unit of this nature because activities are frequently carried out over a large territory and considerable equipment is sometimes necessary for the accomplishment of the program. Experience here has shown that at least one vehicle is necessary for each of the control areas, and one or two others for the procurement of supplies and the transportation of materials for mixing poison. Quarter-ton and half-ton vehicles are best if these can be procured. This unit used three quarter-ton and two half-ton vehicles, one for each of the three control areas and two for other essential transportation.

PERSONNEL

Sufficient manpower is essential to the successful fulfillment of the program. The rodent control unit here consists of one officer and seven enlisted men. Three of the men are permanently assigned to the three control areas into which this base has been divided. Each of these men is in charge of an area. Occasionally it is necessary to control the rodents on a large area or unit and in this event a fourth man assists them. This man also helps take care of the individual complaints that come in from day to day.

The preparation and mixing of poisoned bait for the use of the area-men requires the full time of another individual. One man, charged with the poisoning, fumigation and trapping of rats and mice aboard ships, also obtains live rats for determining the disease potential through the numbers of fleas per rat.

With a constant turnover of personnel and the extension of control to other bases in the Pacific, one function of this unit is the preparation of educational material and the instruction of personnel in the methods and technics of rodent control. Instruction is based upon practical demonstration and application of control methods to existing rodent populations. Instruction given to the new personnel at this unit covers the following aspects:

Investigation:

- Rodent ecology.
- Determination of species.
- Collection of scientific specimens.
- External parasites of rats.
- Flea survey technic.
- Rat problem surveys.

Control:

- Recommendation for control.
- Trapping methods and technics.
- Gassing methods and technics.
- Poisoning methods and technics.

Equipment and supplies:

- Poisons for rodent control, mixing, handling, uses and limitations.
- Feeder station construction.
- Improvising and constructing traps from barrels, cans and boxes.

The above material is covered in 2 weeks, 4 days being devoted to each major topic. A third week of supervised control work completes the training course.

In connection with training of personnel, a bulletin, "South Pacific Rat Control," has been prepared. The material covers the essentials taught under the topics listed above and is designed to be used as a reference work in the South Pacific area.

TECHNICS, EQUIPMENT AND SUPPLIES

Since the inception of the program, the activities of the unit have been divided into two groups: (1) Land-based activities, and (2) ship-shore activities. Because all rats are potential epidemic disease carriers, no distinction has been made between pest rats and disease-bearing rats.

Land-based activities.—Experience shows that land-based ac-

tivities are best controlled by dividing these into areas small enough to be handled by one man per area. Each area at this base consists of from 20 to 30 military units. Each area operator visits all the units in his area once each month, doing the necessary control work as he proceeds through his territory. On large units the technicians work all day but on smaller units only during the afternoon, the morning being occupied with checking the results of previous control efforts at other units. At small units, the area operator ordinarily does the actual control work by use of poisoned bait, traps and gas.

On larger units, the operator gives instructions and demonstrates control technics to individuals or working parties and supplies them with poisons or poisoned bait, traps and fumigation equipment. He often supervises the whole control operation. These operations are always carried out in cooperation with camp medical or sanitary officers who make available, on request, one or more men in their respective areas of responsibility.

Military units at this base are required by regulations to provide one or more men within their unit to assist the rodent control operator on his regular visits. Some larger units have enlisted men attached to dispensary activities who work full time on the control of pests. This regulation makes possible thorough training of selected men in individual military units and provides a reservoir of well trained personnel at the base, available to assist in rodent extermination in the event of an outbreak of a rodent-related disease epidemic.

Control technics used by men in their respective areas vary considerably according to the size of the unit and the conditions found. Best results are usually obtained with poison but there are some circumstances under which better results can be obtained with traps or cyanide gas.

Cyanide gas is used to advantage in burrows, under cement floors, or in ration or supply piles covered with tarpaulins. Whereever cyanide gas can be used advantageously it is employed; animals, reluctant to take poisoned bait or suspicious of traps, will either be destroyed or be driven into the open where they can be killed with gun or club.

Under conditions of a low population density and abundance of food, best results are frequently secured by trapping. Post exchanges are good examples of such a condition. Sometimes large quantities of candy and other material are destroyed by a few rats or mice. Because of the abundance of food stuff, these animals do not find it necessary to eat the poisoned bait put out for them, but they can be caught in traps baited with food, such as candy, that

1. Equipment and supplies carried by area exterminator.

they are accustomed to eating. In view of the decided reduction of rodent populations here, it has been found advisable recently to care for the small units and simple problems by furnishing unit personnel with a small number of traps.

Approximately one teaspoonful of poisoned bait is distributed, either in the form of torpedoes (wrapped in paper) or simply as a ball of the substance, in the openings of burrows, under the edges of buildings, and inside buildings, along the walls. Poisoned bait is always placed in darkened or covered spots. The type of bait to be used is determined by the conditions found. Where considerable food is available, it is desirable to use poisoned ground meat. Under most other conditions, poisoned bread crumbs have been found to be quite satisfactory.

Equipment and materials carried by an operator going into the field (fig. 1) include the following: 20 to 50 pounds of poisoned bait; 10 to 20 pounds of extra poison; a pail and spoon for mixing the poison; up to 100 traps; a gas gun and a supply of calcium cyanide; and sometimes a 22-caliber rifle with dust shot for killing rats that may be driven out of their burrows during gassing operations. Generally a supply of mouse poison is carried along to be distributed to dispensaries, or for use by the unit personnel in their huts. Sodium fluoride also is carried for the control of cockroaches and ants about camps. This last service is strictly a courtesy function of rodent control personnel.

Red squill, barium carbonate, strychnine, and thallium sulfate have been used as poisons here. Because of the limited amount

available and the extreme danger involved to man and other animals, thallium sulfate is utilized only at units out of the urban area where the rat problems are particularly acute. Under such conditions, best results are obtained with this poison. It is used only by well trained unit personnel. Barium carbonate has been used in the past, for it is available in large amounts, but results being quite unpredictable, it is seldom used now. Red squill, because of availability and satisfactory results in spite of a low toxicity, is most frequently used at this base. Strychnine is used exclusively for making mouse poison.

At the present time it is the policy to have one man mix all poison bait used by area men. Thallium and raw meat are mixed as needed; red squill is mixed with dry, ground bread and peanut butter in quantities of 90 to 100 pounds at a time and stored for future use. Stale bread gathered from galleys and mess halls is spread on a tarpaulin to dry. The dry bread is ground up in an ordinary food grinder, mixed with a small amount of peanut butter (2 lbs. peanut butter to 13 lbs. ground, dry bread), again allowed to dry and then mixed with the proper proportion of red squill. If stored in covered G. I. cans it will keep more or less indefinitely. When used it is simply mixed with sufficient water to bring it to a doughy consistency. Strychnine, mixed with whole grain and syrup, is also dried and stored for use as needed.

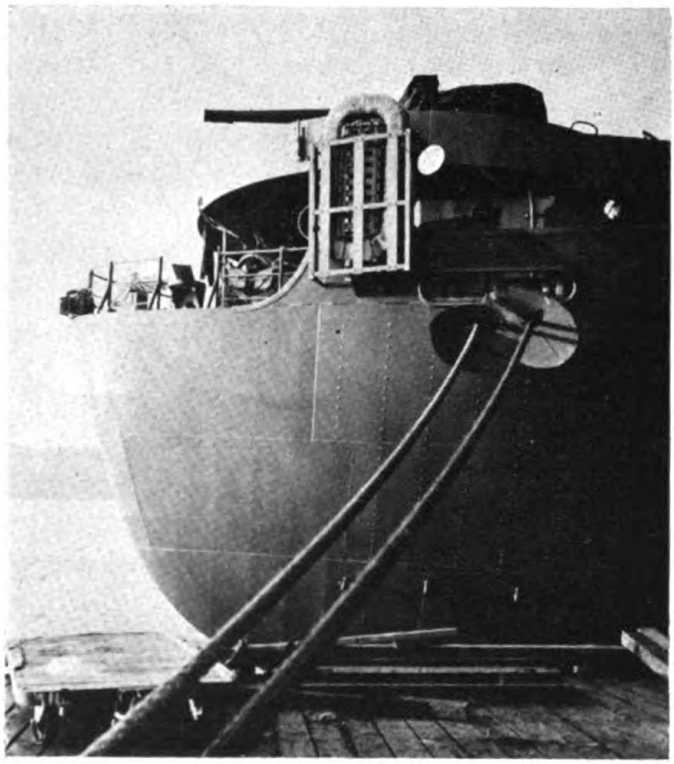
A log book is kept concerning each unit at the base with the following data: (1) Date visited; (2) personnel contacted; (3) problem encountered and recommendations made for control and ratproofing; (4) control work done; and (5) results.

Three or four days after control in any major area a routine visit is made to determine the results. This is necessary properly to evaluate the work. On small simple pest problems results of previous control efforts are not determined or recorded until the area is visited on the following month.

By keeping such records a check is kept on the efficiency of individuals in their respective areas, and over long periods of time the control work in certain areas can be evaluated.

Ship-shore rat control.—Ship-shore activities are largely a matter of published regulations; however it has been found necessary at this base for personnel of the rodent control unit to check all ships docked at wharves and piers for compliance with the regulations. The regulations promulgated by the local unit and enforced at this base, as taken from a base memorandum, are as follows:

1. Rat shields or disks will be maintained on all lines connecting ships with wharves or other ships. Shields will be maintained at all times, so placed

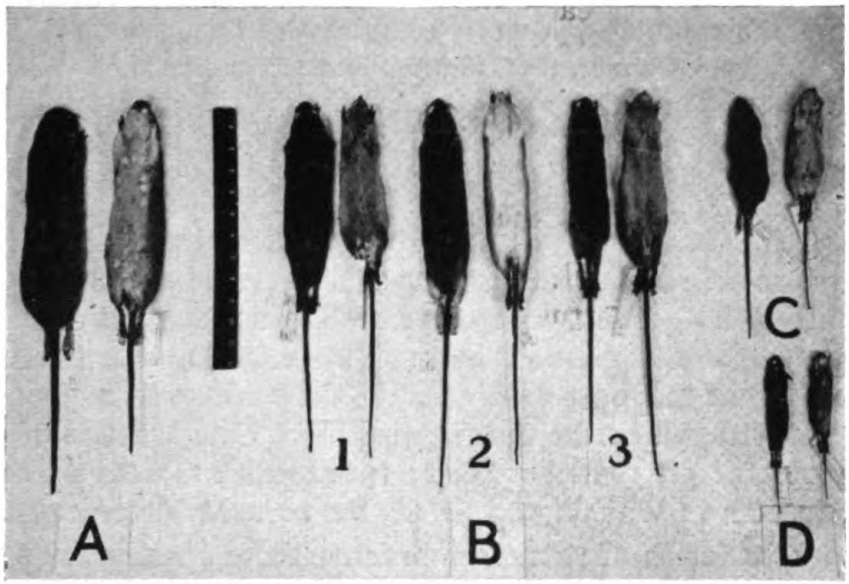


2. Rat guards and cluster lights properly placed and adjusted.

3. Sign used to advertise existing port regulations at piers where ships are docked.

that they effectively prevent the use of such lines for rat travel. Consideration in placing the shields will be given to the ability of a rat to jump from one line to another and avoid such shields.

2. Light clusters will illuminate bow and stern lines at night.



4. Rodent species controlled at this base.
   - A. Brown rat (Rattus norvegicus)
   - B. Black rat (Rattus rattus)
     1. Rattus rattus rattus, black back, grey belly.
     2. Rattus rattus frugivorus, brown back, white belly.
     3. Rattus rattus alexandrinus, brown back, grey belly.
   - C. Polynesian rat (Rattus exulans jessook)
   - D. House mouse (Mus musculus canacorum)

3. All landing stages and gangways between ships and wharves will be removed or raised between sunset and sunrise unless a guard is present at all times.

4. Cargo nets will be removed from the wharf during darkness unless cargo is being worked.

Figure 2 illustrates properly placed rat shields and cluster lights. These regulations, along with other sanitary regulations of the port, are given to ships' masters by port boarding officers. Large conspicuous signs (fig. 3) placed at the ends of piers also advertise the existing regulations.

The rodent control unit formerly inspected all docked ships daily at sunset and two or three hours later. After the second inspection a report of all delinquent ships was made to the dock officers for enforcement of the regulations. This enforcement was prompt; however it was usually necessary only to call the attention of the ships' masters to the violation to bring about prompt compliance. When inspections of ships was temporarily discontinued, violation of the regulations increased; therefore constant inspection by this unit is considered essential to the successful control of ship-shore and shore-ship rodent movement. After about the first four

months, regulations were generally so well understood that it became necessary to make only the first inspection.

RESEARCH

After establishment of a rodent extermination and control program embracing each organization at the base, and after putting into effect adequate ship-to-shore regulations, a limited amount of fundamental research became increasingly necessary. The research at this base embraces the determination of the several species with which the unit is working. This consists of collecting a series of all rodent species; specimens are sent to the National Museum in Washington, D. C., for accurate determination.

Five forms of rattus, embracing three species, have been found at this base (fig. 4). These are the brown rat, Rattus norvegicus; the black rat, Rattus rattus, with three color phases, first a black form (Rattus rattus rattus), second, a brown-backed, white-bellied form (Rattus rattus frugivorus), and third, a brown-backed, grey-bellied form (Rattus rattus alexandrinus); and the Polynesian rat (Rattus exulans jessook). In addition one mouse, the house mouse (Mus musculus canacorum), is found here.

Other investigations are being continually conducted on the distribution of these rodents in the various areas under control, their population densities, the species dominance, ecologic preferences, and certain life history aspects.

Until these investigations were started and carried out routinely by mammalogists attached to the unit, it was repeatedly found that control efforts successfully directed against one species did not reduce the over-all rat population or decrease the disease potential. As soon as one species decreased through successful control efforts, another species would rapidly multiply and again fill the environment to its carrying capacity. This is especially true where Norway rats dominate, but a substantial although inconspicuous seed stock of black rats or fruit-eating rats exists.

It has been found also that time was wasted by using technics applicable to only one species of rats on the wrong species, or by using inefficient methods against rat populations adjusted to peculiar environments. Some of these populations were controlled only after experimental trapping and bait acceptance trials.

During the first 3 months of control, 240 rats were obtained alive, killed by fumigation and searched for rat fleas. An average of 3.9 fleas of the species Xenopsylla cheopis was found on this collection of rats, definitely establishing the critical need for rodent

control. No bacteriologic examination was made on the rats or fleas collected.

SUMMARY AND CONCLUSIONS

1. Systematic rat control has greatly reduced the rat population at an island base and reduced the epidemic disease potential to a minimum.
2. Problems encountered and solved concerned procurement of transportation, training of personnel, and the development and adaptation of technics to existing problems.
3. Responsibilities of the Unit were divided into land-based activities and ship-shore activities. Best results were obtained when land-based activities were divided into areas of control and assigned to individual technicians. Ship-shore activities embraced the establishment of a barrier between ship and shore rats and rat control afloat.
4. Red squill and thallium sulfate poisons give best results. Satisfactory results are also obtained by fumigating with calcium cyanide gas, in peculiar situations adapted to its use.
5. Fundamental research accompanying successful control includes collection and determination of rodent specimens from the various populations; population density studies in the evaluation of control efforts; and flea collection and determination in the evaluation of the epidemic disease potential.

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CHOLERA VACCINE AND TERTIAN MALARIA

A single injection of 0.5 cc. of cholera vaccine A into tertian malaria patients between paroxysms was effective to destroy plasmodium in the blood and reduce splenomegaly. When injected during the paroxysm the result was inconstant. The curative action, however, seemed relatively persistent because in some cases one more paroxysm appeared after the injection before the cure. Cholera vaccine A definitely cleaned out the schizonts from the blood, but whether it can destroy the sexual forms or not is still uncertain in the present experiment. The vaccine more than two months old after preparation began to lose its potency against tertian malaria. The injection of 0.5 cc. of phenol diluted with the physiologic saline solution or a typhoid vaccine was totally ineffective against tertian malaria.—INOUYE, K.: New therapeutic method for tertian malaria by cholera vaccine. Proc. 27th Ann. Meet. Korean M. A. Chosen Igakkai Zassi 29: 2409-2413, November 1939.

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NAVY DEPARTMENT
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NAVMED 112

COVER PHOTOGRAPH

Under the supervisory eye of a nurse, recently returned from overseas duty, hospital corpsmen at a U. S. Naval air station assist in administration of a blood transfusion. The nurse is Lieutenant, junior grade, Margaret B. Gemmill (NC) U.S.N.R.

—Official U. S. Navy Photo.

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

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PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

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It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

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TABLE OF CONTENTS

CLINICAL NOTES

MEDICAL AND SURGICAL DEVICES

EDITORIALS

Page

BOOK NOTICES

PREVENTIVE MEDICINE

U. S. NAVAL MEDICAL BULLETIN

VOL. 44 FEBRUARY 1945 NO. 2

SPECIAL ARTICLES

IMMERSION BLAST INJURY—CLINICAL EXPERIENCES

E. LYLE GAGE
Lieutenant Commander (MC) U.S.N.R.

On 10 October 1943, 98 men who had survived a sinking at sea and subsequent depth charge explosion were brought to this activity. Following the explosion these men had spent 19 hours in the water before being rescued, and 17 hours had elapsed between rescue and hospitalization. During this interval of 36 hours, these men were exposed to oil on the water, sunburn, and immersion (water approximately 77° F.) and suffered from exposure, fatigue, and varying degrees of shock.

By rapid examination on arrival, it was determined that 14 patients were in a critical condition, 5 were seriously injured, and the remaining 79 were considered to be in favorable condition. (Four of those considered favorable later became seriously ill.) Immediate attention was given to the critical and serious cases, but in due time each man was given a detailed examination and the indicated treatment instituted. No patient was permitted to be active until it was assured by complete study that serious internal injury was not present.

The results of this examination revealed that nearly all the patients suffered to some extent from sunburn, conjunctivitis, fatigue, and exposure. In addition a number had evidence of injury to the chest; in one instance there was a pneumothorax with fractured ribs, and in the remainder the injury was revealed by the presence of persistent râles. There were several instances of fractures and bruises. There were no ruptured eardrums, no genitourinary injuries, and apparently no patients suffered organic or inorganic injury to the central nervous system from immersion blast.

Serious intra-abdominal injury occurred in 23 patients and was the cause of the unfavorable condition in those previously noted. Four of these patients died in the first 42 hours and a fifth died 5 days after admission.[1]

Examination of the remaining 18 patients who had abdominal injury revealed that 16 had rigid abdomens, 12 had abdominal distention, 6 had no audible peristalsis, and 13 had diminished peristalsis. X-ray examination was made in 12 of these cases, and evidence of air in the peritoneal cavity was found in four. Of the 6 patients not examined by x-ray, 3 had clinical evidence of peritonitis.

Table 1 presents data on the seriously ill patients; it includes the patient with the fractured ribs and pneumothorax. This shows that 14 patients experienced nausea and vomiting, 3 passed blood by rectum, and 11 had diarrhea. Palpable masses developed in 9, and local or generalized peritonitis in 7 others.

TABLE 1.—*Clinical data on 19 seriously ill patients*

Patient No.	X-ray taken	Free gas perito-neum	Abdom. disten.	Peri-stalsis	Gas by rectum	Nausea vomit-ing	Rigid ab-domen	Pos. chest findings	Visible blood rectum	Diar-rhea	Palp. mass ab-domen
1	yes	yes	yes	no	no	yes	yes	yes	no	yes	yes
2	yes	yes	yes	no	no	no	yes	no	no	yes	yes
3	yes	yes	yes	no	no	yes	yes	no	no	no	no
4	yes	yes	yes	yes	no	yes	yes	yes	no	yes	no
5	no	-	yes	no	yes	yes	yes	no	no	yes	yes
6	no	-	yes	no	no	yes	yes	yes	no	no	no
7	yes	no	yes	yes	yes	yes	yes	no	no	yes	yes
8	yes	no	yes	yes	no	yes	yes	no	no	no	yes
9	yes	no	no	yes	yes	yes	yes	yes	no	yes	yes
10	yes	no	yes	no	yes	yes	yes	no	no	yes	no
11	yes	no	yes	yes	yes	yes	yes	yes	no	no	no
12	no	-	yes	yes	no	yes	yes	no	no	no	no
13	yes	no	no	yes	yes	yes	no	yes	no	yes	yes
14	yes	-	no	yes	yes	yes	slight	no	yes	yes	yes
15	yes	no	no	yes	yes	no	no	3 fr. ribs. pn-th-rax.	no	no	no
16	no	-	yes	yes	yes	no	yes	no	no	yes	yes
17	no	-	no	yes	yes	no	yes	no	yes	no	no
18	no	-	no	yes	no	no	yes	no	yes	no	no
19	yes	no	no	yes	yes	yes	yes	yes	no	yes	no
Total Yes	13	4	12	13	11	14	16	8	3	11	9

Laboratory data on these 19 patients showed only transitory albumin in a few cases, and essentially normal erythrocyte counts and hemoglobin estimations in all. The leukocyte counts ranged between 5,000 and 10,000 per cu. mm., except in those cases in which abscesses or perforation occurred, when the count increased rapidly, in two instances rising to over 30,000. This count receded just as rapidly when the inflammatory process subsided.

[1] A report of the fatal cases, with autopsies, is given in the article by Lieutenant Commander Ashur Yaguda in this issue of the BULLETIN.

Hematocrit studies and blood plasma determinations yielded normal findings in all but two instances. In one of these (case 3) the hematocrit reading was 33 percent after the patient had received large amounts of fluid and plasma but no transfusion. In one instance the hematocrit reading was 37 percent on admission.

Since these patients were received 36 hours after injury, conservative treatment was decided upon. Morphine was given freely to overcome shock, to relieve pain, and to reduce intestinal activity. No patient was given food or an enema until it could definitely be determined that no intra-abdominal injury was present. Plasma, dextrose, or saline was given as indicated by the condition of the patient. In 10 instances it was necessary to pass a Miller-Abbott or Wangensteen suction tube. In 4 instances oxygen was administered. Table 2 shows the clinical course, as well as the main therapeutic measures used in individual patients.

At the end of 10 days, 35 patients remained in the hospital, 58 had been discharged, and 5 had died. Four of the deaths occurred in 7, 27, 30, and 42 hours respectively, the cause being generalized

TABLE 2.—*Treatment—same group of patients*

Patient No.	Plasma	Dextrose & saline	Blood trans.	Sulfadiazine I.V.	Oxygen	Wangensteen suction	Spontaneous drainage	Surgical treatment	Outcome
1....	yes	yes	yes	yes	yes	yes	no	Drainage, sul-diaphragm. abscess	Abscess drained. Suprapubic mass. Recov.
2....	yes	yes	yes	yes	yes	yes	no	Drainage, suprapubic abscess	Abscess drained. Recov.
3....	yes	yes	yes	yes	no	yes	no	no	Recov. May have slight kink in bowel.
4....	yes	yes	no	yes	no	yes	no	no	Recovered. Discharged to duty.
5....	yes	yes	yes	yes	yes	yes	no	no	Recovered. Slight induration abdomen rlq. mass subsiding. Evac.
6....	yes	yes	yes	yes	no	yes	no	no	Recov. Discharged to duty.
7....	yes	yes	no	yes	no	yes	no	no	Rectal abscess not drained. Recov. with absorption.
8....	yes	yes	no	no	no	no	no	no	Mass subsided spontaneously. Recov.
9....	yes	yes	no	no	no	no	no	no	Suprapubic mass subsided. Recov.
10....	yes	yes	no	yes	no	yes	no	no	Recovered.
11....	yes	yes	yes	yes	yes	yes	Yes from incision	Closure of bowel	Diastasis of recti. Convalescent. Evac.
12....	no	yes	no	yes	no	no	no	no	Recovered.
13....	yes	yes	no	yes	no	yes	yes	no	Pelvic abscess drained spontaneously by rectum. Recov.
14....	yes	yes	yes	yes	no	no	no	no	Mass in rectum subsiding. Pt. ambulatory, well, evac.
15....	no	yes	no	yes	no	no	no	no	Lung filled out. Discharged to duty. Well.
16....	yes	yes	no	no	no	no	no	no	Rectal mass subsided. Discharged to duty. Well.
17....	no	no	no	no	no	no	no	no	Rapid, uneventful recov.
18....	no	yes	no	yes	no	no	no	no	Recov. Discharged to U.S.A.
19....	yes	yes	no	yes	no	no	no	no	Recov. but still has occas. cramps.
Total Yes	15	18	7	15	4	10	2	3	All recovered.

peritonitis. At no time were these patients in condition for operation. The fifth death occurred at the end of 5 days, from pooled plasma anaphylaxis. The patient's condition had been deemed satisfactory for operation, and he had been given a supportive amount of plasma. Shock and death immediately ensued.

The clinical course of four of these survivors illustrates the diversity of response to immersion blast perforation of the bowel.

CASE REPORTS

Case 1 (*patient No. 3*).—This patient was in a critical condition when admitted. When on board the rescue vessel, he was given morphine repeatedly, and plasma and saline infusions, but he continued to be nauseated and to have severe abdominal pain. His abdomen was markedly distended, rigid, and there was no audible peristalsis.

He was given additional plasma and morphine and the stomach contents were removed by suction tube. The urine was negative. The hemoglobin content was 55 percent, the red blood cell count 4,200,000, the white blood cell count 10,400 and the cell volume 33 percent. The temperature ranged from 98° to 100° F., the pulse rate was approximately 110, and the respirations between 25 and 30 per minute. An x-ray examination of the abdomen revealed a large amount of gas under the diaphragm.

During the next 3 days treatment consisted of a transfusion, intravenous fluids, intravenous sodium sulfadiazine, and Wangensteen aspiration. There was definite improvement on the fourth day and the patient was allowed water by mouth; on the sixth day his bowels moved. During the last 30 days of hospitalization he had several episodes of abdominal cramping and distention, but these proved uneventful and he was discharged on the thirty-fifth day clinically well.

Case 2 (*patient No. 4*).—This man was admitted in a serious condition with a history of coughing up blood. He was in mild shock.

Examination revealed a few coarse râles over the bases of both lungs but no evidence of consolidation. A chest x-ray showed no abnormality. Examination of the abdomen showed moderate spasm of the muscles, slight distention, and generalized tenderness. X-ray examination revealed evidence of gas in the peritoneal cavity. The laboratory findings were within normal limits.

The patient was given 1 unit of plasma on admission and Wangensteen suction was started. During the next 5 days he was given morphine to control the pain, intravenous fluids, and daily intravenous injections of 5 gm. of sodium sulfadiazine. His temperature ranged from 99° to 102° F. At the end of 5 days the abdominal pain and tenderness had subsided, the suction tube was removed, and by the ninth day the patient was allowed a regular diet. He was discharged to duty after 38 days of hospitalization.

Case 3 (*patient No. 2*).—This patient was admitted in a state of shock. About one hour after the depth charge explosion he had experienced severe abdominal pain, especially on deep inspiration. He had been given food while aboard the rescue vessel but vomited it.

The abdominal pain continued until admission to the hospital. Examination revealed his temperature to be 101.8° F., the pulse rate was 140, and the respirations 30 per minute. The blood pressure was 94/50. The abdomen

was rigid, and very tender in the right upper quadrant; there were no palpable masses. An x-ray examination of the abdomen revealed gas in the peritoneal cavity. The patient's blood count and urine were normal.

He was given morphine, Wangensteen suction was started, and 2 units of plasma were administered. Five gm. of sodium sulfadiazine was given intravenously daily, and supporting amounts of intravenous fluids. On the second day he was given a transfusion of 500 cc. of citrated blood. On the fourth day the abdomen was softer, and flatus was passed by rectum. On the sixth day he had an elevation of temperature, and on examination an indurated tender suprapubic mass was found.

On the ninth day, a cystogram showed posterior vesicle intrusion, and, by palpation, the mass had increased in size. The patient's temperature was now 103° F. On the tenth day, using spinal anesthesia, the suprapubic mass was opened and 700 cc. of pus evacuated. A culture of the pus showed unidentified gram-positive cocci in chains and clusters. By the seventeenth day, the patient's temperature was normal, the bowel movements were regular, and the wound drainage was slight. After 40 days the sinus had closed and the patient was evacuated ambulatory on the forty-fifth day after injury.

Case 4 (patient No. 1).—This patient also was admitted in a critical condition. While on the rescue vessel he had coughed considerably, complained of abdominal pain, and had vomited several times. On examination the breath sounds in the right mid-axillary area were diminished. The abdomen was soft, not tender, and no masses were palpable.

Twelve hours after admission the patient coughed up a bloody mucous plug. Generalized abdominal rigidity and tenderness developed. He was allowed nothing by mouth, and was given intravenous sodium sulfadiazine and dextrose with saline. On the following day the abdomen was still rigid and tender, and a friction rub was heard at the base of the left lung. There was also evidence of fluid in this area. The patient's temperature ranged from 101° to 103° F. X-ray examination revealed air under the diaphragm. There was occasional cyanosis.

On the sixth day the patient's bowels moved twice, the material being black and oily in character. The Wangensteen suction was removed, and following this, the abdomen remained soft but slightly distended. The temperature remained elevated but the patient's color improved. On the seventh day the abdominal distention had increased and Wangensteen suction was again used. At this time the leukocyte count was 9,450. An x-ray examination of the chest showed the left lung area to be clear, but the base of the right lung was cloudy. Bloody purulent fluid was aspirated from this area and on culture revealed Staphylococcus albus.

On the tenth day a transfusion was started, but was discontinued after 20 cc. of citrated blood had been administered because of a reaction. On the thirteenth day, 250 cc. of citrated blood was administered without incident.

The patient's condition continued to be septicemic, and x-ray examination revealed evidence of fluid at the level of the eighth rib on the right side posteriorly, beneath the diaphragm. On the twenty-fourth day of illness he was given another transfusion of 500 cc. of citrated blood, and on the twenty-fifth day a resection of the rib was done and 500 cc. of pus evacuated. As the diaphragm lowered on drainage, there was sucking and blowing from the wound. There was no purulent sputum.

Thereafter the patient's condition steadily improved but on the fortieth day there was para-umbilical pain, with tenderness in the right lower

quadrant of the abdomen. A stool examination showed no occult blood. Cramping pain and some distention continued for the next 5 days, but on the forty-eighth day of hospitalization the patient was symptom free and drainage from the chest wound had ceased. An x-ray examination showed the diaphragm at the normal level. The patient was evacuated ambulatory on the eighty-first day after injury.

QUESTIONING OF SURVIVORS

Hoping to obtain information which might aid in preventing immersion blast injury and in handling patients similarly affected, we asked the survivors to fill out a questionnaire concerning their experiences. An analysis of the replies shows that a few had eaten a sandwich just before the explosion, but most of the men had not eaten since the evening meal, 7 hours before the blast. The time of last urination and defecation was usually during the evening or day previous, or not remembered.

Nearly all the injured men reported that they felt as if they had been kicked in the painful area (stomach, back, testes, etc.), when the depth charge went off. Men seated on the rafts, with only their buttocks and legs submerged, felt as though they had been spanked with a paddle.

The majority of the men swallowed water and some of the vomiting and bowel movements recorded as occurring in the water may well have been due to this factor. No evidence was obtained that water entered the rectum. Only 5 of the severely injured had bowel movements in the water, as compared with 21 of those with minor injuries.

All but two of the patients with serious abdominal injury estimated that they were within 100 feet of the depth charge when it went off. Records of their position in the water when the depth blast went off, show that 38 were on their abdomens, with 13 severe injuries and 25 minor injuries resulting, as compared with 52 men in other positions with 10 serious injuries and 42 minor injuries. A study of the severe abdominal injuries shows that when the depth charge exploded, all these men were on their abdomens or were in water above the abdomen and facing the blast. Sixty-six men complained of pain as a result of the blast and of these, 49 had the pain in the abdomen.

This preponderance of abdominal pain, as well as the percentage of abdominal injuries, is worthy of emphasis in considering immersion blast injury to personnel. Many of the men who had abdominal injury said that while they were in the water the pain did not seem so severe as later. One patient coughed up blood without pain; three felt pain in the chest and in the stomach

simultaneously; and four complained of pain in the testes, but none of these showed swelling, ecchymosis, hematuria, or discharge, and the pain was relieved by the time they were admitted to the dispensary. Four patients complained of transitory numbness or paralysis in the legs. None had residual neurologic signs on admission.

Several stated that they did not notice much pain until they were rescued or were out of the water and on a raft. Ten patients who experienced pain after the blast, either first noted the pain or felt an increase of pain upon removal from the water into the air. One wonders whether there was some attenuation of both pain and infectious processes by the cooling effect of the water.

Eighty-one of the survivors received food or drink aboard the rescue craft and 46 were allowed activity, such as walking about, taking a shower and the like. The advisability of allowing no food or activity until careful examination has been made by a medical officer cannot be overemphasized.

COMMENT

These patients were received 36 hours after injury and consequently the treatment course was conservative. The four patients who died were at no time in condition for operation despite the maintenance of fair blood pressure until death. On the other hand, the others who were treated conservatively lived, and had they been received within 10 or 12 hours after the explosion, surgical intervention might have been deemed necessary in some instances.

Two men who had gas in the peritoneal cavity (by x-ray evidence) as positive evidence of a ruptured viscus, recovered rapidly and did not develop an abdominal or pelvic mass. Two patients showed clinical evidence of secondary perforation of a viscus, even after prolonged rest in bed. In the one the perforation occurred 40 days after the injury.

The one man who was promptly operated upon recovered, and it is the opinion of the surgeon that the operation helped save his life, yet x-ray examination failed to show evidence of gas in the peritoneum, and the perforated area was found to be walled off at operation. By comparison with some of the patients treated conservatively, we are inclined to believe that, with the excellent supportive treatment which he received, he, too, might have recovered without operation. This does not mean that patients with immersion blast injuries with perforation, rescued early, should not be operated upon. It is, however, pointed out that in similar cases when the optimum period for operation has passed, nonoperative treatment can help save many lives.

PATHOLOGY OF IMMERSION BLAST INJURY

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Among the 98 survivors of a sinking at sea, who were also exposed to the results of an explosion of a depth charge, were a number with immersion blast injuries. Some of these succumbed to shock, their injuries, or both soon after they were rescued. Probably some of the dead picked up at sea had also died of injuries resulting from the underwater explosion of the depth charge. In all, 14 bodies were brought in, and as these were removed and buried directly from the ship, postmortem examination was not made.

The clinical findings and the course of the survivors, together with an analysis of the factors involved in this series of blast injuries, are presented elsewhere in this issue.[1] This article will be concerned only with the clinical pathology of the patients who showed evidence, on admission, of blast injury, or who died and came to necropsy.

CLINICAL PATHOLOGY

The survivors were admitted to the dispensary approximately 36 hours after injury and had been treated for shock during the 17 hours they had been aboard the rescuing vessel. None of the critically ill or seriously injured patients were suffering from clinical shock when admitted. This was borne out by the hematocrit readings and by the total plasma protein determination (by the copper sulfate method). These were within normal limits in all but one or two instances in which there was slight hemoconcentration. In two other instances the hematocrit readings showed a decrease in cell volume following the introduction of large amounts of fluid and plasma intravenously.

The red blood cell counts were all essentially normal. The white blood cells ranged from 6,000 to 10,000 per cu. mm., even in the cases with evident peritonitis. The differential cell counts in these patients showed a definite shift to the left. Later during the course of the development of abscesses or secondary perforation,

[1] See "Immersion Blast Injury—Clinical Experiences," by Lieutenant Commander E. Lyle Gage in this issue of the BULLETIN.

the leukocyte count rose rapidly to as high as 30,000 per cu. mm., with corresponding increases in immature cells in the differential cell count.

Except for occasional and transient albuminuria, the urine findings were not significant or abnormal on admission. Later, with the development of pelvic abscesses which encroached upon the bladder, a few red blood cells were found in the urine of those patients.

AUTOPSY FINDINGS, GROSS

Case 1.—A seaman, second class, age 20, had coughed up blood after the blast. He was in deep shock when rescued, had a poor pulse, and generalized abdominal rigidity. He was treated for the shock with 1 unit of plasma. On admission to the dispensary, he had an anxious facies, his skin was cold and clammy, and his respiration shallow. His abdomen was rigid, tense, and tender. His temperature was 100° F., pulse rate 130, respirations 26, and blood pressure 130/70. His condition was critical. He was given 2 units of plasma and later 500 cc. of whole blood. Oxygen was administered and a nasal tube was introduced into the stomach. There was no response to treatment, and the patient expired 7 hours after admission.

Autopsy.—There were no external evidences of injury. The peritoneal cavity contained free air and brownish fecal-smelling fluid. The parietal peritoneum was dull, injected, and covered with fibrinous exudate. A large pocket of fluid was trapped in the pelvis by loops of small intestine which were agglutinated by an easily separated fibrinous exudate. The omentum was on the left side and was thickened, injected, covered with exudate, and adherent to the sigmoid and to loops of small gut. There were small areas of fat necrosis in the omentum.

The anterior wall of the jejunum, approximately 4 cm. from the duodenojejunal fold, showed an irregular, gaping, ragged tear 2 cm. long. The ileum was dilated and its loops were agglutinated by plastic exudate. On separating an adherent loop of ileum from the hepatic flexure, a small perforation of the ileum was seen. This perforation was 0.25 cm. in diameter and its margins were rounded and everted. The colon revealed no external evidence of trauma but did show a peritonitis.

Examination of the opened intestines showed numerous areas of hemorrhage into the mucosa, submucosa, and muscularis. For the most part, the hemorrhages were limited to the lower ileum, but several mucosal hemorrhages were found in the cecum and the sigmoid. Several of the hemorrhagic areas showed secondary infection and ulceration. Some of these ulcers were superficial, others had undermined margins, and one (in the sigmoid) had ulcerated through to the serosa, producing a reactive exudate on the serosa, but had not perforated.

Both pleural cavities contained some bloody fluid, approximately 200 cc. on each side. The lower margins of both lobes of the left lung were firmly adherent to the diaphragm. There were numerous small subpleural hemorrhages. The lung was large and boggy, and the inferior portion of the lower lobe was firmer in consistency than the rest of the lung and was a dark blue in color. The cut surface showed marked edema and multiple areas of intrapulmonary hemorrhage, which were small in size and located almost

completely in the lower lobe, especially at the base.

The right lung was adherent to the thoracic wall at the apex, and in the posterior axillary region and at the base of the lower lobe was adherent to the diaphragm. The inferior border of the lower lobe showed a large, diffuse, subpleural hemorrhage which extended over 3 cm. of the anterior surface and into the lung tissue for a depth of 4 centimeters. There were also numerous small subpleural hemorrhages scattered over the rest of the lung and many small hemorrhages into the lung substance.

Aside from evidence of surface peritonitis and toxic parenchymal changes, the spleen, liver, and pancreas showed no gross evidence of trauma. The kidneys, adrenals, and the heart muscle showed toxic changes. The urinary bladder was small and contracted and the mucosa was edematous. The testes were normal. There was no evidence of injury to the muscles of the chest or abdomen, and no fractures of any of the bones were found. The brain, nasal accessory sinuses, and the internal and middle ears showed no evidence of trauma.

Case 2.—A seaman, second class, age 35, whose condition was reported as "good" when rescued, had slight abdominal rigidity and a temperature of 100° F. with a pulse rate of 100 per minute. Later his condition became worse, and on admission to the dispensary he had moderate dyspnea, cyanosis, and tympanites. He complained of abdominal pain and had a tender, rigid abdomen.

There was dullness on percussion of the base of the left lung and râles at the bases of both lungs. His temperature was 100° F., pulse rate 128, and respirations were 26 per minute. He was given morphine as necessary, 1 unit of plasma, intravenous dextrose in saline, and oxygen. His condition remained fairly good until he coughed up a bloody mucous plug and vomited. Then his bowels moved with a dark oily material. His cyanosis and dyspnea suddenly increased and he died abruptly, 27 hours after admission.

Autopsy.—There were no external evidences of injury. The peritoneal cavity and pelvis contained about 350 cc. of light brown, cloudy, foul-smelling fluid. There was a diffuse generalized peritonitis. The omentum was thickened, rolled up, and adherent to the structures in the left upper quadrant of the abdomen, and there were many small areas of fat necrosis on its undersurface. The loops of small gut were distended with gas and fluid, and held together by easily separated fibrinous adhesions.

There were four "blowout" perforations in a 2-foot section of the middle portion of the ileum. These perforations were all almost exactly opposite the line of mesenteric attachment. There was also a small perforation in the posterior wall of the cecum, 2 cm. from the appendiceal orifice. Numerous small mucosal, submucosal, and muscularis hemorrhages were seen in both the small and large intestine. Some of these had become infected and had ulcerated.

Both pleural cavities contained large amounts of clear yellow fluid in which some large fibrin flakes were present. The lower lobe of the left lung was collapsed and its diaphragmatic surface covered by a fibrinous exudate. The upper lobe showed moderate emphysema. There were many subpleural petechial hemorrhages. On section the lower lobe was found to be completely atelectatic. There were numerous small hemorrhages into the lung tissue of both lobes. The right lung was emphysematous and showed numerous subpleural petechial hemorrhages. Several small areas of nodular

consistency could be felt, and these on section were seen to be the sites of intrapulmonary hemorrhages. They varied in size from pinhead to 2 cm. in diameter.

The liver, spleen, pancreas, adrenals, kidneys, and the heart showed toxic changes but no evidence of hemorrhage or trauma. The skeletal muscles and bony structures showed no evidence of injury, nor did the scalp and skull. The meninges showed some edema and congestion and several small areas of suffusion of blood around the vessels. There was no evidence of hemorrhage or injury to the brain, accessory sinuses, or internal or middle ears.

Case 3.—A chief torpedoman's mate, age 29, when rescued had a temperature of 103° F., pulse rate of 108, and generalized abdominal rigidity. He was given 1 unit of plasma and showed marked improvement overnight. About 2 hours before admission to the dispensary, he had had a sudden severe pain in the lower left part of the chest and shock ensued abruptly. On admission his temperature was 100° F., pulse rate 120 and thready, and he was irrational.

There were râles at the bases of both lungs. The abdomen was moderately distended, had a boardlike rigidity, and peristalsis was not detectable. In spite of treatment as outlined previously, the patient's condition became progressively worse and he died 29½ hours after admission.

Autopsy.—Aside from some superficial contusions of the skin of both lower legs, there was no external evidence of injury. The peritoneal cavity contained about 900 cc. of a cloudy, brown, foul-smelling fluid. There was a generalized peritonitis involving both the parietal and visceral peritoneum. The omentum was adherent to the structures of the left upper quadrant of the abdomen. The loops of ileum were distended and held together by a greenish-yellow plastic exudate. There was one "blowout" perforation at the beginning of the ileum. This perforation was 1 cm. in diameter and was situated just outside the mesenteric attachment. Its edges were hemorrhagic.

Multiple hemorrhages, some of which extended around the entire circumference of the gut, were found in the mucosa, submucosa, and muscularis. Mucosal hemorrhages were also found in the cecum and sigmoid. Some of the hemorrhagic areas showed ulceration and secondary infection. There were some small areas of fat necrosis over the pancreas.

Both pleural cavities contained small amounts of clear fluid (about 150 cc. each). Both lungs showed areas of atelectasis, especially in the lower lobes. There were numerous subpleural petechial hemorrhages. There was a fibrinous exudate covering the diaphragmatic surface of the lower lobe of the right lung. On section the lung was dry and showed many small intrapulmonary hemorrhages.

As in the previous cases, the liver, spleen, kidneys, adrenals, pancreas, and heart showed no evidence of trauma or hemorrhage. The muscular and skeletal systems, the brain and accessory sinuses revealed no evidence of trauma.

Case 4.—This gunner's mate, first class, age 23, when rescued was irrational, had a temperature of 101.6° F., and a pulse rate of 100, and had moderate abdominal rigidity. When admitted to the dispensary, he was irrational, restless, and appeared critically ill. He had brush burns down the entire left side of the head, body, and extremities. His tongue was dry. Percussion resonance was normal, but there were coarse râles over both lung bases, and diminished breath sounds. There was generalized tenderness and

rigidity of the abdomen. The temperature was 101° F., pulse rate 124, and respirations were 26 per minute. The blood pressure was 90/60. Two units of plasma and 1,000 cc. of dextrose were administered that evening, and during the next 36 hours the patient also received morphine as needed, Wangensteen suction, oxygen, intravenous sulfadiazine and 500 cc. of whole blood. Despite this treatment his condition became progressively worse and he died 42 hours after admission.

Autopsy.—Apart from the superficial brush abrasions described, there were no external evidences of injury. Free air and fluid were found in the peritoneal cavity, and there was a generalized peritonitis. The omentum was adherent to the urinary bladder and to the loops of gut in the right lower quadrant of the abdomen. There was beginning organization of the exudate, making it somewhat more difficult to separate these adhesions.

Upon separating the adherent omentum from the bladder and intestines, a large, poorly defined cavity containing purulent, foul-smelling fluid was exposed. The loops of gut forming the lateral walls of the cavity were tied together by fresh adhesions which were separated with some difficulty.

When this portion of the intestine was opened, an area of hemorrhage in the middle ileum, extending around the entire circumference of the gut, was seen. The mucosal surface of a portion of this hemorrhagic area was covered by a thick greenish plastic exudate which, when stripped from the mucosa, revealed a small perforation of the ileum. The corresponding peritoneal surface also showed an exudate covering the perforation and forming part of the wall of the pelvic abscess.

There were multiple other small areas of hemorrhage into the mucosa and submucosa of the ileum. The terminal portion of the sigmoid showed a hemorrhage involving the mucosa and submucosa, with secondary infection and ulceration extending to, but not through, the serosa. The peritoneum over this ulcer was covered with an organizing, rather adherent exudate.

The pleural cavities each contained about 300 cc. of clear yellow fluid. There was massive collapse of both lungs, only approximately 15 percent of air-containing lung tissue being present. Numerous subpleural petechial hemorrhages were seen and there were areas of loss of normal pleural luster, especially in the lower lobe of the right lung. On section the aerated portions of the lung were seen to be edematous; they oozed a frothy fluid and showed areas of emphysema. Many small intrapulmonary hemorrhages were seen both in the aerated and atelectatic lung tissue.

As in the previous cases, no evidence of trauma to other organs was found. There were, however, congestion of the cortical veins and slight suffusion of blood into the pia-arachnoid over the lateral aspect of the left temporal lobe of the cerebrum.

Case 5.—This patient, a pharmacist's mate, first class, age 21, was about 600 yards from the ship when it sank, holding onto a raft with his left hand and holding up two other sailors with his right. The depth charge exploded and he felt pain in the right shoulder and in the stomach. He vomited once shortly after the explosion. When rescued he reported for the men in his liferaft and seemed to be in fair condition. He was found to have a dislocated right shoulder which was reduced. While aboard the ship he developed progressively increasing abdominal symptoms.

On admission to a U. S. Army hospital, physical examination revealed injection of the conjunctivae, a tender right shoulder and soft, tender ab-

domen. X-ray examination showed evidence of air under the diaphragm on the right side. On the morning following admission, the patient's abdomen was slightly more distended and tender, and no peristalsis could be detected. He was started on a strict Ochsner regime (nothing by mouth, morphine by the clock, nasal suction, intravenous fluids, sulfadiazine, and high Fowler's position). The distention did not increase and he began to have some peristalsis and passed gas by rectum. A localized mass developed just above the bladder and in the right lower abdominal quadrant. At 1130 on the fifth day he was given 500 cc. of plasma, following which there was urticaria. This, however, disappeared after administration of 0.25 cc. of 1:1,000 epinephrine. He then developed pulmonary edema which did not respond to administration of epinephrine. Suction, oxygen, and venous section were of no avail. His blood pressure dropped and he expired at 1330.

Autopsy.—(Performed at the Army hospital by Capt. N. C. Bell (MC) A.U.S.). There were no external evidences of trauma. The abdomen was slightly distended and a 15-cm. firm mass could be felt just above the bladder and extending into the right lower abdominal quadrant.

When the abdomen was opened, it was seen to contain approximately 2,000 cc. of blood-tinged fluid. The proximal portion of the small intestine was moderately distended, and the distal portion was involved in a matted mass of adhesions.

In the anterior lower mid-abdomen there was an abscess cavity, 10 by 15 cm., with pseudopodia-like projections between some of the loops, pointing down into the pelvis and toward the distal portion of the rectum. One of the projections communicated with a small hole in the ileum, about 2 feet from the ileocecal valve.

Another perforation was found in the ileum 4 feet proximal to the cecum. The segment was adherent to the anterior abdominal wall, had sealed itself off, and did not communicate with the large abscess cavity.

Thirteen centimeters proximal to the distal end of the rectum, there was a 3-mm. perforation, the serosal surface of which was covered by thick yellow fibrin; it did not communicate with the large abscess. Several loops of small gut, included in the wall of the abscess, were adherent to the anterior abdominal wall. In the distal ileum were some small submucosal hemorrhages, some of which had started to ulcerate. The mucosa between these hemorrhagic areas was edematous. The mesentery in the region of the adhesions was 8 mm. thick, and was firm. There were some ulcerated hemorrhagic areas in the ascending colon and in the rectum.

The pleural cavities each contained about 300 cc. of clear yellow fluid. The lungs were heavy and boggy. The bronchial tree was filled with white foam which welled up on pressure. There was an area of subpleural hemorrhage on the posterior portion of the lower lobe of the right lung. On section the lungs revealed a firm substance, and on scraping there was very little foam. There was some intrapulmonary hemorrhage in the lower lobe of the right lung.

The urinary bladder was contracted and the mucosa over its dome was edematous. The floor of the bladder showed some hemorrhagic areas. The other organs showed no gross changes or evidence of trauma. The right shoulder joint was exposed, and the head of the humerus was found in the glenoid socket, which contained about 50 cc. of bloody fluid. The capsule had a 2½-cm. tear in its anterior and inferior glenoid insertions. The head and brain were not examined.

HISTOPATHOLOGIC FINDINGS

Because of the similarity of the microscopic lesions in these autopsies, and because of the lack of space, the microscopic changes will be described for the group instead of individually.

Microscopic examination of the lesions in the intestinal tract showed all gradations of injury, from simple hemorrhage to perforation. The hemorrhagic lesions were the most numerous and were frequently limited to the mucosa and submucosa. In instances the hemorrhage extended into the muscularis with some fragmentation of the muscle. In two instances (cases 3 and 4) massive hemorrhage, encircling the entire circumference of the gut, was seen.

A common lesion in all cases was necrosis of the mucosa in a hemorrhagic area, with secondary suppurative inflammation and ulceration. In some instances the ulcer was superficial, and in others it penetrated the submucosa and extended under it, producing undermined edges. In a few the suppurative process extended into the muscularis and to the peritoneal coat of the gut, and in at least one instance (case 4) produced a secondary perforation of the gut. Another common microscopic finding was edema of the mucosa in the areas surrounding the hemorrhages.

The major pathologic lesion responsible for the fatalities was perforation of the gut. Microscopic examination showed these perforations to be of two types: (1) "Blowout" perforations which microscopically were characterized by marked disruption of the wall of the gut, with tearing and fragmentation of the muscle and some secondary inflammatory reaction in the hemorrhagic area around the perforation; and (2) secondary perforations which were usually much smaller than the "blowout" type and resulted from an eroding suppurative inflammatory process starting in an ulcerated hemorrhagic area. In this type there was a definite attempt at sealing off of the perforation with a thick fibrinous exudate, which covered the serosal surface and in some instances entirely covered the mucosal ulceration.

Sections of the lungs showed lesions due to the blast in every case. In all, hemorrhage was seen under the pleura, into the alveolar septa, and into the alveolar spaces. There was also rupture of the alveolar walls, usually associated with hemorrhage. Numerous large phagocytic cells filled with blood pigment were present in the alveolar spaces and interalveolar tissues. Areas of atelectasis and others of emphysema were constant findings.

In two instances (cases 1 and 2) small areas of changes consistent with those of peribronchial pneumonia were found. These

areas involved especially the sites of intra-alveolar hemorrhage. Pulmonary edema and congestion were seen, especially in cases four and five.

Microscopic examination of the other organs showed nothing which could be ascribed to direct trauma. The changes in these organs were similar to those found in varying degrees of toxemia and circulatory failure.

COMMENT

Although five autopsies comprise too small a group from which to draw any definite conclusions, the similarity of the pattern of pathologic findings in all of the cases probably indicate the pathology of immersion blast injury.

A universal feature in these cases was the absence of external evidence of injury which could be ascribed to the blast. The muscles of the chest wall and abdomen showed no signs of hemorrhage or trauma. The traumatic lesions were apparently limited to air-containing organs, and it is significant that air-inflated rubber life belts also ruptured as a result of the blast. This damage was similar in nature to that which was suffered by the intestines and lungs, which were the only organs receiving any direct injury as a result of the underwater blast.

The most serious lesions in this series, and the ones seemingly responsible for the deaths, were those in the intestinal tract, although the lungs were also injured in all cases. The lesions varied from minimal mucosal hemorrhages to large perforations of the "blowout" type, resembling the tear in concussion of a blown-up paper bag. The perforations tended to occur where air was pocketed in a more or less fixed position of the gut.

Another lesion of importance was the secondary infection and ulceration of many of the nonperforated injuries (hematomas) in the intestinal wall. The possibility of late perforation in this type of lesion must be kept in mind in the clinical management of these patients and in considering the prognosis of immersion blast injury. In two of the autopsies escape of air from the peritoneal cavity could be detected. Obliteration of liver dullness, or x-ray evidence of subdiaphragmatic air or pneumoperitoneum, are important diagnostic signs and should be looked for in the evaluation of immersion blast injuries, both at first and subsequent examinations, because of the possibility of secondary perforation.

All the patients who died in the first 72 hours after injury had a generalized peritonitis, with evidence of profound toxic changes in the parenchymatous organs. In those who lived longer there was noted a tendency toward localization of the process, with the

formation of localized abscesses. In the patient who lived 5 days the abscess was well walled off, and death was due to a reaction following the intravenous administration of plasma and not to the peritonitis. Other patients similarly developed abscesses which later were drained and the patients recovered.

Fat necrosis was found in the first three autopsies. The lesions were minimal and limited to the omental fat and the fat over the pancreas. No gross or microscopic hemorrhages were found, but marked toxic degeneration of the glandular tissue was present. In all of these cases the area of the pancreas was bathed in fluid exudate.

Injury to the lungs was found in every autopsy. The lesions varied from minimal areas of subpleural, inter- and intra-alveolar hemorrhage, with microscopic rupture of the alveolar walls, to massive hemorrhage and collapse of as much as 85 percent of the air-containing tissue. Hydrothorax or hydropneumothorax was present in all autopsies. A fibrinous pleuritis was found in two of the autopsies, as were patches of peribronchial pneumonia.

From the findings described, it is seen that the damage resulting from immersion blast concussion is suffered chiefly by those organs which are normally air-containing and which are submerged at the time of the detonation. The intestine, therefore, being the most often submerged air-containing organ, bears the brunt of the injury. The lungs suffer relatively less severe injury and, probably when a sufficient number of autopsies are available for statistical study, will be found to be the chief cause of death in only a smaller percentage of immersion blast casualties. It is probable that the total injury in both the lungs and the intestines determines, in the first few hours after injury, whether the patient will die shortly or is capable of recovery.

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CALCIUM GLUCONATE FOR TRANSFUSION CITRATE INTOXICATION

Massive transfusions of citrated whole blood for the treatment of extreme shock (blood pressure of 30–45 mm. Hg), produced by hemorrhage of as much as 60 percent of the estimated blood volume, were safely tolerated in dogs when the replacement of blood loss was made during a period of 20 minutes or longer.

Calcium gluconate was very effective in preventing or alleviating citrate intoxication under these conditions.—ADAMS, W. E.; THORNTON, T. F., JR.; ALLEN, J. G.; and GONZALEZ, D. E.: Danger and prevention of citrate intoxication in massive transfusions of whole blood. Ann. Surg. 120: 656-669, October 1944.

REPORT OF INJURIES AMONG SURVIVORS OF AN AIRPLANE CRASH

JOHN S. THIEMEYER, JR.
Lieutenant Commander (MC) U.S.N.

This is a report of an unusual accident in which there were 15 survivors out of a total of 29 persons aboard an airplane which crashed at sea; only rarely are there so many survivors following a severe crash. Each of 14 survivors reaching this hospital alive has either been or shortly will be returned to active and full duty.

A large Navy plane was transporting 24 aviation enlisted personnel and 5 crew members between two stations about 400 miles apart. About midway in its journey, at 1130, engine trouble developed and the plane was required to make an emergency landing. The crew and passengers were prepared and secured their crash belts, assembled lifesaving gear and awaited a landing, which ordinarily would have been readily accomplished. However a wave rose and struck the plane as it was landing, producing an impact which broke the craft in two. The forward section immediately sank, carrying with it all but one of the men in that part of the plane. This lone survivor was thrown clear and was later rescued.

Of the 29 persons aboard the plane, 15 remained alive, although several were very severely injured and were bleeding profusely. The life rafts were inflated and the less severely injured members aided the unconscious and badly wounded in abandoning the rapidly sinking after section. Among this group was the plane captain who had multiple severe fractures and internal injuries. He survived 30 hours, dying 7 hours after the group was picked up by a chance passing merchantman.

After 23 hours at sea with only the most elementary first-aid treatment, the survivors received dressings, change of clothing and a dry place to rest. About 5 hours later at a small port dispensary the wounds were redressed. A flight surgeon arrived 3 hours later to give transfusions of whole blood and plasma and place the many obvious fractures in temporary splints.

By afternoon of the next day a relief ship arrived and 35 hours later the casualties had reached this hospital. Three days had thus elapsed since the crash. Notice had been received prior to their arrival and preparations were made so that the casualties were

immediately put to bed and examined. X-ray studies were made, dressings changed, fractures reduced and placed in fixation, and supportive therapy was instituted when required.

All had numerous abrasions and lacerations which, because of exposure to sun and sea, were edematous, red-rimmed and dirty despite the application of sulfathiazole ointment dressings 2 days previously. It was found that the majority of these lesions, if all dressings were removed, quickly healed; some, however, required saline irrigations or application of wet dressings.

TABLE 1.—*Types of fractures sustained*

Case No.	Fractures	No. of fractures
1	6th cervical, 6th and 7th thoracic vertebrae	3
2	Fibula, left (transverse, comminuted)	1
3	Mandible and 2d, 3d, 4th metacarpals (spiral)	4
4	Scapula, fibula, clavicle, 6th rib, radius (impacted)	5
5	Humerus (spiral and "T")	1
6	Humerus (avulsion of tuberosity)	1
7	No fracture	0
8	Scapula (simple, multiple of body)	1
9	No fracture	0
10	No fracture	0
11	Humerus (avulsion of tuberosity)	1
12	7th cervical vertebra (articulating surfaces)	1
13	Clavicle (spiral, comminuted)	1
14	Humerus (avulsion of tuberosity), ribs (8th and 9th left)	3
	Total	22

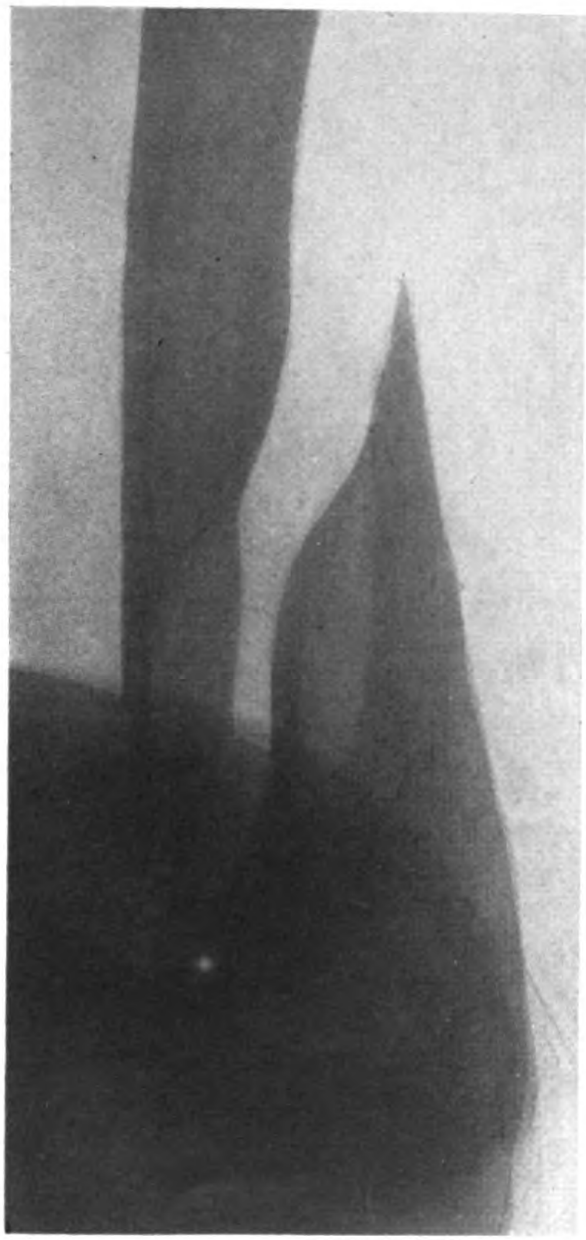
Fractures were the principle disabilities present. It was found that 11 of the survivors had sustained fractures, and that there was a total of 22 fractures. The greatest number in one individual was five. These fractures were unique in being entirely fractures of stress and of change of mass against resistance of muscles and fascia, rather than the result of direct trauma. The fractures present are listed in table 1.

It is interesting to review the fractures as to locality. It is seen that all but two of the fractures are of the upper extremities or trunk. The numerous humeral and clavicular fractures were all the result, as confirmed by the patients' statements, of holding onto a secure part of the plane when it crashed, with resulting stress

TABLE 2.—*Summary of fractures as to locality*

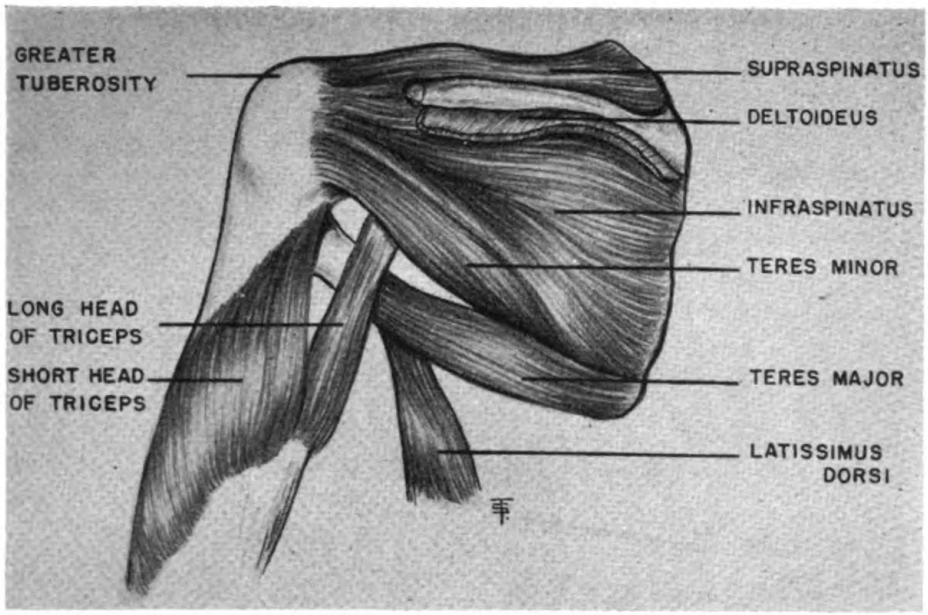
Locality	Number	Locality	Number
Vertebral fractures:		2. Fracture of shaft	1
a. Cervical	2	b. Clavicle	2
b. Thoracic	2	c. Fibula	2
Rib fractures	3	d. Metacarpals	3
Long bones:		e. Radius	1
a. Humerus—		Scapula	2
1. Avulsion of tuberosity	3	Mandible	1
		Total	22

and pull on the arm and shoulder. The cervical fractures were of the type received when the vertebral column is snapped by a sudden stop of a rapidly moving mass. Therefore the bodies of the vertebrae were not crushed, but the articulating surfaces were ripped apart. The men who had no fractures, all stated that their only security had been the safety belt around their waist. They did not have the additional security of holding onto a support or stanchion. The localities of the fractures are summarized in table 2.



1. Spiral and T fracture of the humerus. Lateral displacement measured 2 cm.

The most interesting fractures were those of the vertebrae and the spiral fracture of the humerus. Admission x-ray examination of the latter showed a marked lateral displacement (fig. 1). This had been placed in a primitive airplane splint, with direct tangential pull by adhesive and windlass. Using pentothal anesthesia, reduction was attempted, but with only moderate correction, and the arm was placed in a hanging cast from the end of the proximal fragment to the fingertips, with the elbow at right angles and the forearm in midposition.



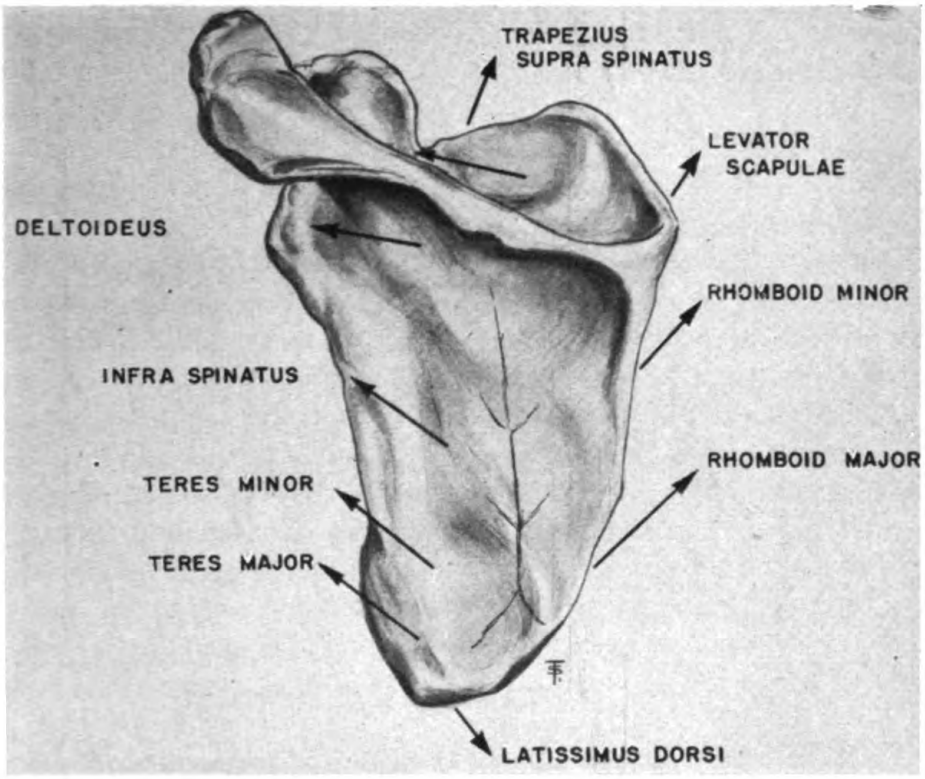
2. The pull of opposing forces of muscles on the scapula causes it to split.

The check x-ray revealed but slight correction of lateral displacement. It was believed that soft tissue intervened and that open reduction would be necessary. Several severe lacerations were present over the projected site of incision, however, so that surgery was delayed 2½ weeks, at the end of which time the skin was healed and check x-rays were taken. Such excellent callus formation and good alinement were demonstrated that surgery was no longer considered necessary. The patient is now regaining function rapidly with the aid of physiotherapy.

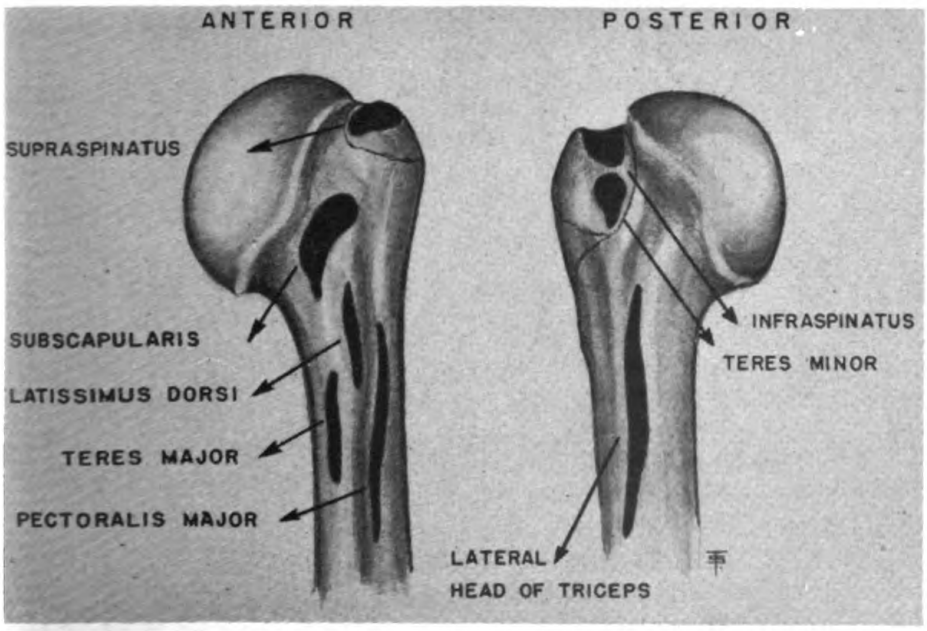
The day after arrival, it was suspected that vertebral fractures were present because of posterior aching of the neck and back rather than because of any deformity or dysfunction. X-ray studies revealed only a slight change of the normal cervical curve in one case. These were bed patients and their neck complaints rapidly subsided with the use of heat and rest. However when they became ambulatory a week later, they again complained of an aching pain in the low posterior part of the neck.

X-rays were taken, this time with the spine in flexion and extension, and the break in the normal cervical curve was apparent. Further x-rays showed the fractures of the articulating surfaces and the patients were placed in head traction for 3 weeks, following which hyperextension casts were applied. At no time were any neurologic signs or symptoms present in these cases.

These cases illustrate the need for repeated x-ray studies when fractures of the vertebral column are suspected, particularly when



3. Arrows indicate direction of lines of force.



4. The same type of fracture was seen in the avulsion fractures of the greater tuberosity of the humerus.

pain or dysfunction persists. If only anteroposterior and lateral views have previously been taken, pictures in the flexed, extended and oblique positions should also be obtained. A patient may be re-

turned to his normal duties, only to have progressive pain or discomfort appear, followed by transient, then persistent neurologic findings, and it is found that over a period of months there has been a gradual forward subluxation of the vertebral body, with narrowing of the foramen and compression of the nerve at that site, making surgical intervention necessary.

The two fractures of the scapula revealed "arbor-vitae" type fracture lines of the body of the bone caused by the tremendous pull of the attached muscles upon the bone, splitting it apart; i.e., the pull of the rhomboideus, major and minor, and the levator scapulae muscles opposed to the supraspinatus and infraspinatus, subscapularis and teres major and minor (figs. 2 and 3).

This same type of fracture caused by transference of mass against muscle resistance is seen also in the avulsion fractures of the greater tuberosity of the humerus. Here the muscles attached to this prominence, the supraspinatus, infraspinatus and teres minor are opposed to the triceps acting rigidly on the one side and the teres major, latissimus dorsi and pectoralis major acting on the other (fig. 4).

Mathematical computation of the lines of force of these opposing muscles, coordinated with a scale of the tensile strength of the bone at various sites, can fairly accurately plot the most likely path of the fracture line.

At the time of writing, 1½ months after the crash, 10 of the survivors are back on full duty, and it is expected that the remaining 4 will be returned to full duty within a month or two.

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METABOLISM OF PROCAINE

Animal experimentation has shown that procaine is rapidly absorbed from the tissues into the blood stream where it is quickly hydrolysed and detoxified by an enzyme which breaks it down into paramine, benzoic acid and diethylaminoethanol. The toxic symptoms decrease even though the blood concentration of these latter two substances rises. The products of detoxification then leave the blood stream rapidly until an equilibrium is reached between the blood and all the other tissues. These products are excreted by the kidney within 10 to 12 hours. Procaine possesses a marked affinity to nerve cells since it depresses selectively the terminal nerve fibers without injuring other cells. It is also a convulsant and stimulant of the cerebral cortex.—MCLACHLIN, J. A.: Intravenous use of novocaine as substitute for morphia in postoperative care; preliminary report. Roy. Canad. Navy M. J. 7: June 1, 1944.

DELAYED ACUTE AERO-OTITIS MEDIA AND METHODS OF PREVENTION

WILLIAM J. BOWEN[1]

During the past few years much has been written in publications on aviation medicine about the necessity for and means of maintaining the pressure within the middle ear equal to the ambient atmospheric pressure. The voluntary procedure for doing this is frequently referred to as "clearing the ears." Unless this process can be accomplished readily, subjection to changes of atmospheric pressure such as occur in aircraft and low-pressure chambers is uncomfortable and may be painful. In such cases the pressure exerted results in trauma and hyperemia of the structures in and associated with the middle ear. These effects have been termed "aero-otitis media." They occur in persons suffering from coryza or having a permanent obstruction in the eustachian tube, who are subjected to great changes of atmospheric pressure.

Behnke and Willmon[2] in 1941 described a similar trauma, hyperemia and unpleasant sensation in the middle ear and associated parts, which occurs in persons who have no difficulty in clearing their ears. These effects according to Behnke and Willmon, appear "not immediately but 18 hours after prolonged inhalation of oxygen at high altitudes. The explanation for this phenomenon appears to be a negative pressure effect brought about by the absorption of oxygen from the middle ear spaces during sleep when voluntary opening of the auditory tubes is not affected."

These effects have been experienced by the personnel of this laboratory working at simulated altitudes requiring the use of oxygen. The effects are like those described by Behnke and Willmon except that the necessity to clear the ears starts before 18 hours have elapsed. Most of the group have felt the need to clear 4 to 6 hours after descent. The severity of the effects varies with different individuals; also it tends to vary inversely with both the absolute pressure attained and with the length of time which elapses between the descent and the time of retiring and falling asleep. The latter holds because the longer the period of voluntary

[1] Associate Physiologist, Industrial Hygiene Research Laboratory, National Institute of Health, Bethesda, Md.

[2] BEHNKE, A. R., and WILLMON, T. L.: Physiological effects of high altitude. U. S. Nav. M. Bull. 39: 163-178, April 1941.

compensating before sleeping, the less the subjection to the negative pressure created as the oxygen is absorbed from the tubotympanum during sleep, when voluntary compensation is not accomplished.

Behnke and Willmon state that removal of the oxygen mask at 10,000 feet and inhalation of air during the remainder of the descent reduces or abolishes the effects. This procedure was tried by our group and found, at the most, only to reduce the severity of the effects. However the introduction of air during descent from 10,000 feet to ground level suggested introducing air from the beginning of descent to ground level. This can be done easily in a low-pressure chamber where quick descents are possible. The method suggested is to inhale approximately three quarters of a full breath of oxygen and then, after removing the mask, take the remainder of the full breath from the air and hold the breath. By this means the lungs contain oxygen and the upper respiratory tract (the "dead space") contains air which enters the gas-filled cavities of the head.

Of course during descents from high altitudes the breath should not be held long because of the compression of the gas in the lungs. This can be overcome by several means. If the descent is very rapid (1,000 or more feet per second) normal breathing of air can be started soon after the beginning of descent. If the descent is slower (circa 500 feet per second) breathing can be limited to successive inhalations of air sufficient to compensate for compression and thereby retaining sufficient oxygen in the lungs, or descent can be stopped momentarily, the measures for rapid descent repeated and then descent resumed.

To test this method of prophylaxis a series of experiments was made on several members of this laboratory.[3] Some of the experiments were made by special "flights," others after routine runs made primarily for other purposes. All descents were made between 1530 and 1700. The time spent at altitude varied from less than one minute to 150 minutes. Descents were usually made at the rate of 1,000 or more feet per second.

Observations were made the following morning after the subjects had slept and undergone a period of no voluntary (and little involuntary) clearing of the ears. The observations consisted of otoscopic examination and verbal reports of subjective sensations. Otoscopic findings were disappointing in that they did not correlate well with the reports of the subjects. Eardrums were sometimes slightly retracted, but more frequently subjects reporting symptoms had normal appearing drums. The amount of retraction

[3] Gratitude is extended to these for their willingness to act as subjects.

varies with the pressure in the middle ear and unless examination is made when negative pressure exists no retraction is seen. When negative pressure exists the tendency, during waking hours, is to relieve it immediately. Greater retraction would probably be seen if examination could be made before the subjects awaken or before they clear immediately after awakening.

Otoscopic examination did frequently reveal redness of the drum which was usually restricted to streaks in Shrapnell's membrane or the handle of the malleus. This may have been due to the delayed aero-otitis media; however it could have been caused by other factors, such as the mechanical maltreatment of the drum during descent, or a slight chronic injection of the blood vessels.

The effects which most consistently occurred were the unpleasant sensation of fullness of the ears which prompts clearing, and the more drastic sensation of slushiness and pain when clearing is done. Frequently tinnitus and tenderness of the ears also occurred in the latter cases. The degrees of severity of these effects were accepted and used as criteria of the results of the experimental procedure. The results are given in tables 1 and 2.

The results shown in these tables are effects which are graded as follows: 0, no effect; 1, had to equalize one to several times during the evening following the descent; 2, same as 1, with the addition of having been awakened during the night by the need to equalize or having had to equalize upon arising in the morning; 3, same as 2, with the addition of tenderness and pain in the ears, tinnitus, and a sensation of slushiness in the tubotympanum undoubtedly caused by hyperemia of the mucosa and exudation of serum into the tubotympanum.

Table 1 gives the results of descents from altitudes between 8,000 and 35,000 feet simulated altitude with oxygen in the dead space (mask on) and from 35,000 feet with air in the dead space. The table shows: (a) That after all descents from 30,000 or 35,000 feet with oxygen in the dead space, all but six of the effects were of grade 3; (b) that although individual susceptibility varied from day to day, as the altitude decreased the effects tended to become less severe; and (c) that after descents from 35,000 feet with air in the dead space there were no effects in all but three cases, and those were grade 1.

The figures in parentheses following the coded effects in table 1 represent the time in minutes spent at the final altitude. It will be noted that there is no correlation between the length of stay at the final altitude and the grade of the effect in the descents either with oxygen or with air in the dead space. This lack of correlation does not support the statement of Behnke and Willmon which implies

TABLE 1.—*Comparison of effects of introducing oxygen with those of introducing air*

Subjects:	Effects after descent with oxygen in the dead space[1,2]						Effects after descent with air in the dead space[1,2]
	30,000 or 35,000	25,000	18,000 or 20,000	15,000 or 16,000	12,000	8,000	35,000
W.B.	3 (5) 3 (150) 3 (10)	2 (150) 2 (120)	3 (90) 3 (<1)	3 (120)	1(<1)		0 (150) 1 (120) 0 (75)
H.B.	 3 (10)		3 (2)	3 (150)		2 (<1)	0 (10) 0 (2)
B.H.	0 (10) 2 (<1) 2 (<1)						 0 (<1)
W.P.	3 (10) 2 (<1)			1 (150)		3 (<1)	0 (10) 0 (60)
O.R.	3 (120) 	3 (<1) 2 (<1)	2 (120) 2 (90)		3 (<1)		0 (10)
A.S.	3 (10) 		2 (<1)	3 (<1)	1 (<1)	0 (<1)	1 (<1) 0 (<1)
J.S.	3 (10)				1 (<1)		0 (60)
H.S.	3 (40) 3 (5)		3 (10)			3 (<1) 3 (<1)	0 (75) 0 (60)
S.S.	3 (10)		2 (<1)				0 (10)
J.W.	2 (10) 2 (<1)			1 (<1)	0 (<1)	0 (<1)	1 (2) 0 (<1)

[1] The effects are given by a numerical code ranging from 0, no effect, to 3, the extreme effect. For details see text.

[2] Parenthetic figures represent the time spent at final altitude.

that this phenomenon occurs only after prolonged breathing of oxygen at high altitudes.

Table 1 gives results of only the relatively few descents which were made under controlled conditions. Actually these results are supported by innumerable reports from the personnel in this laboratory who work at simulated altitudes. Formerly masks were left on during descents and many disagreeable effects were reported. Since it has been found that introducing air into the middle ear during descents abolishes the effects, this procedure has become routine and effects of grade 0 are regularly reported.

Table 2 gives data comparing the effectiveness of three methods of diminishing the effects of introducing oxygen into the middle ear. Method I is that recommended by Behnke and Willmon but with the mask removed at 12,000 rather than 10,000 feet. Method II is that described in this paper, the results given being taken from table 1. Method III consists of descending from 35,000 feet with air in the dead space, after having introduced a large quantity of oxygen into the ears a few minutes before by a descent from 35,000 feet with the mask on. Table 2 shows that each

TABLE 2.—*Effectiveness of three methods of diminishing the effects*[1]

Subjects	Method I[2]	Method II[3]	Method III[4]
W.B.	2	0	2
		1	1–2
		0	1
			1
H.B.	3	0	1–2
W.P.	1	0	0
		0	1
O.R.	2	0	0
A.S.	1–2	1	0
		0	
J.S.	2	0	0
H.S.	3	0	1–2
		0	
S.S.		0	1–2
J.W.	1	1	1
			0

[1] The effects are given by a numerical code ranging from 0, no effect, to 3, the extreme effect. For details see text.
[2] Descent from 35,000 to 12,000 feet with oxygen in the dead space, then to ground level with air in the dead space.
[3] Descent from 35,000 feet to ground level with air in the dead space.
[4] Descent from 35,000 feet with air in dead space after having introduced a large quantity of oxygen a few minutes before by a descent from 35,000 feet with the mask on.

method resulted in fewer grade-3 effects. Method I is effective but none of the results cited were of grade 0 even though air was introduced at an altitude 2,000 feet above that recommended by Behnke and Willmon; nevertheless method I is of great value when slow descents (as in aircraft) are necessary. Of the three methods, II is most effective but is practical only in relatively rapid descents, such as can be made in low-pressure chambers.

Method III is of as much theoretical interest as of practical value. It demonstrates clearly that dilution of the oxygen already introduced into the middle ear is effective in diminishing the effects. It has been put to practical application in this laboratory by persons who are particularly susceptible to the delayed effects and, in order to perform other experiments, have had to descend from 35,000 to 15,000 feet at rates requiring the breathing of oxygen during the descent. When they arrived at 15,000 feet, where the experiment ended, they could either continue descent to ground level with air in the dead space, then ascend again to 35,000 feet and descend with air in the dead space, or they could ascend directly from 15,000 to 35,000 feet and descend with air in the dead space. The former choice results in greater dilution of the oxygen in the middle ear and consequently greater reduction of symptoms. It was of considerable value to these susceptible persons.

SUMMARY

1. A delayed type of aero-otitis media occurs after exposure to changes in barometric pressure. It occurs in persons who are able to and who have made every attempt to equalize the pressure in the middle ear during descent.

2. This aero-otitis media is caused by introducing oxygen into the middle ear during descent from altitudes at which oxygen is breathed.

3. It can be avoided by introducing air into the middle ear during descent.

4. In instances when it is necessary to breathe oxygen during descent, the effects can be diminished by diluting the oxygen introduced into the middle ear with air.

5. Successful methods of introducing air into the middle ear and of diluting oxygen already introduced are presented.

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VITAMIN-C EFFECTS ON WORK IN HOT ENVIRONS

The performance of muscular work in dry heat up to 122° F. was studied in 44 normal young men under rigidly controlled environmental, dietary and work conditions. The stay in heat varied from 3 hours to 4 days.

Comparisons were made between performances on a diet restricted in ascorbic acid intake and a diet supplemented by 500 mg. ascorbic acid daily. The dietary differences were maintained for periods of from 4 to 7 days.

Pulse rates in rest and in work, rectal temperatures, vasomotor stability tests, rates of sweating, general observations and subjective reports all failed to demonstrate any significant advantage for the men receiving supplements of ascorbic acid.

Psychomotor tests and strength tests likewise generally failed to show any advantage in the ascorbic acid supplementation. There apparently was a slight gain in flicker fusion frequency related to the extra intake of vitamin C.

Daily sweat losses were of the order of from 5 to 8 liters but the total loss of vitamin C in the sweat is entirely negligible.

Heat exhaustion occurred with equal frequency in the vitamin-C restricted and supplemented groups.—HENSCHEL, A.; TAYLOR, H. L.; BROZEK, J.; MICKELSEN, O.; and KEYS, A.: Vitamin C and ability to work in hot environments. Am. J. Trop. Med. 24: 259-265, July 1944.

MEDULLARY CANAL WIRE TRANSFIXION IN METACARPAL AND FOREARM FRACTURES

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and
HERBERT C. FETT
Captain (MC) U.S.N.R.

Fractures of the metacarpal shafts are common. The prolonged convalescence and serious disability which result bring the mode of treatment in these fractures under criticism. The spiral type of fracture with the fragments in good position offers no difficulty. In these, dorsal plaster cast fixation for a period of 4 weeks is usually sufficient for good therapeutic results. Transverse fractures in poor position however, require considerably more care. The deformity is caused by overriding and posterior angulation at the fracture site, obliteration of the knuckle lines and recession of the metacarpal head into the palm of the hand. The malposition of the metacarpal head is most disabling.

To these complications must be added the disability resulting from nonunion. This is more prevalent than is commonly appreciated. Accurate hairline reduction, absolute immobility of the fracture site, and early finger motion are necessary prerequisites in minimizing or preventing nonunion, anatomic or functional deformity and prolonged stiffness. Closed manipulation with traction has not proved satisfactory, as reduction is not always successful. Skin or phalangeal traction on the other hand is cumbersome, requires constant vigilance and may result in prolonged convalescence because of finger stiffness.

Medullary canal Kirschner wire transfixion has been gratifying and is consistent with the principles of good treatment in fractures. It permits hairline reduction, absolute immobilization and early finger motion.

PROCEDURE

Procedure.—The procedure consists of a short incision made directly over the fracture site on the dorsum of the hand. The extensor tendons are retracted and the fractured ends are exposed

1. Left—preoperative condition. Center—Kirschner wire in place. Right—final result.

2. Left—preoperative condition. Center—Kirschner wire in place. Right—final result.

and freshened. A fine Kirschner wire is driven into the medullary cavity of the distal fragment, piercing the metacarpal head, and passing through the skin at the metacarpophalangeal junction (fig. 1). The fragments are held securely in apposition while the course of the wire is reversed so as to follow the medullary cavity of the proximal fragment as far as the base of the metacarpal. The fracture is then impacted and the skin wound closed in layers.

No external fixation is used other than a simple dressing. Finger motion is permitted immediately. The wire is left in place for approximately two weeks. The presence of callus as determined by x-ray, or a fracture which locks or sticks after reduction is indication for earlier removal of the wire. In one instance the wire was removed two days postoperatively. In the 12 patients so far treated, all revealed clinical and roentgenographic evidence of union within a month; the fractures healed in anatomic position and none of the patients had stiffness of the fingers.

Although the treatment of fractures of the forearm is beyond the scope of this paper, the same type of intramedullary wire fixa-

tion, however, can be used to advantage in these fractures (fig. 2). It is felt that distinct advantages over plating and screwing are obtained by this method. The technic is simple, operating time is substantially less, and the wires are removed by making a simple skin incision.

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HEMORRHAGE INTO THE RECTUS ABDOMINIS MUSCLE

Hemorrhage into the body of the lower right rectus muscle is becoming common in military personnel, particularly those in training. Its occurrence in paratroopers is one of the most frequent causes of disability, whereas its differentiation from acute appendicitis presents at times an important diagnostic problem.

Case report.—A 27-year-old white male appeared at the dispensary complaining of pain in his right side, which began 2 weeks previously while he was taking setting-up exercises. There was no associated nausea or vomiting, constipation or diarrhea, nor was the pain colicky in type. The soreness lasted several days and was not disabling. When playing volley ball one week later he experienced a similar episode but continued his activities.

The patient was awakened early in the morning by a sharp pain in the lower right rectus muscle region which he considered a "charleyhorse" but which was accompanied by a distressing burning sensation.

On examination a mass approximately 2 by 2 inches was palpated in the lower third of the right rectus muscle region. It was fixed beneath the fascia of the muscle, above which the skin was freely movable. On having the patient sit up, lean forward and strain or cough, the mass remained fixed in the muscle area. Although there was some tenderness, no apparent inflammatory reaction existed.

All laboratory findings were within normal limits and the diagnosis of spontaneous hemorrhage into the right rectus muscle was made.

Palliative hot packs for 4 days resulted in no change either in size or consistency of the mass, and operation for its removal was planned. Under local anesthesia an incision was made over the region of the mass. The fascial sheath was incised, fibers of the rectus muscle separated and a rather large blood clot removed. A bleeding branch of the inferior epigastric artery was ligated. There was some evidence of pressure necrosis of fibers of the muscle. The area was well cleaned and the fibers of the rectus muscle were approximated with plain catgut interrupted sutures. The overlying fascia and skin were closed with running sutures. Ten days later the wound was well healed and the skin sutures were removed. The patient was returned to full duty 16 days following surgery.—HAND, W. F., Commander (MC) U.S.N.R.

THE HAYNES EXTERNAL FIXATION SPLINT IN THE TREATMENT OF LOWER EXTREMITY FRACTURES

WILLIAM M. CASHMAN
Lieutenant Commander (MC) U.S.N.R.

Following the Norfolk Naval Air Station explosion[1] 17 September 1943, a number of compound fractures of the lower extremity were admitted to the hospital. Because there was considerable loss of bony tissue, it was thought that some form of external fixation would be appropriate treatment.

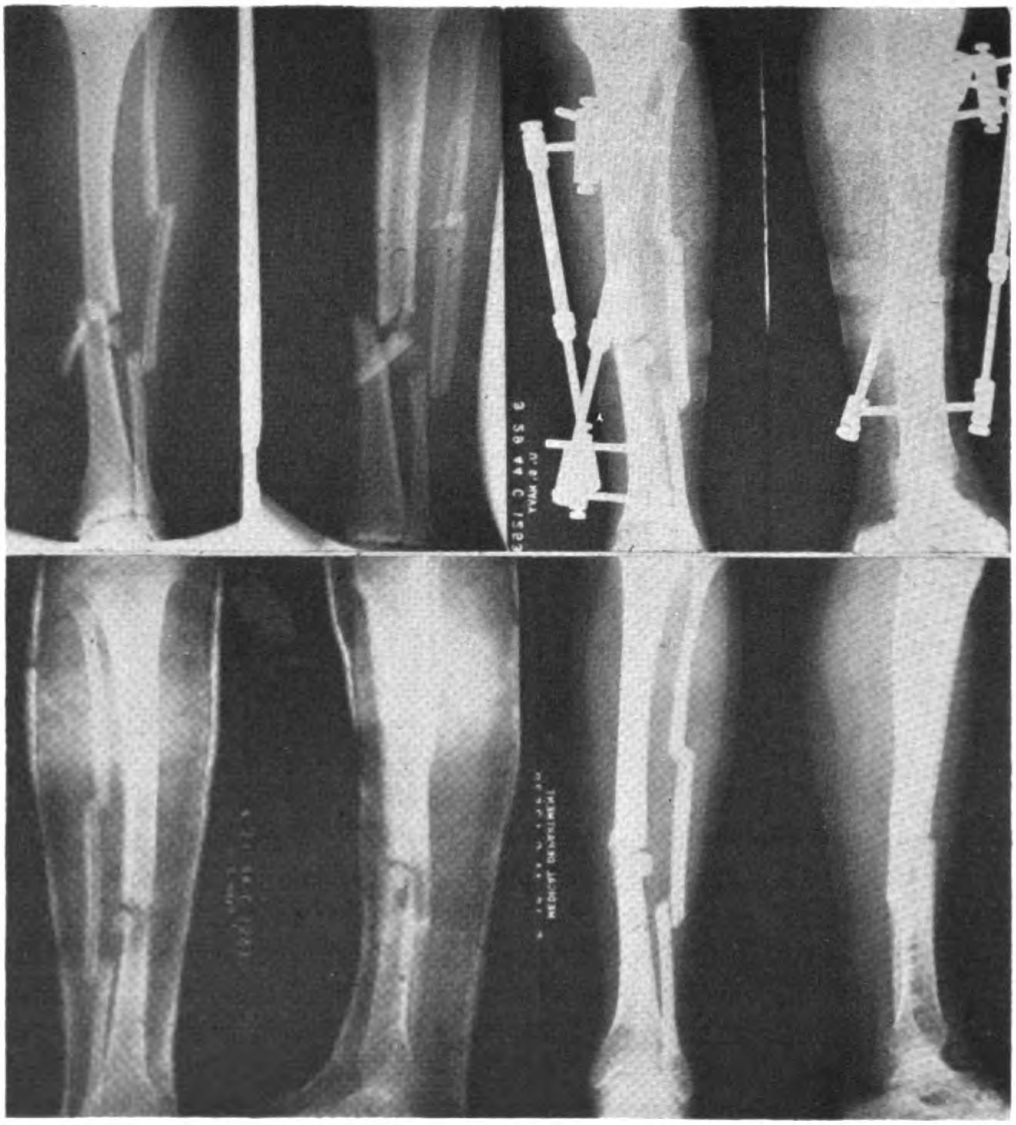
Fractures have been treated at this hospital by four methods: (1) Closed reduction, (2) open reduction, (3) traction, and (4) fixing the fragments with pins or screws and utilization of the fixation units to accomplish reduction and immobilization.

From the management of 30 patients, the disadvantages of this last method have been found to be contamination of the pins either at the time of introduction or by infection along the sinus tract about the pin, and the necessity for the surgeon to become familiar with the use of the apparatus. The advantages of this method however are: (1) It provides a more perfect and accurate means of obtaining a reduction, (2) it provides firm fixation, (3) it avoids distraction when properly tightened, (4) it permits early immobilization, (5) it can be readily adjusted, (6) skin-grafting can be done, (7) reduction of hospital time is obtained, (8) movement of the joints is permitted, (9) there is less nursing care required, (10) the patient is more comfortable, and (11) ordinary clothing can be worn over the splints.

The pin-fixation method has proved valuable in cases of infected compound fractures because dressings and skin-grafting may be done without disturbing the alinement, especially in spiral fractures where plaster alone is incapable of maintaining alinement and reduction.

This paper is the result of eight months' observations of the Haynes apparatus. The specific errors which were made will be noted in the case reports. The apparatus reduces hospital time, prevents stiff knees, stiff ankles, and in fractures of the femur will

[1] CARLL, F. W.; DEAVER, J. M.; and PHILLIPS, R. B.: Norfolk explosion disaster. U. S. Nav. M. Bull. 42: 284-292, February 1944.



Showing compound comminuted fracture of tibia and fibula before and after reduction and after healing. Patient was ambulatory and nearly ready for duty after 165 days. Note amount of callus deposited around tibial fracture site.

prevent atrophy of the quadriceps muscle.

The following tables show the advantages and disadvantages of treatment of the first 20 patients in whom this type of fixation was used.

Table 1—Distribution and type of fracture

Number of patients	20
Bones fractured:	
Tibia alone	17
Both tibias	2
Tibia and fibula	12
Femur alone	1
Compound fractures	16
Simple fractures	4

The Haynes external fixation pins were applied to two patients, both of whom had bilateral tibial fractures. They were able to tolerate these as easily as the ones having the apparatus on one extremity.

The pins were applied in the femur case one month after the original injury and in this patient, there was great deformity and distraction of the parts and a large amount of callus deposition.

The manipulation of the femur as well as tibia should be done with three instead of two pins in each fragment.

Table 2—Cause of fracture

Shrapnel and explosion (Norfolk Naval Air Station disaster)	8
Auto accidents	10
Collision at sea	2

One month elapsed following the shrapnel and explosion accident in 8 cases before the Haynes apparatus was applied. In all of these there was marked deformity and severe loss of bony tissue.

All of the automobile accident cases were compound and the Haynes apparatus was applied immediately.

Table 3—Treatment

External skeletal fixation (Haynes splint)	20
Cast prior to use of Haynes splint	7
Immediate use of Haynes splint	9
Debridement	10
Sulfonamides placed in wound	15
Penicillin	6
Active motion of joints from beginning	20
Bone grafts:	
Sliding	2
From opposite leg	1
Skin grafts	2
Open reduction before insertion of pins	6
Insertion of pins without open reduction	14
Sequestrectomy	4
Plasma prior to operation	15
Plasma following operation	11
Drilling for delayed union	1
Use of Haynes manipulator	8
Amputation	0
Incisions and drainage of localized abscesses	3
Gentian violet applications around pins for localized irritation	9
Osteotomy	0
Use of walking caliper after removal of pins	19

In many of these cases in which there was localized irritation around the pins, it was found that cultures taken from this serous drainage were free of organisms. The use of gentian violet at the pin site stopped the serous drainage. In the use of penicillin, the average dose was 120,000 units.

In the patient with osteomyelitis it is thought that the complication could have been avoided if a plaster cast around the external fixation had been applied. This patient suffered a fractured skull

Table 4—Results of treatment

Returned to duty	9
Still under treatment	11
Transferred to other hospitals	2
Discharged from service	0
Average length of time in hospital	3½ months

complicated by a marked psychosis. The patient rolled continuously over on the pins and kept grasping the pins in her hands and shaking the entire apparatus.

Table 5—Complications

Malunion	2
Nonunion	1
Osteomyelitis from use of pins	1
Lack of full joint motion (knee and ankle)	0
Traumatic arthritis	0
Pain	0
Ulcer following laceration due to compound fracture	4

The one case of nonunion occurred as a result of a shell fragment passing through the tibia, resulting in the loss of one inch of bone.

The cases show the errors committed in using the Haynes apparatus. They are technical errors and hence avoidable. Sterilization of the metal, the proper technic, the exact placing of the pins, the attainment of a satisfactory reduction, no distraction, and adequate fixation are points emphasized by Haynes.[2]

The drainage about the pin appeared to be the result of motion of the joints above and below the fracture and of swelling of the soft parts.

In one patient a bony change was noted because one of the pins was not engaged in the opposite cortex. In 5 cases in which there were badly infected wounds, a plaster cast was applied incorporating the Haynes splint. The disappearance of the infection was striking.

One of the outstanding advantages of the method is the ease with which patients are handled in this splint. They are not tied to the bed; in fact one patient traveled to California with the splint attached to the tibia.

Anderson, Bradford, Wilson, Shaar and others have given a number of rules for using external fixation. They are as follows: (1) Locate the position of the fragments by probing with a steel rod or guide before inserting the pins, (2) pierce into but not beyond the second cortex with the pins, (3) unlock the fragments before trying to reduce the fracture, (4) obtain end-to-end contact, (5) verify position by x-ray before fixing the bars, (6) avoid dis-

[2] HAYNES, H. H.: Skeletal fixation of fractures. Am. J. Surg. 59: 133-135, January 1943.

traction, (7) release all traction before applying fixation, (8) fix the pins and bars firmly, (9) check frequently with x-ray, (10) refrain from frequent dressing, (11) leave pins in situ until callus is present, (12) protect callus with plaster cast when pins are removed, (13) do not allow early weight bearing, (14) start early motion and exercise, and (15) insert pins in the metaphysis.

CONCLUSIONS

External fixation apparatus is a valuable addition to fracture equipment. It enables the patient to get out of bed almost at once. It maintains length and position where there is loss of bone substance. It allows wounds to be dressed without disturbing the fracture.

The insertion of fixation pins is not a complicated affair, but the reduction unit is complicated and takes time and experience to master. The apparatus cannot be used in first-aid or battle dressing stations. It should be used by one versed in the treatment of fractures.

Surgical cleanliness must be maintained.

Less nursing care is required and inspection is greatly simplified. The periods of hospitalization and disability are greatly shortened.

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PHTHALYLSULFATHIAZOLE

Phthalylsulfathiazole, a condensation product of sulfathiazole and phthalic anhydride, is an antibacterial agent of considerable interest and of therapeutic possibilities where activity restricted to the alimentary tract is desired. Approximately five percent of the orally administered therapeutic dose is excreted in the urine. Ordinarily, the concentration of the drug in the blood does not exceed 1.5 mg. per 100 cubic centimeters. As compared to their respective bacteriostatic activities, when measured by their ability to suppress the coliform organisms, phthalylsulfathiazole possesses roughly twice the activity of succinylsulfathiazole. In the absence of diarrhea and ulcerated lesions in the bowel, a single daily dose of phthalylsulfathiazole will effectively lower the coliform organisms in the feces.

It is not necessarily true that the action of either succinylsulfathiazole or phthalylsulfathiazole is entirely due to sulfathiazole resulting from a simple hydrolysis of these acylated compounds. These condensation products may possess in themselves intrinsic properties leading directly or indirectly to manifested antibacterial activity.—POTH, E. J., and ROSS, C. A.: Clinical use of phthalylsulfathiazole. J. Lab. & Clin. Med. 29: 785-808, August 1944.

THE INJECTION TREATMENT OF FLAT FEET

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The injection treatment of flat feet and allied conditions involves two essential parts: (1) The injection of procaine hydrochloride through the sole of the foot into the painful site, and (2) the continuation of moderate ambulatory activity while recovery is occurring.

Leriche first called attention to the value of injecting procaine hydrochloride into the site of a simple sprain as a therapeutic measure. He found that this produced increased circulation of blood and lymph by interrupting the vasomotor changes associated with the injury, and made immediate use of the part possible by eliminating the reflex arc of pain. The period of disability in sprains so treated was greatly decreased and the patients were reported to have had much less pain during the entire period of recovery.

It is a peculiar and interesting fact that when the pain reflex arc is broken and the patient begins immediate activity of the sprained part, then the subsequent period of freedom from pain lasts much longer than does the local anesthetic effect of the procaine hydrochloride.

In those damaged bones and ligaments in which continued activity or weight bearing will not allow deformity to occur, this method of treatment definitely seems to accelerate healing time and does greatly shorten the period of recovery. In recent years articles have been published which clearly and uniformly demonstrate the value of this procedure.

Most of the pain and soreness that persist in the long arch of a normal foot after excessive and unaccustomed exertion is due to overstretching and spraining of supporting ligamentous structures.

This is, of course, doubly true in the foot that is structurally abnormal. It becomes painful more quickly than does a normal one and with less exertion, but the mere altered position of the bones is in itself not productive of pain. The ligaments simply receive more body weight with each step than is normal and are thus more

quickly and more thoroughly stretched and sprained.

This ligamentous stretching, then, may be truly considered as the basic and major cause of persistent pain in all overused feet, if infectious, degenerative, metabolic and gross trauma cases are excluded.

Since this is true, it was considered highly probable that injections of procaine hydrochloride would be helpful in the treatment of most flat feet that were painful from overexertion. Less pain during recovery and a shorter convalescent period could be expected, as in other sprains, and because of continued ambulation during the period of recovery, loss of strength and tone should not occur in leg and foot muscles. Furthermore, an actual increase in strength of the supporting ligaments might be expected, since they would be healing under the stimulus of activity and weight bearing.

Ambulation during recovery does not imply the continued overuse of the foot—that was the traumatizing force, but rather moderate activity which does not place enough strain on the ligaments to prevent their healing. The ligaments should not only heal, but should hypertrophy and become stronger during the process, a natural physiologic response to the increased demands on the foot.

INDICATIONS AND CONTRAINDICATIONS

The treatment is indicated in cases of painful sore arches following exertion in (1) structurally normal feet; (2) valgus or flat feet of a mild or moderate degree; and (3) moderately relaxed feet.

The valgus foot must be of such a degree as to be largely correctable by conservative orthopedic measures. The third instance is the type of foot that is relaxed and flaccid; it spreads out greatly on weight bearing and has little valgus or varus tendency.

Contraindications for the treatment are (1) infectious metabolic and degenerative diseases of the feet; (2) gross trauma; (3) obvious deformities; (4) pes cavus (moderate or severe degree); and (5) pes valgus or planus of severe degree.

Most of the pain in pes cavus is not due to ligament stretch but to bruising of the soft tissue under the rigid metatarsal heads; procaine injections therefore probably would be of no value. The valgus or planus foot condition of such a degree as to be incorrectable by conservative orthopedic measures is not a suitable case, since spraining of the supporting ligaments will very readily recur on resumption of heavy activity.

The first injection is made just as soon after admission to the hospital as possible, regardless of the condition for which it is given. Using proper aseptic precautions, 15 cc. of a 2-percent

solution of procaine hydrochloride is injected into the zones where the patient says he has pain and where examination has revealed tenderness on pressure. The tip of the needle reaches the bone and is withdrawn about 1/16 inch before the injection is made. In most cases the areas injected will be the plantar surfaces of the first and second metatarso-cuneiform bones, the inter-cuneiform bone, the naviculo-cuneiform bone and the talonavicular joints.

The patient, lying prone, now flexes his knees to a right angle while the bottoms of his feet are massaged with an alcohol sponge for 5 minutes. He is then required to walk up and down the ward 25 times, a distance of approximately one fourth mile, after which he is free for the day.

The injections, followed by the walking period, are repeated every third day. Usually after the second injection the patient expresses a desire to return to duty. On discharge from the hospital the patient is given a note requesting two weeks' light duty.

Valgus abnormalities are corrected the first day by the usual shoe alterations, supplemented with physiotherapy, muscle exercises and instructions as to how to stand and walk. Adhesive strapping was discontinued because it limits natural movements of the foot.

Outpatients receive the same treatment except for omitting the walking period immediately after injection. They, too, are given a request for two or three weeks' light duty.

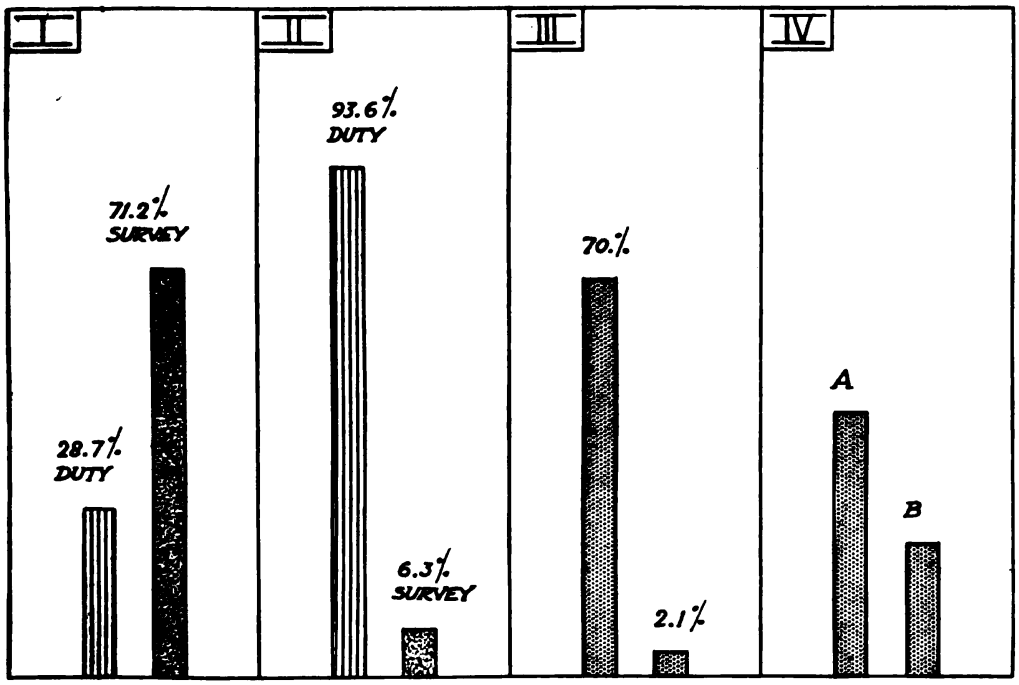
RESULTS

This treatment was carried out over a period of 9 months. For comparison, data was collected on all similar foot cases during the previous 9 months.

All patients during this 18-month period received identical treatment except that the injection regimen was added during the last 9 months. Treatment during the first 9 months (first period) consisted of rest, shoe alterations, physiotherapy, muscle training, strapping, and instructions in proper foot posture.

During the second 9 months (second period) they received injection treatment (procaine hydrochloride injections and ambulation); shoe alterations; physiotherapy; muscle training; and instructions in proper foot posture.

The accompanying graph (columns I and II) illustrates the reduction in the number surveyed and the corresponding increase in the number returning to duty after the inauguration of the injection regimen. Practically all of those surveyed (70 percent), during the first period were recurrent cases, men who had been in



I: Disposition of patients during first period. II: Disposition of patients during second period. III: A, recurrences during first period; B, recurrences during second period. IV: A, number of admissions for foot pain during first period; B, number of admissions for foot pain during second period.

the hospital at least three times with foot pain as their chief complaint. During the second period this percentage of recurrences dropped to 2.1 percent (graph, column III).

It is of further interest to note the degree to which the number of hospital days per foot case decreased. The average number of days per patient during the first period was approximately 33 days. In the second period this dropped to a 6-day average. Of interest also was the manner in which the number of hospital admissions for foot pain fell off after injection treatment was started (graph, column IV). This occurred even though the hospital was growing rapidly in size.

Outpatient visits showed the same tendency to decrease in number and there was a minimum of recurrences; one treatment, sometimes two, seemed to be sufficient.

COMMENT

The success of the injection treatment probably may be explained by an actual beneficial effect on the foot and by the psychologic effect on the patient.

It seems probable that the second factor is the more important in those patients the authenticity of whose complaints might be

questioned. This would account for the 50-percent decrease in the number of admissions during the second period. Malingerers, misfits, dissatisfied men, and those having only a very minor degree of foot discomfort were probably the ones who did not come in when they heard of the new "needle" treatment.

The remaining 50 percent then must be those with genuine foot disability, men whose feet hurt badly enough so that the pain outweighed their fear of needles. This was also our personal impression during the last 6 months of the second period.

Calculations based on this assumption showed that about 20-percent recurrences might be expected if the bona fide foot patients were not receiving permanent benefit. However the recurrences were only 2.1 percent, so it seems highly probable that the treatment does confer considerable benefit of a lasting nature.

It is concluded that the injection treatment as described is based on sound theoretical and practical considerations. Its execution is safe, harmless, and simple and the results of such treatment are excellent. It has reduced the number of hospital days per patient, decreased the number of "survey" cases, increased the number of men returning to duty, decreased the number of recurrences and surprisingly enough has even decreased by about 50 percent the number of hospital admissions for foot pain.

LITHIUM ANTIMONY THIOMALATE FOR FILARIASIS

Lithium antimony thiomalate, a compound given intramuscularly to a series of filaria-infected patients, reduced their microfilaria count 85 to 100 percent. This reduction was maintained for four to five months after the completion of treatment and means presumably that a corresponding number of the adult worms were killed. One patient failed to respond to treatment, and there was no reduction in his microfilaria count.

No reduction in size of enlarged lymph glands or one enlarged scrotum could be detected four to five months after the completion of treatment. One patient noted a pronounced improvement in his inguinal distress on exercise following treatment. The patient's history and physical examination failed to reveal any pathologic changes due to the death of the adult worms or microfilariae.

The toxic manifestations due to lithium antimony thiomalate of vomiting, joint pain, slight fever and rash are not considered sufficient to preclude its continued trial in filariasis.—BROWN, H. W.: Treatment of filariasis (Wuchereria bancrofti). J. A. M. A. 125: 952-958, August 5, 1944.

DIARRHEAL DISEASES IN THE NAVY

THE NAVY'S EXPERIENCE, 1882-1942

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Although the diagnosis of diarrheal diseases has been extremely inaccurate in the Navy, as elsewhere, there are, nevertheless, some facts and trends of real importance to be deduced from the Navy's experience (*1*). It is necessary, however, that we be willing to group essentially similar conditions under certain general headings and ignore the great variety of diagnostic titles used during the period 1882 to 1942.

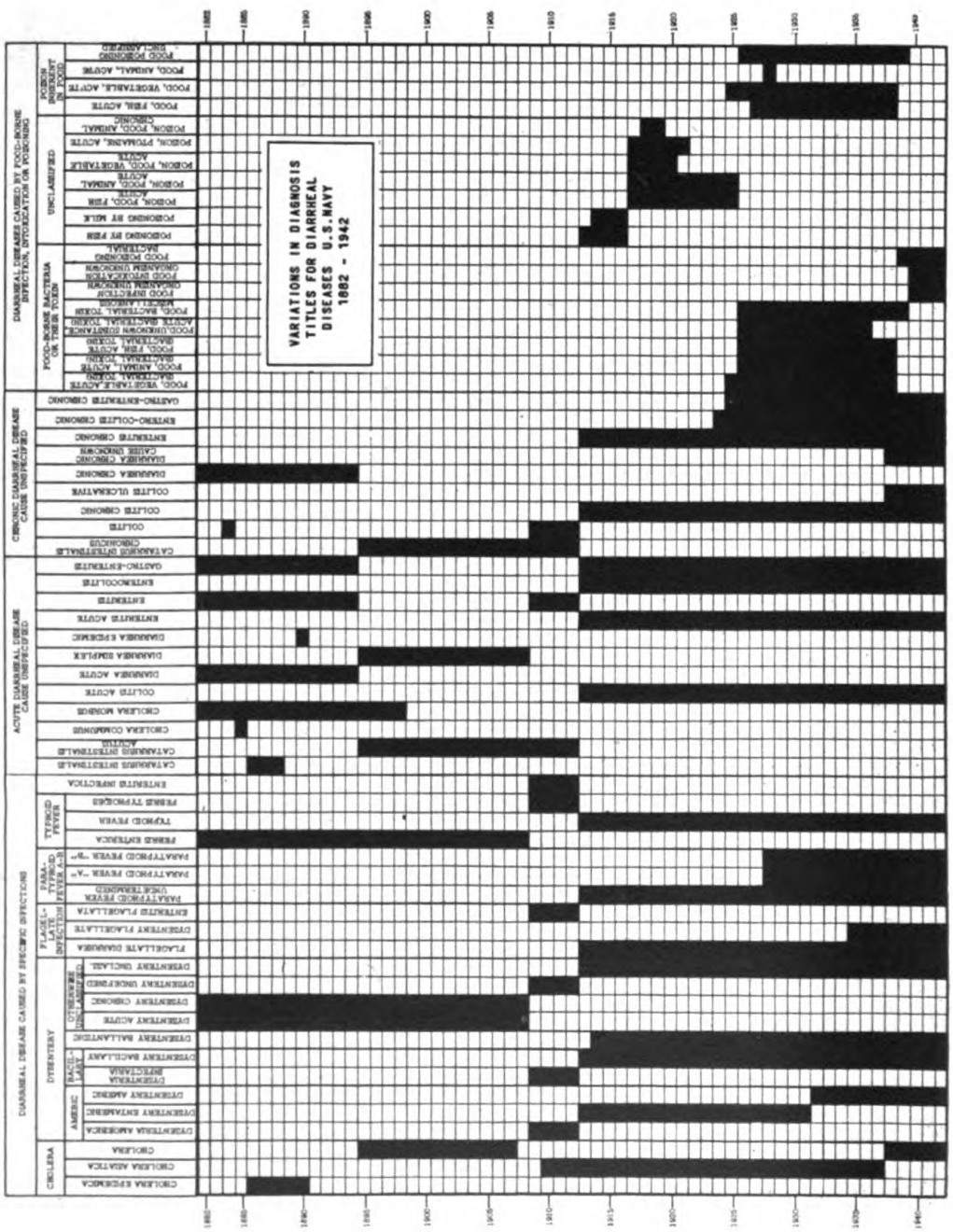
In accordance with that system of grouping, the diarrheal disease experience since 1882 has been analyzed according to the following classification:

I. Diarrheal diseases, all forms—
   A. Acute diarrheal disease, cause unspecified.
   B. Chronic diarrheal disease, cause unspecified.
   C. Diarrheal disease, caused by food-borne infection, intoxication or poisoning.
   D. Diarrheal disease, caused by specific infections.

The variety of diagnostic terms included in these classes during the 61 years studied is shown in graph 1.

It is obvious from this graph that at various times a diagnostic title has been dropped from the nomenclature to be replaced by another. This was true in each of the four groups. The solid bars in the graph indicate the periods during which a certain term was in vogue.

In some instances gaps appear between years. This is caused by the fact that it was general policy during the later eighteen hundreds and the early nineteen hundreds to record in the Annual Report of the Surgeon General only those diseases for which there were admissions to the sick list during the year. When there were no admissions, the disease was not listed. This factor, coupled with the lack of an official Navy Diagnostic Nomenclature during those years, has led to such gaps. Thus, for example, "cholera epidemica" and "cholera" present a gap in the years 1890 to 1895,

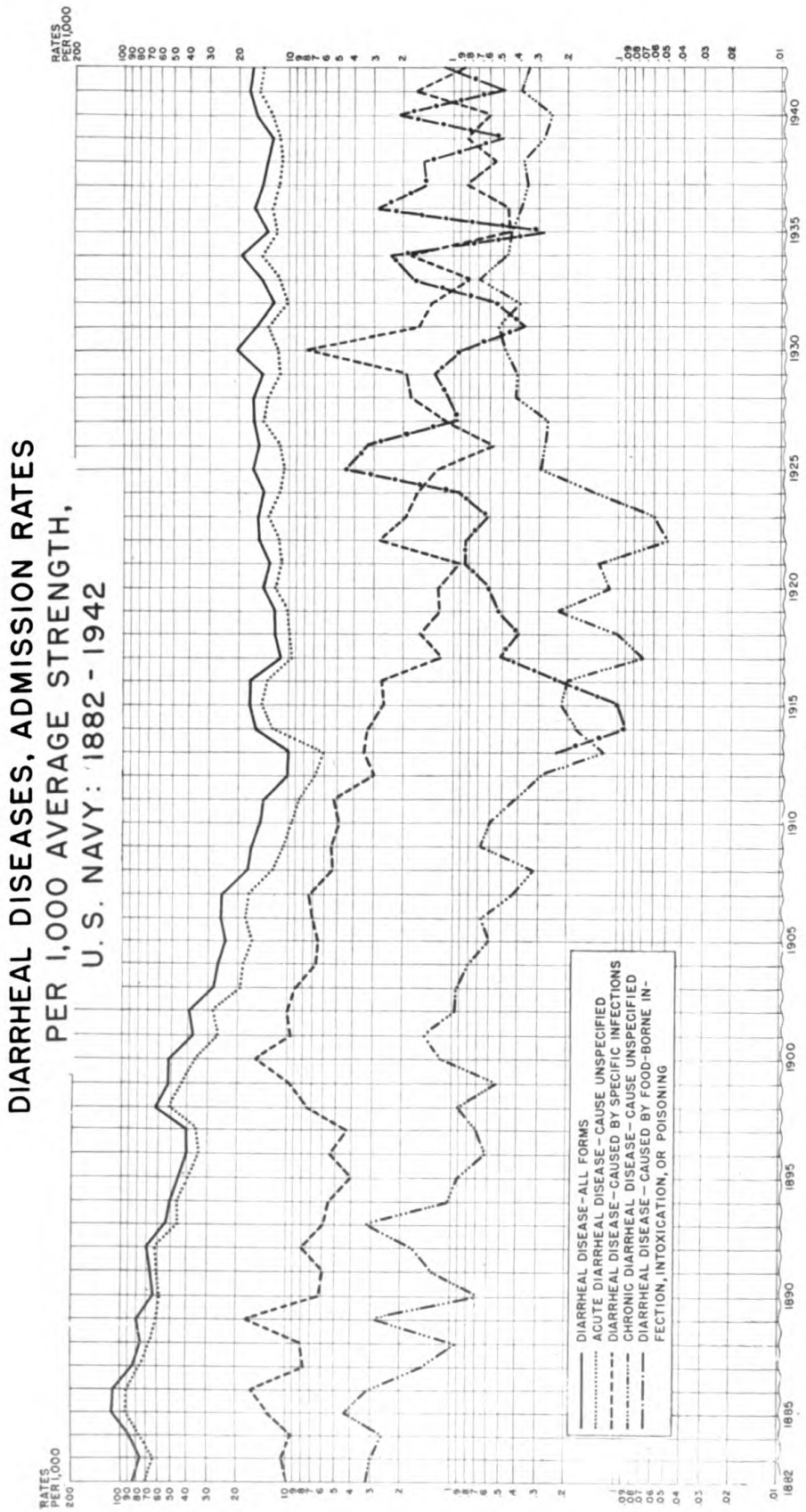


Graph 1.

TABLE 1.—*All diarrheal diseases, admissions and admission rates per 1,000 average strength, U. S. Navy, 1882 to 1942*

Year	Average strength	Total		Caused by specific infections		Acute, cause unspecified		Chronic, cause unspecified		Food-borne infection, intoxication and poisoning	
		Number admissions	Rate per 1,000	Number admissions	Rate per 1,000	Number admissions	Rate per 1,000	Number admissions	Rate per 1,000	Number admissions	Rate per 1,000
1882..	10,631	897	84.38	105	9.88	758	71.30	34	3.20	.....	.....
1883..	9,874	759	76.87	107	10.84	622	62.99	30	3.04	.....	.....
1884..	10,948	971	88.69	102	9.32	841	76.82	28	2.56	.....	.....
1885..	9,191	1,042	113.37	120	13.06	882	95.96	40	4.35	.....	.....
1886..	9,188	1,029	111.99	153	16.65	847	92.19	29	3.16	.....	.....
1887..	9,618	827	85.98	74	7.69	739	76.84	14	1.46	.....	.....
1888..	9,955	758	76.14	81	8.14	668	67.10	9	0.90	.....	.....
1889..	11,219	910	81.11	194	17.29	684	60.97	32	2.85	.....	.....
1890..	11,768	766	65.09	74	6.29	684	58.12	8	0.68	.....	.....
1891..	11,051	751	67.96	66	5.97	671	60.72	14	1.27	.....	.....
1892..	11,775	833	70.74	96	8.15	717	60.89	20	1.70	.....	.....
1893..	12,109	655	54.09	72	5.95	545	45.01	38	3.14	.....	.....
1894..	12,520	647	51.68	69	5.51	565	45.13	13	1.04	.....	.....
1895..	13,191	589	44.65	53	4.02	524	39.72	12	0.91	.....	.....
1896..	14,196	568	40.01	79	5.56	480	33.81	9	0.63	.....	.....
1897..	15,734	630	40.04	67	4.26	552	35.08	11	0.70	.....	.....
1898..	23,986	1,445	60.24	181	7.55	1,242	51.78	22	0.92	.....	.....
1899..	20,819	1,121	53.85	202	9.70	908	43.61	11	0.53	.....	.....
1900..	23,756	1,252	52.70	370	15.58	854	35.95	28	1.18	.....	.....
1901..	26,873	1,001	37.25	254	9.45	708	26.35	39	1.45	.....	.....
1902..	31,240	1,225	39.21	312	9.99	883	28.27	30	0.96	.....	.....
1903..	37,248	1,068	28.67	333	8.94	700	18.79	35	0.94	.....	.....
1904..	40,555	1,060	26.14	271	6.68	756	18.64	33	0.81	.....	.....
1905..	41,313	983	23.79	270	6.54	688	16.65	25	0.61	.....	.....
1906..	42,529	1,096	25.77	301	7.08	766	18.01	29	0.68	.....	.....
1907..	46,336	1,161	25.06	246	5.31	795	17.16	20	0.43	.....	.....
1908..	52,913	950	17.95	281	5.31	652	12.32	17	0.32	.....	.....
1909..	57,172	969	16.95	316	5.53	615	10.76	38	0.67	.....	.....
1910..	58,691	875	14.91	287	4.89	553	9.42	35	0.60	.....	.....
1911..	61,399	877	14.28	323	5.26	528	8.60	26	0.42	.....	.....
1912..	61,897	629	10.16	185	2.99	426	6.88	18	0.29	.....	.....
1913..	65,926	660	10.01	231	3.50	405	6.14	8	0.12	16	0.24
1914..	67,141	1,073	15.98	219	3.26	836	12.45	12	0.18	6	0.09
1915..	68,075	1,221	17.94	180	2.64	1,019	14.97	15	0.22	7	0.10
1916..	69,294	1,185	17.10	189	2.73	967	13.96	14	0.20	15	0.22
1917..	245,580	2,756	11.22	291	1.18	2,323	9.46	17	0.07	125	0.51
1918..	503,792	6,063	12.03	824	1.64	4,987	9.90	50	0.10	202	0.40
1919..	298,774	3,673	12.29	371	1.24	3,072	10.28	68	0.23	162	0.54
1920..	140,773	2,022	14.36	176	1.25	1,742	12.37	15	0.11	89	0.63
1921..	148,861	1,943	13.05	137	0.92	1,657	11.13	19	0.13	130	0.87
1922..	122,126	1,874	15.34	345	2.82	1,418	11.61	6	0.05	105	0.86
1923..	116,565	1,846	15.84	229	1.96	1,536	13.18	7	0.06	74	0.63
1924..	119,280	1,709	14.33	201	1.69	1,380	11.57	17	0.14	111	0.93
1925..	115,381	1,942	16.83	144	1.25	1,240	10.75	33	0.29	525	4.55
1926..	113,756	1,772	15.58	65	0.57	1,291	11.35	32	0.28	384	3.38
1927..	115,316	1,919	16.64	131	1.14	1,650	14.31	31	0.27	107	0.93
1928..	116,047	1,940	16.72	216	1.86	1,546	13.32	49	0.42	129	1.11
1929..	117,388	1,745	14.87	231	1.97	1,311	11.17	48	0.41	155	1.32
1930..	117,453	2,443	20.80	894	7.61	1,390	11.83	57	0.49	102	0.87
1931..	112,767	1,794	15.91	183	1.62	1,507	13.36	61	0.54	43	0.38
1932..	110,717	1,366	12.34	150	1.35	1,112	10.04	43	0.39	61	0.55
1933..	108,183	1,566	14.48	87	0.80	1,212	11.20	75	0.69	192	1.77
1934..	109,383	2,145	19.61	199	1.82	1,629	14.89	51	0.47	266	2.43
1935..	114,188	1,493	13.07	51	0.45	1,360	11.91	50	0.44	32	0.28
1936..	124,408	2,050	16.48	58	0.47	1,586	12.75	48	0.39	358	2.88
1937..	132,855	1,909	14.37	110	0.83	1,554	11.70	47	0.35	198	1.49
1938..	139,216	1,873	13.45	77	0.55	1,530	10.99	51	0.37	215	1.54
1939..	149,618	1,895	12.67	122	0.82	1,656	11.07	42	0.28	75	0.50
1940..	202,614	3,183	15.71	122	0.60	2,590	12.78	50	0.25	421	2.08
1941..	348,926	6,215	17.81	581	1.67	5,334	15.29	132	0.38	168	0.48
1942..	833,920	13,580	16.28	688	0.83	11,606	13.92	294	0.35	992	1.19

neither disease evidently having had any admissions. Which of these diagnoses was in use during this period is difficult to ascertain. The other gaps which appear in graph 1 may be explained in the same manner. This problem did not present itself in more



Graph 2.

recent years because of the introduction of the official *Diagnostic Nomenclature for the Medical Department of the United States Navy.*

Despite these variations in nomenclature it is obvious that the total incidence for the major categories of the diarrheal diseases and their respective subdivisions may be reasonably well determined for the entire 61-year period.

For purposes of investigation, the raw data have been organized into three tables, each of which is pictorially represented by a semi-logarithmic graph. Graph 2 indicates the total experience of diarrheal diseases in the Navy since 1882, each of the above-mentioned five groups or classes being individually plotted. Graphs 3 and 4 present the statistical picture of typhoid and paratyphoid fevers, and dysentery respectively. Because of the inherently vague nature of the classes "Cause unspecified" and "Food-borne infection, intoxication or poisoning," and the small frequencies of the other "specific" infections,[1] these diseases are not presented by individual diagnoses.

DIARRHEAL DISEASES

All forms.—From graph 2 it is seen that:

Starting in 1882 with a rate of 84.38 per 1,000, the curve rose to 113.37 in 1885.

There followed for the next 12 years an almost straight-line decrease until in 1897 the curve stood at 40.04.

The rate rose in 1898 to 60.24 (Spanish-American War) and then there was another decreasing trend for the succeeding 15 years, bringing the curve to 10.01 (the lowest point in the entire 61-year period) in 1913.

The years 1914, 1915, and 1916 showed rather marked increases in the rates (Mexican, Haitian, and Dominican Campaigns), but by 1917 the curve had resumed the level of 11.22.

Between the years 1917 and 1928 there was evidenced a slow but constant increase which carried the rate from 11.22 to 16.72.

It would appear that at this point of the curve, 1928, the trend line again turned downward, despite epidemics of bacillary dysentery in 1930 and 1934. This decreasing trend extended through

[1] Although cholera is regarded as one of the major problems in the administration of maritime quarantine, its incidence in the U. S. Navy from 1882 to 1942 was relatively insignificant. During the 61-year period studied, there were reported only 64 cases for an average annual admission rate of 0.01 per 1,000 strength. The highest single year's incidence occurred in 1886 with a rate of 1.41. Cholera vaccine has been prophylactically used for the protection of specially exposed groups in the U. S. Navy since the early decades of the twentieth century. No conclusive figures indicating the efficacy of this procedure are available.

1939 at which point the curve again rose.

Viewing the period as a whole, it is apparent that the year 1913 may be represented as a pivotal point between a period of rapid decline and a period of relative stability.

Subgroups.—The only points of significance that emerge from an analysis of these curves are:

1. Of the four subgroups, that of Acute Diarrheal Disease, Cause Unspecified, possesses the highest frequencies and has usually been most responsible for variations in the curve for Diarrheal Diseases, All Forms.

2. The curve for Diarrheal Diseases, Caused by Specific Infections, showed a falling trend line 1882 to 1897, rose sharply in 1898, 1899 and 1900, gradually fell through the period 1901 to 1921, and has varied widely around a practically horizontal trend line since 1921.

3. The Diarrheal Diseases, Caused by Food-borne Infection, Intoxication or Poisoning, were first reported in 1913 with a rate of 0.24, increased to a peak rate of 4.55 in 1925, and have fluctuated between the limits of 3.38 and 0.28 since 1925 with no definite downward trend.

4. The curve for Chronic Diarrheal Diseases, Cause Unspecified, showed a downward trend from 1882 through 1922, a definite upward swing during the period 1923 to 1933, and a trend only slightly downward since 1933.

Interpretation.—Although iron tanks as water storage reservoirs began to replace the old water casks aboard ship as early as 1815, and John Ericsson began as early as 1846 to experiment with evaporators for procuring safe, fresh water from salt water, the installation of this sanitary safeguard on all Naval vessels was only gradually brought about. In 1861, Eldridge Lawton installed a practical distilling apparatus on the U.S.S. *Mississippi;* in 1884, it was recommended that one boiler on each ship be set aside for use as an evaporator; in 1887, it was recommended that a Baird evaporator replace one boiler on each ship.

That the use of the distillers was not a panacea is evidenced by the following excerpt from the Annual Report of the Surgeon General for 1886:

> In the spring of 1886 and subsequently the crew of the *U.S.S. Omaha,* then attached to the Asiatic Station, suffered from outbreaks of diarrhoea and other functional diseases of the digestive system. After an investigation of the possible causes there was finally discovered, in two separate instances, an excess of sea salts in the drinking water distilled aboard ship; and upon examination in each case the coils and joints of the distiller were found to be leaking. In both instances, after repair

> of the distiller, the diarrhoea subsided almost immediately, and in a third instance slower distillation brought about a disappearance of a third outbreak within a few days.[2]

It would appear that: (1) Before the introduction of methods for distilling water aboard ship and purifying water ashore, polluted water was the chief cause of diarrheal disease in the United States Navy; (2) the increased provision of distilled water aboard ship (since 1861), and the increased use ashore of filtered water (since 1892) and of chlorinated water (since 1908), were largely responsible for the decrease in diarrheal diseases recorded during the period 1882 to 1913; and (3) since the purification of drinking water was essentially an accomplished fact, as far as the Navy was concerned, by 1913, and yet the diarrheal diseases have continued at a rate between 10 and 21 per 1,000 strength, causes other than polluted drinking water must be sought.

Among these causes may be included the eating of food polluted with organisms of the typhoid, dysentery or salmonella groups or with staphylococcic enterotoxin, and the ingesting of pathogenic organisms as the result of shipside swimming in heavily polluted harbors. The importance of both these factors may well have increased in recent years because of the popular use of raw foods as vitamin sources and because of the increased use of the crawl stroke in swimming.

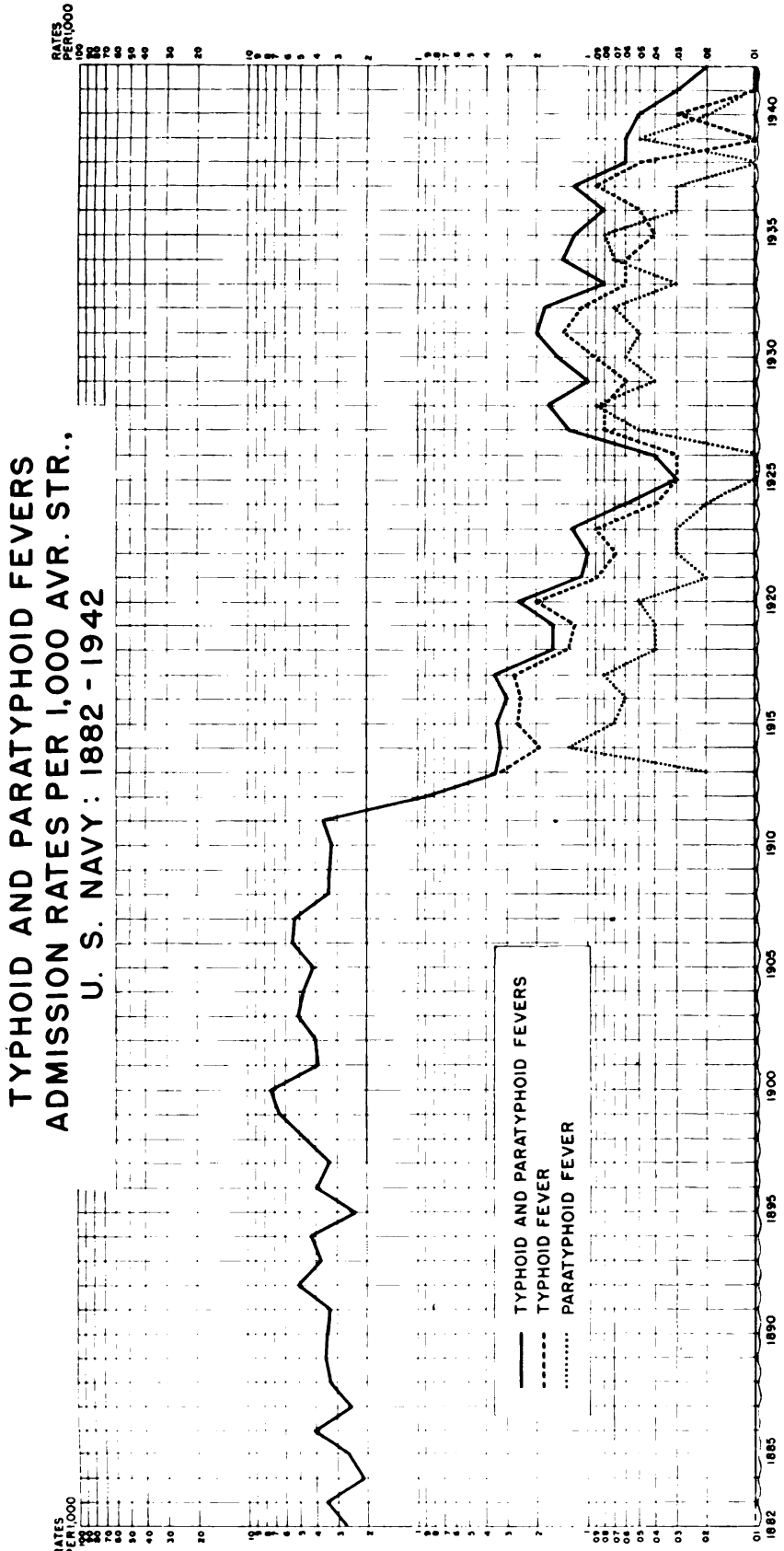
TYPHOID AND PARATYPHOID FEVERS

From a study of graph 3 the following data are apparent:

The period of 1882 through 1911 shows for typhoid and paratyphoid fevers a slightly increasing trend line, with epidemic proportions being reached at various times during the period. (Investigation of the geographic distribution of cases during these years indicates that the disease was prevalent in localities both in the United States and in foreign countries. Foreign stations and ships serving in foreign waters, especially the Asiatic waters, however, contributed more than their share of the cases.) The admission rate per 1,000 strength fell below 3.00 in only 5 years of the 30-year period. The rate rose above 5.00 in 6 different years and reached the peak rate of 7.37 in 1900, apparently as a result of the United States Navy's participation in the China Relief Expedition (Boxer Rebellion).

In 1911 the rate was 3.62. In 1912 the rate dropped to 0.92, in

[2] Evidence that similar hazards still exist today in the form of defective gaskets, cross-connections, back-siphonage, etc., is presented in chapter 3 of A Manual of Naval Hygiene (8).



Graph 3.

1913 to 0.35. (Typhoid vaccine was made available in 1910 to all Naval personnel who requested it. Inoculation of all Naval personnel was required by General Order No. 133, dated 1 December 1911.)

During the years 1914, 1915, 1916, and 1917 the combined typhoid and paratyphoid rates remained rather constant, varying between 0.30 and 0.35, despite Mexican service which caused the curve for All Diarrheal Diseases to rise.

Through the years 1918 through 1925, the trend was downward, reaching a low point of 0.03 in 1925.

Between 1926 and 1931 there was a definite swing upward, the curve reaching its peak with a rate of 0.20 in 1931.

In 1932 the curve again turned downward, the rate of decrease accelerating in 1940, until in 1942 the all-time low of 0.02 per 1,000 strength was reached.

Interpretation.—The water supply aboard ship in the period under study apparently had little if any relation to the incidence of typhoid fever, since the improvement of water supplies in the period 1882 to 1910, was not accompanied by decreasing typhoid rates.

The offering of typhoid vaccine to Naval personnel on a purely voluntary basis in 1910 obviously had no effect on the typhoid incidence, but the requirement for universal immunization in December 1911 was followed by an immediate drop to 0.92 in 1912[3] and 0.35 in 1913. This sudden drop is statistically significant, lying well beyond the limits of chance variation. The experience of the years succeeding 1913 further substantiates the value of the vaccine.

Monovalent typhoid vaccine containing one thousand million killed Rawling's strain typhoid organisms per cubic centimeter was used from 1912 to October 1917; T.A.B. vaccine containing one thousand million killed Rawling's strain typhoid organisms, two hundred fifty million killed paratyphoid A organisms and two hundred fifty million killed paratyphoid B organisms per cubic centimeter was used from October 1917 through the summer of 1924. Return was made to the monovalent Rawling's strain vaccine during the period November 1924 through August 1940 (with the provision of special paratyphoid inoculation for personnel entering areas where paratyphoid was known to be common). The Rawling's strain was abandoned and a more antigenic strain of typhoid organisms substituted late in 1936; in September 1940, the T.A.B. vaccine was again required.

The possible correlations between these changes and the inci-

[3] The year 1912 represents a period of incomplete prophylaxis.

dence of typhoid and paratyphoid fevers are as follows:

1. The universal requirement of monovalent vaccine in December 1911 was accompanied by a marked drop in the incidence of typhoid-paratyphoid infections in 1912 and 1913.

2. The addition of two hundred fifty million paratyphoid A organisms and two hundred fifty million paratyphoid B organisms to each cubic centimeter of the vaccine in October 1917 was apparently correlated with a rapid drop in both typhoid and paratyphoid infections from 1918 through 1925.

3. Withdrawal of the paratyphoid organisms from the vaccine in November 1924 seems to be correlated with a relative rise in the incidence of typhoid-paratyphoid infections during the years 1926 to 1931, with only a gradual falling off of the incidence during the period 1932 to 1940.

4. The addition of two hundred fifty million paratyphoid A organisms and two hundred fifty million paratyphoid B organisms to each cubic centimeter of the vaccine again in September 1940 was apparently accompanied by an accelerated rate of decrease for both typhoid and paratyphoid infections.

In view of the very low level of the typhoid-paratyphoid rates and the small amount of absolute change noted, as well as the existence of many uncontrollable variables, these correlative hypotheses must be viewed with extreme caution.[4] Included among the variables which may have been responsible for the discussed fluctuations of the typhoid-paratyphoid curve is the element of heavy exposure overcoming the effect of prophylactic immunization.

Immunization affords protection against incidental and moderate exposure, but it is known that men who have completed full courses of typhoid-paratyphoid prophylaxis have at times contracted the disease. Examination of the peaks which occurred during the period 1913 to 1942 indicates that most of the cases were limited to the areas of China, Samoa, Guam, the Philippines, and Hawaii, thus further substantiating this possibility.

Another variable is the ingestion of infective organisms by the individual prior to completion of his full course of three inoculations. Also, through error or oversight, some individuals undoubtedly escape immunization despite regulations.

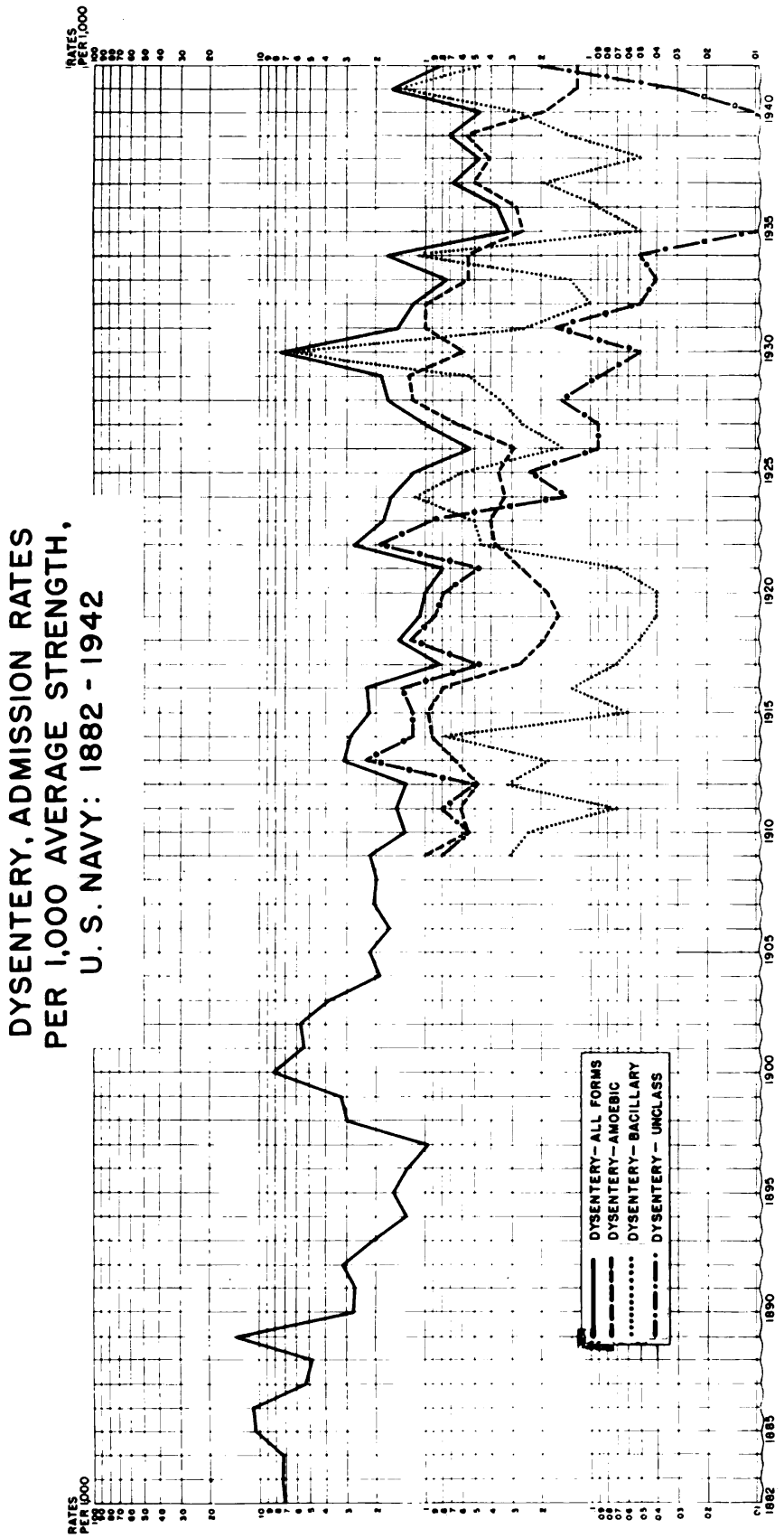
How many of the cases occurring between 1913 and 1942 can be attributed to these factors is impossible to determine. Despite these possibilities, however, it remains of considerable interest

[4] The typhoid-paratyphoid experience of the U. S. Army during 1913 to 1942 apparently does not indicate as close a relationship between the incidence of these infections and variations in the character of the vaccine as that found in the Navy.

TABLE 2.—*Typhoid and paratyphoid fevers, admissions and admission rates per 1,000 average strength, U. S. Navy, 1882 to 1942*

Year	Average strength	Total Typhoid-paratyphoid fevers		Typhoid fever		Paratyphoid fevers	
		Number admissions	Rate per 1,000	Number admissions	Rate per 1,000	Number admissions	Rate per 1,000
1882	10,631	29	2.73	.....	.....	.....	.....
1883	9,874	35	3.54	.....	.....	.....	.....
1884	10,948	23	2.10	.....	.....	.....	.....
1885	9,191	24	2.61	.....	.....	.....	.....
1886	9,188	38	4.14	.....	.....	.....	.....
1887	9,618	24	2.50	.....	.....	.....	.....
1888	9,955	33	3.31	.....	.....	.....	.....
1889	11,219	40	3.57	.....	.....	.....	.....
1890	11,768	41	3.48	.....	.....	.....	.....
1891	11,051	37	3.35	.....	.....	.....	.....
1892	11,775	59	5.01	.....	.....	.....	.....
1893	12,109	47	3.88	.....	.....	.....	.....
1894	12,520	53	4.23	.....	.....	.....	.....
1895	13,191	31	2.35	.....	.....	.....	.....
1896	14,196	56	3.94	.....	.....	.....	.....
1897	15,734	52	3.30	.....	.....	.....	.....
1898	23,986	109	4.54	.....	.....	.....	.....
1899	20,819	134	6.44	.....	.....	.....	.....
1900	23,756	175	7.37	.....	.....	.....	.....
1901	26,873	105	3.91	.....	.....	.....	.....
1902	31,240	125	4.00	.....	.....	.....	.....
1903	37,248	188	5.05	.....	.....	.....	.....
1904	40,555	194	4.78	.....	.....	.....	.....
1905	41,313	172	4.16	.....	.....	.....	.....
1906	42,529	230	5.41	.....	.....	.....	.....
1907	46,336	249	5.37	.....	.....	.....	.....
1908	52,913	176	3.33	.....	.....	.....	.....
1909	57,172	189	3.31	.....	.....	.....	.....
1910	58,691	193	3.29	.....	.....	.....	.....
1911	61,399	222	3.62	.....	.....	.....	.....
1912	61,897	57	0.92	.....	.....	.....	.....
1913	65,926	23	0.35	22	0.33	1	0.02
1914	67,141	22	0.33	13	0.19	9	0.13
1915	68,075	23	0.34	18	0.26	5	0.07
1916	69,294	21	0.30	17	0.25	4	0.06
1917	245,580	86	0.35	66	0.27	20	0.08
1918	503,792	83	0.16	65	0.13	18	0.04
1919	298,774	49	0.16	36	0.12	13	0.04
1920	140,773	35	0.25	28	0.20	7	0.05
1921	148,861	16	0.11	13	0.09	3	0.02
1922	122,126	12	0.10	8	0.07	4	0.03
1923	116,565	14	0.12	11	0.09	3	0.03
1924	119,280	7	0.06	5	0.04	2	0.02
1925	115,381	4	0.03	3	0.03	1	0.01
1926	113,756	4	0.04	3	0.03	1	0.01
1927	115,316	15	0.13	9	0.08	6	0.05
1928	116,047	20	0.17	9	0.08	11	0.09
1929	117,388	12	0.10	7	0.06	5	0.04
1930	117,453	18	0.15	11	0.09	7	0.06
1931	112,767	22	0.20	16	0.14	6	0.05
1932	110,717	20	0.18	12	0.11	8	0.07
1933	108,183	9	0.08	6	0.06	3	0.03
1934	109,383	15	0.14	7	0.06	8	0.07
1935	114,188	14	0.12	5	0.04	9	0.08
1936	124,408	11	0.08	7	0.05	4	0.03
1937	132,855	16	0.12	12	0.09	4	0.03
1938	139,216	9	0.06	7	0.05	2	0.01
1939	149,618	9	0.06	1	0.01	8	0.05
1940	202,614	11	0.05	6	0.03	5	0.02
1941	348,926	10	0.03	5	0.01	5	0.01
1942	833,920	14	0.02	8	0.01	6	0.01

that variations in the incidence of typhoid fever were synchronous with changes made in the constitution of the vaccine. The question as to whether this phenomenon represents cause and effect or mere coincidence still demands answer.



Graph 4.

DYSENTERY

From a study of graph 4 it is apparent that prior to 1909, all dysentery in the United States Navy was unclassified as to type. Since 1909 the dysenteries have been grouped into four classes, i.e., amebic, bacillary, balantidic, and "otherwise unclassified." The balantidic type has occurred so infrequently that discussion of this type has been omitted.

The curve for dysentery, all forms, from 1882 through 1942, makes possible the following observations.

There is a very slowly decreasing trend interrupted by eight definite epidemic peaks.

In the 30 years between 1882 and 1912 (the period of improving water sanitation, without dysentery or typhoid vaccination), the average annual admission rate per 1,000 strength for dysentery, all forms, was 3.21, with a high of 13.73 in 1889 and a low of 0.95 in 1897. (The average admission rate for typhoid-paratyphoid infections during the same period was 4.12, with a high of 7.37 in 1900 and a low of 2.10 in 1884.)

From the curve for amebic dysentery it is obvious that (1) between 1909 and 1942, the rate for admissions has varied from a high of 1.24 in 1929 to a low of 0.12 in 1941 and 1942; (2) although peaks and troughs of varying length and amplitude are evident, there have been no sharp, epidemic outbreaks; and (3) two separate trend lines are perceptible, 1909 through 1926 and 1928 through 1942.

The bacillary dysentery curve leads to the following deductions: (1) Between 1909 and 1942, the admission rate for bacillary dysentery varied widely from a high of 6.83 in 1930 to a low of 0.04 in 1919 and 1920; (2) since 1922, this disease has been the chief component making up the epidemic peaks of the curve for dysentery, all forms; (3) since 1909, there have been six sharp outbreaks of bacillary dysentery; and (4) trend analysis of this curve is dependent upon the interpretation of the "unclassified" group.

It is obvious from the curve for dysentery, unclassified, that although this disease was the chief component making up the peaks in the curve for all forms of dysentery through the period 1909 to 1923, since 1922 much less dysentery has been reported as dysentery, unclassified.

It would seem that the low rates for bacillary dysentery during 1909 through 1922 are largely due to the fact that many cases of bacillary dysentery were being reported as dysentery, unclassified. If correction is made, assuming the truth of this postulate, a

TABLE 3.—*Dysentery, admissions and admission rates per 1,000 average strength, U. S. Navy, 1882 to 1942*

Year	Average strength	All forms*		Amebic		Bacillary		Unclassified	
		Number admissions	Rate per 1,000	Number admissions	Rate per 1,000	Number admissions	Rate per 1,000	Number admissions	Rate per 1,000
1882	10,631	76	7.15					76	7.15
1883	9,874	72	7.29					72	7.29
1884	10,948	79	7.22					79	7.22
1885	9,191	96	10.45					96	10.45
1886	9,188	102	11.10					102	11.10
1887	9,618	50	5.20					50	5.20
1888	9,955	48	4.82					48	4.82
1889	11,219	154	13.73					154	13.73
1890	11,768	32	2.72					32	2.72
1891	11,051	29	2.62					29	2.62
1892	11,775	37	3.14					37	3.14
1893	12,109	25	2.06					25	2.06
1894	12,520	16	1.28					16	1.28
1895	13,191	20	1.52					20	1.52
1896	14,196	18	1.27					18	1.27
1897	15,734	15	0.95					15	0.95
1898	23,986	72	3.00					72	3.00
1899	20,819	68	3.27					68	3.27
1900	23,756	195	8.21					195	8.21
1901	26,873	149	5.54					149	5.54
1902	31,240	176	5.63					176	5.63
1903	37,248	143	3.84					143	3.84
1904	40,555	77	1.90					77	1.90
1905	41,313	88	2.13					88	2.13
1906	42,529	71	1.67					71	1.67
1907	46,336	95	2.05					95	2.05
1908	52,913	105	1.98					105	1.98
1909	57,172	122	2.13	58	1.01	18	0.31	46	0.80
1910	58,691	78	1.33	33	0.56	14	0.24	31	0.53
1911	61,399	91	1.48	38	0.62	4	0.07	49	0.80
1912	61,897	81	1.31	30	0.48	20	0.32	31	0.50
1913	65,926	205	3.11	44	0.67	12	0.18	149	2.26
1914	67,141	193	2.87	62	0.92	50	0.74	80	1.19
1915	68,075	152	2.23	66	0.97	4	0.06	81	1.19
1916	69,294	159	2.29	54	0.78	9	0.13	94	1.36
1917	245,580	203	0.83	67	0.27	18	0.07	118	0.48
1918	503,792	735	1.46	94	0.19	25	0.05	614	1.22
1919	298,774	322	1.08	48	0.16	12	0.04	262	0.88
1920	140,773	141	1.00	25	0.18	6	0.04	110	0.78
1921	148,861	120	0.81	38	0.26	11	0.07	70	0.47
1922	122,126	331	2.71	47	0.38	55	0.45	229	1.88
1923	116,565	213	1.83	47	0.40	59	0.51	107	0.92
1924	119,280	194	1.63	39	0.33	138	1.16	17	0.14
1925	115,381	139	1.20	42	0.36	71	0.62	26	0.23
1926	113,756	60	0.53	33	0.29	17	0.15	10	0.09
1927	115,316	116	1.01	76	0.66	30	0.26	10	0.09
1928	116,047	196	1.69	138	1.19	41	0.35	17	0.15
1929	117,388	219	1.87	145	1.24	63	0.54	11	0.09
1930	117,453	876	7.46	68	0.58	802	6.83	6	0.05
1931	112,767	161	1.43	115	1.02	28	0.25	18	0.16
1932	110,717	128	1.16	111	1.00	11	0.10	6	0.05
1933	108,183	78	0.72	60	0.55	14	0.13	4	0.04
1934	109,383	184	1.68	60	0.55	119	1.09	5	0.05
1935	114,188	36	0.32	30	0.26	6	0.05	0	0
1936	124,408	47	0.38	35	0.28	11	0.09	0	0
1937	132,855	91	0.68	66	0.50	25	0.19	0	0
1938	139,216	65	0.47	58	0.42	7	0.05	0	0
1939	149,618	103	0.69	84	0.56	19	0.13	0	0
1940	202,614	95	0.47	38	0.19	55	0.27	2	0.01
1941	348,926	563	1.61	41	0.12	511	1.46	10	0.03
1942	833,920	676	0.81	104	0.12	392	0.47	179	0.21

*Includes balantidic dysentery.

downward trend in the bacillary dysentery curve is demonstrable.

Interpretation.—That the greatest reductions in dysentery rates in the United States Navy had already been made before 1882 is evidenced by the following statement from Gatewood's "Naval Hygiene" (*3*):

> Prior to the Civil War a ship on the Asiatic Station would have more deaths from dysentery than all the ships of the service had annually after the general introduction of distilled water. Since that change the force afloat has been relatively free from the disease that in the old days was a scourge of the sea. The history shows clearly, as in the case with typhoid fever and cholera, that dysentery is generally a water-borne disease and that the prophylaxis is much the same.

The variety of causes that continued to produce epidemics of dysentery, even after all drinking water afloat was distilled, is of some interest. These causes, as mentioned in the various annual reports of ships and stations, have been:

1. Flies carrying infection from feces to food (in association with landing operations at Vera Cruz, 1913).
2. A crack in the sewage line draining the crew's main head topside which resulted in the contamination of food and mess gear in the No. 3 mess compartment underneath (U.S.S. *Louisville*, 1941).
3. Swimming over the side in polluted waters (Guantanamo Bay, Cuba, epidemic of 1930).
4. Pollution of fresh fruits and vegetables with the spray of harbor water in transfer from shore to ship in ship's boats (U.S.S. *Indianapolis*, 1941).
5. Liberty parties ashore ingesting infected food or water (U.S.S. *Denebola* in Bermuda, 1941).

Typical of the geographic distribution of the dysentery cases are the following reports: In 1923, of the 59 admissions for bacillary dysentery, 5 were reported from the Asiatic Fleet; 4 from China; 19 from Guam; 22 from Haiti; 5 from Santa Domingo; 2 from the Philippine Islands; 1 from Hawaii; and 1 from the United States (*4*). In 1937, "Of the 66 admissions for amebic dysentery, 21 were reported from the expeditionary forces in China; 6 from Guam; 2 from the Canal Zone; and 1 from Samoa; 6 from shore stations in the United States; and 30 from 19 ships, of which 19 admissions were from 11 ships of the Asiatic Fleet" (*5*).

SUMMARY

1. Diarrheal diseases have been reported in the United States Navy under 63 different names since 1882.
2. Admissions for diarrheal diseases in the Navy gradually decreased from an annual rate of 84.38 per 1,000 in 1882 to a rate of 10.01 in 1913.
3. Since 1913 there has been no consistently downward trend for diarrheal diseases.
4. The admissions for typhoid and paratyphoid fevers combined

showed no tendency to decrease during the period 1882 through 1911.

5. The admissions for typhoid and paratyphoid fevers combined spectacularly fell in 1912 and 1913 and have continued to follow a generally decreasing trend-line since 1913.

6. The admissions for dysentery, all forms, in the United States Navy have gradually decreased from a rate of 7.15 in 1882, to a rate of 0.81 in 1942, but the downward trend has been interrupted by outbreaks which have produced rates as high as 13.73, 11.10, 10.45 and 8.21.

7. Since 1909, when subclassification of the dysenteries in the Navy was begun, the amebic dysentery rate has fluctuated between a high of 1.24 and a low of 0.12 per 1,000 strength, while the bacillary dysentery rate has varied much more widely between a high of 6.83 and a low of 0.04.

CONCLUSIONS

(1) The spectacular reduction in typhoid-paratyphoid admissions in the United States Navy is primarily the result of the immunization program inaugurated in December 1911 and continued since that time.

(2) Improving sanitation of water and food supplies in the U. S. Navy, unsupported by typhoid immunization produced no measurable decrease in the typhoid-paratyphoid admission rates through the period 1882-1911.

(3) Dysentery admission rates, both amebic and bacillary, have slowly decreased in the Navy during the years since 1881, but they stand at present about where the typhoid and paratyphoid rates stood in 1912.

(4) Credit is probably due the improved sanitation of water and food, both ashore and afloat, for this reduction in dysentery admissions through the 61-year period studied. The urgent need for a specific means of immunization against dysentery is, however, quite obvious.

(5) The curves for diarrheal disease admissions as a whole make it evident that though progress in control was definite from 1882 to 1913, since 1913 definite progress can be demonstrated only in the typhoid-paratyphoid infections. (Since 1913 the admission rates for acute diarrheal diseases, cause unspecified, have slightly increased; since 1922 admissions for chronic diarrheal diseases, cause unspecified, have definitely increased; since 1914 the admission rates for diarrheal diseases, caused by food-borne infections, intoxication or poisoning have definitely increased.)

6. It would appear that if we are to resume the march of progress in control of the diarrheal diseases, which apparently came to a halt in 1913, we must speed up our development of specific immunizations against the dysentery organisms and attack more vigorously the question of food-borne infections and intoxications.

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PENICILLIN INACTIVATION BY SERUM

Penicillin is inactivated by contact with human serum or blood. The degree of inactivation varies greatly with different specimens of serum, and is much greater at body temperature than at lower temperatures.

This inactivation may lead to underestimation of the amount of penicillin in a patient's serum. Inactivation in vivo is probably important chiefly in cases in which excretion of penicillin by the kidneys is slow.—BIGGER, J. W.: Inactivation of penicillin by serum. Lancet 2: 400-402, September 23, 1944.

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PENICILLIN INEFFECTIVE IN GRANULOMA INGUINALE

Two cases of chronic granuloma inguinale proved by biopsy of the lesion, each showing clear-cut Donovan bodies were treated with penicillin. One patient received 1,360,000 Florey units of intramuscular sodium penicillin in a period of 4½ days; the other received 2,800,000 units during a 15-day treatment course. No significant change was observed in the lesions in either patient in the following 30 to 40 days. Donovan bodies were still present in the tissues of the first patient 27 days after therapy was begun.—NELSON, R. A.: Penicillin in treatment of granuloma inguinale. Am. J. Syph., Gonor. & Ven. Dis. 28: 611-619, September 1944.

USE OF PAREDRINE HYDROBROMIDE

PARAHYDROXY-α-METHYL-PHENYL-ETHYLAMINE HYDROBROMIDE IN CONTROL OF CARDIAC ARRHYTHMIAS WITH A REVIEW OF THE LITERATURE

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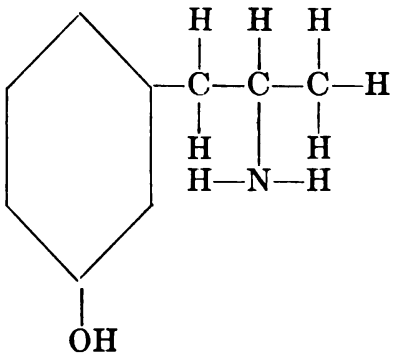
The purpose of this study is to present a review of the literature on the animal and human pharmacology of paredrine hydrobromide and the clinical investigations of the drug's action. Also an unusual case of ventricular tachycardia, lasting 48 days, is presented, together with case reports on allied disturbances of cardiac rhythm treated with this drug.

Paredrine is parahydroxy-α-methyl-phenyl-ethylamine and is available as the racemic hydrobromide salt. Its basic chemical formula is



and differs from that of benzedrine in that it possesses a parahydroxyl radical.

Animal pharmacology.—In animal pharmacology the *central action* has been observed by Alles (*1*), Loewe (*2*), and Schulte and his associates (*3*). Alles observed that paredrine, like other phenolic amines, was less effective in waking anesthetized animals than were amines lacking the ring hydroxyl. There is therefore no wakefulness caused by the use of this drug.

In animals the *cardiovascular action* was studied by von Issekutz (*4*), Tainter and associates (*5*), Crismon and Tainter (*6*) (*7*), and Jackson (*8*). Paredrine gives a distinct pressor reaction, and the blood pressure is definitely elevated. Von Issekutz, in his studies on decapitated cats, injected 0.1 milligram per kilogram intra-

venously. This dose raised systolic pressure from 60 to 220 millimeters of mercury. Subcutaneous injection always had more gradual effects. Paredrine was usually more effective than paredrinol (N-methyl-paredrine) in raising blood pressure, and never less effective.

Tainter and his associates (*5*) found that a dose of 0.2 mg. per kg. was required for a moderate pressor effect in the normal circulation of cats. Crismon and Tainter (*7*) observed that the rise in arterial pressure reached its peak in about 45 to 50 seconds and lasted 6½ minutes. Jackson, after injecting 2 mg. per kg. into dogs, noted a marked rise in blood pressure accompanied by bradycardia.

Tainter and his coworkers noted that effective doses of paredrine kept the pressure elevated for an appreciably greater length of time than did other amines studied.

The cardiac response to the drug showed an increased stroke output; increase in rate with small doses; decrease in rate with larger doses; increased auriculoventricular conductivity, and definite increased ventricular stimulation. Alles observed that the amplitude of the pulse was increased after intravenous injection of paredrine.

Orth and his collaborators (*9*) (*10*) and Meek (*11*) reported that intravenous doses of 0.75 to 1.0 milligram per kilogram given to dogs slowed the heart rate. There was also evidence of ventricular stimulation. Megibow and Katz (*12*) (*13*) noted a progressive increase in atrioventricular conductivity in both innervated and denervated hearts of dogs anesthetized with pentobarbital sodium. In innervated hearts there was an initial transitory depression due to vagal reflex. Others (*1*) (*4*) also observed myocardial stimulation in the dog, cat and rat.

Crismon and Tainter (*6*) found in heart-lung preparations in patients with cardiac failure that a single dose of 4 micrograms of paredrine increased cardiac output 33 percent, and increased systolic, diastolic and stroke volumes. Therefore it seems likely that the drug acts locally on the myocardial fiber and on the specialized fibers forming the conduction system, increasing the activity of these tissues.

The chief peripheral action seems to be a constriction of the veins. Some vasoconstrictor effect was noted, especially in the mucosa of the nasal membranes.

Von Issekutz reported that paredrine increased the kidney volume and decreased spleen volume. The increase in the kidney volume occurred simultaneously with the rise in blood pressure.

After injecting 5 to 20 milligrams of paredrine into the ear veins of rabbits, Iglauer and Altshule (*14*) observed a decrease of from 5 to 20 percent in the diameter of the veins of the omentum and mesentery. They also observed that when the perfusion liquid contained 2-percent paredrine, the rate of flow in dogs (through a segment of the saphenous vein equivalent to the diameter of the vein) decreased sharply.

Skeletal muscles show a marked decrease in tonus. Loewe (*15*) obtained a marked decrease in tonus of abdominal wall muscles of guinea pigs by an injection of a 2-percent solution of paredrine.

The *toxicity* of paredrine is less than that of benzedrine or paredrinol, and very much lower than that of synephrin or epinephrine. Injections of lethal doses of paredrine produce mydriasis, piloerection and generalized tremor followed by clonic convulsions (*1*) (*4*).

TABLE 1.—*Toxicity of paredrine hydrobromide*

Animal	Lethal dose in mg. per kg.	Method of administration	Reference
Rat	400–500	intravenous	*4*
Rat	320	subcutaneous	*5*
Guinea pig	160	subcutaneous	*1*

Human pharmacology.—The *central action* as evidenced by observation of the waking effect is similar in the human to that noted in animals. There is a lack of waking effect. Korns and Randall (*16*) stated that paredrine, even in doses as large as 400 milligrams a day, did not cause insomnia. Loman, Myerson and their coworkers (*17*) (*18*) were unable to detect that paredrine intravenously administered had any effect in altering the course of amytal narcosis.

The *cardiovascular action* has been studied from the standpoint of blood pressure, venous pressure, heart action and peripheral effect. Paredrine has a pressor effect when administered orally or parenterally; it has a more reliable pressor effect than certain related compounds, particularly upon oral administration (*17*) (*19*) (*20*). Abbott and Henry (*19*) found it one-fiftieth as active as adrenalin on subcutaneous injection and twice as potent as ephedrine on ingestion. Loman and his associates (*17*) found that paredrine was more potent than benzedrine for raising blood pressure when given intravenously, and that each is more potent than propadrine. The effect of single doses of paredrine hydrobromide on blood pressure is illustrated by table 2.

Abbott and Henry (*19*) studied the effect of repeated doses of

TABLE 2.—*Effect of single doses on blood pressure*

Method	Dose in mg.	Systolic		Rise in mm. Hg diastolic		Duration in minutes	References
		Max.	Min.	Max.	Min.		
By mouth	20	60	0	20	0	90–140	*19*
	30	44		20			*21*
	40	100	6	50	0	75–140	*19*
	50	100		30		60	*21*
	60	62	26	40	10	90–120	*19*
	70	96		28			*21*
Subcutaneous	10	38	20	22	8	85–90	*19*
	20	94	26	30	6	50–105	*19*
	40	96	48	50	20	85–120	*19*
Intramuscular	15	60	20	18	6		*17, 21*
	20	118	20	12	10 fleeting		*17, 21*
	25	73		40			*14*
	30	82		34			*14*
Intravenous	5–8	82	28	56	8		*17, 14*
	10	50	44	32	26 fleeting		*17*
	15	98	70	45	18		*17*
	20	102	56	22	20		*17*

paredrine. Following a week's observation of pulse and blood pressure, three doses of 20 milligrams each were given daily for 1 week. During this time there was no significant change in basal blood pressure.

Venous pressure is increased by paredrine. Iglauer and Altschule (*14*) increased venous pressure with oral, intramuscular or intravenous administration of paredrine. The extent of the effect and the time of onset, peak and duration were not closely correlated with the effect on arterial pressure.

The effect of paredrine on the heart results in a slowing of the rate, a normal or slightly increased cardiac output, and a definite stimulation of the ventricular muscle. Pressor doses of paredrine usually cause an initial slowing of the pulse rate (*14*) (*17*) (*21*) (*22*) (*23*). Altschule and Iglauer (*23*) showed this effect was due to a vagus reflex. Starr and Rawson (*24*) observed that the decrease of cardiac output, occurring in certain instances when a normal subject stood up, was more than compensated by the previous injection of 20 milligrams of paredrine or paredrinol subcutaneously. Nathanson (*22*) (*25*) demonstrated by electrocardiographic studies that paredrine was an efficient ventricular stimulant. From experience gained in the treatment of the cardiac arrhythmias, it is believed that the refractory period of the muscle is lessened and that the conductive tissues are stimulated.

Other smooth muscle effects.—Iglauer and Altschule (*26*) concluded that the pressor effects of paredrine must be due to peripheral constriction, since the drug remained active when the re-

flexes were paralyzed by the effects of spinal anesthesia.

The *metabolism* was studied by Altschule and Iglauer (*21*) (*26*), who reported that paredrine has little or no effect on basal metabolic rates in the human.

The *untoward effects* of the drug can be predicted from its physiologic action. The unfavorable reactions to its systemic administration are usually in the nature of cardiovascular or gastro-intestinal effects. They may include palpitation, substernal discomfort, headache, sweating, nausea, vomiting and gastro-intestinal pain (*19*) (*25*) (*27*). Nathanson observed such symptoms in one out of fifteen cases; Laval (*28*) in one out of more than a thousand cases.

Clinical investigations.—Clinical investigations have been carried out on possible cardiovascular, carotid sinus syndrome, heart block, shock, and respiratory effects of paredrine. The drug has a pressor effect without cerebral excitation. Korns and Randall (*16*) concluded that combined benzedrine and paredrine therapy was best, particularly in view of the fact that the patient's lassitude was not relieved unless benzedrine was added.

There is also a definitely stimulating effect on the atrioventricular conduction system and on lower ventricular centers. This was shown by Nathanson (*22*) (*25*) who prevented spontaneous or induced cardiac standstill in patients with a hyperirritable carotid sinus reflex by administering from 40 milligrams to 60 milligrams of paredrine orally. The beneficial effect appeared in 7 out of 14 cases, because of the development of atrioventricular rhythm, and in 3 cases because of activation of lower ventricular centers. The effect was apparent in 30 minutes and lasted for from 1 to 3 hours. Ephedrine was less effective than paredrine.

Heart block is influenced favorably by paredrine. Nathanson (*25*) administered 60 milligrams of paredrine orally or 25 milligrams intravenously to four patients with complete and two with partial heart block. After 1 hour the average increase in ventricular rate was 25 beats per minute, and there was improvement in all cases. The usual maintenance dose was 60 milligrams three times a day. Herrmann (*29*) recommended the intracardiac or intrajugular injection of paredrine in cases of Adams-Stokes convulsive seizure.

Shock can be prevented and blood pressure restored by the use of paredrine either perorally or by subcutaneous injection. Altschule and Iglauer (*21*) found that paredrine gave favorable results in restoring the blood pressure to normal in cases of Addison's disease and in shock due to coronary thrombosis, and was a useful adjunct in the treatment of peripheral vasomotor collapse

of hemorrhage, pulmonary embolism, and surgical shock. They had less satisfactory results in shock due to overwhelming infection. Myerson and Loman (*30*) suggested that paredrine given by the intravenous drip method was useful in shock.

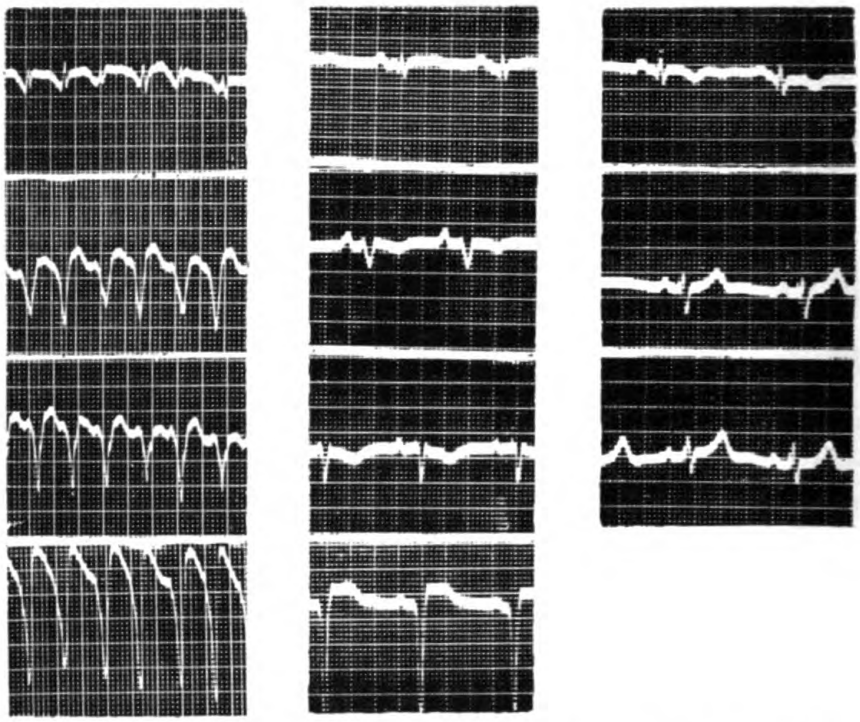
Altschule and Gilman (*31*) administered paredrine to 30 patients in whom a rapid, marked fall in blood pressure occurred during spinal anesthesia. In each instance the systolic blood pressure returned to above 100 millimeters of mercury. If no rise was observed within 5 minutes after intramuscular injection of 10 milligrams, a second injection was given. The systolic pressure remained above 100 for from 30 minutes to 2 hours following the injection. After intravenous injection the blood pressure rose in 2 to 3 minutes and lasted 20 to 50 minutes.

In 12 patients a dose of 10 milligrams of paredrine was given intramuscularly prior to spinal anesthesia. In most cases a fall in blood pressure was prevented, and in other cases was delayed and restored by a second injection. The authors emphasized the fact that paredrine had certain advantages over other pressor drugs, in that its action was lasting, and it did not cause cerebral hyperactivity. Iglauer and Altschule (*26*) reported that 10 milligrams of paredrine intramuscularly raised the blood pressure in eight patients under spinal anesthesia from a minimum of 0/0 and a maximum of 60/40 to a minimum of 90/60 and a maximum of 180/120.

CASE REPORTS

Case 1.—A welder, age 20, was admitted to the hospital on 17 March 1940 because of marked tachycardia. He had been well until 5 weeks previously when, while bowling, his heart suddenly began to beat very fast. He was dyspneic, cyanotic, and had precordial pain. He was taken to a nearby hospital on the following day, where he was given large doses of quinidine sulfate, a total of 560 grains by mouth in 11 days. There was no perceptible effect upon his pulse rate, and he was discharged home 11 days after admission. He had continued to have a very rapid pulse, weakness, dyspnea and vomiting. The blood pressure was 80/50. Throughout the period of home care he was given 30 grains of quinidine sulfate daily. Three attempts were made at digitalization. Large doses of sedation were given without any effect upon the pulse rate.

At the time of admission, electrocardiographic studies showed a ventricular heart rate of 210. Daily electrocardiograms were taken, the rate varying from 190 to 210, during which time the patient was placed in an oxygen tent and given large doses of quinidine by mouth, but the apical rate continued unabated, and the peripheral pulse rate varied between 80 and 160. The patient was frequently thought to be moribund. Mecholyl chloride, prostigmine, quinine and sedatives in large doses were administered without any effect. On 22 March paredrine hydrobromide, 20 milligrams, was given at 3-hour intervals. On the following day the ventricular rate was 180, and the patient's subjective and objective condition was much improved.



1. Case 1. Electrocardiograms showing changes in heart rate after administration of paredrine hydrobromide. Left, rate 210 on 10 April 1940; center, 80 on 25 April; and right, 70 on 11 October after administration of paredrine.

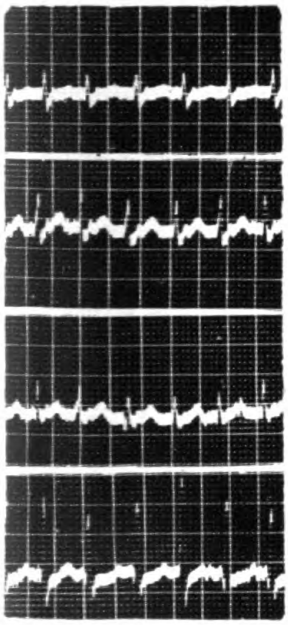
On 24 March, 48 days after onset of symptoms, the apical rate and pulse rate corresponded for the first time, at a rate of 80.

Paredrine hydrobromide was continued for 4 more days, after which the patient had no further tachycardia. He was discharged on 6 May 1940, with a pulse rate of 70. He has been followed since this time, and at no time has he had a recurrence of his ventricular tachycardia. He now works as a welder in a Navy yard. He has no symptoms of cardiac insufficiency, has a heart rate of 80, and his blood pressure is 126/80 while doing a regular 8-hour day's work.

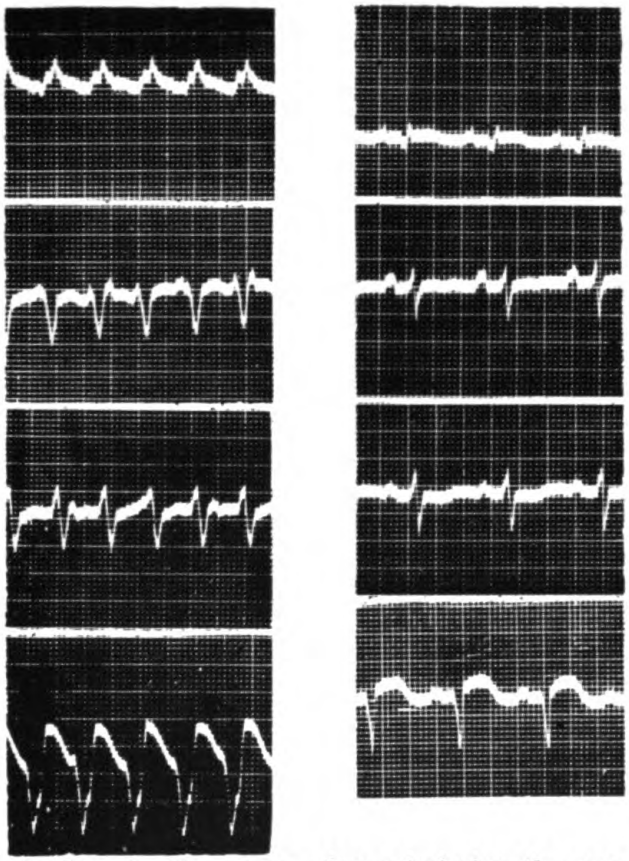
Case 2.—The patient, a male, age 64, was admitted on 7 January 1941 in a crisis of a previously diagnosed adrenal insufficiency. He was given cortin, adrenalin, and large doses of salt as substitution therapy, and he did moderately well for several weeks. An electrocardiogram made during this period revealed a heart rate of 110, auricular hypertrophy, coronary insufficiency and myocardial fibrosis, or both, with a question of adherent pericarditis.

On 4 March the patient suddenly became dyspneic and cyanotic and had severe palpitation. His blood pressure remained at its usual level of about 100/60, and the apical rate was far too rapid to count. Quinidine was given throughout the day without effect. At 2200 the patient was given 20 milligrams of paredrine hydrobromide, and 20 minutes later an electrocardiogram was taken, which revealed an auricular tachycardia, with a rate of 160 beats per minute. At 2330 the rate was 96. The paredrine hydrobromide was repeated every 4 hours for 24 hours, without a recurrence of the tachycardia.

Death occurred 4 days later from a bronchopneumonia, without evidence



2. Case 2. Electrocardiogram made before admission. Heart rate 200.



3. Case 3. Two days after admission the ventricular rate was 170; five days later it was 90.

of an adrenal insufficiency crisis or recurrence of abnormal cardiac rhythm. Autopsy findings showed tuberculous destruction of the adrenal glands, and moderate coronary artery sclerosis.

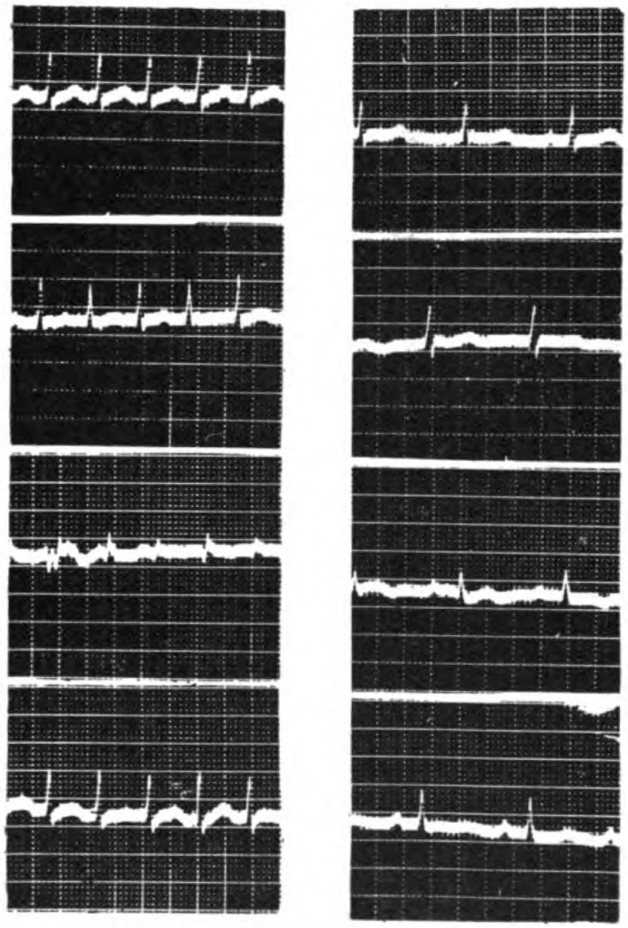
It is believed that in this case the paroxysmal tachycardia was controlled and recurrence prevented by the use of paredrine hydrobromide.

Case 3.—This patient, 60 years old, had an acute anterior coronary occlusion on 26 September 1941 and did perfectly well after the first day until 20 November, when he suddenly developed dyspnea, palpitation and vomiting. For the second time during his illness he was completely digitalized. He was admitted to the hospital 4 days later in severe shock, and at this time the physical findings were blood pressure 104/82, apical rate above 200, pulse irregular and about 180, and respirations 24 per minute. The patient was cyanotic and orthopneic, and there were moist râles at the bases of both lungs.

Pressure on each carotid sinus reduced the peripheral pulse to 70 and the apical rate to about 160; but the rate immediately returned to above 200 upon releasing pressure. An electrocardiogram taken the following day showed a ventricular rate of 170, and a diagnosis of ventricular tachycardia was made.

On admission the patient was started on quinidine sulfate, grains 5 every 4 hours. Two days later the quinidine was stopped and he was given paredrine hydrobromide in doses of 10 milligrams every 4 hours. Two hours after the

first dose, his apical rate was 140 and pulse 112 beats per minute. The next day the apical rate was 112, the pulse rate 104 per minute. Two days later the heart and apical rate were 100 per minute. An electrocardiogram made several days later revealed a rate of 90 and evidences of a recent anterior coronary occlusion, as had electrocardiograms before the onset of the ventricular tachycardia. This patient's pulse rate has remained below 90 and there has been no recurrence of a pulse deficit.



4. Case 4. Rate 160 before and 75 after administration of paredrine hydrobromide.

Case 4.—A 36-year old woman was admitted to another hospital in July 1940, because of palpitation, weakness and vomiting. The pulse and apical rates were too rapid to count. There was a marked pulse deficit, but no irregularity in rhythm. The electrocardiogram showed evidence of auricular paroxysmal tachycardia. The blood pressure was 100/70.

The patient was given 10 milligrams of paredrine hydrobromide by mouth and 20 minutes after administration the apical rate was 180 and the pulse rate 110 per minute. The dose was repeated after 1 hour, and 1 hour after the second dose the pulse and apical rates were both 76 per minute. There was no further recurrence of tachycardia.

Case 5.—A male, age 68, retired, had been well, except for paroxysmal attacks of forceful, irregular beating of his heart for 3 years. He had none of the diseases predisposing to cardiac pathologic changes, except mild peripheral arteriosclerosis, and there were no symptoms of myocardial insufficiency. The heart rate was 80, pulse rate 80, and blood pressure 90/60.

During an attack of palpitation the heart rate rose to 120 and the pulse rate to 90 beats per minute, with a total irregularity of rhythm. There were no signs of failure, no cough, no cyanosis, no dyspnea, but only the discomfort of forceful beating of the heart. The attacks were typical paroxysmal auricular fibrillation.

The attacks had increased in frequency from once monthly to three times

weekly, and in duration from 1 hour to 10 to 12 hours. Digitalization had been maintained for 3 years, and the patient had received adequate doses of quinidine sulfate and large amounts of thiamine with calcium.

A complete gastro-intestinal study showed no pathologic changes. Paredrine hydrobromide was given in 5-milligram doses orally every 6 hours for 1 month, without a recurrence of paroxysmal auricular fibrillation. The dosage was reduced to 5 milligrams every 8 hours, and there was no recurrence of symptoms unless the drug was withdrawn. During the administration of this small dose of paredrine hydrobromide the blood pressure remained at 130/80. Upon withdrawal of the drug the blood pressure dropped to 110/80, with recurrence of the attacks. The patient stated that he felt well after 3 months' continued use of the drug, and desired to continue its use. There had been no insomnia or other untoward symptoms.

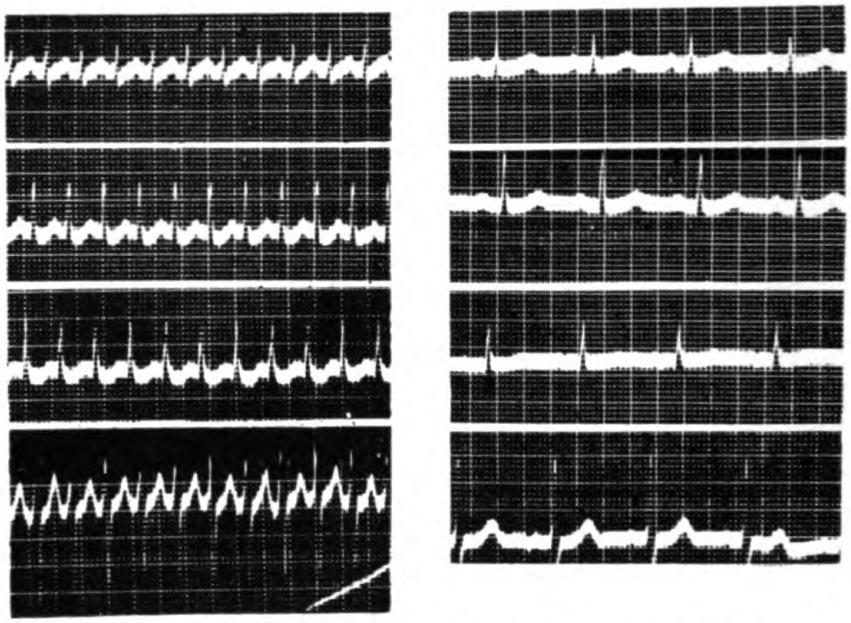
Case 6.—This patient, 68 years old, had mild hypertensive heart disease. He was, however, thought to be a good risk for prostatectomy which was performed. He did excellently for the first 21 days postoperatively, and then developed a very severe auricular paroxysmal tachycardia, with the blood pressure dropping from 146/90 to 90/70. The patient failed to respond to administration of a blood transfusion and to quinidine sulfate therapy. He was given 10 milligrams of paredrine hydrobromide by mouth every third hour, and in 12 hours the heart rate had returned to 100, with a normal sinus rhythm.

Case 7.—A 63-year-old woman, had been well until September 1940, when, following a mental shock, she began having attacks of paroxysmal auricular tachycardia. Physical examination did not reveal any significant abnormalities. The basal metabolic rate was slightly elevated, being plus-6 and plus-16. There was no cardiac enlargement and no evidence of any myocardial damage. The average pulse rate was 88, and during the attacks 120 to 140 beats per minute.

The attacks of paroxysmal auricular tachycardia were not controlled by quinidine sulfate, calcium salts, thiamine chloride or theobromine compounds. Contrary to better judgment a dose of 10 milligrams of paredrine hydrobromide was given which resulted in exacerbation of symptoms; the palpitation became worse, the heart beat increased from 160 to 210 per minute, and the blood pressure rose from 170/100 to 200/120. Headache, dizziness, nausea and vomiting followed within 15 minutes of oral administration.

Cases 8 and 9.—Two patients with Adams-Stokes syndrome were effectively relieved of syncopal attacks by administration of 10 milligrams of paredrine hydrobromide every 3 hours by mouth. Although the ventricular rate increase was negligible (from 30 to 36 beats per minute), the average rise of the blood pressure was 18 mm. of mercury systolic and 10 mm. diastolic. The outstanding sign of improvement in these cases was disappearance of the signs of shock; that is, color improvement, warm skin and a full pulse replaced the pallor, the moist, cool skin and the weak, feeble pulse.

Case 10.—A patient with a carotid sinus syndrome, with first-degree heart block was relieved by removing a constricting collar. The attacks were reproduced by pressure on either carotid sinus. After the administration of paredrine hydrobromide, 20 milligrams every 4 hours for 4 doses, there was no response to pressure on the carotid sinuses. However, there was no effect on the auriculoventricular conduction time.



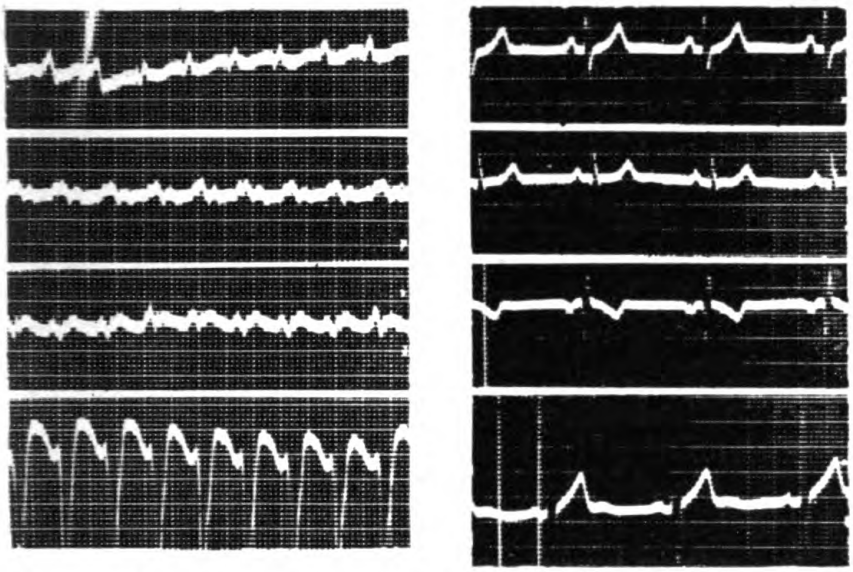
5. Case 11. Ventricular rate 210 at 1000 (left); at 1800 (right).

Case 11.—This patient, age 54, was in excellent health until one morning at his golf club he noticed weakness, faintness and palpitation. He was brought into the hospital. Upon arrival the patient was orthopneic, markedly cyanotic and was in severe shock. The temperature was 96° F., and the blood pressure 40/7, respirations 40 per minute, sighing; the heart rate was over 200 per minute (240 by electrocardiogram), and the pulse was not palpable. Electrocardiographic tracing showed a paroxysmal auricular tachycardia.

There was no response to oxygen and quinidine sulfate, grains 10 every 2 hours for 3 doses. Paredrine hydrobromide was then given orally by the following schedule; 20 milligrams at 1400; and 20 milligrams at 1500, after which the blood pressure rose to 60/20; 40 milligrams at 1600, and 40 milligrams at 1700. At 1715 normal sinus rhythm was restored. All laboratory studies had negative results.

Case 12.—A man, age 56, had had daily attacks of paroxysmal tachycardia over a period of 3 years. The attacks became much more frequent, and by 1 August 1943 lasted from 10 to 17 days. Quinidine in massive doses had no effect. Digitalis was without benefit. On 23 August 1943, the patient was placed on a regimen of 20 milligrams of paredrine hydrobromide every 2 hours for 24 hours, and the paroxysms ceased. Regular sinus rhythm was maintained with a daily dose of paredrine, 10 milligrams 3 times a day, until February 1944 when an acute coronary occlusion occurred. A paroxysmal ventricular tachycardia then began, which lasted, uncontrolled by quinidine, paredrine or digitalis, for 6 days. The patient expired then from an extensive acute anterior coronary occlusion.

Case 13.—While in North Africa this patient, age 21, had several attacks of paroxysmal ventricular tachycardia. He recovered and was surveyed home. He was admitted to a hospital in January 1944, in a moribund condition from an attack of 6 days' duration. The heart rate by electrocardiogram was 210 per minute and the blood pressure 80/40, with marked passive congestion of



6. Case 13. Paroxysmal ventricular tachycardia. Heart rate 168 on 21 November 1943 and 64 (normal rhythm) on 14 December.

the bases of both lungs. The patient was digitalized and given quinidine sulfate, grains 10 every 3 hours for 3 doses, followed by 20 milligrams of paredrine every 2 hours for 12 hours, at which time regular sinus rhythm was restored.

Case 14.—This patient, age 56, was in good health until 16 October 1943, when paroxysmal auricular tachycardia developed. He failed to respond to digitalization or to quinidine therapy, but did respond within 12 hours to administration of paredrine hydrobromide, 20 milligrams every 3 hours.

COMMENT

Forty-two patients have been treated in the receiving wards of two city hospitals after the diagnosis of paroxysmal auricular or ventricular tachycardia had been established. When there was failure of response to vagal and eyeball pressure, or to change in position (head bending forward to the floor), 20 milligrams of paredrine hydrobromide were given at 1-hour intervals for 1 to 3 doses. All but 6 patients recovered within the 3-hour period. The remaining 6 were hospitalized and treated by the described method. There were no deaths in this series of 42 patients.

In hypotensive states, such as those seen during attacks of paroxysmal auricular and ventricular tachycardia, paroxysmal auricular fibrillation, and Adams-Stokes syndrome, paredrine hydrobromide produces definite clinical effects, bringing about an improvement in the state of shock, and a restoration of rhythm, except in the complete block. The drug is effective in moderate doses when given by mouth.

In cases 1, 2, 3, 4, 6, 11, 12, 13, and 14, as well as in 36 outpatients, all representing cases of paroxysmal tachycardia, the attacks were terminated within 30 minutes to 20 hours after the administration of paredrine hydrobromide in doses of 10 milligrams every 1 to 3 hours, without any untoward effects.

In case 5, one of paroxysmal auricular fibrillation in a hypotensive arteriosclerotic patient, with biweekly attacks over a period of 3 years, the attacks were effectively controlled by the drug. The patient described in case 7 had a masked hyperthyroidism with paroxysmal tachycardia. Upon administration of a single dose of 10 milligrams of paredrine hydrobromide, he developed tachycardia, elevation of the blood pressure, nausea, vomiting, sweating and extreme apprehension. From this and other experiences it is concluded that paredrine hydrobromide should not be administered to patients in hypertensive states.

In cases 8 and 9 marked clinical improvement was exhibited by the disappearance of the signs of Adams-Stokes phenomenon. In case 10 there was definite control of an irritable carotid sinus with the use of the drug.

SUMMARY

1. An adrenalin-like drug, paredrine hydrobromide, is described; the drug differs chemically from amphetamine only in that it has an hydroxyl radical added to the carboxyl ring.

2. Pharmacologic studies on animals showed that (a) the drug does not have a waking effect; (b) it definitely elevates both the arterial and venous blood pressure for not more than 30 minutes to 2 hours; (c) no allergic phenomena are exhibited in small doses; and (d) the toxicity is very low. The minimal lethal dose is from 160 milligrams to 500 milligrams per kilogram of body weight.

3. The pharmacologic action of the drug in humans appears to be very similar to that found in animals. Insomnia is not produced by its use. It definitely elevates the blood pressure by its action on the smooth muscle fibers of the peripheral arterioles, by constriction of the veins, and by stimulating action on the myocardial fibers. It is effective as a ventricular stimulant. It slows the heart rate only by the increased filling of the ventricular cavities and its stimulation of the vagus nerve through a carotid sinus reflex. The refractory period of the muscle is lessened and the conductive tissues are stimulated, thus decreasing the conduction time. Paredrine does not increase the metabolic rate.

Untoward effects are elicited only if the drug is given in the hyperreactor group of patients, as in cases of hypertension and

hyperthyroidism. It is not effective in the control of chronic auricular fibrillation, or in congestive heart failure, and should not be used to replace digitalis in these conditions.

4. Clinical investigations show the drug to be very useful in the carotid sinus syndrome. in shock, in heart block and (as reported here) in the effective control of the paroxysmal arrhythmias. A case is included in which recovery occurred in a patient with ventricular paroxysmal tachycardia lasting 48 days.

5. Paredrine hydrobromide does not have a digitalizing effect, and should not be used as a digitalizing drug.

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VENOPRESSOR MECHANISM IN THE PRODUCTION OF SHOCK

ITS TREATMENT WITH NIKETHAMIDE

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Recent editorial comment on the role played by venopressor mechanism in the maintenance of peripheral circulation (*1*) (*2*) (*3*), makes it imperative, in the present emergency, that treatment based on the pathologic physiology of this mechanism in shock be clarified and emphasized.

The maintenance of an effective circulation depends not only upon the integrity of the heart muscle, but also upon the quantity of blood flowing into the chambers of the heart. The function of the venopressor mechanism in maintaining the flow of blood to the heart, has been repeatedly pointed out (*3*).

The venopressor mechanism is the venous pump. The physiologic principle of muscle tonus (intramuscular pressure) is responsible for its operation. The alternating contraction and relaxation of groups of discrete muscle bundles, which constitute muscle tonus, and the summation of their contractions during work exert a pumplike action which creates venous flow and venous pressure and which sustains the circulation (*4*) (*5*) (*6*). During life, intramuscular pressure is a measurement of muscle tonus (*7*). A flaccid skeletal musculature goes hand in hand with a fall of intramuscular pressure and a loss of muscle tonus. Under these circumstances the capillary pump ceases to operate and venous return to the heart diminishes.

Since the heart is filled entirely passively, the amount of blood expelled depends upon the amount which enters during diastole. Any significant diminution in the filling of the right ventricle results in a decline in the cardiac output, a decrease in arterial circulation, and a fall in systolic blood pressure (*4*).

In surgical, hemorrhagic, and traumatic shock, the heart does not fail. The ventricles remain efficient and capable of pumping all blood brought to them. It is the circulation in secondary shock, however, which fails and this occurs because of inadequate filling of the right ventricle. The loss of muscle tonus, in these conditions, results in failure of the venopressor mechanism. The venous

pump consequently ceases to function, the return of blood to the heart becomes inadequate, and the peripheral circulation decompensates (*8*).

MAINTENANCE OF VENOPRESSOR MECHANISM

The maintenance of an effective venopressor mechanism depends upon the integrity of muscle tonus (intramuscular pressure). A normal range of intramuscular pressure, 60 to 90 mm. of water (*9*), is associated with a normal level of venous pressure and an adequate peripheral circulation (*10*).[1] The venopressor mechanism at these increments of intramuscular pressure is normal and is functioning as a venous pump. The veins are full. Needles can be easily inserted into them (*11*). Contrariwise a loss of muscle tonus precedes failure of the venopressor mechanism in surgical shock. The veins become collapsed and venipuncture is performed with difficulty (*12*).[2] Peripheral circulatory failure is evident. Agents which increase intramuscular pressure restore the failed venopressor mechanism in surgical shock and in shock associated with hemorrhage, and reestablish the peripheral circulation (*13*).

Peripheral circulatory failure in surgical, traumatic and hemorrhagic shock, seen in hospital practice, is always associated with and preceded by a decline in intramuscular pressure (*8*). Shock, observed under these circumstances, is never manifest without the finding of a low intramuscular pressure. The value for intramuscular pressure may be found as low as 20 mm. of water. This level indicates a complete absence of muscle tonus and a complete failure of the venous pump (*7*).[3]

An increase in intramuscular pressure, either spontaneously or induced by treatment, to above 40 mm. of water, always coincides with compensation of a failing peripheral circulation (*11*). During shock, increasing intramuscular pressure to above 40 mm. of water, will raise the venous pressure from values as low as 1 cm. of water to the normal range (*12*). Veins which are collapsed so

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[1] Excluding congestive heart failure, wherein the normal range of intramuscular pressure may occur with high venous pressure.

[2] Exception: In the shock of coronary occlusion with concurrent backward failure (congestive heart failure), intramuscular pressure drops to low values and venous pressure may be high or within the normal range (unpublished data).

[3] For purposes of brevity and clarification, in this paper, where the word shock occurs, the author refers to those forms of shock termed secondary shock, which include surgical, hemorrhagic (oligemic or hematogenic), and the delayed phenomenon in traumatic shock. The references in these instances are to actual measurement of intramuscular pressure in these circumstances, which have been recorded in previous publications or to unpublished data. The author has made no measurements in the primary, or neurogenic forms of shock, represented by syncope, and the immediate phenomena after wounds on the field of battle.

badly that the insertion of needles for treatment is difficult, become full and admit needles easily. Clinical improvement coincides with the increasing levels of intramuscular pressure (*9*) (*13*).

COMPARATIVE CHANGES IN THE VENOPRESSOR MECHANISM AND IN PLASMA VOLUME

Failure of the peripheral circulation can occur without a decrease in plasma volume in the human being. A decrease in plasma volume of 2 units (500 cc.) does not cause decompensation of the peripheral circulation, providing that muscle tonus remains at an adequate level. A failing peripheral circulation, with plasma volume decreased by 416 cc., can be restored and clinical improvement obtained by the simple expedient of increasing the level of intramuscular pressure by nikethamide (*14*).

Of the many substances studied, which have a pressor action on intramuscular pressure, only two accomplished a restoration of a low intramuscular pressure. There were human plasma (*8*), and a 25-percent solution of pyridine-beta-carboxylic-acid-diethylamide which is known as nikethamide. This drug has been used for many years as a respiratory stimulant. It is derived from nicotinic acid. and has positive antipellagral activity when given orally (*10*) (*12*) (*13*).

Whole blood transfusions, as ordinarily employed in amounts of 500 cc., will not heighten the venopressor mechanism. The amount of blood has no effect on a lowered level of intramuscular pressure (*13*). A whole blood transfusion of 1,000 cc., however, will restore the blood volume in surgical shock accompanied by hemorrhage, and compensate a failed peripheral circulation (*14*). The compensation of the circulation, despite the 416 cc. plasma volume loss, followed the increase of intramuscular pressure resulting from the administration of nikethamide.

The restoration of a low muscle tonus by human plasma is slow, requiring from 70 to 100 minutes before its pressor action on the venopressor mechanism becomes manifest (*8*). It must be given in not less than 3-unit (750 cc.) amounts. Nikethamide, on the other hand, acts quickly, and restores muscle tonus within 5 to 10 minutes after it has been administered intravenously (*10*) (*13*). The required dose is large, 5 to 10 cubic centimeters. A single administration of 3 units of plasma will heighten the venopressor mechanism for approximately 3 hours, or longer, whereas 10 cc. of nikethamide will accomplish the same effect for at least 2 hours (*10*). The clinical improvement after the use of either substance is remarkable.

THE DRUG TREATMENT OF SHOCK

It is not proposed that nikethamide should replace the use of plasma or of whole blood transfusions in supporting the failing venopressor mechanism. Because of its rapid effect, nikethamide has its particular place in treatment before the administration of plasma. Its support of the venopressor mechanism is immediate, its duration relatively short, but long enough to maintain the circulation until the pressor action of plasma on the venopressor mechanism can become effective. It should be used as an adjunct in the treatment of shock before venopressor collapse and in conjunction with plasma to maintain intramuscular pressure. In the absence of plasma, or whole blood, the peripheral circulation can be successfully compensated in shock for about 2 hours and maintained for a longer period by the repeated administration of this drug used in dosage of from 5 to 10 cc., intravenously, at intervals of from 2 to 3 hours (*11*) (*13*).

The restoration of the failing venopressor mechanism by the repeated administration of nikethamide in the treatment of surgical shock has been successfully employed in a group of 97 patients in whom studies of the venopressor mechanism were being conducted. Observations on 53 of the group have been reported (*8*). At this station, nikethamide is used in the routine treatment of shock from burns, preceding the use of plasma and in conjunction with plasma. At another station in the Pacific area, however, it has been used in traumatic shock as an adjunct to plasma.

Nikethamide has been observed to restore the failing venopressor mechanism with resultant compensation in the peripheral circulation when human plasma has failed to do so. The specific instance occurred at this station in the treatment of a burn involving approximately 90 percent of the body surface. The loss of protein from the skin was as great as the amount of plasma administered. After receiving 10 units of plasma (2,500 cc.) the serum proteins were only 5 percent, and the patient continued in shock. The veins were so collapsed, a venipuncture with a large needle to administer plasma could not be accomplished. However, a small needle was inserted into a vein in the hand, and 10 cc. of nikethamide given. Within 10 minutes the collapsed veins became full, a venipuncture with a larger needle was made possible and the administration of plasma was again instituted. Both nikethamide and plasma were given concurrently, the nikethamide being spaced at 3-hour intervals until the critical period had passed. The patient survived.

It has been shown that "elapsed time" is a large factor in the

mortality of combat casualties. Many deaths occur from shock before adequate treatment can be instituted (*15*). The period that elapses from the time shock has been clinically evaluated, along with the additional 100 minutes required for plasma to become effective, makes the immediate period after injury a critical one. War injuries, however, are now receiving treatment much sooner than when the report on deaths from shock was made following the action at Pearl Harbor. Nevertheless there is a need in the treatment of shock, both in hospital and field practice, for a substance that has a quick action in supporting the peripheral circulation.

It is thought that the immediate restoration of muscle tonus after the use of nikethamide fills this need. The substance is simple to administer and can be given by any one trained to administer intravenous therapy. The pressor action on intramuscular pressure is extremely rapid. Even in severe surgical shock, the increase in intramuscular pressure after a single injection persists for about 2 hours before it declines and before a second treatment, which may be given without risk, becomes necessary. This is an ample period for protection of the patient until plasma can become effective.

The ideal procedure would be the immediate administration of 10 cc. of nikethamide when shock has been diagnosed, or is anticipated, to be followed through the same needle by an infusion of plasma. If the veins are collapsed and cannot be entered with a large needle, nikethamide can be administered by a small caliber needle. A vein may then be entered with the larger plasma needle after the collapsed veins become full through the restoration effect of the venopressor mechanism. Additional nikethamide, when required, should be given at 3-hour intervals.

There is no contraindication for the use of the drug in the treatment of circulatory collapse in shock from burns, traumatic and surgical shock, or from shock attendant on hemorrhage. Nikethamide furthermore is listed in the Navy Supply Catalog in 1.5-cc. ampules.

RELATIVE TOXICITY OF NIKETHAMIDE

The toxicity of nikethamide is very low. Normal individuals tolerate less than unconscious ones, or those in shock. The drug can be given during or after massive hemorrhage. A massive blood loss of 2,000 cc. is no contraindication to the intravenous administration of nikethamide in the treatment of shock (*13*). There are two warnings of maximum single dosage which can be easily observed. The first is a cough reflex. If this is overlooked,

mild convulsive movements of the extremities set in, indicating the maximum toleration dose of the patient. These movements pass quickly. The dangerous dose is still remote even after this phase of intolerance has been induced.

PHARMACOLOGIC AND CLINICAL EFFECTS

The intravenous administration of nikethamide may cause restlessness, which disappears in 10 to 15 minutes. A comatose patient in shock will stir and moan. Otherwise the patient experiences a feeling of warmth such as that after the intravenous administration of calcium salts or of aminophyllin. The restlessness is easily controlled by assurance and is never great enough to become a cause of concern for an operative wound or after hemorrhage.

In convalescent patients, and in the normal person studied, the intravenous administration of from 5 to 10 cc. of nikethamide has a definite pressor effect on arterial pressure. Systolic pressure is markedly increased following these doses (*10*). However in shock from massive hemorrhage this pressor effect was not observed. The low arterial pressure after hemorrhage does not increase immediately after the intravenous administration of these amounts of nikethamide (*13*). Whether by coincidence or otherwise, the bleeding in a massive hemorrhage from peptic ulcer did not increase after the intravenous administration of nikethamide (*13*).

In surgical shock arterial pressure will increase to the normal range approximately an hour after muscle tonus has been restored and the peripheral circulation compensated by its use.

The immediate effect is a flushing of the skin and a deep hyperpnea. The full pharmacologic effect is not attained in the absence of this respiratory phenomenon, indicating that further amounts of the drug are required. The patient in shock must, however, be treated with at least 5 cc. or more of the drug. Thirty cubic centimeters have been given intravenously over a period of 30 minutes with beneficial results in the treatment of severe surgical shock. The 1.5-cc. ampule in the Navy Supply Catalog, and the usual one found in the physician's bag is absolutely inadequate. It is recommended that 5 such ampules be used for the minimum dose for each intravenous administration in the treatment of shock. A 5-cc. hospital-size ampule is available. This ampule facilitates ease and speed in treatment.

The compensation in the failing peripheral circulation after the use of nikethamide is the same as is seen after the use of plasma. The clinical effect of restoring muscle tonus and the circulation

with nikethamide is immediate. Circulatory events that occur an hour or more after the use of plasma are compressed relatively into a matter of minutes after the use of nikethamide.

CONCLUSIONS

1. A loss of muscle tonus precedes the failure of the venopressor mechanism and decompensation of the peripheral circulation.
2. Restoration of intramuscular pressure will compensate a failing peripheral circulation.
3. Human plasma and nikethamide each have a pressor action on muscle tonus and in sufficient dosage will raise a low level of intramuscular pressure to physiologically effective levels.
4. Human plasma acts slowly, requiring from 70 to 100 minutes to manifest its pressor action on the venopressor mechanism.
5. Nikethamide acts rapidly, manifesting its pressor action on the venopressor mechanism within from 5 to 10 minutes, but the effect does not last as long as with plasma.
6. The use of nikethamide as an adjunct in the treatment of peripheral circulatory failure should precede the use of plasma. The intravenous administration of nikethamide in adequate dosage will support the venopressor mechanism during the time needed for plasma to become effective. Nikethamide is not recommended as a treatment to be used instead of plasma, but as an adjunct before or concurrently with plasma.
7. The use of nikethamide to support the venopressor mechanism is not contraindicated by massive hemorrhage, and its use does not increase bleeding.
8. Nikethamide is relatively without toxicity. It can and must be given in large amounts intravenously to be effective. It is not effective for restoration of muscle tonus when administered by mouth or intramuscularly.

NOTE.—Coramine (Ciba) brand of pyridine-beta-carboxylic acid-diethylamide was used throughout this study. This chemical is supplied in ampules by a number of different drug manufacturers, as nikethamide.

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SULFANILAMIDE IN HERNIOPLASTY WOUNDS

Sulfanilamide in inguinal hernioplasty wounds, done by a catgut technic, frequently produces hemorrhage into the wound and surrounding tissues, sometimes produces increased induration of the wound, but has no effect on healing as determined by physical examination.—SOUTHWORTH, J. L.: Effects of sulfanilamide locally implanted in clean wounds. Am. J. Surg. 66: 245-248, November 1944.

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REDUCED ATMOSPHERIC THERAPY FOR PARANASAL SINUSITIS

Of 125 patients who were treated for chronic sinus disease in a high altitude chamber by rapid decompression of atmospheric pressure to 522.6 mm. of mercury, 89.5 percent experienced subjective improvement at the conclusion of their course of treatment.—BUTLER, D. B.; GREENWOOOD, G. J.; and IVY, A. C.: Reduced atmospheric pressure as form of treatment for paranasal sinusitis. Arch. Otolaryng. 40: 266-274, October 1944.

MEDICINE IN THE SOUTH PACIFIC

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The island on which we were stationed was one of the Solomons, approximately seven degrees south of the equator. We landed early in December 1943, just at the beginning of the rainy season. In fact we disembarked in a torrential downpour which continued, unabated, for 5 days. The rainy season is usually over by the middle of April but in our particular instance it continued until the last week in May. The temperature in the shade was 85° to 90° F. and in the sun 110° to 120° F. The high humidity of 80 percent made the climate unpleasant to say the least. Daniel[1] in his "Islands of the Pacific" says, "The climate of the Solomons is not healthful for Europeans, since both the humidity and the heat are excessive. Rainfall generally surpasses 160 inches a year."

The medical officers, together with hospital corpsmen and other enlisted personnel, actually built the hospital. They constructed temporary and then permanent living quarters, established water supply and bathing facilities, built the roads, set up machinery, assembled the prefabricated steel buildings, hospital wards, etc. Construction Battalion help was available only to a minor degree. Work in the first few months was performed in mud, often two or three feet deep. Fortunately malarial control had already been established on the island, and mosquitoes were not too numerous.

Drugs were difficult to obtain on the island. Although ours was a large hospital, there was a definite limitation as to choice of drugs.

UPPER RESPIRATORY INFECTIONS

Upper respiratory infections were frequently observed. The men were exposed to the elements, rain, heat, mud, and lack of bathing and washing facilities, while building the hospital. Hence acute pharyngitis, acute tonsillitis, acute tracheitis, and acute catarrhal otitis media were common.

It was found that by instituting a sulfonamide routine the men could continue to work. Sulfadiazine, 2 gm., was given immediately and 1 gm. every 4 hours on the first day. On the second day

[1] DANIEL, H.: Islands of the Pacific. G. P. Putnam's Sons, N. Y., 1943. p. 143.

the dosage was halved. The men were urged to drink plenty of water and to report if the urine was scanty. Only very occasionally did the drug produce gastro-intestinal complaints, which were alleviated by dispensing sodium bicarbonate with the sulfadiazine. Of the hundreds who received this drug, only three patients were observed with untoward reactions of fever, rash, and restlessness.

Men with slight temperature elevations who did not seem to be ill were allowed to continue with their duties because of an acute manpower shortage. The average patient suffering from an upper respiratory infection recovered in 2 days. Occasionally he was treated for 3 or 4 days. About one in twenty was sick enough to be in bed.

The sulfonamides saved many manhours of work during the months of constructing the hospital. Only from 2 to 4 men turned into the sickbay daily after the more liberal regimen of sulfadiazine was begun; yet the personnel numbered nearly 600 and the men worked 7 days a week.

A word might be said concerning tobacco and upper respiratory infection, especially sinusitis. Everyone smoked and usually to excess. The tobacco, in which glycerin had been replaced by a war substitute, was found to be irritating to the throat and in many instances precipitated and aggravated upper respiratory infections, including sinusitis. In asthma, too, smoking was often a factor.

In this hot, humid, rainy climate, wheezing in the chest was frequently heard. Occasionally actual cases of bronchial asthma appeared. The mild to moderately sick patient, with wheezing but no definitely classic attack of bronchial asthma, was often helped by epinephrine and ephedrine subcutaneously. Capsules of ephedrine sulfate were not available, and patients had to be sent to rear areas who otherwise could have returned to duty.

Primary atypical pneumonia occurred. When the patient coughed, complained of pain in the chest, and if there was considerable sputum but it was not blood-streaked, x-ray examination of the chest was ordered. In my experience the clinical picture in atypical pneumonia was bizarre. The chest was occasionally full of asthmatic wheezes, but rarely was there any considerable pleural effusion. One patient became psychotic.

The chief points of differential diagnosis between atypical pneumonia and lobar pneumonia were the milder pattern of the former disease generally, the practically normal leukocyte count, the lack of response to sulfonamides, and the changes on the x-ray film which were characteristic. The edges of the mottled shadow were irregular and spread out in a fanlike fashion. This was unlike the homogeneous opaque shadow of lobar pneumonia.

GASTRO-INTESTINAL DISEASE

There were many cases of diarrhea. No laboratory facilities were available at first but the "diarrhea" was undoubtedly infectious in origin. Coconuts often caused trouble. They had to be eaten shortly after falling, and chewed well. Sulfadiazine quickly cleared up the infection in a day or two. Washing the hands before meals, and cleaning and dipping the mess gear in boiling water before and after meals, undoubtedly helped stay the spread of the infection. When sulfadiazine was not used, these simple diarrheas incapacitated the victim for at least a week or two because of prostration.

It may well be that some of the patients suffered from mild bacillary dysentery, and that the 2- to 3-day sulfadiazine treatment effected a cure. After the hospital was established there were cases of bacillary dysentery among the admissions. The patients were often quite sick, with a fever of 103° or 104° F., and numerous yellow-green, watery stools which became mucopurulent and bloody. Both sulfadiazine and sulfaguanidine were administered, the latter in doses of 6 gm. immediately and 3 gm. every 4 hours until two stool cultures were negative. Sulfadiazine was believed to be as effective as sulfaguanidine, if not more so.

There were only five cases of amebic dysentery and the patients were treated with emetine, carbarsone and vioform.

Among the hospital admissions a goodly percentage were gastric neuroses. There were a few instances of proved peptic ulcer.

Patients suffering from chronic arthritis who showed bone changes upon x-ray examination were encountered. Acute arthritis, too, was not uncommon but rheumatic fever was rare.

SKIN INFECTIONS

Skin infections were common and practically everyone who had been in the tropics for any length of time had his share of annoying, if not incapacitating skin diseases. The heat and humidity and lack of proper bathing facilities predisposed to skin disease. It was not uncommon to find the skin between the toes macerated and split after the men had been swimming in the salt water. The same condition was observed in the skin folds of the crotch and postanal region.

Even slight abrasions and lacerations became infected easily with pyogenic organisms in this tropical region. Coral lacerations were particularly obstinate in healing. White soap and water and mild topical applications were used and it was observed that time was saved and complications avoided by dispensing sulfadiazine

for 2 days by the method already outlined. Sulfanilamide powder dusted on an abrasion or shallow ulcer proved unsuccessful; there apparently was not enough absorption of the drug into the blood.

Impetigo was frequently observed. The face, scalp, groin, axilla, trunk and legs were frequently involved. White soap and water, showers, tincture of merthiolate, or other mild antiseptics were used routinely and with good results. Sulfathiazole ointment (3 to 5 percent) was a specific but was only used in obstinate cases. Sulfadiazine was given internally. Often scores of bullous lesions appeared in the axillae. In this region ointments often macerated the skin.

A very prevalent and stubborn disease was fungus and pyogenic infection of the feet and groin, the groin infection being the more severe. Soap and water, and thorough drying with application of talcum powder proved good preventives as well as a means of therapy in mild cases. Tincture of merthiolate or weak iodine solutions were beneficial; ointments macerated the skin. Hot lockers for keeping clothes dry, particularly socks, were invaluable; otherwise hanging the clothes out in the sunlight was in order.

There was an idea prevalent in this area that swimming in sea water produced fungus infections of the feet, crotch, and ears. It was my opinion that the swimming or bathing did this only indirectly by softening the skin and thus making it vulnerable to ubiquitous fungi and bacteria. The secondary infection of the skin which frequently was present was benefited not only by the treatment outlined but particularly by sulfadiazine.

Miliaria (prickly heat) was the most frequently observed skin disease. The constantly moist skin and clothing made response to therapy difficult and recurrences were frequent. Many of the patients developed a superimposed secondary pyogenic infection, with impetiginous lesions of the axillae and groin. The inexorable needlelike prickly sensation in the skin was occasionally unendurable. Everyone seemed to suffer from miliaria sooner or later, particularly fair and red-skinned persons. The miliaria usually appeared on the trunk and the waistline. Very mild soap and water or showers twice a day helped. Talcum powder, calamine and zinc lotion, or a mixture of 3-percent resorcinol and 5-percent sulfur often were successful. Tanning was advised and multivitamins and salt tablets were dispensed. No phenol was used in the applications because even very weak solutions irritated many skins.

Wearing a skivvy shirt under the khaki blouse was frequently of benefit. It absorbed the perspiration more efficiently than did the khaki shirt. Chlorine water and soap used in the laundry seemed at times to cause the miliaria, and washing the underwear

in rain water often was observed to clear up the condition.

Ear infections were troublesome. Although commonly diagnosed as fungus, the ear condition was probably a pyogenic infection with a mixture of macerated skin cells and cerumen. To prevent infection the men were advised to dry their ears as thoroughly as possible after a swim, to take a shower thereafter and again to dry the external ear, turning that side of the head down. As treatment a pledget of gauze dipped in a 2-percent solution of salicylic acid in alcohol or metacresyl acetate was found useful.

Tropical or leg ulcers were common. Elevating the feet in bed, keeping them clean and dry, and the administration of sulfonamides internally were potent factors in cure. The careful use of topical applications played an important role.

Pubic lice, although not a serious condition, caused considerable annoyance at first, and if not controlled spread among the men. The enlisted men often borrowed clothes from one another. The pyrethrum insect spray and even better, the aerosol bomb, were found effective. If the former was used, the patient had to be near the shower as a severe burning sensation often developed in the scrotum. Boiling the clothes was useful to rid them of the eggs.

TROPICAL DISEASES

In the first 3½ months more than 500 cases of malaria were seen. Chills, fever and sweats were the classic symptoms, but headache, backache, and gastro-intestinal complaints were common. Headache was probably the most frequent presenting symptom. Many medical conditions were simulated. Only the thick smear was used by the laboratory in searching for the plasmodium. The treatment as outlined by the National Naval Medical Center was followed with good results.

Relapses were not uncommon. Very sick patients were occasionally seen in whom atabrine, 3 grains intramuscularly, was very effective. This treatment was also indicated in the few patients who vomited medication taken by mouth. Seven patients among about 400 did not tolerate atabrine and it was necessary to use quinine.

The malarial patients who had just recovered from an attack did not react to work well. The majority of our malaria patients were recurrent cases, averaging about four attacks. Actually the average number was double this, as treatment had often been given by a hospital corpsman on outpost duty and no notation made in the health record. It was amazing occasionally to see men who had had ten to fifteen attacks of malaria but whose physical condition was quite good. However a moderate to severe secondary

anemia was often present, and the patient had occasionally lost considerable weight. He was therefore evacuated to a cooler climate.

Practically all of our patients were infected with Plasmodium vivax. By the time the patients arrived at this hospital no P. falciparum was found. Perhaps the atabrine already dispensed accounted for this. Furthermore no blackwater fever was observed and this, too, was probably explained by the absence of falciparum infection. Only twice was a mixed infection observed.

Frequently a thick smear was repeatedly negative in patients in whom malaria was suspected. Sternal puncture occasionally disclosed the plasmodium when the ordinary thick smear, or one following administration of epinephrine, was negative.

A positive Kahn test was obtained in 15 to 20 percent of the malaria patients. Complications that simulated appendicitis and renal calculus, combinations of diseases such as malaria and dysentery, malaria and hookworm, and malaria and scrub typhus, were not infrequent. Often in examining a thick smear preparation the laboratory reported an unsuspected eosinophilia. No contraindication to atabrine was found in any of these latter diseases.

A point that has been emphasized frequently but bears repeating is the absolute necessity for close scrutiny of the dispensing of the atabrine. The hospital corpsman must stand by throughout the entire act of swallowing the tablets.

Filariasis cases were mild and did not present any lymphangitis. However a thickened spermatic cord was often present and an upper extremity occasionally became swollen after exercise. Some patients complained of chronic fatigue, especially in the morning after a few hours' work.

Patients with tsutsugamushi fever (mite typhus or scrub typhus) were admitted to this hospital from nearby islands. Malaise, headache, chilliness, even chills, fever as high as 104° and 105° F., and a macular rash on the face, chest, trunk and extremities were observed. The primary ulcer (bite) became black, that is, necrotic, and the regional lymph nodes enlarged. Later a generalized lymphadenopathy often appeared. The skin was sensitive and the conjunctivae injected. An enlarged spleen, a leukopenia, and a positive Weil-Felix agglutination reaction definitely established the diagnosis.

The disease was much more severe than the endemic typhus seen in the United States. The patient was critically ill, and there was a long period of convalescence. Patients were admitted to the hospital fully 6 months after the onset of the disease because they tired easily and developed a tachycardia on slight exertion.

Hookworm was common. Stool examinations for parasites were made on patients who were debilitated and revealed secondary anemias or who presented an eosinophilia in ordinary blood smear or in a smear taken for malaria. It was estimated that 10 to 20 percent of Marines who had been fighting and living in jungle territory for 6 months or more had hookworms in the stools. Only a few presented clinical hookworm disease. The stools of native labor battalions on this tropical island were examined and 90 percent were found to show parasites of this disease. In natives from a nearby island the percentage was practically one hundred.

Two patients with Strongyloides stercoralis were seen and in one patient the larva was found in the sputum. No enteric-coated tablets of gentian violet were on hand, so 15 cc. of a 1-percent aqueous solution was instilled into the duodenum.

Diphyllobothrium latum and Hymenolepis diminuta were observed. No oleoresin of aspidium was available but carbon tetrachloride was used with success.

One case of larva migrans, produced by the cat or dog hookworm, was seen. The larvae had burrowed in a serpiginous fashion in the skin on both lower extremities, producing a highly pruritic macular tunnel.

CARDIAC DISEASE

Tachycardia was a diagnosis commonly made. It was usually a part of the picture of neurocirculatory asthenia or effort syndrome. The tachycardia was caused by the tropical heat, humidity, and work under these conditions. No organic disease in the ordinary sense was evident. The patient was usually of the long, thin type with a slender or "small heart." The writer is of the opinion that this "small heart" is congenital and insufficient for exertion or for the strain placed on the cardiovascular system by tropical conditions. The response to standardized exercise disclosed a lag in return of systolic blood pressure and pulse rate, and an electrocardiogram revealed RS-T depressions and T-wave inversions following this standardized exercise (Master 2-step). These changes did not occur in the normal individuals.

Excessive smoking was an aggravating factor, perhaps even a precipitating factor. A mild bronchitis was occasionally present in this type of patient. The tachycardia seemed to become worse and many of these patients had to be sent to a cooler area.

One case of chronic cardiac valvular disease (mitral and aortic valve involvement), one case of coronary sclerosis, and only one case of coronary occlusion were found.

Headache was often a chief complaint, occurring frequently in

malaria and dysentery. Numerous patients were studied in whom the cause of the headache was obscure. Sinusitis and eyestrain were frequent causes. The glare from sun reflections on clouds, coral, and water was marked, and had tinted eyeglasses been available they might have relieved some of the headaches.

Experience with penicillin was only recent. So far about forty patients suffering from sulfonamide-resistant gonorrhea, pneumonia, empyema, pelvic abscess, and a severe generalized pyodermic infection, have been successfully treated with penicillin.

In addition to the type of medicine classed possibly as "war medicine," we have seen patients of the type observed in the large general hospitals in the States. In one week a man of 27 years with acute gout, a Seabee, aged 24, with diabetic acidosis, a patient with osteoporosis, and one with a large hydronephrotic kidney, were admitted.

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ENERGY EXPENDITURE IN SWIMMING

The energy cost of swimming crawl, back, breast, butterfly and side strokes at speeds not greater than 2 ft./sec. was found on twenty-four subjects of both sexes.

Swimming at speeds higher than 2 ft./sec. should be considered a vigorous exercise because metabolism rises to more than 10 times the basal rate. At speeds beyond 5 ft./sec. metabolism may be more than 100 times higher than basal. Unskilled swimmers expend 2 to 5 times as much energy as skilled swimmers. Fluctuation between individuals is greater for the lower speeds than the higher ones.

The swimming strokes may be arranged in order of increasing energy cost as follows: Crawl, back, breast, and side. This relationship holds true for any corresponding speed. The butterfly stroke, however, has certain peculiarities. It is the least economical of the five strokes under 2.5 ft./sec. Above this speed it becomes more efficient than the side stroke and at 3 ft./sec. it is more economical than the breast stroke.

A greater fatiguing effect of the butterfly stroke as compared with the breast style may be due to local fatigue of the shoulder girdle muscles.

No sex difference in the relative cost of swimming was observed.—KARPOVICH, P. V., and MILLMAN, N.: Energy expenditure in swimming. Am. J. Physiol. 142: 140-144, August 1, 1944.

SPECIAL PROBLEMS IN ACUTE RHEUMATIC FEVER

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Rheumatic fever, especially the acute stage, presents some interesting and unsolved problems. Among the more important are those concerning the causation of the disease and its early accurate diagnosis, the public health aspects of the disease in the armed forces, the disposition of the man with a rheumatic history before entrance into the service, and the disposition of the man who "recovers" from an acute attack incurred while in service.

From a public health viewpoint rheumatic fever is comparable to syphilis and tuberculosis. In recent years the predisposing geophysical and socioeconomic factors have received much literary emphasis, so that their influence both on the incidence, course, and recurrences of rheumatic fever has become almost axiomatic. According to Paul (*1*), the differences in the concept of the disease, the difficulties in making the diagnosis and the absence of any specific diagnostic test contribute to the indefiniteness regarding the incidence of the disease in any given geographic area. It is commonly agreed, nevertheless, that cold and dampness, crowded living conditions, lack of sunlight and undernutrition are epidemiologically recognizable predisposing factors and form a common denominator for the majority of cases.

Infection with hemolytic streptococcus, therefore, becomes of primary importance etiologically in considering the public health aspects of the disease in the armed forces. Although the exact place of the hemolytic streptococcus in the pathogenesis of rheumatic fever is not clear, it appears that from the studies of Coburn and Pauli (*2*), Todd (*3*), Swift and Hodge (*4*), and Boisvert (*5*), concerning the immunologic reactions that occur in rheumatic fever, infection with hemolytic streptococcus must be held accountable. Consequently rheumatic fever in the armed forces should be held in the same light as meningococcal infections.

Crowding of raw, unseasoned young men in World War I has been shown by Glover (*6*), to have raised the rate of hemolytic streptococcal infections of the upper respiratory tract, which in turn was followed by rheumatic fever. These same conditions were accompanied by a rise in the meningococcal carrier rate. Swift

(*7*), contrasts the status of a rheumatic patient to a person with open tuberculosis.

The importance of rheumatic fever, therefore, as a public health problem becomes threefold: (*1*) The relationship of crowding, fatigue, exposure to cold and dampness to the transmission of hemolytic streptococci initiating an upper respiratory infection to be followed by rheumatic fever; (*2*) the status of the "recovered" rheumatic who has been discharged back to duty to the same conditions that gave him his rheumatic fever; and (*3*) the status of the recruit with a history of rheumatic fever or any of its equivalents prior to entrance into the service.

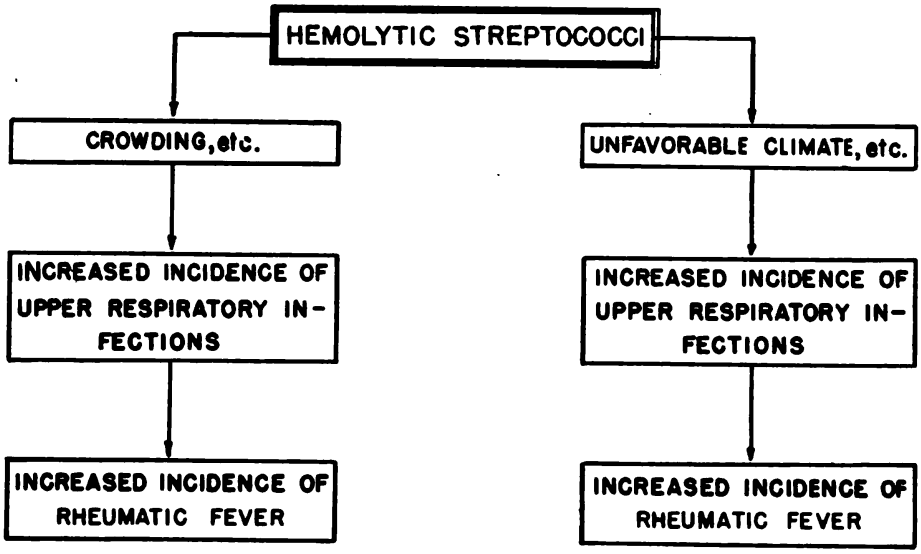
These last two points evoke the separate problem of individual susceptibility. Paul and Salinger (*8*) suggest that the rheumatic patient who has recovered from one attack is a specially susceptible subject. Coburn (*9*) speaks of the faulty disposal of Streptococcus haemolyticus within the rheumatic or potentially rheumatic patient.

Characteristic of rheumatic fever are its recurrences. Whether these are due to a peculiar organ susceptibility or to subclinical continued activity that flares up under adverse conditions it is impossible to state at the present time and the lack of an adequate explanation for recurrences makes the problem all the more serious.

ETIOLOGIC STUDIES

Geophysical factors in the incidence and course of rheumatic fever have been extensively reviewed by Swift (*7*) and Paul (*1*). The weight of evidence shows that the incidence of rheumatic fever is greater in cold, damp areas and less in warm, dry areas. The principle objection to this statement is that the data was compiled from mean annual death rates per 100,000 from heart disease in age groups 5 to 24 years, and moreover from mortality rates for rheumatic heart disease and not rheumatic fever. Hedley (*10*) pointed out, however, the value of using cardiac mortality rates in the age group 5 to 24 for estimating trends in mortality from rheumatic heart disease. With only a small exception, cardiac deaths in that age group are from rheumatic heart disease. Rheumatic heart disease presupposes acute rheumatic fever. The analysis of hospital admission rates and studies on the incidence of rheumatic heart disease in school children also helps to determine the incidence of rheumatic fever.

Atwater (*11*), Rosenau (*12*), Schlesinger (*13*), Collis (*14*), and Zuger (*15*), have demonstrated the statistical increase in both upper respiratory infections and rheumatic fever in winter



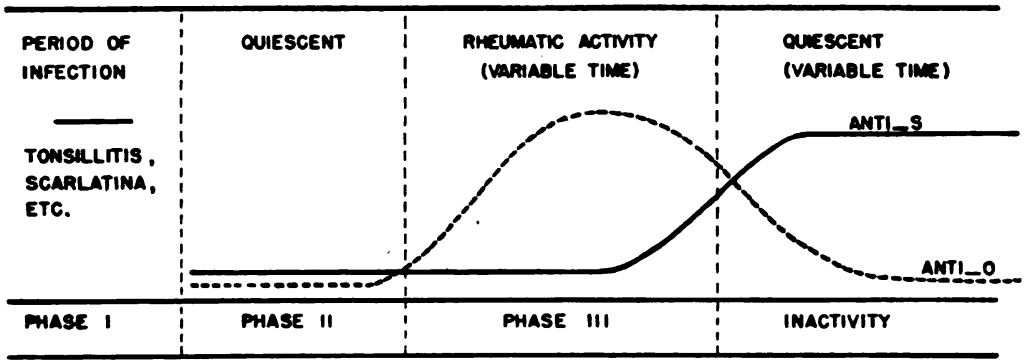
months. Paul believes that the association between upper respiratory infections and rheumatic fever is clear enough, and probably means that both an increase of upper respiratory infections and crowding indoors are concomitant in winter, one dependent on and responsible for the other. Another piece of evidence in the patchwork argument regarding the cause of the disease is the demonstration of parallelism between the incidence of scarlet fever, acute tonsillitis and erysipelas (hemolytic streptococcal infections) and active rheumatic fever, with a demonstrable lag of several weeks in the peak of the latter following the peaks for the other infections (*16*).

Socioeconomic factors have been studied extensively by English and American observers. Paul (*17*) has found a high incidence in damp dwellings, and in the poor (*18*). An interesting fact is brought out by Swift (*7*). He reviewed the work of Fernando (*19*) and Stott (*20*) who found a fairly high incidence of rheumatic heart disease among natives of Southern India and Ceylon with the same differences in incidence among the wealthy and poor as in New York and London. Hence it was inferred that poor housing, undernutrition, poor ventilation, and uncleanliness are important etiologic factors in the tropics.

A double mechanism as seen in the above outline for the propagation of hemolytic streptococci might therefore be involved.

Thus the optimum combination for respiratory infections and for rheumatic fever would be a combination of both, such as seen in the crowded east side of lower Manhattan in late winter or early spring.

The exact position of the hemolytic streptococcus as the precipi-



tating agent is still undetermined. Coburn and Pauli (*2*) describe the course of events in three phases: Phase I, the acute infection with β-hemolytic streptococci; Phase II, quiescent period; and Phase III, rheumatic activity.

The study of the immunologic reactions during these phases has fortified the belief in the hemolytic streptococcus as the precipitating agent. Todd in 1932 first observed a rise in the antistreptolysin titer during these phases. The specific antigen is known as the oxygen-labile streptolysin-O. Later Todd (*21*) described a second antigen, oxygen-stable streptolysin-S. Following a streptococcal infection in general there is a rise in titer of both antibodies.

Todd, Coburn, and Hill (*22*) showed that antistreptolysin-O was higher during rheumatic activity and a decrease occurred as the process became inactive, whereas antistreptolysin-S was higher during recovery and low during the acute phase. This can be illustrated schematically. This seems to be positive evidence that patients with or recovering from rheumatic fever have an active, or recently active infection with the hemolytic streptococcus.

At present there is no way of knowing whether rheumatic activity represents an hyperergic phenomenon, or whether an unknown factor exists, as yet undescribed. Certainly the concept of Schlesinger and associates (*23*) and Eagles and his coworkers (*24*) about elementary bodies isolated from the serum of patients with active rheumatic fever has been disproved (*25*), as has a virus causation. Pleuropneumonia-like organisms were once implicated. Thus it appears that the final answer concerning the cause of rheumatic fever is yet to be written.

DIAGNOSIS

Sir William Osler is said to have described rheumatic fever as a disease that licks the joints, but bites the heart. Although in most cases the "bite" occurs despite an early accurate diagnosis and management, quite frequently, especially in young adult males, the

early accurate evaluation of the case and proper management may save him from serious sequelae. When confronted with a case suspected of being acute active rheumatic fever, the physician should first determine whether heart disease exists. In other words, the case should be classified as rheumatic fever with rheumatic heart disease, or as rheumatic fever with potential heart disease.

No case of acute rheumatic fever should ever be considered entirely free of heart disease; once the etiologic stigma exists, the potentiality of heart disease is ever-present until the activity has subsided. Even then morphologic cardiac changes may have occurred, to be demonstrable at a later date or by more accurate observations. Between 50 and 60 percent of all cases of rheumatic fever have some cardiac involvement, which may not necessarily be demonstrably permanent damage.

Another fact of importance to the physician is whether the attack is the first, or whether the patient had rheumatic fever in any manifestation previously. A positive past history places the case in an acute active recurrent rheumatic fever category and increases the possibility of heart involvement. There may be no present evidence of heart disease; this does not exclude, however, potential heart disease. There may be, however, acute rheumatic heart disease, evidence of old cardiac involvement alone, or signs of old and recent involvement. If the latter, the heart disease is considered active and inactive.

The recent antecedent history is of importance in a case of polyarthritis. An upper respiratory infection, tonsillitis, pharyngitis, or scarlatina from 1 to 5 weeks previously should immediately suggest the possibility of rheumatic fever. The absence of such a history however, should not militate against the diagnosis in the presence of clinical symptoms.

Typically, rheumatic joint involvement is a migratory polyarthritis, lingering a few days usually in the knees, ankles, wrists, elbows, or shoulders, and involving first one joint, then another, sometimes with fleeting rapidity. The joint may become red, hot and swollen, with motion exquisitely painful; just as often, these symptoms are absent. The small joints of the hands or feet, the sternoclavicular, costovertebral or intervertebral joints may be involved. Frequently too, a rheumatic synovitis, or myositis may be present; rheumatic torticollis occurs when myositis of the sternocleidomastoid muscle is present.

The systemic temperature in the acute stage is usually between 100° and 101° F. It is rarely higher than 103° F. Fatigue is prominent. Sydenham's chorea, rarely seen under 5 years of age, and present more often in females than males, is the central ner-

vous system manifestation of acute rheumatic fever. The skin is also a site of rheumatic manifestation. Subcutaneous nodules, small movable masses felt over joints or in the scalp are the most common cutaneous signs; erythema multiforme, usually the marginatum type, erythema nodosum, and purpura rheumatica are rarer manifestations. Abdominal pain, presumably from intra-abdominal mesodermal infiltration, is occasionally seen and may be severe enough to initiate exploratory laparotomy. Rheumatic pleurisy and iritis are debatable manifestations. Epistaxis is sometimes present.

Carditis, or more accurately, pancarditis, is the term applied to acute cardiac involvement; the myocardium, endocardium, including the valves, the aorta and occasionally the pericardium are involved in the process. Even the coronary arteries may suffer a periarteritis. The condition is suspected on examination when tachycardia exists greater than that which would be expected from the temperature, from an enlargement of the heart, from a prolonged or roughened first mitral sound, or from the acquisition of an arrhythmia exclusive of sinus arrhythmia or tachycardia. The diagnosis is almost certain if there is present a short apical systolic murmur, particularly if none previously existed, or if the murmur lengthens and is transmitted to the left and is accompanied by a middiastolic localized apical puff.

It is to be understood that these murmurs do not mean permanent valvular damage; the usual mechanism of their production is valvular edema with fibrinoid exudate, and a relative insufficiency (incompetency) of the valve by dilatation of the ventricular chamber. In the same way, aortic or tricuspid valvular involvement may occur. Scarring and deformity of the valves, and verrucous growth on opposing cusp edges are manifestations of chronic heart disease. Pericarditis with effusion may occur; it is suspected when the patient complains of substernal pain and when the temperature begins to climb; when an apical leathery to-and-fro friction rub synchronous with the heart beat is heard. Later as fluid collects in the pericardial sac, the rub seems to move toward the base, and the heart sounds become quieter and cardiac dullness is increased. Ewart's pulmonary compression signs at the angle of the left scapula are also diagnostic aids.

The laboratory aids to the diagnosis are several in number. The erythrocyte sedimentation rate is a delicate test of infection; it was considered by Struthers and Bacal (*26*) to be the most delicate test of rheumatic activity. They found that it required months for a return to normal. Clifton (*27*) however, showed that chorea was the only rheumatic manifestation characterized by a normal

sedimentation rate. Conversely Wasson and her coworkers (*28*) are of the opinion that it is an error to assume the presence of rheumatic infection when an elevation of the sedimentation rate is the only evidence.

The leukocyte count, although a general index of infection, is considered unreliable for gaging the extent of activity. The neutrophil count (Schilling count) has been extolled by Wasson as an invariable index of infection, often a severe one, whereas King (*29*), Rogatz (*30*) and others deprecate its value because of the early return to normal, which is long before the sedimentation rate returns to normal.

Capillary resistance is found by Wasson and her associates to be greatest in acute rheumatic fever patients with epistaxis; the lowest erythropermeability being present in spring months when the incidence of acute attacks is greatest.

In two-thirds of the patients with rheumatic fever a reduced platelet count occurs. Tocantins (*31*) observed thrombocytopenia during acute stages of infectious diseases including rheumatic fever. Wasson corroborated this observation for rheumatic fever, finding a progressive reduction of platelets during the initial phases of an acute attack, with a marked fall during the later weeks followed by a rapid rise.

Hemoglobin determinations are of value in determining severity or activity only if serial estimations are made in a given case.

The electrocardiogram aids in the diagnosis of carditis in the absence of audible murmurs or demonstrable cardiac enlargement. If the PR interval is greater than 0.20 seconds when corrected for age and heart rate, auriculoventricular conduction time has been impaired, and carditis is present. An arrhythmia exclusive of sinus arrhythmia or sinus bradycardia in the presence of other signs of activity of a rheumatic nature is also considered evidence of carditis; whereas P-wave changes thought to be seen in auriculitis, QRS changes in shape, ST segment abnormalities, T-wave changes, alteration in the deviation of the electrical axis are highly suggestive, especially if seen in serial records. These latter changes are not diagnostic by themselves, however, and great caution should be taken against overemphasizing the importance of minor deviations from normal. More reliance should be placed in the total clinical picture.

The usual clinical signs of activity are joint or muscle pains, an elevated temperature, chorea and skin manifestations, an increase in sedimentation rate, an elevated leukocyte count, and electrocardiographic evidence, particularly an increased PR interval. A combination of two or more of these signs should be taken as positive

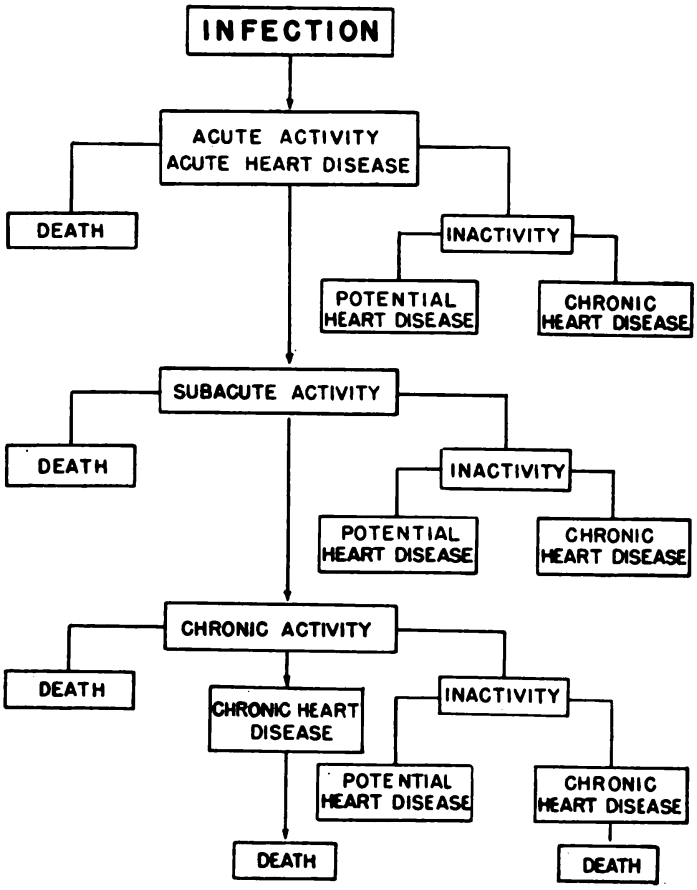
evidence of continued activity of the disease, with the exception of fever and leukocytosis, with or without an increased sedimentation rate. The continued elevation above normal of these signs may mean continued activity, but also may mean infection of another nature elsewhere in the body.

The prolonged elevation of the sedimentation rate in the absence of other signs should initiate a search for a cause such as an anemia, a low-grade infection focus, a tuberculous focus, or a malignancy. Similarly a persistent leukocytosis by itself, or low-grade temperature curve should stimulate a search for some other cause. A prolonged A-V block after all other signs of activity have disappeared should initiate investigation of vagus hyperactivity which may be abolished by atropine. Prolonged joint pains may, in some as yet unexplained manner, be caused by an esoteric alveolar abscess, or by a chronic prostatitis. These, however, are ruled out should there be present a Sydenham's chorea. Sutton and Dodge (*32*) found that rheumatic heart disease develops in about 20 percent of patients who have chorea as the only clinical manifestation; there is an even chance of developing rheumatic heart disease if a child begins his rheumatic career with chorea.

Similarly when subcutaneous nodules or when erythema multiforme with other rheumatic manifestations are present, no diagnostic problem presents itself. In patients with a polyarthritis, or a monarthritis, with no other contributory clinical evidence, differentiation becomes difficult. Joint and muscle pain is present in many forms of illness; the more common are rheumatoid arthritis including Still's disease, tuberculosis, gout, chronic foot strain, and osteoarthritis. Less common but none the less important from a differentiation viewpoint are syphilis, brucellosis, leukemia, bursitis, fibrositis, and epiphysitis.

It must be remembered that infectious diseases such as osteomyelitis, chancroid, lymphogranuloma venereum, focal infections, amebic and bacillary dysentery, cerebrospinal fever, influenza, lobar pneumonia, puerperal fever, scarlatina, subacute bacterial endocarditis, and typhoid fever may present an arthritis as a manifestation at any point in their course. Rarer causes of arthritis are neuropathies (syringomyelia), psoriasis, climacteric, pulmonary osteoarthropathy, serum sickness, Barlow's disease, sickle cell anemia, hemophilia, Felty's syndrome, poliomyelitis, multiple peripheral neuritis, ulcerative colitis, and Haverhill fever.

The use of the terms active and inactive, acute and chronic, presents other diagnostic problems. The words active and inactive refer to the presence or absence of infection; the infectious process may be acutely, subacutely, or chronically active; these are arbi-



trary time limits for particular periods of the disease. In acute activity there is acute heart disease, but inactivity may develop leaving a permanently damaged heart which goes on to chronic heart disease. Similarly chronic heart disease can occur after subacute activity or chronic activity. The above diagram will help to clarify the terms.

RHEUMATIC FEVER IN THE ARMED FORCES

Concerning rheumatic fever in the armed forces, there are those predisposing factors that are present in the training of men, and certainly present in the environs of the actual fighting forces. Meningococcal infection in the first world war was adequately handled by proper spacing of beds in the barracks, and gradual seasoning of raw recruits. Similarly improving the living conditions of the serviceman today would remove considerably the factor called socio-economic in civilian life. The geophysical factor seems insurmountable, there are fighting forces in every temperature zone of the globe and hence rheumatic fever should be recognized as a public health problem in the armed forces.

The "recovered" rheumatic person remaining in the armed service offers another problem. By "recovered" is meant the patient who becomes free of activity and who has no detectable signs of cardiac involvement. Master (*33*) believes that once a member of the armed forces develops rheumatic fever while in service he should not be retained. This may seem a radical procedure, but it has merits. Recurrent active rheumatic fever is of frequent occurrence. There was one boy included in this study who had seven attacks in three years, each of the last six occurring after a return to duty following discharge from sickbay or hospital. If it is true that one attack predisposes to others, or that rheumatic fever is a continuous chronic disease with recrudescences, then it would seem fair to the individual to remove him from conditions unfavorable to his disease.

On the other hand refusal to accept into the armed forces individuals who have a previous history of rheumatic fever seems equally a fair policy. One might argue that returning the unsuccessful candidate for the service to his original environment, and the recovered serviceman to his, would in no way prevent recurrences, because in most cases the home environment is even less salubrious. The indefinite position of geophysical and socioeconomic factors in the production of the disease, however, suggests a middle road. A return to duty for those mildly infected, who after a suitable period of convalescence have no clinical evidence of heart disease and who have demonstrated their individual importance to the service, is in order. But this group should be kept small. Perhaps the final answer will come when the incidence of recrudescences among recovered patients returned to duty is studied, and compared with the recrudescences among those recovered and discharged from the service. Certainly if a draft quota can be suitably made up from a given area excluding those with a definitely established rheumatic fever history, these should be denied entrance into the service equally as well as the man who has an enlarged heart or an apical systolic murmur.

SUMMARY

1. Predisposing causative factors of rheumatic fever are discussed. There is good evidence that geophysical and socioeconomic factors are of importance in the production and course of the disease.

2. Immunologic studies indicate that the β-hemolytic streptococcus is an etiologically significant precipitating factor in rheumatic fever.

3. Early and accurate diagnosis and management of the acute stage will prevent serious sequelae.

4. Rheumatic fever is of epidemiologic importance in the armed forces.

5. It seems best to discharge most recovered patients with rheumatic fever from the armed forces; some indispensable few should be returned to a trial of duty.

6. Wherever feasible induction centers should exclude those with a positive history of rheumatic fever.

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SUPPRESSION OF URINE COMPLICATING SULFADIAZINE THERAPY

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Urinary suppression is one of the more serious complications of sulfonamide therapy. During an 8-week period early in 1944, 5 cases of complete urinary suppression were seen by the Urologic Service at this mobile hospital. During this same period 1 patient with severe oliguria was also treated. All 6 cases followed the administration of sulfadiazine.

The histories given by these patients prior to their admission to this hospital were fairly similar. They had reported to their battalion or regimental sickbays with the following complaints. Three had upper respiratory infections and the other three had respectively, otitis media, urinary frequency, and diarrhea. After the preliminary diagnosis had been made, the patients were given sulfadiazine. The total doses varied from 18 to 20 gm. within a period of from 3 to 5 days. With the exception of the patient with oliguria, the others stated that they had not increased their fluid intake while receiving the medication. Four patients were treated on an ambulatory status. The remaining two, one of whom developed the oliguria, were hospitalized in their local sickbays.

Painless hematuria was the first objective symptom in the cases of complete suppression. Flank pains, abdominal pains, dysuria, burning on urination, and nausea and vomiting followed the hematuria within 12 hours. During this period the urinary output diminished and finally the patients ceased to void. Catheterizations at the local sickbays revealed the bladder to be dry. The patients were transferred to this hospital from 12 to 72 hours after this complication developed.

When the one patient with oliguria developed the flank pain and urinary symptoms, chemotherapy was withdrawn, fluids forced, and alkalies given immediately. At the time of his admission to this hospital he was voiding small amounts of urine. The urine showed a positive sulfadiazine test. Complete recovery was rapid and the patient returned to duty in 5 days.

Cystoscopy was performed on all the patients with urinary suppression shortly after their admission, and an attempt was made to pass ureteral catheters. This was successful on the right

side in two patients and bilaterally in the third; it was unsuccessful in the two remaining patients. The catheters were left in place for 24 hours and irrigating fluids were instilled every 2 hours. Fluids were given intravenously and by mouth as tolerated. Alkalies in the form of sodium bicarbonate and sodium citrate were also administered. It is worthy of note that these three patients were seen within 24 hours after the onset of the suppression, and treatment was instituted within that period. The blood nonprotein nitrogens were elevated slightly in two of these cases and to 61.2 mg. percent in the third. The blood sulfadiazine level was done only in the third case and it was 3.75 mg. percent. Recovery was complete in these cases and microscopic hematuria disappeared within 4 days. Two patients were discharged to duty in 5 and 10 days respectively and the third was evacuated for prolonged convalescence for reasons other than his urinary complaints.

In 2 cases the ureteral catheters could not be passed. The first of these patients was seen 36 hours after the onset of urinary symptoms. His blood nonprotein nitrogen level was 54.86 mg. percent and his sulfadiazine level was 5.28 mg. percent. Fluids were given intravenously and by mouth as were alkalies. The patient voided spontaneously within 18 hours and his recovery was uneventful. He was discharged to duty in 6 days.

The last patient was not admitted to this hospital until 72 hours after the onset of his urinary suppression. This occurred after 2 days of sulfadiazine medication. The drug, however, was continued for a third day, and 2 more days elapsed before any treatment was instituted. When first seen the patient was very drowsy and had edema of the face and eyelids. He was unable to retain food or fluids. His nonprotein nitrogen was elevated to 40.7 mg. percent, and his blood sulfadiazine level was 7.7 mg. percent. He was cystoscoped daily for 3 days and all attempts to pass ureteral catheters were unsuccessful. His bladder continued to remain empty. His nonprotein nitrogen rose to 94.7 mg. percent and his blood pressure to 154/120. A venesection was done and 500 cc. of blood was removed. This lowered his blood pressure slightly, but had no effect upon his increasing drowsiness. Intravenous fluids and alkalies had been given with no effect.

On his fourth hospital day, the patient, in critical condition, was taken to the operating room. Under spinal anesthesia his left kidney was exposed. A completely intrarenal pelvis was found and an opening was made in the upper ureter. Approximately 30 cc. of clear urine gushed out under marked pressure. Following this a nephrostomy was done and the wound closed with the nephrostomy tube in place. During the first twenty-four postoperative

hours he passed 2,000 cc. of urine through the tube. On the third day he voided spontaneously. At this time his blood nonprotein nitrogen had fallen to 39.2 mg. percent. On the fourth day drainage through the nephrostomy tube ceased. The tube was removed on the sixth day and his recovery has been uneventful. At the present time, 20 days after the operation, he is ready for discharge to duty.

Cystoscopic examination presented a similar picture in all patients. The mucosal membranes were reddened, the trigones injected, and the areas surrounding the ureteral orifices showed marked bullous edema. Extruding from and completely filling the orifices were densely packed masses of thick and adherent whitish material. The intravesical portions of the ureters were distended simulating the appearance of a calculus impacted in that area. Attempts were made to break the obstructions with the tips of the ureteral catheters and to pass the catheters to the pelvis. Where this procedure was successful, it was observed that the obstructing material extended a distance of not more than from 1 to 1½ cm. above the ureteral orifice. This distance was determined by manipulations of the catheters. Bright red blood as well as old clots were seen coming from the orifices during this procedure. In the operative case the upper ureter and pelvis were found to be completely free from any macroscopic crystals.

Once the obstruction in the lower ureter was overcome, the catheters passed to the renal pelvis with no difficulty. From gross inspection clear urine under increased pressure was found in these patients. Within a few minutes, the flow of urine through the catheters appeared normal. Where this procedure was not successful, there occurred a spontaneous disappearance of the obstruction and eventually a resumption of a normal urinary flow.

From these observations the causative mechanism involved can only be surmised. The pressure of the crystalline masses in the intramural ureter may result in fatigue and consequent relaxation of the surrounding musculature. That, combined with the hydrostatic pressure, may be sufficient to force the crystalline mass into the bladder. In none of these patients were typical symptoms of ureteral colic present, although the obstructing material acted in much the same manner as a calculus.

The findings revealed in these cases show that the crystals tend to coalesce and pack in the intramural portion of the ureter. This is the narrowest portion of the ureter, and is always under pressure of the surrounding bladder musculature. Once the block has started, the crystals which are present in the urine gather in this area and increase the density of the obstruction. A large intake

and high blood level of the drug are not necessary factors in the development of urinary suppression. With a diminished renal output, whether due to extrarenal loss of fluids or insufficient intake even in the presence of low sulfadiazine levels, a few crystals may pass out of solution, coalesce, and become obstructed in the lower ureter causing the suppression of the urinary flow.

It is interesting to speculate what effects the tropics have in producing the syndrome. Its occurrence has been described frequently in the temperate zones. However in this area the proportion of the total body fluid output lost through renal excretion is greatly diminished. The amount of fluid lost through the skin is greatly increased. Examination of any casual urine specimen in the healthy as well as the sick reveals the presence of large quantities of phosphates, carbonates, or oxalates, depending upon the acidity or alkalinity of the urine. The majority of patients with ureteral colic which pass through this hospital show no evidence of urinary tract pathosis. An increase in the urinary crystals, and frequently a microscopic hematuria are generally the only positive findings. A reversal of the urinary pH and an increased urinary output, for the most part, are all that is necessary to relieve these patients of their symptoms.

Whether or not there is any relationship or dependence of the sulfadiazine crystals upon the other crystals which form the obstruction could not be determined. At no time, however, has a true obstruction of more than a very transient nature been seen which was caused by phosphates, carbonates, or oxalates alone.

CONCLUSIONS

1. The crystallization of sulfadiazine in the urinary stream may in some patients cause a suppression of urine by forming an obstruction in the lower end of the ureter. Renal pathosis will be secondary to this obstruction and dependent upon the duration of the back pressure.

2. Hematuria is one of the earliest signs of sulfadiazine crystallization in the urine. This finding should be an indication to stop the therapy, increase fluid intake, and promote alkalization of the urine. Early recognition of this complication and immediate therapy will frequently limit the severity of the condition and possibly avoid the necessity of surgical intervention.

3. Cystoscopy and ureteral catheterization are advisable in every case. If the catheters can be passed to the renal pelves they should be left in place for at least 12 hours and fluid instilled frequently. If the catheters cannot be passed, and recovery is not spontaneous within a period which can only be determined by the

clinical course of the patient, a nephrostomy or pyelostomy is indicated.

4. Patients who are receiving chemotherapy should take sufficient fluid to keep their urinary output above an arbitrary figure of 1500 cc. daily. The maintenance of urine with an alkaline reaction is advisable.

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ANTACID EFFECTS ON GASTRIC pH

Addition of calcium carbonate to milk enhances the buffering properties of the milk, which, in turn, prevents the calcium carbonate from causing an excessive pH rise. The prolonged effect of the combination would also avoid the often unpleasant necessity of repeated administration of milk alone at frequent intervals.

Similarly, the combination of milk of magnesia and colloidal aluminum hydroxide results in more prolonged effect than colloidal aluminum hydroxide alone, with the subsequent necessity of smaller and less frequent doses. The undesirable initial rise in pH resulting from the use of milk of magnesia alone is avoided, and the constipating effect of aluminum hydroxide is offset. The milk of magnesia content may be varied from 4 to 15 cc. without raising the pH of the resultant mixture above 7.5, and affords a means of supplying any desired laxative action.—ROSETTE, N. E., and FLEXNER, J.: Effect of certain antacids in man measured by simplified method for continuous recording of gastric pH. Ann. Int. Med. 21: 119-121, July 1944.

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SENSITIVITY OF THE HUMAN EYE

Under the most favorable conditions, the smallest amount of light which the human eye can detect is 58-148 quanta, representing an energy of 2-6 x 10^{10}- ergs. This 58-148 quanta is the amount of light falling on the cornea, but only about 10 percent (5-14 quanta) of this is actually absorbed by the retina; the rest is lost by corneal reflection (4 percent), absorption by ocular media (50 percent) and passing on beyond the retina (36 percent.) The 5-14 quanta were absorbed by an area of retina which contained about five hundred receptor cells (rods). It seems reasonable to suppose, therefore, that each quantum was absorbed by a separate receptor cell. Chemical studies have shown that one quantum of light changes (bleaches) one molecule of visual purple. The conclusion reached is that we can see a light when the energy from it is sufficient to bleach one molecule of visual purple in each of 5-14 separate receptor cells.—HECHT, S.: Sensitivity of human eye. Nature, London 154: 13, July 1, 1944.

FLUOROSCOPIC HAZARDS

INCLUDING USE OF UNPROTECTED RADIOGRAPHIC SCREENS

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Fluoroscopy has been in extensive and ever-increasing use since the discovery of the x-rays by Wilhelm Conrad von Roentgen in 1895. Much has been learned about these rays since then, but it can still be said that not only is there room for much more knowledge, but that there is also a very regrettable need for wider dissemination and appreciation of what is now known.

One difficulty is that knowledge of the pertinent facts about fluoroscopy brings into the picture the need for hampering restrictions and annoying precautions. There is a tendency to shrug off such details, and in fact, since the effects of such recklessness are often slow, insidious, and haphazard in making an appearance, the uninitiated are apt to become impatient over admonitions.

Be that as it may, the fact remains that carelessness persists and that radiation injuries to fluoroscopists are far from rare and often severe. It is thus worthwhile, especially in view of war conditions, to review fluoroscopic hazards and record some further studies.

The first consideration is the amount of radiation employed. Table 1 will provide the answer to this for the usual physical factors involved. Two self-rectified, oil-immersed, shockproof units were used for test purposes as representing types of apparatus in very frequent use, especially in the field and aboard ship.

TABLE 1.—*Fluoroscopic radiation intensities*

Target distance in inches	Kilovolts	Milliamperes	Radiation in r per minute		
			Machine A ½ Al filter*	Machine B ½ Al filter*	Machine B No filter*
10	65	3	19	.....	.....
10	75	3	23	.....	.....
10	85	3	29	.....	.....
10	65	5	32	.....	.....
10	75	5	39	.....	.....
10	85	5	46	.....	.....
12	65	3	13.5	12	19
12	75	3	16.5	14.5	23
12	85	3	19.5	.....	.....
12	65	5	21	20	33
12	75	5	26	23.5	38
12	85	5	32	.....	.....

*Inherent filtration equivalent 0.5 mm. Al.

This table indicates the serious possibilities of danger. Thus, for instance, at an anode distance of 12 inches, which is one apt to be employed, and with the often-used current of 5 ma. and 75 kv., the intensity will be about 25 r per minute with a filter in place (0.5 Al). Omission of the filter causes an increase to 38 r per minute. Since threshold erythema is likely to result from 250 to 300 r, it follows that exposure to about 10 minutes of such radiation will produce this effect. Naturally if no more than erythema were involved there would be no need for concern, but unfortunately such is not the case.

There is, as should be well known, the matter of cumulative deleterious effects which often, and perhaps without any acute erythema, eventuate in skin atrophy, chronic dermatitis, telangiectasis, chronic ulcers and at times malignancy. Nor does the picture cease here. Even small doses if frequently repeated lead to insidious effects, such as lowering of the erythrocyte and leukocyte counts, obscure damage to the germ plasm, sterility and probably other conditions. It is, therefore, *a prime necessity for those doing fluoroscopy regularly to avoid all exposure to direct x-rays.*

Further, it has been estimated that general exposure of the body resulting largely from stray and secondary radiation should fall below 0.1 r per day—a very small amount. It is estimated that a day's work in a fluoroscopic room will call for approximately one hour of active tube operation due to intermittence of exposure. This affords, therefore, a convenient method of figuring probable exposure.

In general the figures may be said to indicate that aside from cumulative and insidious effects, the patient, fluoroscopist, or both might receive a dangerous amount of radiation in the course of a single examination.

Inasmuch as usually only the patient comes close to the x-ray tube, the patient absorbs most of the radiation. However, especially in attempted reduction of fractures under fluoroscopic guidance, the hands of the operator will be exposed unless the procedure is followed of limiting fluoroscopic observation to intervals between manipulation. In this procedure, the operator's hands can be kept out of the direct beam. This method is earnestly recommended by Chamberlain (*1*). Also, in gastro-intestinal examinations the left hand of the fluoroscopist will often be placed toward the back of the patient for counter-pressure or to steady the patient.

Thus the danger is very real. Moreover, despite the fact that patients seldom require more than one or two heavy exposures and are not subject to day-in and day-out radiation, they are not thereby immune to danger, for a single examination made without due re-

gard to safety factors can occasion disastrous results. Not only the skin but also, in the case of children, the growth centers can be damaged or functionally destroyed by the roentgen rays. Finally attention is called to the marked effect of the aluminum filter. This factor is so important that it should no more be neglected than is the preoperative scrub-up in surgery.

The next point for consideration is the amount of radiation that reaches the examiner through the patient. In order to estimate this, varying thicknesses of presswood were used with results as shown in table 2. A self-rectified oil-immersed shockproof unit and an 0.5 aluminum filter are used.

TABLE 2.—*Absorption of radiation in compressed wood fiber (Masonite)*

Physical factors			Intensities in r per minute with phantoms of varying thicknesses			
Kv.	Ma.	Anode part distance inches	2.5 cm.	5 cm.	10 cm.	20 cm.
65	3	10	6.50	2.75	0.80	0.38
75	3	10	8.50	3.50	1.00	0.40
85	3	10	10.00	4.75	2.30	0.45
65	5	10	10.50	4.40	1.50	0.40
75	5	10	13.00	5.53	1.84	0.49
85	5	10	17.00	7.66	2.40	0.55

It is obvious from table 2 that there is considerable reduction in radiation intensity as compared to the original table. Thus if we consider the factors of 75 kv. and 5 ma. through 20-cm. wood fiber—the approximate equivalent of the human body—we have the following: Radiation intensity in air calculated from table 1 is 30 r per minute at 10 inches (about 25 cm.). In the course of another 20 centimeters this would be reduced to approximately 12.5 r in accordance with the law of the inverse square. Absorption in the wood fiber, however, brings the intensity to 0.49 r, roughly one twenty-fifth of what it would otherwise be.

Half an r per minute to the palpating hand, which is the amount that would ordinarily be involved in practical work, is scarcely formidable, especially as filtration through the body removes the softer, less penetrating rays which most affect the skin. In addition, the barium sulfate, which is often present in the patient, will absorb still more. Finally, at a 12-inch anode target distance, intensity will be less. White, Cowie and De Lorimier (*2*) reported an intensity of 0.11 r per minute on the top side of their phantom.

Nevertheless it must be remembered that as the hand nears the lateral aspect of the abdomen, the relative intensity of the rays upon the hand will be increased, and at times the hand is apt to slip into the direct beam. Then too, radiation passing through thinner parts will have more effect upon the operator, certainly

for regular workers; moreover in the case of thinner parts, overall size is less and there will often be direct radiation beyond the borders of the irradiated part. *The use of lead-impregnated gloves is essential.*

Next in line of fire comes the face of the examiner. It has long been recognized that protection of the face is necessary and the usual method has been to place a lead glass screen over the fluoroscopic screen proper, the protection being equivalent to about 1.5 mm. lead screen as per usual safety recommendations (*3*).

Lately it has been pointed out by Downs and Haskins (*4*) that if no regular fluoroscopic assembly is available, an ordinary radiographic screen will suffice. This is true as regards producing an image on the screen. However it also poses the question of how much radiation will pass through such a screen to the examiner's face, although it should be noted that the authors recommend great caution. However the matter is of such concern that quantitative studies were deemed advisable and were undertaken, again employing a self-rectified, oil-immersed, shockproof unit. The results of the first tests are shown in table 3.

TABLE 3.—*Radiographic intensities after passage through regular radiographic intensifying screens*

Anode-screen distance inches	Kv.	Ma.	Filter Al	Radiation intensities		
				No screen	Thin screen	Thick screen
10	65	3	0.5	19.0	8.0	6.5
10	75	3	0.5	23.0	12.0	8.5
10	85	3	0.5	29.0	15.0	10.5
10	65	5	0.5	32.0	15.5	10.5
10	75	5	0.5	39.0	18.0	14.0
10	85	5	0.5	46.0	23.0	18.0
12	65	3	0.5	13.5	6.5	4.5
12	75	3	0.5	16.5	8.0	6.0
12	85	3	0.5	19.5	10.5	8.0
12	65	5	0.5	21.0	11.0	6.6
12	75	5	0.5	26.0	13.6	9.2
12	85	5	0.5	32.0	16.5	12.6

Tests with another machine of the same type, conducted both with and without added filtration, gave similar results but with the added indication that the aluminum filtration had relatively little effect on the radiation intensity beyond the radiographic screens. This of course is to be expected since the rays that pass through the filter will be preponderantly of shorter wave length and will pass through the screens in greater measure.

From table 4 it can be seen that with an average set of factors such as 75 kv., 5 ma., and 0.5 Al filter the intensity will be 8 r per minute just beyond the thick type screen. At a usual viewing distance of about 12 inches, reduction becomes considerable but two or more r per minute will inevitably reach the face whenever

TABLE 4.—*Effect of filtration on intensities through intensifying screens*

Anode-screen distance 12 inches		Intensities in r per minute					
		No filter			½ Al filter		
Ma.	Kv.	No screen	Thin screen	Thick screen	No screen	Thin screen	Thick screen
3	65	19	7	4.2	12	5	3.5
3	75	23	8.2	5.2	14.5	6.5	5
5	65	33	10	7	20	8.5	6
5	75	38	12.5	8.3	23.5	11	8

the beam is not intercepted by the patient.

The question then is how important is this amount of radiation. In view of the erythema dose, the intensity is not great, and is permissible for emergency purposes, especially for the occasional operator. It is, however, entirely beyond acceptable limits for routine use over any considerable period of time. Cumulative effects from such dosage, day in and day out, bear dangerous possibilities.

To provide comparison, studies were made with the regular lead glass screen (1.5 mm. pb. equivalent). As might be expected, the figures indicate that practically no radiation passes the lead glass screen, the average readings being below 0.002 r per minute, 10 inches from the lead glass screen, and this is due largely to secondary radiation. An hour's continuous operation or a day's work would thus produce less than 0.12 r exposure from this source.

Finally it is well further to consider secondary and stray radiation. Secondary radiation is given off by all objects struck by x-rays, notably the patient under examination and the shutters or diaphragms of the fluoroscopic assembly. Stray radiation is that radiation which escapes from the tube other than in the direct anode beam. It is not absent even in so-called "ray-proof" tubes. The intensity of radiation from these sources varies greatly with the size and intensity of the beam, the construction of the table, type of tube housing, and the parts examined.

The subject has been comprehensively reviewed by White, Cowie and De Lorimier. They indicate that this radiation is serious in degree, and warrants good built-in protection and the use of lead-impregnated protective apron and gloves. In fact the use of such gloves and apron is compulsory with the Army field units (*5*).

Our own studies indicate intensities varying from 0.018 to 0.061 r per minute, lateral to the center of a conventional heavy-duty table and in line with the interval between the table top and side panels. This amounts to totals of from 1.08 to 3.66 r for an hour of continuous operation, or an approximate day's work. At 4 feet, the intensity decreases to .002 to .003 r, or about 0.120 r per diem,

for more remote attendants. These, it would appear, are fairly safe. It is apparent, however, that the fluoroscopist and others working close to the fluoroscopic assembly, if the latter is continuously employed, are certain to exceed the desirable limit of 0.1 r per diem unless they protect themselves.

It is further to be remembered that the unprotected light types of apparatus will permit the escape of more stray and scattered radiation than will the "heavy duty" type with side panels. Use of auxiliary lead-impregnated shielding is advisable with such apparatus (*4*) (*5*).

PROTECTIVE MEASURES

With the foregoing in mind, it is pertinent to list protective measures. These are substantially as outlined in the instruction manual (Fundamentals of X-ray Physics and Technique) issued by the Naval Medical School and procurable by request through regular channels, to the commanding officer of that activity.

1. *Obtain a high degree of dark adaptation* before attempting work. Otherwise not only will you fail to see all you should, but will be tempted to call for heavier x-ray factors. It is usually recommended that dark goggles be worn for 5 minutes, or that the same period of time be spent in a totally darkened or very dimly lighted room. This is not enough except where gross and well contrasting outlines are involved. For good visualization of detail, from 20 to 30 minutes of preparation are essential.

Both green and red goggles are available for the purpose, but red appears preferable since it leaves the eyes better sensitized to the greenish light of the fluoroscopic screen. The goggles now used for accommodation of the eyes to night flying are excellent. When light is brilliant, preliminary use of ordinary sun glasses is helpful. Vitamin A deficiency is to be remembered as a possible factor if dark adaptation is poor.

2. *Use moderate current.* Three to 4 ma. at about 75 kv. will answer general fluoroscopic needs. An increase to 85 kv. will give sufficient penetration for most stout people without any increase in ma.

3. *Keep a "light foot" on the switch.* That is to say that exposures should be intermittent. Flashes of from 4 to 8 seconds followed by equally long or longer "off" periods should be the rule.

4. A large field is needed only for very brief periods. The greater part of the work will be benefited by reducing the x-ray field to the smallest possible size. This improves definition and also cuts down the exposure upon both the patient and the operator. Hence the rule, *"Keep the x-ray beam small."*

5. *Keep the hands out of the direct x-ray beam.* This is one of

the most important rules. It is most apt to be disregarded in attempted reduction of fractures and dislocations under fluoroscopic control. If the hand is invariably kept in front of the patient, so that he acts as a screen or filter, very few damaging rays will reach it. However, this is not easy to manage. Accordingly, to the above rule should be added: *"Always wear leaded gloves."* If for some special purpose the usual heavy glove cannot be used, even a light glove will afford some protection from the soft and most damaging rays.

6. *Aluminum filtration should always be present:* ½ mm. for shockproof tubes; 1 mm. for others.

7. *Use lead-impregnated aprons and gloves* as a consistent routine practice. If a light, open-type table is employed, a protective panel of lead-impregnated material should be provided.

8. *Make occasional tests* for excessive radiation exposure by placing dental films, bearing a paper clip, in several pockets. After two weeks develop the films. If a clear image of the paper clip is obtained there has been too much exposure and better protective measures should be taken. Make tests with a minometer if possible.

9. If the lead glass on the fluoroscopic screen becomes cracked or broken, it should be replaced at once.

10. Use of an ordinary intensifying screen is possible when regular fluoroscopic equipment is lacking. It should be remembered, however, that there will be no lead glass protection and that, accordingly, the operator is certain to be dangerously exposed if any considerable volume of work is done. Therefore, such use of an intensifying screen is justifiable only on a real emergency basis.

11. *The total exposure limits* for the patient should be borne in mind.

12. *A blood count should be made every quarter,* and oftener if exposure is heavy. A low leukocyte count is often the first indication of excessive exposure. A count below 5,000 indicates need for caution and one below 4,000 calls for a ban on any exposure for several months at least, as well as need for better protective measures.

13. *Good ventilation* should be maintained in the fluoroscopic room.

14. It is to be remembered that, with certain obvious exceptions, fluoroscopy is a poor and dangerous substitute for radiography. This is so because of the diminished retinal sensitivity at the low intensities of fluoroscopic screen illumination, the impossibility of leisurely meticulous study and lack of a permanent record.

15. It is a good plan to post a list of the more important precautions on the fluoroscope, particularly if it is ever used by people relatively untrained in roentgenology. A sample list is as follows:

NOTICE

Use of Fluoroscopic Equipment

1. Fluoroscopic equipment is a source of great danger to all concerned unless safe methods and exposure factors are used. Furthermore the machine itself can easily be damaged.

2. Do not operate the machine unless you are familiar with its operation in all respects. No unauthorized person should tamper with it.

3. Fluoroscopy calls for: (a) Proper accommodation of the eyes (20-30 min.); (b) a current of about 75 kv. and 3 ma.; (c) brief and intermittent exposures; (d) operator's hand out of the direct beam of x-rays; (e) target-skin distance not less than 12 inches; (f) aluminum filter; (g) use of leaded protection garments.

4. *Safe limits for patient at 12 inches, 3 ma. with 1 mm. Al filter*: Head, 575 ma. or total of 3 minutes, 12 seconds of actual exposure at 3 ma.; other parts, 768 ma. or 4 minutes, 16 seconds of actual exposure at 3 ma.

SUMMARY

1. Serious dangers incident to fluoroscopy are pointed out and quantitative studies presented.

2. The use of unprotected radiographic screens for fluoroscopy is not recommended except on an emergency basis.

3. The necessity for the strict use of lead-impregnated gloves and aprons is stressed.

4. Great care is urged in the reduction of fractures under fluoroscopic control.

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ELECTROENCEPHALOGRAPHY IN THE STUDY OF CHRONIC BEHAVIOR PROBLEMS

A REVIEW

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One of the important problems engendered by the need for securing and maintaining a large fighting force in time of war is the obvious but sometimes neglected fact that all men are by no means psychologically suited for military duty. The great expense —to the individual, the service, and society—caused by the admission of such misfits to the various services during World War I led to more active attempts during the present conflict to eliminate them early in the course of their military careers.

The more apparent of the potential psychiatric casualties are rejected by the brief interviews at induction centers, while others are detected at the training camps, carefully studied and hospitalized, discharged from the service, or even assigned to trial duty. Despite these efforts at early detection, however, many a man passes through the primary period of instruction only to display a mental or emotional inaptitude, after considerable time and money have been expended in his training but before he has been able to contribute to the effectiveness of his group. Such men are seen in every psychiatric ward and in every psychiatric review of the disciplinary barracks.

The problem is greatly complicated in that many men have no desire to be in the service, and that the careful study of recruits carried out in peacetime is not always possible during war. Thus there enter the service many psychopathic individuals, the borderline mentally defective, and persons with severe behavior problems. Some of these may eventually make a satisfactory military adjustment, but all too often they become a constant source of difficulty in their group, are destructive of morale, interfere with the training program, and give rise to multiple disciplinary problems.

Every supervisor of a military group, from commanding officer to platoon leader, is painfully aware of the trouble caused by the individual who cannot seem to conform to the rules. Such offenders are usually dealt with at first as purely disciplinary problems, but as the offenses multiply the psychiatrist may be

consulted. The psychiatrist may apply some diagnostic term to the case under consideration, as psychopathic personality, adult maladjustment, constitutional inferior, and the like, with the result that the individual is thereafter under medical supervision, and may then receive a medical release, all charges having been dropped. A natural reaction to this method of disposition is to look upon the psychiatrist as one who too often protects those in need of punishment, and who offers a means of escape for those whose sense of social obligation and adaptability may be considered defective.

It is difficult not to be angered by the psychopathic individuals and those with behavior problems, whose acts may be irritating, apparently unreasonable, or deliberately provoking, and who at times may even seem to be malingering. Punishment, however, is notoriously ineffective. There is a need to see these conditions for what they are, actual illnesses, and to further our understanding of them by every means of medical study.

Unfortunately diagnosis is often a matter of subjective opinion, based upon observation of the individual and study of his history, and the cause of the behavior is too often obscure, while treatment is admittedly unsatisfactory. The entire problem would appear more tangible if objective criteria could be applied. As yet such criteria are not too well established, but there is growing evidence that many behavior problems and many psychopathic reactions have their origin in disturbances of cerebral activity representing a profound physiologic defect.

It is the purpose here to review some of the evidence for this point of view and to suggest the more extensive use of the objective methods of study of personality problems that are now available. The electroencephalograph has been found helpful in measuring abnormal electrical activity in such disturbances, and gives us a more objective approach to the problem. The bibliography appended is not complete, but is representative of the work done in this field during the past 15 years.

A great deal of work has been done in anatomic, biochemic and physiologic study of the nervous system, yet no organic cause has been demonstrated for many of the psychiatric clinical entities. On the other hand, extensive research into the psychology of those illnesses has not always produced a satisfactory answer.

Considerable attention has been given to the relationship between hypothalamic functions and personality patterns (*5*) (*6*) (*24*) (*25*) (*35*) (*36*) (*42*) (*67*) (*68*) (*83*) (*86*). It is known that lesions in the hypothalamus may give rise to marked alterations in mood and personality. Apparently the cerebral cortex exerts an

inhibiting influence on the hypothalamus, thus holding in check expressions of rage, excitement, and the like. It is also suggested that the hypothalamus, in turn, may inhibit cortical activity (*5*).

As the hypothalamus is an organ located centrally between the cerebral cortex and the peripheral autonomic system, and connected directly and indirectly with both systems by two-way nerve fiber paths, it plays an important role in aiding the individual to adjust satisfactorily to his surroundings (*35*). It has been suggested that some of those who fail so grossly in making an acceptable adjustment to their environment may have actual defects in structure or function of these integrative and regulative centers.

Singer (*83*) and Ingham (*42*) suggest that the psychopathic inferior and psychopathic state may have congenital or primary structural defects in the central autonomic system. Speaking of the psychopath, Bender (*6*) says:

> There is an interference with the establishment of habit patterns as an expression of the integration between the instinctive, impulsive, affective, autonomic functions of the ventricular gray and basal ganglion, and the intellectual, elaborative, and judgment functions which are dependent upon the cortex and its long-distance perceptors which keep it in touch with its environment. The proper integration of these two levels produces what we know as the character of the adult human being. . . A disturbance in the integration of these two levels by normal maturation processes produces an intellectually normal, but emotionally immature psychopathic personality, with emotional instability, poorly handled impulses, and asocial judgment without a super-ego.

Such defects might arise from birth injuries to subcortical areas, head trauma, encephalitis, or constitutional defects, and efforts to study normal and abnormal electrical potentials in the hypothalamic area have already been made by use of a nasal lead from the electroencephalograph (*35*). The exact cause of the injury or the site of the lesion, as well as the influence of environmental factors on such personalities, is not known, but it is helpful to see the early beginnings of a closer relationship between what in the past have unfortunately been designated as the "functional" and the "organic." With this present trend in mind it is interesting to recall the words of Thomas Henry Huxley in his *Life of Hume*, "The roots of psychology lie in the physiology of the central nervous system. What we call the operations of the mind are functions of the brain, and the materials of consciousness are products of cerebral activity."

Among those presenting chronic behavior difficulties in the military service will be found numerous types of individuals. In many, careful study may reveal no evidence of any structural or functional defect of the nervous system as an explanation for the asocial be-

havior. Unless systematic and thorough studies are made, however, many such defects will escape detection. Careful developmental history, complete physical and neurologic examinations, laboratory determinations, psychologic tests, and psychiatric evaluation of the personality are all needed. The problem should not be so much the applying of a diagnostic term, as the searching, so far as possible, for the underlying disturbances that make the application of such a term necessary.

The personality changes occurring in some individuals following encephalitis are well known (*63*), and undoubtedly a few such persons will gain entrance to the military service. Children with cerebral birth injuries, although they may show no actual palsies, may display distractibility, hyperactivity, and mental retardation, which later may develop into more severe behavior disorders (*76*). Following injury to the head the possibility of alterations in behavior later in life cannot be ignored (*8*).

The military services are dealing in a large part with a comparatively young age group, and many of the severe maladjustments in training are closely related to the behavior problems seen in child psychiatry (*47*) (*48*) (*49*). Not infrequently it will be found that homesickness, an overprotective home situation, and inexperience have contributed to an emotional immaturity that too often fails to make the rapid adjustment to military life required at present, the reaction to this failure occasionally being shown by rebellion against authority, desertion, and the like. In such cases careful social and psychiatric investigations must be made, supplemented by such tests as the Rorschach and psychometric.

Among the disciplinary problems will be found the true psychopath, although the term is used rather loosely, and should not be applied without a well established history of the individual's prolonged failure to adjust socially. No problem is more difficult to attack, and as yet there is no satisfactory solution, legally or medically (*7*) (*50*) (*51*). The most striking characteristic of such people is their apparent failure to learn from experience, and there is reason to believe that there is present an underlying structural defect, the exact nature of which is not known (*14*) (*60*) (*71*).

Chornyak (*13*) suggests that in some psychopaths early cerebral damage may have occurred from anoxemia and concludes: "No further differentiation into the mature, altruistic level of personality can occur after such damage." Certainly we know that many psychopathic states do not seem to be explained satisfactorily in terms of environmental stresses. Henderson[1] said that he is

[1] HENDERSON, D. K.: Psychopathic States. W. W. Norton & Co., Inc., New York, 1939.

"opposed to the conception of those who believe that the great preponderance of behavior disorders is superimposed by bad training, or environment, or both upon a perfectly normal mentality." This would seem logical. There is growing evidence to support the opinion that the mentality in severe behavior problems is not entirely normal, and may be structurally defective. The possibility of such a defect should be carefully investigated in all such cases.

Since the studies of Berger, first published in 1929, a great deal of progress has been made in utilizing the electroencephalographic recordings of cerebral cortical electrical activity. The technic and general application of the method have been reviewed by Newman (*69*) and Walter (*90*), and certain aspects of the problem have been reported by numerous other authors (*1*) (*3*) (*4*) (*17*) (*28*) (*41*) (*59*) (*61*) (*62*) (*84*).

The study of electrical potentials emanating from the cerebral cortex in cases of epilepsy has been put to a very practical use, and it has been gratifying to see how readily this new method has been accepted by the medical profession. The electroencephalogram is now as much a part of the study of the convulsive state as the electrocardiogram is of the study of cardiac diseases (*27*) (*29*) (*30*) (*31*) (*33*) (*38*) (*43*) (*44*) (*56*) (*57*) (*58*) (*72*) (*73*) (*74*) (*78*) (*80*).

Certain types of cerebral dysrhythmias are recognized as typical of petit mal, grand mal, and psychomotor epilepsy. Electroencephalographic studies have been made of the psychoses and of mental deficiency (*18*) (*19*) (*20*) (*21*) (*22*) (*32*) (*53*) (*95*), and as yet typical brain wave patterns have not been identified, although Gibbs and his associates (*32*) say, "Schizophrenia and certain abnormal behavior may, like epilepsy, be spoken of as a form of cerebral dysrhythmia."

Many efforts have been made to determine if any relationship exists between brain potentials and personality (*34*) (*39*) (*55*) (*75*) (*89*), and there is some evidence (*26*) to indicate that unusually slow waves may be associated with a "poor personality." A natural corollary to such studies was to apply this technic to the investigation of delinquents and problem children (*9*) (*10*) (*11*) (*16*) (*45*) (*46*) (*64*) (*70*) (*87*). This work has considerable interest for those in military life, where we must so frequently deal with the individual who cannot make an adequate social adjustment and as a result becomes a disciplinary problem.

In a study of 28 children seen before the Domestic Relations Court of the City of New York, 61 percent had abnormal electroencephalograms, "suggesting the presence of an underlying cerebral disorder in a majority of children with severe behavior

disorders" (*10*). The electroencephalograms in 85 percent of a group of 20 delinquent boys were abnormal (*11*), while 71 percent of another group of 71 behavior-problem children showed abnormal brain waves. In these cases the essential abnormality consisted of slow (2 to 5 per second to 5 to 8 per second), often flat-topped waves. In some, waves suggestive of petit mal were found, and in still others the abnormal recording was made only with hyperventilation.

In groups of supposedly normal individuals, only 10 to 15 percent show cerebral dysrhythmia as recorded by the electroencephalograph. Further investigation with larger groups needs to be carried out, but the present studies have done much in that they have helped us to a better understanding of certain of the behavior problems and have offered a more objective means of approach. The following remarks by Williams (*93*) are of interest here:

> An abnormal EEG in an otherwise normal person is strong evidence of an inborn constitutional abnormality involving the central nervous system. . . This abnormality appears to be nonspecific, and may manifest itself in the subject or his offspring as a behavior disturbance which may be psychoneurotic, psychopathic, or epileptic in type.

More recently attention has been turned to the electroencephalographic findings in psychopathic states (*40*) (*52*) (*81*). Anyone who has had contact with these unfortunate individuals in civil or military life has been impressed by their unremitting conflict with society and any authority, their apparently intact intellect, and the difficulties inherent in any attempt to rehabilitate them. Of a group of 75 criminal psychopaths, the electroencephalographic findings were abnormal or borderline in 80 percent (*81*). Another encephalographic study of 54 psychopaths revealed evidence of abnormality in 52 percent (*52*), and in another group of 151 such cases, 48 percent had records indicating abnormality (*40*). Of this last group Hill and Watterson (*40*) say:

> On the evidence gathered by us from control material and patients, and on that obtained by other workers, one can have little doubt that an abnormal EEG constitutes for its possessor a handicap in the business of biologic adapation, failure of which may show itself, as in our present series, in undesirable, asocial behavior.

Several writers have discussed the use of the electroencephalograph in military medical problems (*66*) (*77*) (*79*) (*82*) (*85*), and it is an accepted means of studying convulsive states, cerebral trauma, fainting, brain tumor, and possible epileptic equivalents such as psychomotor episodes, periods of dullness and confusion (*74*), and certain cases of enuresis. There seems to be growing evidence to support the opinion that the use of this technic should

be extended to the investigation of severe behavior problems and psychopathic states, a careful search being made for any possible evidence of organic cerebral disturbance.

The possibility of treatment of individuals with behavior disorders and abnormal brain waves by amphetamine sulfate and certain of the drugs used in the therapy of the epilepsies is still to be investigated (*9*). Treatment, psychiatric, medical, or a combination, can be more effectively applied as our understanding of these disorders increases. The study of the electrical activity of the brain is helping to improve that understanding. The use of the electroencephalograph is beginning to show us that in many such cases actual measurable organic cerebral defects exist and may form the basis for chronic social maladjustments. Bradley (*9*) presents the situation clearly:

> In the present state of our knowledge it is probably wise to assume that in interpreting behavior disorders, an abnormal electroencephalogram is an indication of a poorly integrated, poorly stabilized, or immature central nervous system which proves a handicap in social adjustment, just as would poor vision, faulty muscular coordination, or a similar constitutional defect. The abnormal electroencephalogram indicates physiological imbalance. . .

CONCLUSIONS

1. Some of the men who are constant disciplinary problems in the military service are found to be mentally ill.

2. In such a group of chronic offenders we must look for the psychopathic personality, the severe neurotic, the behavior problem, the postencephalitic personality, the epileptic (who may display psychomotor states), the individual with a history of severe birth injury, the man who has undergone a change of personality after head trauma, and the early psychotic personality.

3. There is growing evidence that some of the gross behavior abnormalities may be traced to dysfunction of certain cerebral areas such as the hypothalamus.

4. Electroencephalographic studies of psychopaths and behavior-problem individuals show a high percentage of abnormal brain waves, suggestive of a profound disturbance in cerebral physiology. Work is now being done in the recording of electrical potentials from the region of the diencephalon in an effort to determine the relation of dysrhythmias in that area to personality disorders.

5. As we come to realize the basic defects existing in the psychopath and others of this type, we shall be able to deal with them more understandingly and more effectively.

6. It would seem advisable to use the electroencephalograph

routinely in a study of all severe behavior problems.

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COMPRESSION OF NERVE BY A METAL CLIP

Compression of a nerve by a metal clip exerting a tension of 170 to 430 gm. for 2 hours induced transient paralysis lasting five to eighteen days. This paralysis was not associated with a gross defect in sensation, and the distal portion of the nerve fibers did not degenerate. It was accompanied by intermittent loss of myelin at the nodes of Ranvier in the compressed area. The lesion was identical with the "intermediate degree of pressure lesion" induced by compression with a tourniquet. Though recovery of motor conduction occurred early, the restitution of the myelin defect was only slightly advanced after six to eight weeks and was still defective after six months.

The effect of pressure on nerve is considered to be due entirely to ischemia, and the characteristic histologic lesion and dissociated paralysis form a distinctive type of neuropathologic reaction. The histologic evidence indicates that the dissociation between sensory and motor function is due to a functional property of the disorder of the axoplasm, and not to selective effect related to the size of the fiber.—DENNY-BROWN, D., and BRENNER, C.: Lesion in peripheral nerve resulting from compression by spring clip. Arch. Neurol. & Psychiat. 52: 1-19, July 1944.

FRACTURES OF INTEREST TO THE DENTAL OFFICER

REPORT OF THREE CASES

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No specific mechanical gadget can be a panacea for fractures about the face and jaws. The determinant in treatment is thorough and complete diagnosis, especially the correlation of clinical and roentgenographic observations. A clear mental picture of the number, extent, character, and position of the fracture lines, as well as of the displacement of parts, is essential to a well-conceived plan of treatment. With this background, the proper type of mechanical device for treatment may be selected.

Occasionally it may be found that two or more mechanical methods of treatment may be equally efficacious. Selection may then be made on the basis of the following:

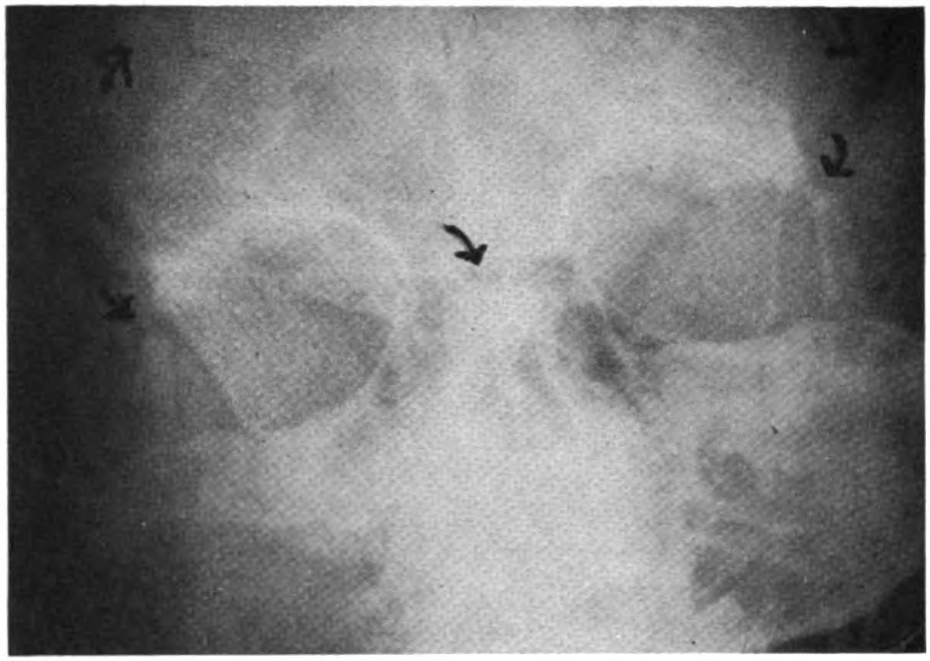
1. Availability of facilities, material, and equipment.
2. The simplest appliance that will obtain a good functional and esthetic end-result.
3. The appliance that will be the most comfortably tolerated by the patient, with the least interference with his normal daily routine.
4. The appliance with which the operator is the most familiar, so that it will give the most satisfactory results in his hands.
5. The time when treatment may be instituted, because of the condition of the patient.

REPORT OF CASES

Case 1.—A seaman, second class, had a severe crushing injury of the face. His head had been caught between the deck and the breech of a 5-inch gun while the gun was being elevated. He was brought in a semiconscious condition to the sickbay by members of a ship repair party.

Clinical examination showed bilateral compound fractures at both angles of the mandible and a transverse fracture of the maxillae. The left cheek was markedly swollen, the left eye was closed, there was ecchymosis of both eyes, and edema of the lids. There was bleeding from the nares and the oral cavity. A diagonal laceration, about 1½ inches long, between the eyes, revealed a separation of the nasal bones from nasofrontal suture lines. A small laceration about three-fourths of an inch long was present on the left side of the chin.

Roentgenograms confirmed the lines of fracture and showed further frac-



1. Case 1. Roentgenogram depicting fracture line, orbital.

tures as follows: (1) A depressed fracture of the left malar bone; (2) a fracture of the perpendicular plate of the ethmoid; (3) a slight separation at the right xygomaticofrontal suture line; (4) nasal bones separated and dropped about 0.5 cm. at the nasofrontal suture lines; (5) fracture lines at the medial and inferior aspects of the left orbit; and (6) a transverse fracture of the maxillae (figs. 1 and 2).

The airway was cleared and the hemorrhage controlled. The patient was put to bed and given 500 cc. of 5-percent dextrose with 4.5 gm. of sodium sulfadiazine intravenously.

Gross reduction and minor operative treatment.—Seven hours after admission, under double block mandibular anesthesia (procaine hydrochloride 2-percent), a gross reduction was made of the mandible and maxillae. Arch bars were adapted to the upper and lower remaining teeth and intermaxilliary elastics were applied for traction. Lacerations of the face were sutured. The occlusal plane showed the maxilla to be tipped from the horizontal, impacted upward on the right side for approximately 2 cm. and downward on the left. The free anterior segment of the mandible was pulled posteriorly and rotated toward the right. Further operative procedure was not considered advisable at that time.

On the second day after admission, elastic traction had brought the teeth of the fractured maxillae and mandible into fair occlusion. The patient had a freer airway. The left ramus remained displaced outward and forward. Drainage from the nares was still present. Forced fluids were continued along with sulfadiazine therapy.

A plaster headcap was applied with bases for necessary regulating appliances. The oral cavity was irrigated and smaller intermaxillary elastics were applied. The blood sulfadiazine level was 9.5 mg. per 100 cubic centimeters.

2. Case 1. Roentgenogram showing arch bars applied in preliminary phase of treatment. Note separation of nasal bones at nasofrontal suture line.

Operative procedure.—On the third day after admission, the patient was prepared for operation under the direction of the general surgeon, rhinologist, and dental officer.

1. Under regional anesthesia (procaine hydrochloride 2-percent), the lower right third molar which was in the line of fracture was removed. A root tip, probably fractured, remained in situ.
2. An extra-oral incision was made at the left angle of the mandible.
3. The traction wire was drawn through a hole drilled at the angle, and secured to a rod embedded in the plaster headcap, according to Darcissac's method.
4. The malar bones were elevated by the intra-oral approach. The bones of the upper portion of the face were manipulated into as normal a position as possible for the reestablishment of good facial contour.
5. At the same time the remaining teeth were brought into occlusion.
6. Fixation was maintained by an extra-oral jaw brace and arch bars.

3. Case 1. Anterior view. Extra-oral appliance in place.

Postoperative course.—Regulation of appliances and oral irrigations were done daily at the dental office.

Eight days after admission, fixation was maintained. The sutures were removed from lacerated facial areas. There was a slight depression observed in the left malar area. The patient subsisted on a "fracture diet," the liquid diet consisting of eggnog, broth, and fruit juices. The sulfadiazine level at this time was 4.9 mg. per 100 cubic centimeters.

Postreduction roentgenograms showed the teeth to be in good occlusion. The left ramus of the mandible was held posteriorly and inward by the external wire from the headcap. Approximation was fair, with only a moderate buccal overlap of the ramus at the fracture line. Approximation of the fracture at the right angle of the mandible and approximation of other fractures of facial bones was satisfactory. Facial contour and symmetry were good.

Ten days after admission a buccal abscess, which had developed adjacent to the upper left third molar, was incised intra-orally. About half an ounce of thick yellowish-white pus was obtained. A drain was inserted; drainage ceased after 4 days.

Fourteen days after admission the patient was transferred to a Naval hospital, where he was seen 7 days later and found to be progressing satisfactorily. The extra-oral wire for retraction of the left ramus was detached. Roentgenographic examination showed an apparent overlapping of the left ramus over the body of the mandible, the ramus being outward and forward approximately 3 millimeters. When tested for union, however, consolidation seemed to be progressing favorably. Postero-anterior roentgenograms, depending on the position of the x-ray tube, frequently tend to exaggerate separations through the angle areas.

Seven weeks after the original admission, the dental officer at the hospital wrote: "He (the patient) is now able to eat a regular diet and the jaw is moveable in all directions. He has gained in weight and looks fine. When we removed the wires from the mandible from the outside, we also removed scar tissues."

In this case the patient was treated at sea, two thousand miles from any prosthetic laboratory, with facilities for splint construction not available. This would have been an ideal case for skeletal immobilization of the left ramus had means been at hand.

Skeletal fixation for mandibular fractures of certain types is a useful and efficient procedure when properly used. Frequently it has the advantage of giving to the patient a functioning or partly functioning jaw during a large part of the treatment period. When early function is desirable to prevent cicatrization with ensuing limited jaw movement, such as in temporomandibular joint injuries, skeletal fixation has special indication.

In order to assure the reestablishment of normal occlusion of the remaining teeth, a temporary procedure is to use simple intermaxillary wiring prior to the "final set" of the skeletal appliance. Had skeletal fixation been used in this case, it would have been imperative to use supplemental intermaxillary ligation for the early phase of treatment.

Case 2.—A hospital apprentice, age 18, was admitted to the Naval Hospital, Bethesda, Md., following an automobile accident.

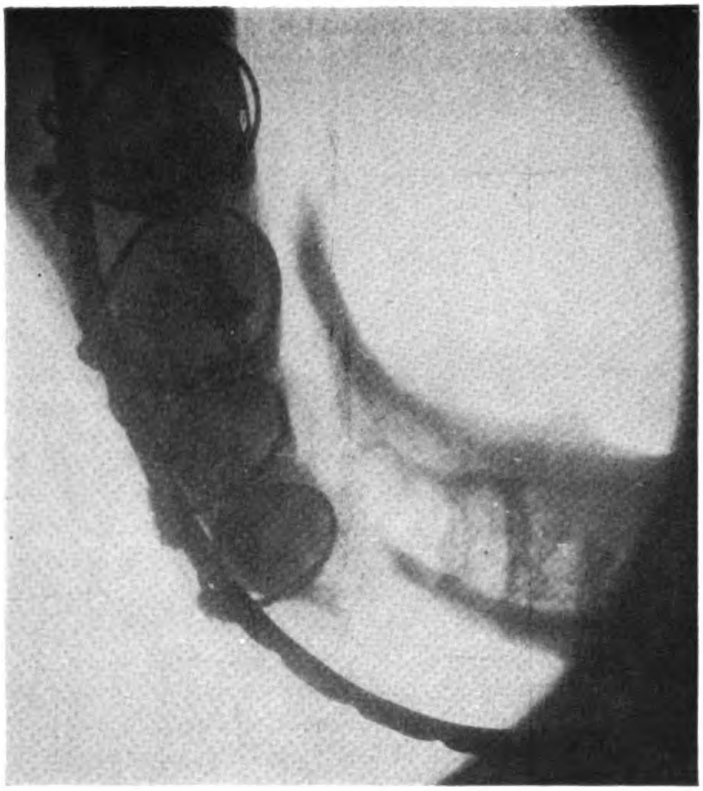
The orthopedic service submitted the following report.

"The patient is a semiconscious young white man with an obvious head injury, but he shows no signs of shock or increased intracranial pressure. The jaws are asymmetrical with suggested dislocation on the right side. There is no crepitus. The patient is unable to move the jaw, which is probably dislocated, and there is probably a fracture of the right side of the jaw."

Right and left lateral, and postero-anterior head roentgenograms showed no evidence of fracture.

The patient's mouth was wide open and could not be closed. There were severe perforating lacerations of the upper and lower lips. External sutures had been placed. There was an abrasion, 6 inches in length, from the edge of the lower lip laceration, downward and backward along the right side of the body of the mandible. Intra-orally, the upper and lower lips were lacerated. The upper lip presented to the left of the median line, and on the internal aspect there was a laceration about 1 inch long opening into and continuous with an external laceration. A lower incisor was buried in the substance of the upper lip, and was removed. A horizontal jagged laceration, about 1½ inches long, on the internal aspect of the lower lip was continuous with the external laceration.

The following five lower teeth were avulsed: Right cuspid, right lateral, right central, left central, and left lateral. The incisal half of the upper right lateral incisor was broken off and the two upper central incisors were markedly loosened. It was possible that the root of the upper central incisor was fractured. The tissues of the floor of the mouth at the site of the frenum linguae were lacerated and swollen; the tongue was elevated. There was a horizontal laceration 1½ inches long in the right vestibule adjacent to the apexes of the lower right bicuspids. Palpation and observation revealed distortion of the anterior region of the mandible, and temporomandibular anterior dislocation. Severe swelling of the right side of the face and anterior



4. Case 2. Occlusal roentgenogram showing fracture line.

triangle of the neck was present. The first roentgenograms taken included a view of the anterior part of the mandible but did not show any evidence of fracture. Lateral extra-oral views showed the condyles bilaterally and anteriorly dislocated; the right condyle was anteriorly displaced over the articular eminence to a greater degree than was the left. Subsequent roentgenograms showed a comminuted oblique fracture, extending from the alveolus of the lower right cuspid downward and backward to the lower border of the mandible in the region of the root of the lower right second bicuspid.

Diagnosis.—A diagnosis was made of bilateral dislocation of the mandible with a compound fracture of the body of the mandible, and perforating lacerations of the lips and laceration of the floor of the mouth.

Treatment.—1. Under sodium pentothal anesthesia the anterior dislocations of the condyles were reduced.

2. Arch bars were wired to the upper and lower teeth and intermaxillary elastics were applied. The teeth of the left half of the mandible interdigitated normally with their corresponding upper teeth; teeth of the right half of the mandible were forward about 3 mm. from the normal position and in slightly open-bite relationship.

3. Elastic traction was applied to pull the left half of the mandible posteriorly and upward.

4. Lacerations in the mouth and lips were filled with sulfanilamide powder and were sutured.

The patient developed a postreduction hemorrhage from a hematoma in

the floor of the mouth. Two avulsed fragments of the lower alveolar process were removed from the soft tissues in the sublingual region and hemorrhage was controlled by packing with gauze strips soaked in thromboplastin. One thousand cubic centimeters of 5-percent dextrose solution was given intravenously.

Course of treatment.—On the first day after admission, the right body of the mandible was tipped lingually and about 3 mm. forward of its normal position. Elastic traction was used to move the teeth distally. Outward pressure was exerted on the internal surface of the right ramus to tip the lower right molars and bicuspids buccally. A readjustment was made of the lower arch wires and elastics. The laceration in the floor of the mouth was refilled with sulfanilamide powder.

On the second day after admission, the teeth were in normal occlusion. There was good approximation of the bone ends at the site of fracture. There was considerable swelling of the right anterior triangle of the neck and of the tissues of the right side of the floor of the mouth. The patient complained of pain in the region of the right condyle. Roentgenologic study of both temporomandibular articulations showed no apparent abnormality.

One month after admission, the fixation appliances were removed. There was moderate trismus. Five weeks after admission, function of both temporomandibular articulations was unimpaired. There was normal opening of the mouth, and the patient returned to duty.

Case 2 was interesting in that a fracture of the mandible associated with a bilateral temporomandibular dislocation is rare. On clinical examination the fracture was masked by the muscle spasm incident to the dislocation; the lower jaw was rigid with no obvious asymmetry or mobility to indicate the presence of a fracture.

A second interesting point is that the first roentgenologic study showed no evidence of fracture. This stresses the necessity for intra-oral views. In this instance, routine lateral and postero-anterior roentgenograms did not disclose a fracture, whereas an occlusal intra-oral view showed clearly the fracture and displacement.

Clinical examination and roentgenologic study should be correlated. In addition to routine roentgenograms, the clinician frequently requires roentgenographic views taken at prescribed angulations in order to delineate fracture lines more clearly; especially is this true in cases of multiple fracture of the mid-face portion of the head where shadows and overlapping of normal anatomic structures makes interpretation difficult.

Case 3.—A coxswain was admitted to the sickbay of this ship because of a sore and swollen right jaw as the result of a fight.

The patient was a well-developed white man, age 23, 5 feet 11½ inches tall, weighing 170 pounds. Temperature, pulse rate, and respirations were normal.

There was extensive swelling of the right jaw adjacent to the right angle of the mandible. Intra-oral examination revealed a deviation of the mandible

from normal occlusion. There was extreme tenderness and laceration of alveolar tissues in the right third molar region. Palpation revealed a disruption of normal bone continuity in this area, with the right ramus apparently pulled upward and outward. Roentgenographic examination showed an oblique fracture line from the right angle upward and forward to the right second molar, with the ramus displaced forward, upward, and outward.

Treatment.—1. Under regional, mandibular block anesthesia with 2-percent procaine hydrochloride, arch bars were applied to the upper and lower teeth.

2. Sulfathiazole powder was placed into the intra-oral laceration, and the alveolar tissues were sutured. A drain was inserted.

3. Intermaxillary elastics were applied which readily brought the teeth into normal occlusion.

4. By digital manipulation the ramus was pushed backward and downward and the fracture was thus reduced. At sea where prosthetic facilities were not available, the problem was to devise a way of holding the ramus in the reduced position. If an extra-oral appliance, such as the Roger Anderson appliance, had been available, its application would have been indicated. It was not thought necessary to use the Darcissac method of headcap with traction on the angle of the mandible.

5. Recourse was had to the simple expedient of molding warmed, high-fusing compound between the distal end of the arch bar and the anterior border of the ramus. The ramus was kept in the reduced position until the compound cooled. The result was satisfactory as observed by postreduction roentgenogram.

6. The patient was put to bed and given sedation as required for the relief of pain. A hot water bottle was placed to the right jaw.

7. Oral irrigations were ordered every 4 hours during the day.

8. A "jaw fracture diet" was instituted.

Five days after admission, swelling of the jaw subsided. The patient was up and about and progressing well. The intra-oral drain was removed, with no evidence of infection. Particular watchfulness was kept for evidence of soft tissue necrosis from the pressure of the compound splint bearing on the ramus. Daily oral irrigations were continued.

Twenty-one days after admission, the compound splint was cut away from the distal end of the arch bar. Adequate organization and fibrous union were considered sufficient to hold the ramus in the reduced position. Intermaxillary fixation was maintained. Palpation and roentgenographic study revealed good approximation of fractured parts.

Five weeks after admission the patient was returned to duty. The degree of opening was nearly normal.

CONCLUSION

Owing to the varying conditions of military life, treatment in certain jaw fracture cases may call for much ingenuity and judgment. In the absence of customary equipment and facilities, it may not always be possible to use an orthodox and accepted mode of treatment. Under such circumstances the simplest practicable method that will obtain a good end-result, functionally and esthetically, is the most desirable.

SCLEROSING AGENT IN TREATMENT OF SUBLUXATION OF MANDIBLE AND OF HEMANGIOMAS OF MOUTH

IRVING SALMAN
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Subluxation of the temporomandibular joint is an incomplete dislocation or a self-reducing dislocation. It is a common occurrence which is often observed following excessive forceful opening of the mouth, as in yawning, overstretching of the joint with a mouth gag as in tonsil and oral operations under general anesthesia, in prolonged dental treatment, and following removal of teeth. Subluxation and pain of the temporomandibular joint are also thought to be due to abnormalities of occlusion, or occlusal disharmonies. Premature occlusal contact associated with an unbalanced bite, malocclusion, or replacement of an inlay or bridge which may be high, will result in traumatization of the meniscus.

In many instances, the pain in the area of the temporomandibular joint may be alleviated with the correction of the occlusion. Riesner (*1*) in an excellent roentgenographic study demonstrates by the position of the mandibular condyle the tension on the temporomandibular joint as a result of occlusal disharmony. In the same study, however, he also shows when bite raising is contraindicated. The treatment, therefore, must be something other than mechanical. Riesner gives reasons for the abnormal excursion of the condyle with its painful reactions.

When the mouth is opened wide, the joint locks and the condyles recede with an audible cracking, snapping sound which is frequently accompanied by pain. In the early stages, following this excessive path of the condyles with resultant locking, it is often necessary for the patient to manipulate the mandible before the mouth can be closed again. As the condition persists, however, the condyles may slide into the glenoid fossae without any difficulty.

At times, following the initial injury, there may be a gradual limitation of opening of the mouth, with pain over one or both joints. The most frequent symptom is the characteristic clicking and snapping noise heard when the mouth is opened or during the excursions of the mandible in lateral movement. This noise

is probably due to the slipping or displacement of the meniscus. Vaughan (*2*), in an anatomic study of the temporomandibular joint, states that the meniscus frequently does not have the same range of movement as the condyle head.

TREATMENT

The surgical treatments, such as the partial or complete removal of the meniscus, or the attempt to restore the tuberculum articulare (eminentia articularis) by inserting a bony spur to limit the forward movement of the head of the condyle, have not been successful. Dorrance reported satisfactory results by scratching the joint surface with a needle, traumatizing the joint, and setting up an inflammation.

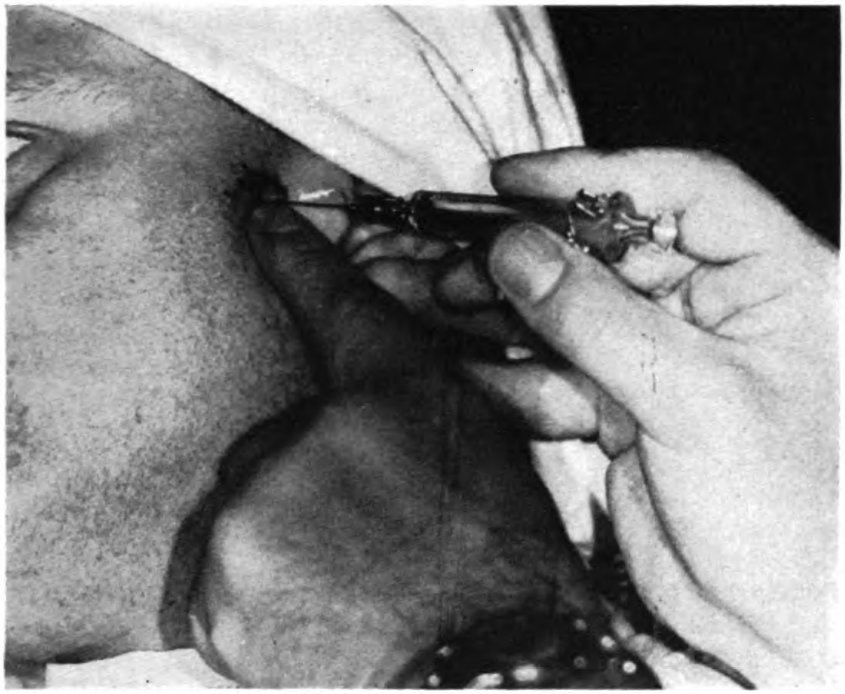
The injection of a sclerosing agent into the temporomandibular joint for the treatment of subluxation was first described by Schultz (*3*) in December, 1937. Schultz, in his animal experiments, found that 5-percent sodium psylliate solution produced a firmer gross specimen in all infected areas than did that of sodium morrhuate. The experiments showed no alteration of the joint cavity and no change in the ligaments, other than their thickening which strengthened the ligaments holding the joint within its cavity. There were no symptoms from injecting large doses directly into the blood stream or into the heart, and no infections followed.

TECHNIC

With the ball of the index finger placed in front of the tragus of the ear, the head of the condyle can be felt in its forward movement as the mouth is opened.

After sterilizing the field of operation, with the mouth open, a 26-gage needle, 1½ inches long, on a 1-cc. or 2-cc. syringe, is inserted directly posterior to the head of the condyle in a slightly upward and inward direction until contact is made with the medial wall of the glenoid fossa. The penetration of the needle will be from 2 cm. to 3 cm. (fig. 1).

Deposit a drop of the solution and make the aspiration test by withdrawing the plunger. If no blood enters the syringe, the needle has not penetrated a blood vessel and the remainder of the solution may be deposited. From 0.25 cc. to 0.5 cc. of a solution of 5-percent sodium psylliate mixed with an equal part of 2-percent procaine hydrochloride, or eucupine in oil, is injected inside each capsule. This mixture is used to minimize the postoperative pain. The injection is made into both joint cavities, even if the symptoms are present only in one joint.



1. Needle inserted into glenoid fossa directly behind head of condyle. Mouth opened.

The postoperative reaction may be pain, some edema over the temporomandibular joint, partial trismus, and shifting of the occlusion to a protrusive bite. The pain can be controlled by mild sedatives. The trismus and shifting of occlusion will return to normal in 4 or 5 days. The patient is instructed to continue the normal function of the jaws and not to spare them. Favorable results have been obtained with single injections or the injections can be repeated every week or 10 days, depending on the symptoms, until there is a sufficient fibrosis. Four or five injections may be the maximum number required to obtain the desired results. The occlusion should be checked and corrected in conjunction with the treatment, and missing teeth should be properly restored.

REPORT OF CASES

Case 1.—A seaman, second class, aged 32, noticed clicking and locking of the lower jaw, with difficulty in opening his mouth on awakening in the morning. This condition was of 8 months' duration. Chewing resulted in soreness around the temporomandibular joints. There was no history of injury or apparent cause for this condition. Five months before entering the service, missing teeth were replaced. Correction of occlusion did not alleviate the pain. Examination revealed an audible clicking of both right and left temporomandibular joints when opening the mouth and in lateral excursion. There was no apparent locking or subluxation. Occlusion was good.

Treatment.—Both joint cavities were injected with a mixture of 5-percent sodium psylliate (sylnasol) and eucupine, 0.5 cc. in each joint. For the first 2 days there was pain, slight swelling in front of the left tragus of the ear, and the jaws closed in protrusive position. The symptoms gradually subsided. One week later there was normal movement of the mandible with absence of clicking and pain. Examination 6 weeks later, before transfer to other duty, revealed no recurrence of the original symptoms.

Case 2.—A seaman, second class, aged 28, gave a history of fracture of the right condyle of the mandible 5 years previously. After the fracture healed, the patient noticed a clicking and cracking sound when opening his mouth. This became progressively worse, and embarrassing because the sound could be heard across the table at meals. The patient experienced pain on change of weather or when biting into anything hard.

Treatment.—Injection of 0.5 cc. of emulsion of eucupine and sodium psylliate was made into each joint. One week later, there was a marked reduction in clicking on movement of the jaw. The injection was repeated. The second injection was followed by some pain, with limitation in lateral excursion of the mandible for 5 days. At final checkup, 6 weeks later, the patient did not have any recurrence of pain or clicking; occlusion was normal with normal function of the mandible. The patient was transferred to other duty.

Case 3.—A seaman, second class, aged 30, had marked clicking and occasional locking of the jaw when the mouth was opened to the fullest extent. This was followed by pain in the temporomandibular joint. The patient gave a history of dislocation of the jaw 5 years previously following the removal of a tooth. The dislocation was reduced but the present symptoms followed.

Treatment. —One week following the first injection there was slight clicking on lateral excursion. A second injection was given 3 days later. Postoperative reaction was slight. When last seen, 5 weeks after the initial injection, there was good function, normal occlusion, and absence of original symptoms.

Case 4.—A seaman, first class, aged 36, gave a history of locking and clicking after yawning which first occurred about 3 years previously. Very little pain was present.

Treatment.—One injection was given in both joint cavities, followed by little postoperative reaction, except shifting in occlusion to protrusive bite with limitation in lateral movements. This subsided within 1 week. At final checkup, 1 month later, there were none of the original symptoms present There was a good functional result.

Case 5.—A seaman, second class, aged 23, experienced a cracking sound when eating which was of 4 or 5 years' duration. There was no pain. Examination revealed a cross or locked bite on the left side with an asymmetrical development of the face. The left condyle could be palpated; whereas the right could not be when the mouth was opened. The chin would deviate to the left side. Occlusion did not permit lateral excursion.

Treatment.—Two injections were given within the first week. There was virtually no postoperative reaction, except for some trismus the first few days following each injection. The teeth were ground to permit some lateral excursion in occlusion but could not be satisfactorily corrected in this way. One month later, before transfer to another station, there was no clicking.

Case 6.—A fireman, third class, aged 22, for 2 years had experienced locking of the jaws and difficulty in closing after yawning, or in opening his mouth wide. There was some pain after locking, with occasional clicking in lateral excursion.

Treatment.—Following one injection of 1 cc. of equal parts of sylnasol and procaine, 2 percent, in each joint cavity, there was little pain, slight protrusive occlusion, and some limitation in opening the mouth. One week later there was slight pain at the right joint on opening the mouth wide; there was good function and no clicking. At the time of the final checkup, before his transfer and 5 weeks after his treatment, the patient was completely relieved of the original symptoms.

Case 7.—A radioman, third class, aged 23, gave a history of clicking on opening his mouth wide, of 6 months' duration, with little accompanying pain. The cause was not apparent.

Treatment.—One week after one injection of 1 cc. of equal parts of a sclerosing agent and procaine, 2 percent, in each cavity, there was no pain or clicking, and there was good function. Three weeks later, none of the original symptoms was present, and the patient had good function of the mandible.

Case 8.—A storekeeper, third class, aged 43, had pain in the right temporomandibular joint. Four days previously, the patient awoke with pain and difficulty in chewing. Examination revealed partial trismus and tenderness on palpating the area over the right temporomandibular joint. Occlusion was in protrusive relationship.

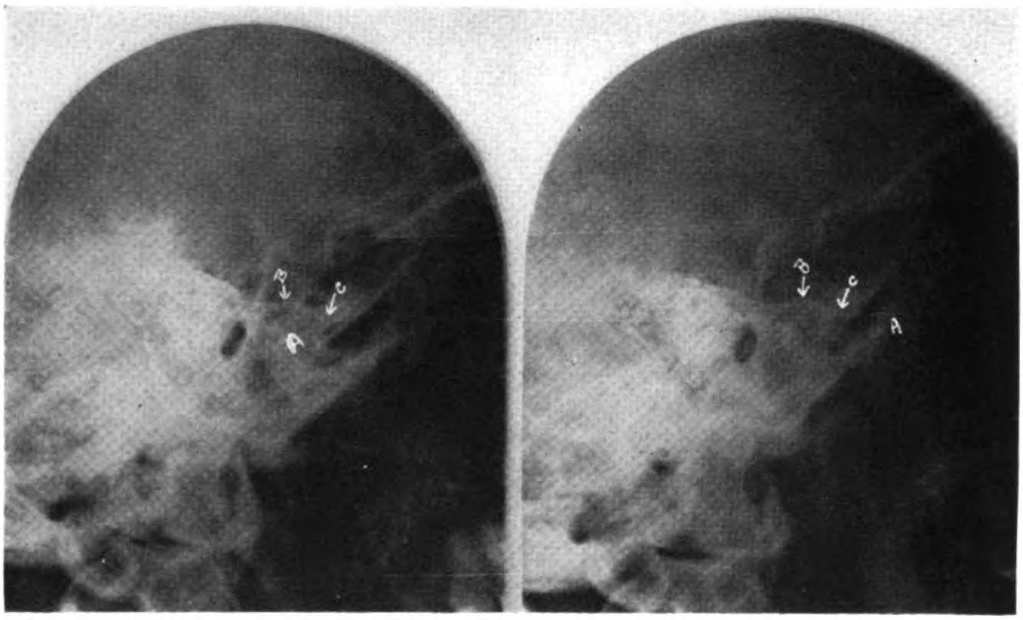
Treatment.—Both joints were injected with a mixture of equal parts of a sclerosing agent and procaine. Two days later there was marked trismus present and pain over both joints, which gradually subsided. Eight days following the injections there was no pain. The mouth could be opened almost to normal width and there was good function. Premature contact was relieved by spot-grinding the second molar. The patient was transferred 6 weeks later. There was no pain, and good functional movement of the mandible was present at the time of his transfer.

Case 9.—A fireman, second class, aged 34, gave a history of having had an accident at the age of ten. He had been aware of a strain at the temporomandibular joints since then. During the last year the condition gradually became more marked, with pain when opening the mouth wide, and with a grinding, clicking, and grating sensation on lateral excursion. The pain was chiefly in the right joint and was also present when biting into anything hard.

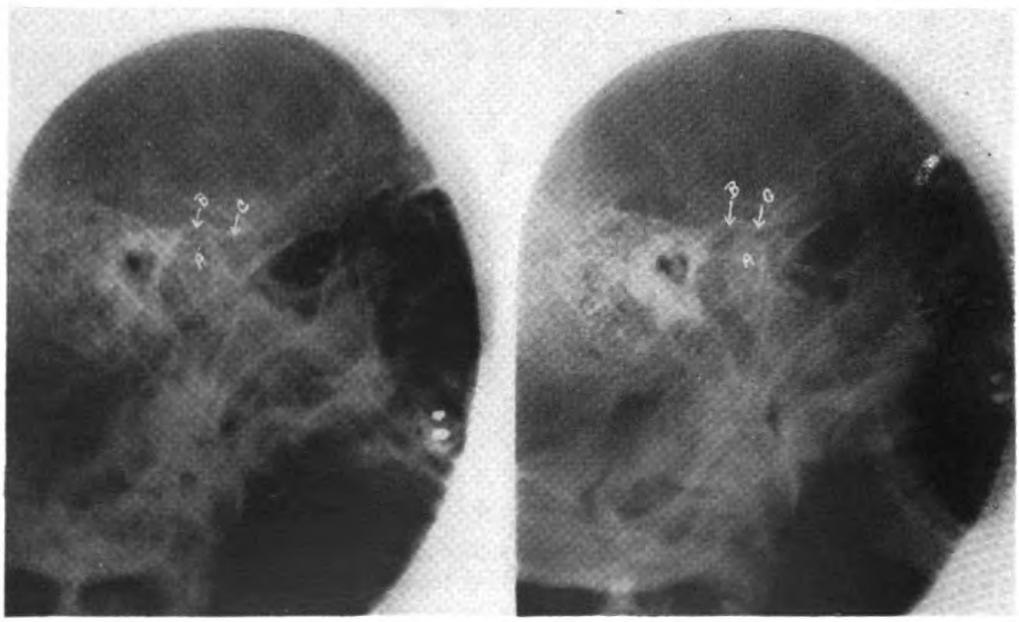
Treatment.—An injection was made of a 0.5-cc. mixture of the sclerosing agent (sylnasol) with equal parts of 2-percent procaine into each joint cavity. This was followed by slight swelling about both joints, slight pain, some trismus, and a slight protrusive bite. These symptoms gradually disappeared. One week later the patient had good function, with a normal degree of opening and comfort.

Case 10.—A gunner's mate, first class, aged 31, noticed a clicking sound following yawning. This condition was of 5 years' duration. The clicking was occasionally followed by locking, which required the patient to swing the lower jaw around in order to close his mouth. Within the last year, however, there had been slight locking, and closure of the mouth required little manual manipulation.

Examination.—There was good occlusion. When the patient opened his

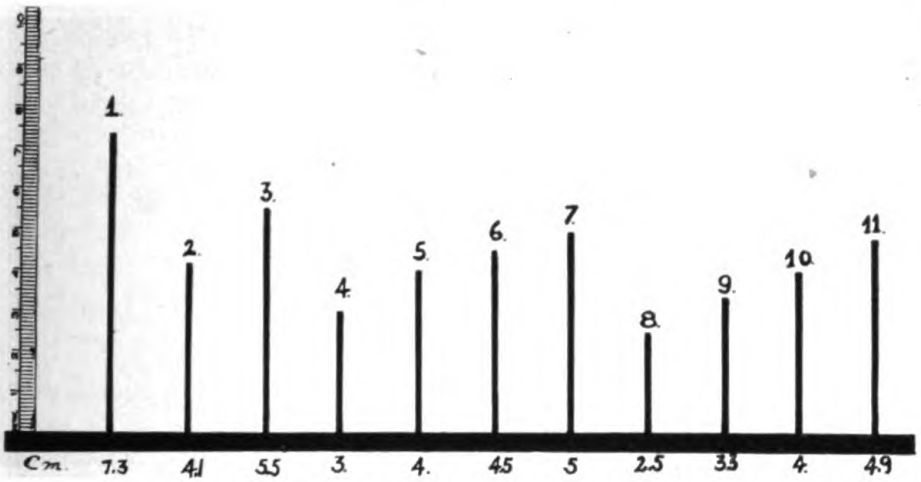


2. Case 10.—Roentgenogram of right condyle; mouth in closed and open positions before treatment, showing right condyle out of glenoid fossa and in the zygomatic fossa. (A) Condyle head; (B) glenoid fossa; (C) eminentia articularis.



3. Case 10.—Roentgenogram of right condyle; mouth in closed and open position 6 weeks after treatment, showing head of condyle below eminentia articularis in open-mouth position. (A) Condyle head; (B) glenoid fossa; (C) eminentia articularis.

mouth wide, both heads of the condyles could be felt to slip over the eminentia articularis, with marked forward excursion. Clicking was heard with lateral and protrusive movements of the mandible and also when the condyle



4. Case 10.—Maximum degree of opening of mouth measured from the incisal edges of the upper and lower left central incisors.

1. Degree of opening before treatment, 7.3 cm.
2. Degree of opening 2 days following first injection, 4.1 cm.
3. Degree of opening prior to second injection, 4 days after treatment was instituted, 5.5 cm.
4. Degree of opening 1 day following second injection, 3.0 cm.
5. Degree of opening 7 days after treatment was instituted, 4.0 cm.
6. Degree of opening 10 days after treatment was instituted, 4.5 cm.
7. Degree of opening 14 days after treatment was instituted, 5.0 cm.
8. Degree of opening 2 days following third injection, 2.5 cm.
9. Degree of opening 4 days following third injection, 3.3 cm.
10. Degree of opening 6 days following third injection, 4.0 cm.
11. Degree of opening 6 weeks following third injection, 4.9 cm.

heads slipped back into the glenoid fossae. There was an excessive degree of opening between the anterior teeth in open position.

Roentgenographic examination.—Figure 2, showing the mouth in open position, reveals the right condyle completely out of its glenoid fossa and in the zygomatic fossa, with complete dislocation.

Treatment.—In view of the duration of the condition and the marked forward movement of the condyles, a second injection was given in 4 days, although there was a favorable result following the first injection. There was little reaction after each injection and 3 weeks later there was good function of the mandible, no locking, and a normal degree of opening with only occasional clicking on lateral motion. An injection given for the third time was followed by trismus and protrusive occlusion which disappeared within 5 days. Three weeks following the third injection, or 6 weeks after treatment was instituted, none of the original symptoms remained. Roentgenographic examination of the temporomandibular joint at this time revealed the condyle head in normal position when the mouth was open (fig. 3).

HEMANGIOMAS

Description.—Hemangiomas of the oral cavity may be single or multiple. They are due to proliferation and dilatation of capillaries and smaller veins. They are generally congenital but may

arise from trauma. They are bluish red, soft and painless. The cavernous type are usually uneven or nodular and can be emptied, or may disappear on pressure, to reappear or refill when pressure is released.

Treatment.—Favorable results have been obtained by injecting the tumor with sclerosing solution. The solution causes a thrombosis of the blood channels with resulting fibrosis.

Technic.—Insert a 23-gage needle attached to a Luer lock syringe into the blood tumor. When blood is aspirated into the syringe, it means that the needle has penetrated a blood sinus or one of the capillaries.

Detach the syringe carefully, leaving the needle in place, and attach another syringe containing from 1 cc. to 3 cc. of the sclerosing solution and inject slowly. The quantity of solution used depends on the size of the lesion.

To prevent the needle from slipping out of the blood sinus, the syringe with the required amount of the solution can be used with the needle in its initial penetration into the angioma. The blood may be aspirated and permitted to mix with the solution, and the entire mixture injected into the tumor.

Following removal of the needle, pressure with gauze over the needle puncture will control bleeding. Repeated injections are made, if necessary, when all local symptoms subside.

Although a relatively small group of patients is represented in this report, the treatment is not new. In the last 6 years, I have found a high percentage of gratifying results after periodic checkup following treatment.

The treatment is harmless and simple; there is no loss of time from duty for the patient, and it is, therefore, specifically indicated for use in our armed forces.

SUMMARY

1. Ten cases of subluxation of the temporomandibular joint treated by injecting a solution of 5-percent sodium psylliate into the joint cavities are reported.

2. The mixture of the sclerosing agent with an equal part of either 2-percent procaine or eucupine in oil has minimized the postoperative reaction.

3. The treatment was successful in all subjects. Their stay at the station of treatment, however, was not of sufficient duration to permit further checkup. Results in other patients treated have proved to be satisfactory.

4. The treatment of hemangiomas of the oral cavity by injecting a sclerosing solution is also described.

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STREPTOCOCCI SENSITIVITY TO PENICILLIN

There is very little in vitro variation in sensitivity among strains A through N streptococci within any single group. The size of the inoculum could be varied within wide limits (100 to 1,000 fold) without changing the amount of penicillin required to inhibit growth completely. Group M strains were the most sensitive and required only 0.0039 Oxford unit to sterilize an inoculum containing 25,000 to 35,000 cells. Strains belonging to groups A, C, G, H and L required 0.0078 to 0.0313 of a unit to kill 1,000 to 10,000 bacteria. Growth of all the group A strains and most of those belonging to the other members of these groups were completely inhibited by 0.0156 unit. Strains belonging to groups B, E, F, K and N were slightly more resistant and generally required 0.0625 unit to sterilize an inoculum containing 1,000 to 10,000 cells. Group D strains, which required 2.0 to 5.0 units to kill a similar number of bacteria, were most resistant to the action of penicillin.

From this experience it appears that with the doses and methods of administration currently used in patients, concentrations of more than 1 Oxford unit per cc. of blood would be difficult to maintain for an appreciable length of time. It therefore seems unlikely that human infections with group D streptococci that require systemic treatment would respond readily to penicillin therapy in amounts commonly used now. Possibly localized infections, where higher concentrations of penicillin could be maintained, might respond favorably to this drug. On the other hand, infections with strains of groups A, B, C, E, F, G, H, K, L, M and N would be expected to respond favorably to penicillin since they are susceptible in concentrations that can be readily maintained in either the circulation or locally.—WATSON, R. F.: Sensitivity of various serological (Lancefield) groups of streptococci to penicillin. To be published.

BIOSTATISTICS IN MEDICAL RESEARCH[1]

III. SAMPLES WHICH ARE 100-PERCENT POSITIVE

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In research one is frequently asked a question such as: "If ten rabbits treated with an arsenical compound at a given dosage have all died, how many rabbits must be observed to determine that this dosage is always fatal?" or in more general terms: "When observations are consistently positive, how many observations must be made to be sure that they will always be positive?" In theory the answer is: "An infinite number." In practice, however, a more useful answer can be given by a simple application of the laws of chance. For the sake of the argument it is assumed that it is convenient, in the case of the rabbits, to administer only the indicated dosage, and that the fact of death is the only significant observation which can be made.

If it were possible to observe an infinite number of rabbits, and if they all died as a result of this treatment, that would constitute proof that the treatment is always fatal. If out of this infinite number of rabbits, all but one died, the treatment might still be called uniformly fatal, but there would then be evidence that it is possible for a given rabbit not to die as a result of the treatment. From a practical point of view, however, one would certainly expect all ten rabbits in a group of ten to die.

The probability of a rabbit's dying, commonly denoted by the letter p, is the proportion which die in an indefinitely large "universe" of rabbits. Since one usually cannot observe all the rabbits in a universe, the true value of p is not known. The value may be anything from 0, no rabbits in the universe dying, to 1, all rabbits in the universe dying. Whatever the true value of p may be, the proportion of rabbits in a given sample which will die of this treatment may be equal to p, or it may not. If p is not actually equal to 1, the laws of probability indicate that out of ten rabbits the number dying may vary due to chance alone, and for certain

[1] The first article in this series on biostatistics in medical research, I. Significant Differences, appeared in the December BULLETIN. The second article, II. Probabilities in Small Samples, appeared in the January BULLETIN. This is the third and concluding article.

values of p this variation may be quite large. The proportion of rabbits dying in a given sample therefore does not necessarily indicate the true probability of dying in the universe.

These laws of chance provide a formula which indicates the Probability[2] of obtaining, due to chance alone, a sample in which all rabbits die:

$$P = p^n$$

where: P = the Probability of obtaining, due to chance, a sample in which all rabbits have died,

p = the true probability of dying in the universe, which is the probability of any one rabbit's dying, and

n = the number of rabbits in the observed sample.

Since p is less than 1, the larger the value of n, the smaller is P.

This means that if the true effect of the treatment were a 90-percent fatality ($p = 0.90$), the Probability of obtaining 10 dead rabbits in a sample of 10 would be 0.35:

$$(0.90)^{10} = 0.35$$

In other words, if 100 successive samples of 10 rabbits each were treated, all 10 could be expected to die in 35 of the samples due to chance alone. In the remaining 65 samples not all 10 rabbits would die. A given sample of 10 rabbits, all dead, therefore, could easily be the result of chance when $p = 0.90$.

By the same formula, when $p = 0.80$, $P = 0.11$. Thus, if the true probability of dying because of this treatment were known to be 0.80, then in groups of 10 rabbits, all 10 would be expected to die in 11 samples out of one hundred due to chance alone. The sample of 10 rabbits, all dead, therefore could easily be the result of chance when p is as low as 0.80.

It is clear from the discussion so far that it is not possible to tell the true value of p, because the result of 10 deaths in a sample of 10 could easily occur due to chance even when p is decidedly less than one. It is possible, however, to set a limit below which we could not reasonably expect p to occur. For example, if the fatality of the treatment were assumed to be 60 percent ($p = 0.60$), then P for samples of 10 would be 0.006. That is, in this case one could expect 10 deaths in samples of 10, only 6 times out of one thousand due to chance alone. It is common practice, in statistical reasoning, to state that if an event could occur due to chance less than

[2] For the convenience of the reader the probability of dying in the universe is written with a lower case p and the probability of obtaining a given result in a sample of rabbits is written with a capital P.

once in a hundred times, it is an improbable event.[3] Therefore it may be said that it is unlikely that 10 rabbits would die in a sample of 10 when p is as low as 0.60. From this it is deduced that p was not as low as 0.60.

A result which could occur due to chance just once in a hundred times is represented by the Probability $P = 0.01$. Substituting this in the formula:

$$0.01 = (p)^{10}; \text{ whence}$$
$$p = 0.6310$$

In other words, if p were less than 0.63 one would not expect to find 10 deaths in a sample of ten, and it is therefore safe to assume that p is not below 0.63.

Nothing more specific than this can be said about p, based on the evidence of 10 deaths in a sample of 10 rabbits. How, then, can one obtain evidence that p is higher than this value? Only by observing a larger number of rabbits. If 20 rabbits are observed, all dead, and $P = 0.01$ is accepted as the limit below which the event is considered unlikely, the formula becomes:

$$0.01 = (p)^{20}, \text{ and}$$
$$p = 0.7943$$

When there are 20 deaths in a sample of 20, therefore, it is safe to assume that the true fatality of the dosage is not below 79 percent.

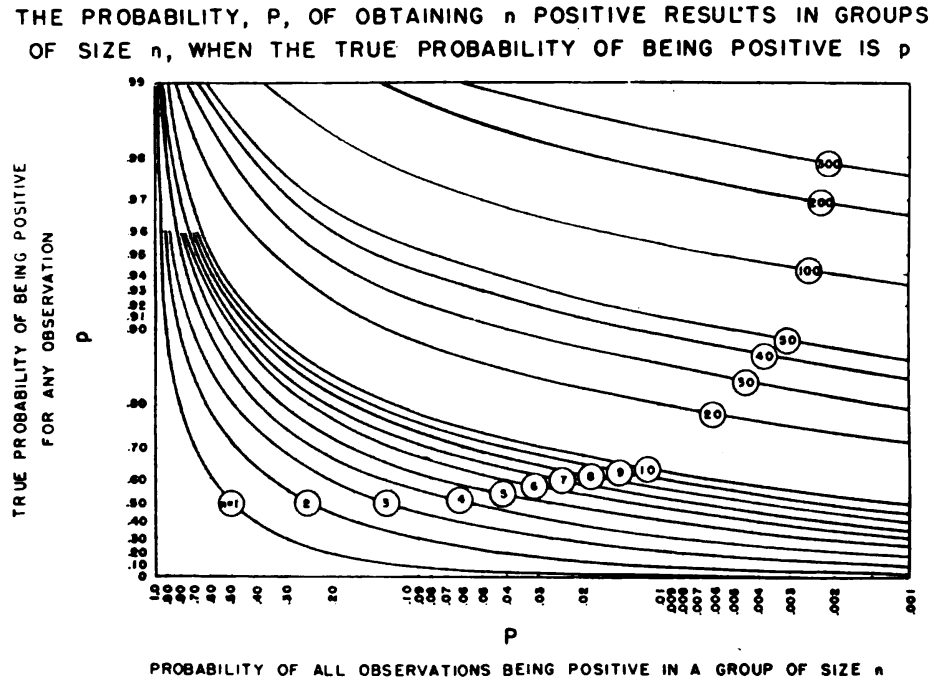
It is now clear that the larger the number of rabbits observed in a sample, all dead, the higher will be the value of p which it is safe to accept as a minimum. From the formula it is also evident that in order to be sure that $p = 1.0$, an infinite number of rabbits must be observed. And since this is not possible, one must be satisfied with a finite number of rabbits, and therefore with some value of p less than 1 (although possibly very close to it) as being equivalent to the term "always fatal" in the original question.

The accompanying chart shows a series of values of n in the formula:

$$P = p^n$$

In using the chart it is important to keep in mind that p is the probability of *dying* in the universe, and that P is the Probability of all rabbits in a given sample *dying*. The positive event must be the same in both terms. If p were the probability of survival, then P would be the Probability of all rabbits in a sample surviving.

[3] It is by no means universally accepted that an event is unlikely only if it can be expected to occur due to chance less than once in a hundred times. In some cases it may be satisfactory to set the limit at once in twenty times. This is a matter of judgment in relation to the problem at hand.



Accepting $P = 0.01$ as the limit below which an event is considered unlikely to occur due to chance alone, one may follow the vertical line for this value in the accompanying chart and observe that, in samples in which all rabbits die:

If the sample size is	30, p	is probably not below	0.86
do	40, p	do	0.89
do	50, p	do	0.911
do	100, p	do	0.955

and so on.

In order to determine how many rabbits must be observed, it is necessary to decide on a minimum value of p which can be called "always fatal." If one selects $p = 0.95$, then about 90 rabbits must be observed, all dead, to be safe in saying that p is not lower than 0.95. It must be remembered that this lower limit is selected on the basis of $P = 0.01$.

If it were sufficient to say that less than once in *twenty* times may be considered an unlikely event, P would then be 0.05, and the various values of p are read from the chart for successive group sizes on the vertical line for $P = 0.05$. In this case it would be safe to say that if 30 rabbits were observed, all dead, p is probably not below 0.906. And if it is desired to select 0.95 as a lower limit of p, it would be necessary to observe about 60 rabbits.

From this discussion it can be seen that in order to answer the original question, it is necessary to decide upon: (1) P, the value below which an event may be considered unlikely to occur due to

chance; and (2) the lower limit of p which may be accepted as meaning "always fatal." Having decided these two points, the chart gives the number of rabbits which must be observed. Now it is quite possible that this number turns out to be impractically large. In that event, the chart is useful in determining, for a given number of rabbits which have all died, the numerical values that may be given to the definitions of "an event unlikely to occur due to chance" and "always fatal," meaning a "probability of dying approaching certainty."

If, however, economic limitations as to the number of observations possible on the one hand, and limitations imposed by proper judgment as to suitable values for near certainty and for confidence on the other hand, are irreconcilable, other methods of answering the question must be resorted to. Such methods would include varying dosages, observing durations of survival, and so forth, which are not within the scope of this discussion.

It should be pointed out that, whereas experiments with animals are subject to variation and repetition with modified criteria, observations of humans can sometimes not be repeated, and the number may be strictly limited by existing availability of material. For example, let us assume that certain data indicate that all cases of a given type of wound terminate fatally. The question is whether this type of wound must be considered always fatal. Experimentation with patients to determine this is certainly not practical. It is important to know, therefore, how many patients should be observed in order to have convincing evidence. And it is also important to be able to arrive at some quantitative measure of the validity of the evidence presented by the number which has been observed. That is, having observed a given number of these patients, what is a reasonable minimum value to give to the probability of dying from this type of wound (p), and with what confidence may this reasonable minimum value be accepted. (The lower the value of P the greater the confidence.)

SO-CALLED REITER'S DISEASE

THE TRIAD OF ACUTE ARTHRITIS, CONJUNCTIVITIS, AND URETHRITIS

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Reiter, in 1916, described a syndrome characterized by arthritis, urethritis, and conjunctivitis, not caused by gonorrhea.[1] Since then, additional cases have been placed on record, including 6 reported by Bauer and Engleman,[2] whose report was the first one originating in this country. The paucity of the literature and the general lack of awareness of the existence of the condition suggests that it is a rare condition. Yet our experience of observing 10 cases within a year sheds doubt on this conclusion.

There are reasons why this disease could occur more commonly than has been supposed. These include its superficial resemblance to other diseases, the diversity of the bodily systems involved, and, particularly, lack of knowledge of its existence.

Recognition of the syndrome is important for various reasons. Experience with the cases to be reported here has shown that it is usually called by other names which may carry misleading implications of therapy and prognosis. Thus some of the cases were diagnosed initially as some type of constitutional disturbance (especially rheumatic fever and in one instance gout), and others were designated by such descriptive terms as prostatitis, nonspecific urethritis, gonorrhea, acute conjunctivitis, and acute arthritis, which were inadequate descriptions of the disease as a whole.

CLINICAL FEATURES

So-called Reiter's disease has been recognized only in young men. It is characterized principally by acute purulent urethritis, acute conjunctivitis, and acute arthritis, often occurring in that order. The conjunctivitis and urethritis are fairly transient (lasting days or weeks); the arthritis is more persistent and lasts 2 to 3 months

[1] REITER, H.: Über eine bisher unerkannte Spirochaetinfektion (Spirochaetosis arthritica). Deutsche med. Wchnschr. 42: 1288, October 19, 1916.

[2] BAUER, W., and ENGLEMAN, E. P.: Syndrome of unknown etiology characterized by urethritis, conjunctivitis, and arthritis (so-called Reiter's disease). Tr. A. Am. Physicians 57: 307-313, 1942.

or longer. Any one of these symptoms, particularly the arthritis, may recur, or there may be a recurrence of all symptoms. Recurrences may develop as long as 2½ years after the original illness.

There has been no basis for considering Reiter's disease venereal; however one of the patients in this study reported sexual contact with one woman on two occasions, separated by an interval of 2½ years. Two and three weeks respectively following each exposure he developed the triad of symptoms. In the first illness, urethral smears were negative, and in the second, urethral smears, urethral and prostatic cultures, conjunctival smears, cultures, and scrapings, all were negative for evidence of gonorrhea. The blood serum complement fixation test for gonococci was negative. With the exception of this case, sexual contact was denied by all the patients for any period in which gonorrheal infection could reasonably be thought to be possible, the shortest admitted period between the last previous exposure and the onset of symptoms being 5½ weeks.

The 10 patients observed were males between the ages of 19 and 35 years. Five of the cases had arisen locally, and five patients had been returned on the sick list from the South Pacific area. One patient was seen in his second attack; another had a recurrence of all symptoms 8 months after having been discharged from the hospital, and yet another had had recurrent attacks of conjunctivitis without other manifestations in the year preceding the onset of the acute triad.

The first symptom was usually urethral discharge, at first mucoid, then purulent, followed by conjunctival discharge, and joint pain and swelling. The triad of symptoms was usually complete within the first week of illness. At this period there was moderate fever, but no chills were reported.

By the time of the patient's admission to the hospital, whether or not urethral discharge was present, the major symptom was moderate to severe joint pain. In two patients the conjunctivitis appeared initially after admission. The patients appeared only moderately ill. The knees, ankles, hips, and interphalangeal joints of the fingers and toes were those most commonly affected, redness, tenderness, and swelling being characteristic. Increased joint fluid in the knee was occasionally observed.

In one patient, superficial excoriations of the mucous membrane of the mouth and pharynx were seen. Ocular findings usually consisted of conjunctivitis of moderate degree with purulent discharge; however, superficial keratitis was observed in two patients and widespread subconjunctival ecchymosis in one.

Urologic complications, aside from the urethritis, included pros-

tatitis of varying degree in at least 5 of the 10 patients. Symptoms of acute cystitis occurred in two, and a superficial balanitis in two others. None of the patients was cystoscoped.

X-ray examination of the involved joints showed no significant changes other than evidence of soft-tissue swelling and the presence of joint fluid, except in one instance in which narrowing of the joint spaces was noted in the interphalangeal joints. This occurred in the most acutely ill patient of the series, who displayed a definite, but variable, and now subsiding, spindle-shaped deformity, with joint narrowing and destruction in several fingers such as is seen in rheumatoid arthritis. This patient also had a widespread, acute eruption resembling erythema multiforme; this eruption led to desquamation and denudation of the soles of both feet, the glans penis, and the oral and pharyngeal mucosa.

LABORATORY EXAMINATION

During the acute period, moderate elevation of the sedimentation rate (10 to 20 mm. per hour) and of the leukocyte count (10,000 to 20,000 per cu. mm.) was found. Cultures and smears of the exudates from the conjunctiva, urethra, and prostate were negative for gonococci. Complement fixation tests for gonorrheal infection were carried out in 7 of the 10 cases and results were negative. Conjunctival scrapings were studied in 3 patients and no inclusion bodies were found. Darkfield examination of a penile lesion (balanitis) in one patient was negative. No animal inoculations were made, nor was the joint fluid examined in this series of cases.

Joint fluid characteristics were reported by Bauer and Engleman who also described the pathologic findings of synovial membrane (knee) biopsy in a case of Reiter's disease. Blood cultures were made in five of the cases reported here and yielded negative results.

Normal electrocardiographic findings were obtained in all cases. The urine was normal in all cases except during the acute stage of the illness when pus cells were found.

TREATMENT

Administration of sulfathiazole and sulfadiazine in seven cases had no apparent beneficial effect. Two courses of penicillin of one million units each, and seven injections of neoarsphenamine were administered to the most acutely ill patient, with no apparent benefit. Full doses of sodium salicylate, 10 gm. per day, were administered to five of the patients in this series and no substantial relief of the joint pains was obtained. In two patients, col-

chicine was given to the limit of tolerance with no alleviation of symptoms. The most helpful analgesic appeared to be combined acetylsalicylic acid and codeine in moderate doses.

In conclusion, it is hoped that more cases of this triad of symptoms of unknown etiology will be studied and reported so that light may be shed on its cause or causative factors.

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SEROLOGIC POSITIVITY IN INFECTIOUS HEPATITIS

In a study of 63 cases of infectious hepatitis among allied military personnel in Sicily, 15 cases showed false positive or doubtful positive serologic reactions after the clinical appearance of jaundice. The serologic studies in this series were not made prior to the onset of jaundice. This places infectious hepatitis in a group with yaws, leprosy, infectious mononucleosis, and some other diseases as one of the principal causes of false positive serology. In 8 or 9 positive cases when both the Kahn and Wassermann tests were performed, the Kahn test was more strongly positive and remained so for a longer time.

In a study of 20 cases showing false positives there was a pronounced trend toward negativity in the third week after icterus appeared; only 7 remained positive after the third week; and only one case was faintly positive in the seventh week.—News and Comment: False positive serology in infectious hepatitis. Bull. U. S. Army M. Dept. No. 80: 3, September 1944.

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SPACED PREGNANCIES

Infants born from twelve to twenty-four months after a previous viable delivery (that is, during the second year) have at least as low a stillbirth and neonatal mortality as do infants born after longer intervals. The longer the interval between births, the more likely the mother is to suffer from some form of hypertensive toxemia of pregnancy. The incidence of this complication is lowest when the interval is twelve to twenty-four months, significantly higher when it is twenty-four to forty-eight months, and much higher when it exceeds four years. In patients who have had a previous hypertensive toxemia of pregnancy, the likelihood of repetition becomes progressively greater as the interval becomes longer. The incidence of premature labor, anemia, postpartum hemorrhage and puerperal infection is no greater when the interval is twelve to twenty-four months than when it is longer, nor are mothers in this brief interval group less able to nurse their babies. The weight of the mature babies was approximately the same regardless of the interval.—EASTMAN, N. J.: Abuse of rest in obstetrics. J.A.M.A. 125: 1077-1079, August 19, 1944.

MENINGITIS IN AN ISLAND NAVAL AIR STATION DISPENSARY

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There were ten cases of meningococcic meningitis confirmed by diagnostic lumbar puncture at this island Naval air station dispensary. The dispensary is responsible for the medical care, not only of the personnel attached to the base, but also for a large number of transients, most of whom are attached to ships sent here for shakedown cruises. Their personnel consequently were recently detached from training stations in the United States where they had opportunity for contact with the disease.

Two of the ten patients were on duty in these environs for over 12 months; one was attached to the Construction Battalion and the other aboard a tender anchored in the neighboring waters. The other eight cases were from destroyers or destroyer escorts which recently arrived here from the States. There were no two cases from the same ship or activity. The youngest patient afflicted with meningitis was 18 and the oldest was 35 with the average age of 23.9 years. All cases were among the enlisted personnel.

The intracellular gram-negative organism was identified in all cases but one. In the case where the microorganism was not found, the patient had been on sulfonamide therapy for about 24 hours prior to admission to the dispensary.

TABLE 1.—*Symptomatology*

Symptom	Frequency	Symptom	Frequency
Headache	10	Vomiting	3
Fever	10	Backache	2
Malaise	10	Photophobia	2
Nuchal rigidity	8	Urinary incontinence	2
Kernig's sign	6	Muscular twitchings	1
Coma	5	Fecal incontinence	1
Sore throat	5	Nausea	1

Symptomology—The signs and symptoms encountered in these 10 patients as well as incidence frequency are seen in table 1. Headache and fever were the most constant findings. The headache was occasionally obscured by coma or delirium but became manifest as soon as the patient was lucid. Headache invariably was the last symptom to disappear. In 6 cases the onset of the disease

was preceded by an acute upper respiratory infection. It is interesting to note that no petechiae were found despite careful search. Coma or delirium was present in 5 patients on admission. This high incidence was due to the fact that the patients developed their initial symptoms enroute to the island and were treated for catarrhal fever or some other condition without benefit of sulfonamide therapy. A number of the ships were without a medical officer and consequently a diagnostic lumbar puncture was unavailable even if the disease had been suspected.

The medical histories, taken after the comatose patients had become rational, indicate that in none was there a fulminating type of onset but rather the usual headache, fever, sore throat and malaise. The coma developed in from 1 to 3 days.

Laboratory findings.—All spinal fluids were cloudy and under increased pressure. The lowest cell count was 6,000 per cu. mm. and the highest 90,000 per cu. mm. The average was 9,800 cells per cu. mm. In no case was there more than one lumbar puncture.

In nine patients treated with sulfadiazine, sulfonamide levels were obtained. The highest level was 15 mg. per 100 cc. and the lowest 6.3 mg. per 100 cc., with an average of 9.5 mg.

All cases showed a polymorphonuclear leukocytosis with a predominance of banded forms.

Treatment.—Nine patients were treated with sulfadiazine and one with penicillin. The sulfonamide therapy was given by mouth. The comatose patients were given the drug intravenously until they were able to take it orally. In no case was the intravenous therapy given for more than 36 hours. In one patient after the administration of 5 gm. of sulfadiazine, the patient developed pain in the right kidney region along with frank hematuria. This was considered caused by sulfonamide precipitation and the therapy was changed to penicillin intrathecally. Fluids were forced while codeine and nembutal were used for pain and restlessness.

All ten patients recovered, seven uneventfully.

Complications.—The hematuria in the patient who had 5 gm. of sulfadiazine has already been indicated. Recovery was uneventful however, after changing to penicillin therapy. One patient came into the dispensary in a mentally confused, uncooperative state with marked dehydration. He was immediately put on sulfadiazine intravenously along with 5-percent dextrose solution and was apparently doing well. Intravenous medication and fluids were discontinued and fluids by mouth were forced along with sulfonamide therapy orally. He suddenly had a vascular collapse, becoming extremely cyanotic and dyspneic. Pleuritic effusion became alarming. Fluids and medication were stopped and within 12

hours he appeared normal mentally, and the dyspnea and all signs of intrathoracic fluid were gone. Sulfonamide therapy was resumed and the patient made an uneventful recovery. This case indicates the importance of controlling the water balance in meningitis.

In another patient a 4-plus Kahn reaction was revealed during the routine laboratory examinations. This remained positive for as long as one month after recovery and then antiluetic therapy was instituted. There was no history of syphilis, although there had been contact. After his third mapharsen injection, the patient developed a severe chill and temperature up to 103° F. The following day the temperature dropped to normal only to go up to 104° F. in the next 24 hours after another chill. On the day following his second chill the temperature dropped to normal and remained so until the patient's transfer. He never fully recovered from his initial meningitis, complaining of generalized joint pains and weakness. Analgesics and supportive treatment did not give him his usual strength and vigor. Continued arsenical therapy was considered unsafe. The patient consequently was sent to a Naval hospital in the United States for further treatment and disposition.

Prophylaxis.—One case of meningitis came from a tender which was anchored in these waters for over a year. The entire ship's company of about 1,200 officers and men were given sulfathiazole, 3 gm. a day for 3 days. The cases that came from the destroyers or destroyer escorts came through the sickbays of two tenders anchored in these waters. As a result prophylaxis was given to the entire complement of these ships and to the pharmacist's mates of the tender who had contact with the patient during his transfer to the dispensary.

SUMMARY

1. A series of ten cases is reported from an island Naval air station dispensary.

2. Five of the cases were admitted in comatose condition due tc failure to recognize the disease early. Symptomatology and onset were essentially the same as reported in other series from various continental camps and hospitals.

3. There were no deaths.

4. Sulfadiazine is the drug of choice if tolerated. Penicillin may be substituted if there is an idiosyncrasy to sulfadiazine.

5. Prophylaxis was carried out as thoroughly as practicable.

THE SUBCUTICULAR SUTURE

In an attempt to find the most satisfactory skin suture, various types of material were investigated in a small series of cases, utilizing the running, lock, vertical and horizontal mattress methods of skin closure. Wire was believed the most inert and satisfactory although it was somewhat difficult to handle.

Recently it was decided to test the efficacy of subcuticular suture on all clean cases on the surgical ward of this hospital. Approximately 300 patients were subjected to this method of skin closure. The series consisted mainly of abdominal operations but included also surgery involving the head, face, neck, breasts and extremities.

In the obese patient and in upper abdominal surgery, the subcuticular suture was employed in conjunction with retention sutures. It was not used where any previous contamination of the wound existed.

The method of skin suture is of minor importance in the ultimate result of the surgery but it is believed to be of some significance in the duration of morbidity.

Advantages of subcuticular suture are: (a) It is the only method by which the suture is not carried into the skin a number of times and is thus less liable to become infected; (b) the removal is simple and the least uncomfortable; (c) the possibility of strangulation of the skin edges and local bleeding are less; (d) skin edges are perfectly approximated and a more satisfactory appearance results.

This suture when removed on the seventh or eighth postoperative day leaves a scar equally as strong as that produced by any other method.

When operating on the face and neck, there is no necessity for removing the sutures on the third or fourth day in attempts to produce better cosmetic results.

In this group of patients there were no wound infections attributable to this type of suture.

The method used was the usually described technic, excepting that the suture was of smaller size and was doubled. This does away with securing the ends by an additional stitch or with the use of especially prepared beads. The ends of the double thread are separated and tied over a small piece of hernia tape or tuft of gauze, taking care not to pucker the wound by drawing the ends together too tightly. Thumb forceps with teeth are necessary to handle the skin edge and the assistant should use a curved artery forceps to take up slack and insure that the suture does not become twisted. This latter step prevents the suture from locking beneath the skin.

The suture is removed by drawing out and cutting the double suture on one end. Grasping the other end removes it along the axis of the incision.—GARRITY, R. W., Lieutenant Commander (MC) U.S.N.

CLINICAL NOTES

ACUTE SUPPURATIVE PERICARDITIS

SUCCESSFULLY TREATED WITH INTRAPERICARDIAL PENICILLIN AND SYSTEMIC CHEMOTHERAPY

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and
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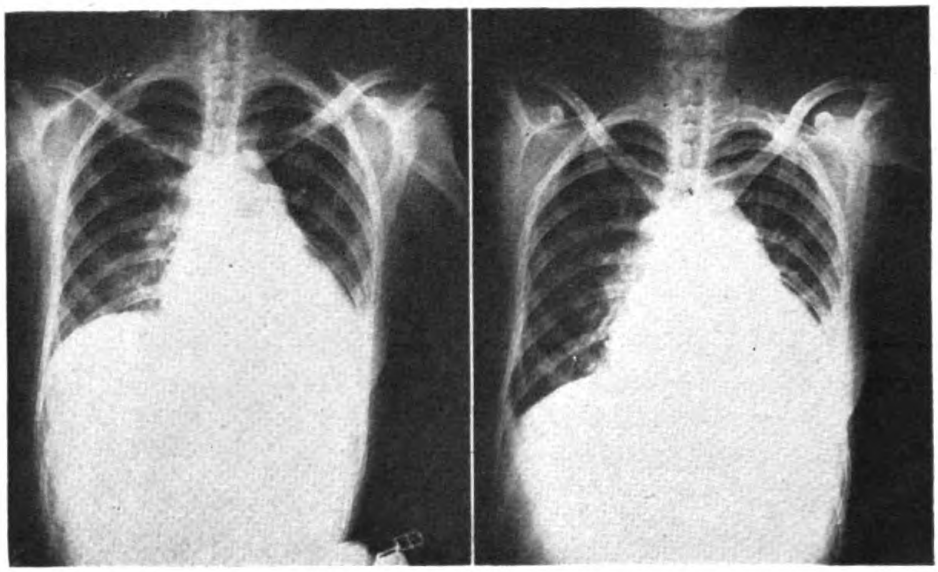
Prior to the introduction of the sulfonamides the diagnosis of acute suppurative pericarditis usually indicated a fatal outcome. These drugs, although effective in some cases, were inhibited in their action by the presence of purulent material even when they were employed locally. Penicillin seemed to offer greater hope in this almost uniformly fatal disease, but it too was not completely effective when used systemically. Therefore when we encountered a case of acute suppurative pericarditis, in which penicillin, as well as sulfadiazine, administered systemically was not effective in combating the progression of the disease, it was decided to inject the drug locally into the pericardial sac.

Although penicillin has been used successfully in the treatment of pleural empyema when used locally as well as systemically [1, 2] a careful search of the literature has failed to reveal any reports of its local use in acute suppurative pericarditis. In the case reported here penicillin instilled locally into the pericardial sac apparently contributed significantly to the patient's recovery.

Case report.—A WAVE, 25 years old, was admitted to the U. S. Naval Hospital, Brooklyn, N. Y., on 2 April 1944. The present illness had begun 4 days previously with a sore throat which became worse during the next 24 hours and was on the following day accompanied by several shaking chills, aching pains in the large joints, and a sense of tightness in the upper left side of the chest anteriorly. A slight cough developed, and the temperature rose to 103° F. on the evening of 1 April, when for the first time petechiae were noted on the trunk and upper extremities.

[1] TILLETT, W. S.; CAMBIER, M. J.; and MCCORMACK, J. E.: Treatment of lobar pneumonia and pneumococcal empyema with penicillin. Bull. New York Acad. Med. 20: 142-178, March 1944.

[2] HAGEMAN, P. O.; MARTIN, S. P.; and WOOD, W. B., JR.: Penicillin: Clinical study of its therapeutic effectiveness. (In Soc. Proc.) J. A. M. A. 124: 798, March 18, 1944.



1. Admission x-ray examination.

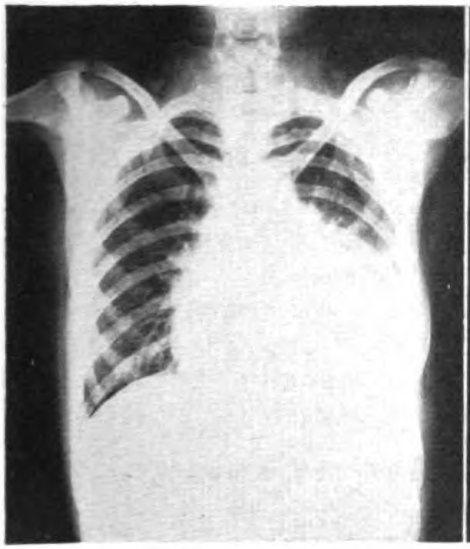
2. The x-ray on 5 April showed evidence of increased pericardial effusion.

On admission the temperature was 101° F., pulse rate 130 and respirations 40 per minute. The blood pressure was 76/40. The patient was acutely ill, pale, slightly cyanotic and tachypneic. Approximately 15 petechiae, varying in size from 1 to 3 mm., were found distributed over the upper part of the back, the chest, the abdomen, and upper extremities, the larger lesions being noted in the latter sites. There were no hemorrhagic manifestations in the mucous membranes.

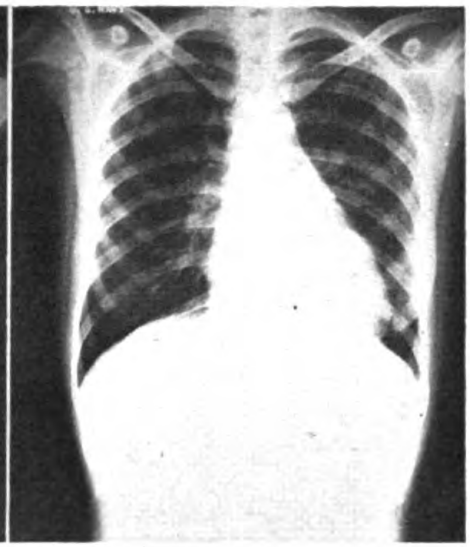
The skull showed no abnormalities. The eyes were somewhat sunken. The pupils were equal and their reaction normal. The ears and nose were normal. The mucous membranes of the fauces and pharynx were moderately edematous and reddened, but no exudate was noted. There was no nuchal rigidity. A moderate degree of regional cervical lymphadenopathy was present. The cervical veins were moderately distended, but did not reveal any abnormal pulsations. The trachea was found in the midline. The chest was symmetrical and narrow.

The heart was regular. The apex impulse was visible in the fifth left intercostal space midway between the left midclavicular and anterior axillary lines. Relative cardiac dullness, however, began 2 cm. outside the maximal apical impulse. The entire left border was found to be enlarged upon percussion; the arch and right border were within normal limits. Both sounds at the apex were moderately diminished in intensity, and there were no apical murmurs.

In the third and fourth left intercostal spaces, just inside the left border of cardiac dullness, a fairly loud to-and-fro friction rub was audible. The aortic and pulmonic sounds were slightly muffled, but otherwise were clear. The right lung was apparently normal. Over the left lower lobe posteriorly, however, there was slightly increased tactile fremitus, a dull percussion note and bronchovesicular breath sounds with increased transmission of spoken and whispered voice, but no râles. These pulmonary signs could be accentu-



3. On 7 April there was x-ray evidence of greater increase in pericardial fluid.



4. By 19 April the heart picture was normal.

ated or diminished respectively by turning the patient on either her right or left side, and were believed to be produced by the pericardial effusion (Ewart's sign).

The abdomen was flat and soft. The liver and spleen were apparently normal in size. No abnormal masses were palpable. The lower extremities were normal.

The erythrocyte count was 3,500,000 per cu. mm., and the hemoglobin content was 13.5 gm. per 100 cubic centimeters. There were 19,800 leukocytes with 87-percent neutrophils. Blood culture taken after admission revealed no growth. The urine was normal.

Roentgenologic study of the chest (fig. 1) revealed the heart shadow to be generally enlarged, particularly on the left side where the apex reached the periphery of the chest. The aorta was well delineated and the cardiohepatic angle was acute. A slight degree of pulmonary congestion was noted.

Treatment was begun immediately, 5 gm. of sodium sulfadiazine being administered intravenously and 60,000 units of penicillin intramuscularly. Three succeeding 2½-gm. doses of sodium sulfadiazine were administered intravenously at 4-hour intervals, and during the next 4 days, 1 gm. of sulfadiazine was given perorally every 4 hours. Following this 30,000 units of sodium penicillin were administered intramuscularly every 3 hours for the next 7 days. A total of 1,740,000 units was given by this route.

On 5 April, 56 hours after beginning this therapy, the heart size had increased, the pericardial friction rub had disappeared, and signs of cardiac tamponade with a pulsus paradoxus became apparent. X-ray examination (fig. 2) showed confirmatory evidence of increased pericardial effusion.

At this time, a pericardial paracentesis was performed and 200 cc. of grayish-red purulent fluid containing fibrin flakes was removed. Before removing the paracentesis needle, 20,000 units of sodium penicillin dissolved in 10 cc. of sterile distilled water were injected directly into the pericardial sac. Cul-

ture of the pericardial fluid did not show any growth either aerobically or anaerobically, but Gram stain of the fluid revealed in addition to many pus cells, gram-positive cocci in short chains resembling streptococci.

Four daily pericardial paracenteses were performed from 6 to 9 April with injection of 20,000 units of sodium penicillin each time. In all, 1,090 cc. of purulent fluid was removed from the pericardial sac, and on 9 April the fluid was found to be thinner, lighter in color, and less purulent. Roentgenographic examination of the heart on 7 April (fig. 3) had revealed a still greater increase in the amount of pericardial fluid.

By 10 April general improvement was well under way, the shortness of breath had greatly diminished, and the signs of cardiac tamponade had disappeared. The temperature, pulse rate, and respirations gradually returned to normal, and by 19 April roentgenographic study of the chest (fig. 4) showed a normal cardiac picture.

COMMENT

A patient with acute suppurative pericarditis, a disease which previously even with the use of the sulfonamides, resulted in an extremely high mortality rate, was in this case successfully treated by the intrapericardial administration of sodium penicillin and aspirations of the pericardial pus, combined with sulfadiazine and penicillin administered systemically. In all 100,000 units of penicillin, in 5 daily doses of 20,000 units each, was instilled into the pericardial sac following pericardial paracenteses, combined with the systemic administration of sulfadiazine and 1,740,000 units of penicillin.

Because of the history of sore throat, chills, fever, petechiae, and suppurative pericarditis, the condition was believed to be a streptococcal septicemia. Although this could not be proved conclusively, inasmuch as culture of the blood and pericardial fluid showed no growth, the finding of what appeared to be streptococci in the pericardial fluid on Gram stain, as well as the fact that intensive chemotherapy was instituted before culture of the pericardial fluid was obtained, are certainly suggestive of this diagnosis.

Despite the fact that the blood and pericardial fluid were culturally negative, and that seemingly adequate doses of sulfadiazine and penicillin had been administered systemically, the patient's condition continued to become graver and the pericardial effusion increased. The improvement following pericardial aspirations and injection intrapericardially of sodium penicillin would seem reasonably attributable to these measures. The reported success of the intrapleural injection of penicillin in pleural empyema would appear to confirm this opinion.

GONORRHEAL OPHTHALMIA

TREATED WITH PENICILLIN

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Gonorrheal ophthalmia treated with penicillin, has been reported by McNair[1]. However, the end results in the 2 cases were unsatisfactory because the penicillin was necessarily started too late in the course of the disease. In case one an evisceration was required and in case two a descemetocele resulted.

As penicillin by intramuscular injection has proved so highly efficacious in patients with gonorrheal urethritis, it was felt that it might be equally successful in gonorrheal ophthalmia. The gonococcus is especially susceptible to penicillin therapy. Consequently, when the occasion arose to treat a patient with an early gonorrheal ophthalmia, it was decided to use penicillin exclusively, dispensing with the usual frequent eye irrigations. It is thought that these, by producing a portal of entry, are often the cause of damage to the cornea.

Case report.—An electrician's mate, first class, age 22, was admitted with a profuse, yellow discharge from the eye, which had been present for 24 hours. There was a history of gonorrhea in 1942, but none since that time. The right eyelids were intensely edematous so that it was impossible to open them. There was a constant discharge of thick, creamy, yellow pus. The conjunctiva was markedly edematous and hyperemic. Examination of the cornea revealed it to be clear. No discharge was present from the urethra, but a smear was positive for neisserian infection. A smear and culture taken from the eyelids were positive for gram-negative intracellular diplococci. The Kahn reaction was negative and a blood count showed a mild leukocytosis.

Treatment consisted of intramuscular injections of penicillin. In the second day of the disease, 20,000 units were given every 2½ hours until 140,000 units were injected. During the third day, 200,000 units were given and on the fourth day 140,000 units were injected. A total of 480,000 units were consequently administered. Forty-eight hours after the onset of therapy, a smear examination showed pus cells but no organisms. The edema and discharge rapidly subsided and four days after the beginning of treatment the eye had returned to normal. No local therapy was used except the instillation of atropine once each day, and no prophylactic treatment was administered for the uninfected eye.

[1] McNair, S. S.: Gonorrheal ophthalmia. U. S. Nav. M. Bull. 43: 532-534, September 1944.

SUMMARY

This case of recovery demonstrates the efficacy of penicillin in gonorrheal ophthalmia. With the use of this new drug, no local treatment to the eye is necessary providing the cornea has not been infected.

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POSTOPERATIVE FOOT EXERCISES

Much thought has been devoted in recent years to the treatment of thrombophlebitis, phlebothrombosis, and the frequently associated pulmonary complications and subsequent leg edemas. Less attention has been paid to the prevention of these serious and distressing conditions. The usual preventive measure for circulatory stasis in the legs has been the use of bicycle or some other form of exercise.

The advantages of the foot exercises are as follows:

1. They are easy and simple to perform.
2. They are painless.
3. They effectively and frequently stimulate the venous circulation of the calf where most of the dangerous and silent thrombi originate.

Written instructions in the performance and necessity of the exercises, given to patients to read preoperatively, also enhance the possibility of successful prophylaxis against thrombosis.

This is accomplished by giving the patient the following letter the day before operation (except in cases of thyroid and nose and throat surgery):

After your operation the surgeon would like to have you do foot exercises. Just as soon as you are able, you are to start moving the ball of each foot up and down slowly, as if, for instance, you were trying to reach down with your toes and touch the end of the bed. One or both feet can be exercised at the same time. It is not necessary to move the legs except to stiffen them out occasionally. These exercises should be done nearly a thousand times in 24 hours.

In certain cases the nurse will awaken the patient several times during the night and request that foot exercises be done for a few minutes. Any time that you happen to awaken during the night the exercises should be done for a few minutes. These simple exercises contract the muscles of the lower leg and this helps to speed up the circulation which has been slowed down because you are confined to bed. If you notice any discomfort, no matter how slight, in the legs and particularly in the calves, that you did not notice before, please report it to the nurse.—BOEHME, E. J., and ADAMS, R.: Prophylaxis against thrombosis. Lahey Clin. Bull. 3: 142–145, July 1943.

At the end of three days' treatment.

At the end of the first day's treatment.

Before treatment was started.

GONORRHEAL OPHTHALMIA

TREATMENT WITH INTRA-OCULAR PENICILLIN
REPORT OF A CASE

CHARLES A. SEELIG
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The seriousness of gonorrheal infections of the eye and their sequlae is well known. Two factors are responsible for the extensive destruction and permanent damage, namely, (1) virulence of the organism, and (2) poor blood supply of the parts. The latter factor is responsible for the limitation of the effectiveness of drugs such as the sulfonamides and penicillin.

Struble and Bellows[1] have been able to demonstrate in dogs that even by intravenous injection of large doses of penicillin, the concentration of the drug recoverable from the cornea and conjunctiva is extremely small, whereas great concentrations are present following subconjunctival injection. The cornea showed 28 times higher concentration of the drug recoverable following this method as compared with intravenous administration. Similar results are obtained after a constant corneal bath.

Case report.—A 35-year old seaman, second class, was admitted to an advance base dispensary from an outlying base with the diagnosis of gonococcus infection, right eye. Several positive smears from the eye, confirmed here, accompanied the patient. There was a history of digital contact with vaginal secretions. There were no genital lesions. At the time of admission the case was of 15 days' duration. The patient had been treated with a routine course of sulfathiazole and 200,000 units of penicillin intramuscularly, application to corneal ulcers of 7-percent tincture of iodine, and intravenous injections of triple typhoid vaccine.

Examination on admission revealed the left eye to be normal. The right eyelids were inflamed, and purulent drainage was visible at the inner canthus. The sclera was markedly engorged and diffusely reddened throughout, with some chemosis present. The cornea was dull, grayish, and steamy. There were two large, active, serpiginous ulcers at 4 and 8 o'clock with evidence of recent spread involving approximately 40 percent of the corneal surface. The pupil was sluggish but not fixed. The anterior chamber was shallow. The fundus was not visible. There was evidence of an extremely active kerato-iritis. The patient had total loss of vision for form and objects, but near perception of light was still present.

Treatment consisted of 0.25 cc. (1,250 units) of penicillin injected into

[1] STRUBLE, G. C., and BELLOWS, J. G.: Studies on distribution of penicillin in the eye; and its clinical application. J.A.M.A. 125: 685-690, July 8, 1944.

the right eye subconjunctivally along with 1 minim of 5-percent procaine hydrochloride. This was followed by direct instillation of 3 minims of a solution containing 500 units of penicillin into the conjunctival sac every half hour as a corneal bath. The subconjunctival injection was repeated every fourth day for 12 days and the corneal bath for 14 days. The corneal ulcers were touched daily during the first 7 days with 100-percent trichloracetic acid and three times during the following 10 days. For dilatation of the pupil and prevention of adhesions 2-percent atropine was instilled three times daily. Heat was applied locally as often as was practicable. Sensitivity to atropine after prolonged use was overcome by substituting scopolamine in 0.333-percent solution. Similar sensitivity to scopolamine developed after 5 days.

After 29 days of active therapy, the patient's visual acuity was 20/20. The ulcers were completely healed, with two small scars remaining at the periphery of the cornea, visible through a loop.

COMMENT

This case is presented to demonstrate a successful method of administration of penicillin in gonorrheal infection of the eye. Despite the use of both sulfonamides and penicillin systemically, the activity of the infectious process at the time of admission was so great that it was felt very definitely that this patient would either lose his eye or sustain some permanent damage to the visual acuity.

PERSISTERS

Failure to sterilize broth containing Staphylococcus pyogenes is due to the survival of a small number of staphylococci called persisters. Persisters are insensitive to penicillin because they are temporarily in a nondividing phase and because penicillin kills only bacteria which are about to divide. Unlike resistant strains, descendants of persisters are easily killed by penicillin. Penicillin fails to cure staphylococcal infections in the body because some of the cocci are in the persister phase. To treat persisters penicillin is alternatively administered and withheld; during treatment, all cocci in a susceptible phase are killed; during periods of absence of treatment, persisters commence dividing and are susceptible to penicillin.—BIGGER, J. W.: Treatment of staphylococcal infections with penicillin; by intermittent sterilization. Lancet 2: 497-500, October 14, 1944.

RUPTURED ANEURYSM FOLLOWING TYPHOID-TETANUS BOOSTER INJECTION[1]

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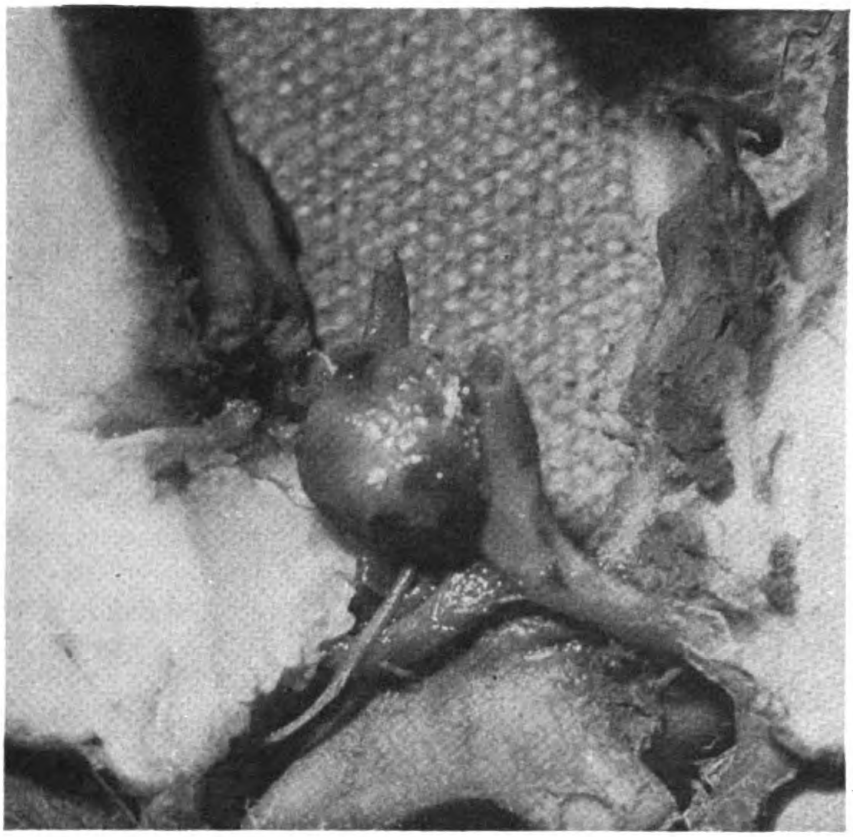
The occurrence of intracerebral hemorrhage in a young man shortly after receiving a booster injection for typhoid and tetanus immunization has not been recorded. Although the behavior of intracerebral aneurysms is unpredictable, it is reasonable to assume that alterations produced by foreign protein injection may hasten the rupture of an artery that is damaged. In a sensitized person, both arterial spasm and decreased coagulability of the blood may result if an anaphylactic type of reaction occurs.

Serum sickness, serum allergy, and anaphylactic shock have all been reported following active immunization against tetanus with either plain or alum-precipitated toxoid (*1*). These reactions, although relatively rare, are common enough to be borne in mind. The onset of symptoms is rapid and usually occurs within two hours after the injection. In 1940, Whittingham reviewed 61,042 immunizations and found reactions in 0.02 percent. They varied from mild constitutional reactions to anaphylaxis (*2*). He attributed these reactions to proteoses or peptones in the immunizing material. In the same year, Cunningham (*3*) reported anaphylaxis. Urticaria was reported by Hall in 1937 (*4*) and by Bigler and Werner in 1941 (*5*). Generalized constitutional symptoms were observed by Gold in 1938 (*6*) and by Parish and Oakley in 1940 (*7*).

Most of the experimental work on anaphylaxis to date has been done with animals because of the scarcity of suitable human material. A prominent feature of anaphylaxis which has been demonstrated in dogs is a dramatic decrease in coagulability of the blood. While investigating the mechanism of this loss of coagulability, Jacques and Waters (*8*) recovered crystalline heparin from the blood. They concluded that heparin production by the liver is accelerated during anaphylaxis. In 1936 Quick expressed similar views (*9*).

Anaphylaxis in monkeys is accompanied by hemorrhages in the lungs, intestines, and other viscera, as demonstrated by the

[1] From the U. S. Naval Medical School, Bethesda, Md.



Aneurysm of the left anterior cerebral artery arising in close proximity to the anterior communicating artery.

Kopeloffs in 1939 (*10*) (*11*).

Stimulation of nonstriated musculature throughout the body, including the blood vessels, was added to the syndrome of anaphylaxis by Wells in 1921 (*12*). In the case which follows, no clinical symptoms of anaphylaxis were noted, but the patient was not under observation when he first became ill.

Case report.—A 29-year-old white male, petty officer was evacuated from the South Pacific area in September 1943, because of malaria and loss of 20 pounds in weight. On his return to the United States improvement was prompt and satisfactory except for one episode of chills and fever. In November recovery was complete enough to enable him to undergo an uneventful bilateral herniorrhaphy.

On 26 January 1944 he felt well and was given injections of 0.1 cc. triple typhoid vaccine[2] intradermally and 0.5 cc. alum-precipitated tetanus toxoid[3] intramuscularly. The same morning, an unknown time after but within two hours of the time of the injection, he suddenly developed severe gen-

[2] Triple typhoid vaccine type 1940 was prepared under the supervision of the Army Medical School and contained:

Typhoid bacillus	1,000 million per cc.
Paratyphoid A	250 " " "
Paratyphoid B	250 " " "

[3] Alum-precipitated tetanus toxoid contained 1:10,000 merthiolate preservative.

eralized headache, became nauseated, and vomited. Both the headache and vomiting persisted and sedation was necessary.

On admission to the hospital later during the same day, the patient's temperature was 99° F., pulse 70, respiration 18, and blood pressure 136/58. The left pupil was larger than the right, and there were equivocal signs of meningeal irritation, including a questionable stiff neck and Kernig's sign. Blood smears were negative for malarial parasites. The spinal fluid contained 3 erythrocytes and 2 leukocytes per cubic millimeter. Spinal fluid Kahn and Wassermann reactions and the gold curve were normal; chlorides were 193 mg. percent; sugar 60 mg. percent; and total proteins 25 mg. percent. Headache was continuous, and the temperature varied between 98° and 100° F. The peripheral blood showed normal red, white, and differential cell counts. It was thought that the patient was suffering from a mild subarachnoid hemorrhage.

Two weeks after admission, the original symptoms of headache and nausea reappeared in exaggerated form, and a lumbar puncture disclosed bloody fluid under an initial pressure of 340 mm. of water; after removal of 7 cc. the pressure was 160 mm. Total spinal fluid proteins at this time were 129 mg. percent, with 10,150 erythrocytes and 16 leukocytes per cubic millimeter. The clinical course was uneventful for the next 4 weeks and there was slow improvement. No localizing neurologic signs could be elicited. On two occasions electroencephalograms revealed foci of electric abnormality in both occipital regions, more prominent on the right side.

Six weeks after the original attack, after straining at stool, the patient was found prostrate, vomiting and complaining of intense headache. Blood pressure was 130/80, rising to 180/80 during the next few hours. The sensorium grew progressively less clear, and coma with decerebrate rigidity developed. Pathologic toe reflexes (Babinski, Chaddock, and Oppenheim) were present bilaterally and both eyes deviated to the right. Dyspnea and cyanosis developed and râles were heard throughout the chest. Death occurred 24 hours after the onset of the last attack.

At necropsy, there was a ruptured polypoid aneurysm of the right anterior cerebral artery measuring 1.5 cm. in diameter, with subarachnoid hemorrhage involving the base of the brain, medial aspects of both hemispheres, and the cerebellum. There was blood in all the ventricles. The only microscopic evidence of malaria in any of the organs was the presence of an increased amount of blood pigment in the spleen. There was a subcapsular hematoma in the right lobe of the liver. The aneurysm is shown in the accompanying photograph.

SUMMARY

A case is presented in which fatal hemorrhage from an aneurysm of the anterior cerebral artery had its onset shortly after administration of a booster injection for typhoid and tetanus. Some of the physiologic changes accompanying anaphylaxis are given, with emphasis on those which may be related to this case.

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12. WELLS, H. G.: Present status of problems of anaphylaxis. Physiol. Rev. 1: 44-83, January 1921.

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GLYCOSURIA IN MENINGITIS

Spontaneous glycosuria occurs frequently at the onset of meningitis. It was encountered in meningitis caused by the meningococcus, the pneumococcus, the staphylococcus, the tubercle bacillus, and in one case in which the causative organism was not isolated. It was accompanied in many instances by ketosis, hyperglycemia and diminished tolerance to sugar. Glycosuria was transient, persisting beyond the third day in only three of the 16 cases studied. Coma with glycosuria and ketosis at the onset of meningitis may mask the signs of meningeal involvement, lead to a diagnosis of diabetic acidosis and cause serious or fatal delay in instituting appropriate treatment for the meningitis.—FERGUSON, F., and BARR, D.: Glycosuria in meningitis. Ann. Int. Med. 21: 173-186, August 1944.

DELAYED SPLENIC RUPTURE

REPORT OF CASE

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Delayed splenic rupture is an infrequent abdominal emergency that needs not so much expert surgical skill as early and accurate diagnosis. Zabinski and Harkins[1] in their review of 177 cases mention only one case in which the diagnosis was made in the so-called latent period of the syndrome, with prophylactic splenectomy. All other cases were operated, if at all, in the stage of acute hemorrhage. The pitfalls in diagnosis lie in not being fully aware of such a clinical entity and in failure to obtain a history of antecedent trauma; or if such history is obtained, in its disregard, possibility of late hemorrhage not being kept in mind.

The condition of delayed splenic rupture can be divided into three phases: (1) The original injury; (2) the latent period; (3) the acute secondary hemorrhage.

Trauma, varying in type and severity, and usually with a concomitant injury such as a fractured rib, accounts for rupture of the normal spleen in almost all cases. Automobile accidents are cited as the greatest single source, with falls of various types next in line. In our reported case a fall down the hatchway of a ship was the cause of injury.

The extent of subcutaneous damage to the spleen in the initial stage of injury is difficult to evaluate. Often there is no complaint after the temporary disability. Undoubtedly some degree of hemorrhage exists, either intrasplenic, subcapsular, or perisplenic with capsular tear, but for some reason the bleeding is stopped or retarded, leaving the physician with only the superficial injury to distract his attention.

Credit is given Baudet for the term "latent period," which denotes the asymptomatic period following the initial injury until

[1]ZABINSKI, E. J., and HARKINS, H. N.: Delayed splenic rupture; clinical syndrome following trauma; report of 4 cases with analysis of 177 cases collected from literature. Arch. Surg. 46: 186-213, February 1943.

secondary hemorrhage occurs. The duration of the latent period is a matter of hours, days, weeks, or months; our case had a latent period of 18 days. This asymptomatic period of apparent well-being is the red herring that diverts the physician from the track of delayed splenic rupture.

All diagnostic means at the physician's command should be employed to determine the extent of splenic injury, as prophylactic splenectomy during the latent period will lower operative risk and mortality. Minor complaints of these patients should not be dismissed lightly. Pain in any degree should receive the utmost attention as to its location, duration, and distribution. Persistent pain in the left hypochondrium with increased resistance and tenderness may be present for several days following the accident. Vague abdominal discomfort with indigestion may be a symptom. Gradual enlargement of splenic dullness may be an early sign. Elevation of the diaphragm and costal breathing are due to an irritation of the diaphragm by an aseptic perisplenitis as a result of local bleeding. A persistent leukocytosis and progressive anemia may be encountered in the retarded perisplenic hematoma.

Roentgen examination may show increased density of splenic area, elevation of the diaphragm, displacement of the stomach and of the splenic flexure of the colon. Lienography with colloidal thorium dioxide has been advocated by Burke and Madigan (quoted by Zabinski and Harkins). Wright and Prigot[2] used paracentesis in their two cases of delayed splenic rupture. Peritoneoscopy has not been used but should prove of definite value in making a diagnosis during the latent period.

ACUTE SECONDARY HEMORRHAGE

The sudden appearance of the secondary hemorrhage demands active treatment. In its wake follow various signs and symptoms not unlike those of ruptured ectopic pregnancy. The first symptom is a sudden severe abdominal pain, usually localized in the epigastrium but which may start also in the left hypochondrium, upper abdomen, or para-umbilically. The pain eventually radiates to the lower left quadrant and then becomes generalized. Tenderness and muscle rigidity are noted over the entire abdomen and may be more marked in the epigastrium.

Abdominal distention is noted fairly early and some authors emphasize distention as an early sign. Intestinal distention follows the partial obstruction set up by the adynamic ileus in the splenic

[2] WRIGHT, L. T., and PRIGOT, A.: Traumatic subcutaneous rupture of normal spleen. Arch. Surg. 39: 551-576, October 1939.

flexure as a result of the irritation, and aseptic peritonitis from the bleeding lacerated spleen.

The following signs may or may not be present: Nausea, vomiting, slightly elevated temperature, tachycardia, tachypnea, and costal breathing.

Shock will develop in direct proportion to the rate of hemorrhage. In our case there were no signs of shock until the operation was started. Acute anemia and leukocytosis are common findings. Blood pressure is normal at the outset but gradually lowers as hemorrhage and shock progress. The ashen pallor of concealed hemorrhage is commonly noted.

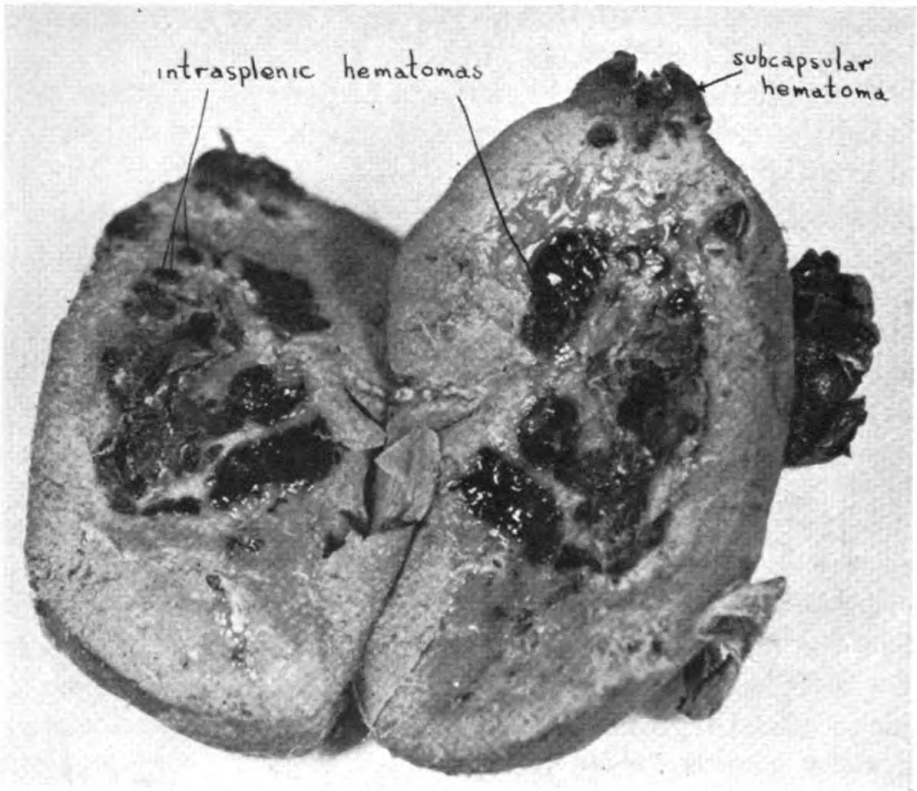
Kehr's sign is referred pain in the left shoulder due to diaphragmatic irritation transmitted along the phrenic nerve. It may be present in the latent stage in the presence of a perisplenic hematoma. Ballance's sign is an increasing area of dullness elicited on percussion over the left flank, remaining fixed with changes of position. Cullen's sign of umbilical discoloration in ruptured extrauterine pregnancy may be encountered in hemoperitoneum of splenic origin. Claybrook's sign is the transmission of cardiac and respiratory sounds, heard on auscultation over an abdomen full of blood or other fluid. Kehr's sign is encountered most frequently, whereas the others are helpful if present but of no significance if absent.

In the stage of secondary hemorrhage from delayed rupture of the spleen, laparotomy is done with no definite diagnosis in mind, but the surgeon feels the need for exploration. The common mistakes in diagnosis are: Perforated peptic ulcer, ruptured appendicitis with peritonitis, acute pancreatitis, and ruptured ectopic pregnancy.

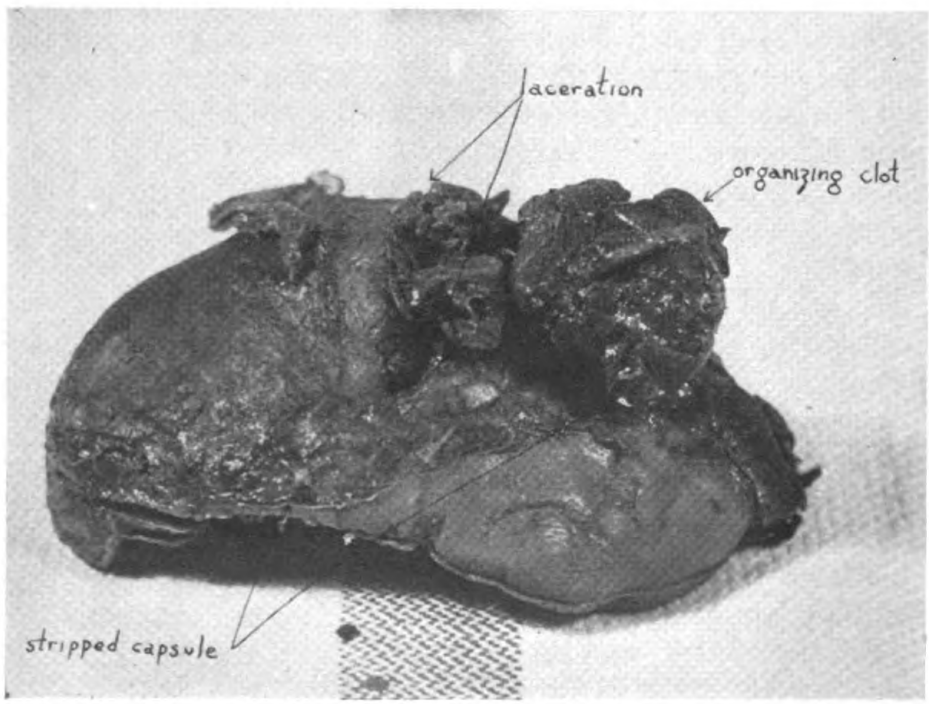
PATHOLOGY

Study of the spleen from our case showed the following pathologic changes: (1) Capsular laceration with perisplenic hematoma; (2) subcapsular hematomas; (3) intrasplenic hematomas; and (4) coalescence of all three lesions. The degree of these pathologic changes depends on the severity of the initial injury. What occurs during the latent period up to the time of secondary hemorrhage is a matter of speculation and theory. Suffice to say that there is an insidious bleeding that is held in check by the coagulability of the blood, the splenic capsule, tamponade by the omentum and the surrounding viscera, and formation of adhesions.

Case report.—On 12 January 1944, the patient fell down the commissary hold on a destroyer, striking his lower left chest. No fracture of the ribs was found, but he was confined to bed for one week for observation. The



1. Sagittal section.



2. Diaphragmatic surface.

course was uneventful except for a persistent dull pain over the left lower chest. The patient was discharged to duty and remained without significant complaint until 30 January 1944, when he reported to the sickbay complaining of generalized abdominal pain associated with nausea. He vomited once. Prior to onset of pain he had been working in an overheated fireroom. The pain was severe in character, localized over the umbilicus with no immediate radiation. There was spasticity of abdominal recti muscles and tenderness both local and rebound over the entire abdomen. A tentative diagnosis of acute ruptured appendicitis was made and the patient transferred at sea to this seaplane tender.

The patient was received with the note of 30 January; in the course of repeating the history the patient did mention his trauma of 12 January, but this fact was neglected. By this time the pain had localized to the left of epigastrium with radiation to the lower abdomen.

On admission his temperature was 99° F., pulse 92, respirations 18 per minute, and blood pressure 110/60. His general appearance was that of a well-developed, well-nourished white male of 20 years, with acute abdominal distress, fully alert and oriented, somewhat narcotized. The abdomen was flat with normal liver dullness. Generalized tenderness was present over the entire abdomen and in the left costovertebral angle. There was increased resistance to palpation in the epigastrium, less so in other areas. Rebound tenderness was present. There was absence of rectal tenderness.

The white blood cell count was 10,500 with 56-percent neutrophils and 44-percent lymphocytes. Urinalysis was negative.

An infusion of 1,000 cc. of 5-percent dextrose in saline was given. Two hours later the temperature, pulse, respirations and leukocyte count were all elevated. The abdomen was definitely distended and rigid with maximum signs of tenderness, rebound, and rigidity in left epigastrium and left lower quadrant. Liver dullness was absent. The intestines were quiet on auscultation.

With a provisional diagnosis of perforated gastric ulcer the abdomen was opened under spinal anesthesia.

Upon entering the peritoneum through a high upper right rectus incision there was a gush of dark red blood and blood clots. Exploration revealed a lacerated, hemorrhaging spleen. The incision was made L-shaped and the spleen removed. The patient began to react and open drop ether was started. The abdomen became tense and rapid closure was done using No. 2 chromic catgut in continuous suture throughout. Total blood loss was estimated at 2,000 cubic centimeters.

Immediately after the operation 1,500 cc. of citrated blood was given and continuous infusion maintained using 1,500 cc. of 5-percent dextrose in saline.

Postoperative course was somewhat stormy, featured by distention requiring Wangensteen suction, and by wound dehiscence following a paroxysm of emesis. This was closed under local anesthesia, using silk suture, a mattress stitch incorporating fascia, muscle and skin.

LABORATORY REPORT

The spleen measured 12 by 7 by 5 cm., and weighed about 225 grams. There was a ragged rupture through the central portion of the diaphragmatic surface measuring 2 by 4 cm. from which protruded a large organizing clot. The visceral surface of the spleen showed subcapsular areas of hemorrhage

and thrombosis. Sagittal section showed a number of small separate hematomas varying in size from 0.5 to 2 centimeters.

After being transferred to a shore facility the patient developed a jejunal fistula which closed spontaneously, but he failed to rally and on 29 February suddently died of bilateral lobar pneumonia.

COMMENT

The diagnosis of delayed rupture of the spleen is difficult to make. Such a possibility must always be kept in mind following trauma to the left hypochondrium or left lower chest, especially with a persistence of signs or symptoms. Splenectomy during the latent period is the best prophylaxis for secondary hemorrhage. When splenorrhagia ensues, a surgical emergency of the first order exists and an hour's delay may be fatal. Postoperatively an aseptic peritonitis of hemoperitonitic origin exists, leading to an adynamic obstruction of the splenic flexure, distention, and emesis.

Trauma to the tail of the pancreas with liberation of digestive enzymes is mentioned as a possible source of trouble in the postoperative convalescence of splenectomy.

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PROFLAVINE POWDER IN WOUNDS

In suppurating battle wounds the use of proflavine leads to satisfactory healing within a reasonable time and with a notable lack of scar tissue.

Proflavine has also been used with success in a series of suppurative lesions of soft tissues and in the treatment of burns.

To ascertain its prophylactic value it has been applied to fresh wounds. There is, however, danger of overdosage.—RAVEN, R. W.: Proflavine powder in wounds. Lancet 2: 73-75. July 15, 1944.

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PROCHININ

"Prochinin," introduced as a wartime substitute for quinine, is a mixture of cinchonine (47.5 percent), cinchonidine (47.5 percent) and quinidine (5 percent). Chemotherapeutic tests on mice, rats, rabbits, guinea pigs and canaries; tests of its inhibitory action on diastase, pepsin and yeast; of its effect on fever, blood pressure, hyperglycemia and on smooth muscle; and of its excretion in the urine; all gave very similar results to those obtained with quinine.—JOHANNESSOHN, F.: Was ist Prochinin? Münch. med. Woch. 90: 635-636, November 5, 1943.

MEDICAL AND SURGICAL DEVICES

REPAIR OF ACRYLIC DENTURES

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Dentures are broken frequently. Their repair creates a problem at all prosthetic activities, the most serious of which is the time consumed by the laboratory personnel in making repairs, and by the patients who should be more gainfully employed.

Various methods of repairing dentures made of acrylic resins have been used. These methods range from processing the cases in a manner similar to that used for the repair of vulcanite, to moistening the edges of the break with the monomer of methyl methacrylate and holding the fragments in contact until union takes place. One of the proprietary repair materials offered to the dental profession is irolite, which is believed to be essentially a thin mixture of the polymer (powder) of methyl methacrylate in the monomer (liquid).

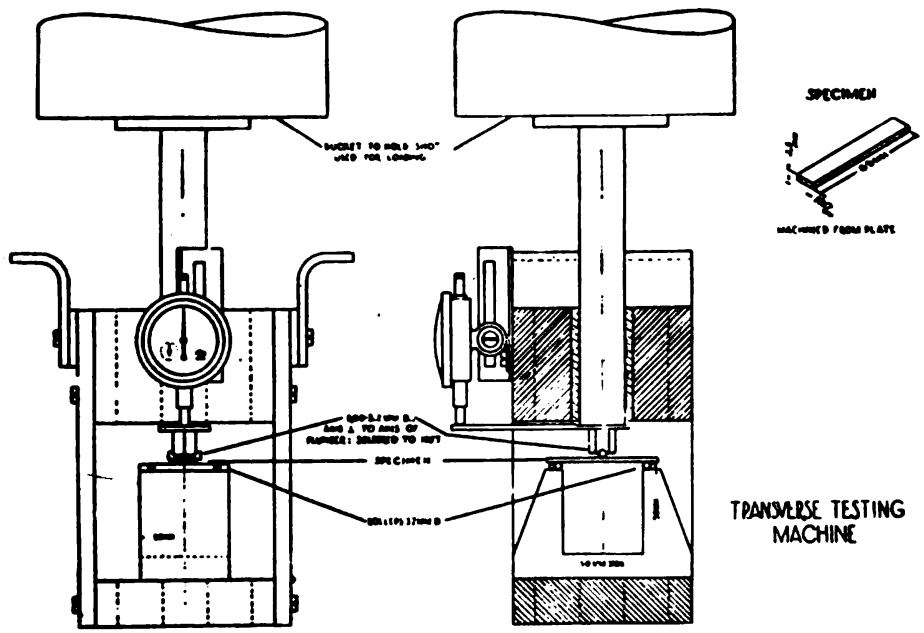
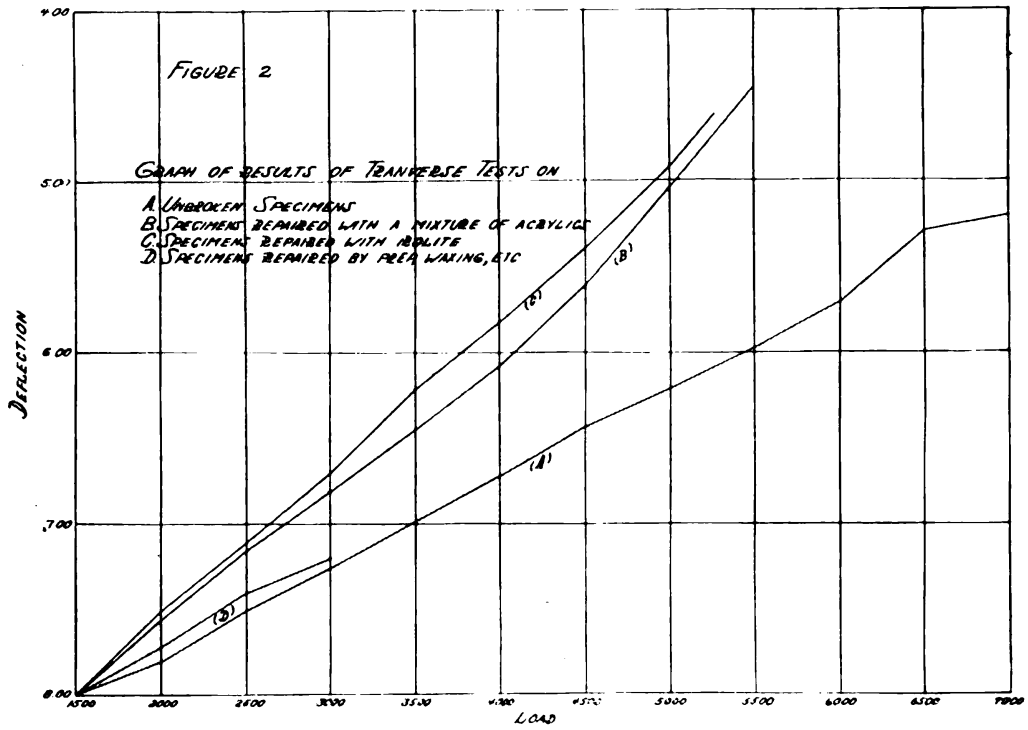


FIGURE 1



A thin mixture of methyl methacrylate polymer and monomer may be made just prior to use, from materials now listed in the Supply Catalog as Stock Number 11-830, "Denture Material, Synthetic Resin, Powder and Liquid (*4 parts liquid to 1 of powder, stirred in water bath of 50° F. for 25 minutes*)."

STUDY OF COMPARATIVE STRENGTH

The comparative transverse strength was determined on specimens repaired with irolite, with a thin mixture of methyl methacrylates, and with a mixture of the consistency commonly used in packing flasked repairs.

Specimens were cut into by filing a V-shaped notch in the center. Three specimens were then repaired by each of the foregoing methods. The transverse strength tests were made according to the procedure prescribed in Federal Specification for Denture Base Material U-D-226, Section F3. The apparatus used was the Transverse Testing Machine shown in figure 1. The loads required to fracture the repaired specimens are shown in figure 2.

Method.—1. The case is first assembled and a cast poured.

2. The case is removed from the cast and the thin mixture of methyl methacrylate applied to the broken edges.

3. The pieces are reassembled on the cast.

4. The case is embedded in plaster in a flask and boiled for half

an hour, chilled, removed from the flask, and polished.

Advantage.—Time is saved as the foregoing method eliminates preparation, waxing, flasking in two sections, separation, boiling, and trial-packing.

Conclusions.—1. These data show that repairs made with a thin mixture of methyl methacrylates are stronger than those made with the thick mixture commonly employed.

2. It is therefore recommended that simple repairs be made by using a thin mixture of acrylic powder and liquid, materials for which are available in Stock Number 11-830, so that there is no need to purchase proprietary materials of unknown composition.

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GENTIAN VIOLET SELECTIVITY IN BACTERIAL CULTURAL GROWTH

Blood agar plates containing gentian violet used in duplicate with blood agar plates without dye, permitted the isolation of many aerobes and anaerobes which would have been missed had the inhibiting medium not been employed. Such results appear to be due to the inhibition by gentian violet of the rapidly growing staphylococci and aerobic sporeformers, and to the fact that clostridia give less spreading overgrowth with this medium.—HOLMES, L. F., and WILSON, M. E.: Gentian violet–blood agar plates used in aerobic and anaerobic cultures of wounds. J. Lab. & Clin. Med. 29: 1090-1093, October 1944.

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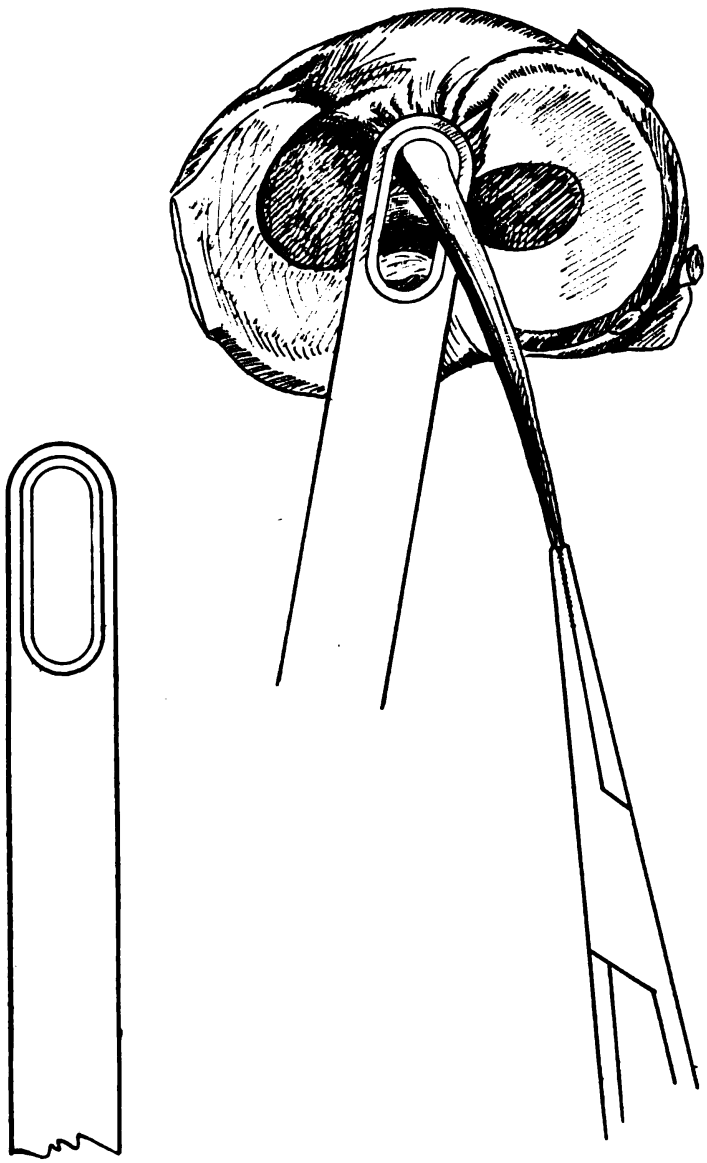
COMPLICATIONS OF RADIOACTIVE PHOSPHORUS THERAPY

Radioactive phosphorus is a valuable therapeutic agent in the treatment of polycythemia and chronic leukemias. However, severe thrombocytopenia, leukopenia, a moderate anemia, and aplasia of the bone marrow may occur as complications of the therapy. The blood of patients treated in this manner should be studied at frequent intervals so that the hematologic changes can be recognized early and further administration stopped before irreversible toxic effects on the bone marrow are produced. —HEMPELMANN, L. A., JR.; REINHARD, E. H.; MOORE, C. V.; BIERBAUM, O. S.; and MOORE, S.: Hematologic complications of therapy with radioactive phosphorus. J. Lab. & Clin. Med. 29: 1020-1041, October 1944.

A NEW KNEE-CARTILAGE KNIFE

GORDON M. MORRISON
Lieutenant Commander (MC) U.S.N.R.

Surgical removal of a medial meniscus is not without difficulty, particularly when removing the posterior part of the cartilage. Lacking the necessary instruments while stationed on an island base in the South Pacific, an eyelet knife was designed and fashioned from a hacksaw blade. Using this knife, blind dissection of



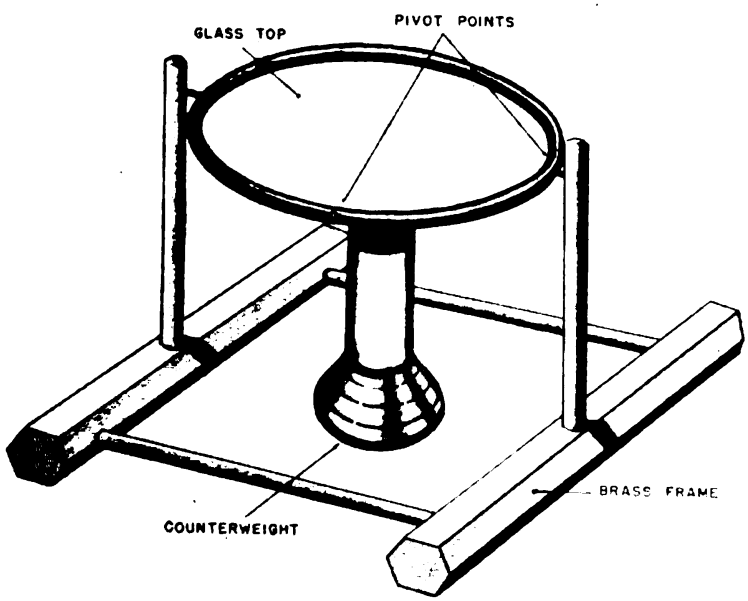
the posterior part of the cartilage became the easiest part of the operation. The knife has since been tried on additional cases and by other operators with equally satisfactory results.

The anterior and medial aspects of the cartilage are detached under direct vision in the usual manner. The cartilage is passed through the eyelet of the knife, and while keeping tension on the cartilage, the posterior part is easily removed. Only structures within the eyelet can be cut, as the knife automatically retracts other structures, and blind dissection is not hazardous. Construction of the instrument is simple and self-explanatory from the accompanying diagram.

STABILIZED STAINING RACK

HENRY B. TURNER
Lieutenant (MC) U.S.N.R.

Difficulty in obtaining properly stained slides at sea suggested the illustrated stabilized staining rack.



It is essentially hung in gimbals, the principal parts consisting of a disk, a ring, a pendulum, pivot points, and a stand. The dimensions and material used may be changed, depending on available stock, and it may be constructed in any ship's machine shop. In this instance the material was brass stock. The disk diameter is 5 inches and the over-all height is 4½ inches.

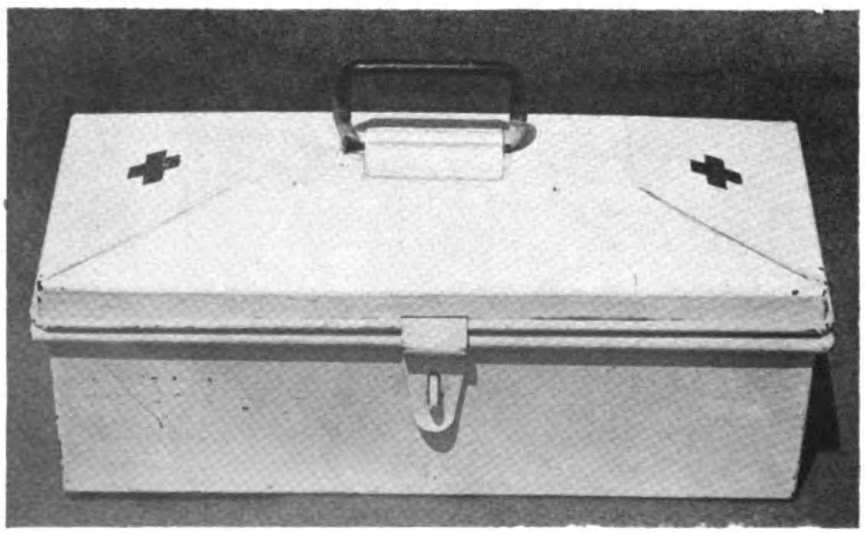
Preparation of stained smears and other material for microscopic study is facilitated; the staining solution remains on the slide even during moderate roll of the ship.

Such a rack should prove useful in all smaller ships which are equipped to carry out simple laboratory procedures.

A "SEAGOING" FIRST-AID KIT

DAVID W. PALMER
Lieutenant (MC) U.S.N.R.

As a convoy escort medical officer it has been necessary to make numerous transfers at sea in a small boat to attend sick patients on other ships in the convoy. It is imperative to carry enough medical and surgical equipment to meet almost any emergency. The medical kit must be compact, watertight, and strong, as during these transfers at sea the kit is subjected to considerable abuse.



Official U. S. Navy Photo.

Figure 1.

Official U. S. Navy Photo.

Figure 2.

To meet this need an ordinary Navy shipfitter's tool box, 18 by 6 by 7 inches, has been used (fig. 1). It is inexpensive and has advantages over the leather medical bag or the Hospital Corps pouch. Articles in this kit will remain unbroken and neatly in place under practically all circumstances.

Within is a small tray secured by racks. This tray can be used to sterilize instruments. It may be necessary, however, to solder the corners of the tray to make it watertight. All articles are listed according to whether they are medical or surgical, and the list is posted on the inside of the lid and covered with shellac for waterproofing. In order to conserve space, tablets of drugs for hypodermic administration are placed in No. O capsules and a small slip of paper with the name and size of the tablets is placed in the capsule. All such capsules are in one small cardboard pill-box with an outside label listing all the drugs.

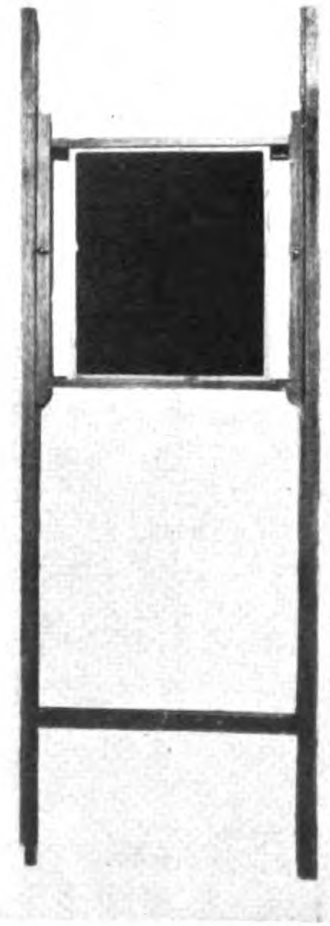
The medical stores of any ship requesting aid will carry the usual first-aid equipment such as gauze bandages, antiseptics, and the like. Only a minimum amount of these articles therefore need be carried in the first-aid box (fig. 2).

IMPROVISED CASSETTE HOLDER FOR CHEST X-RAYS

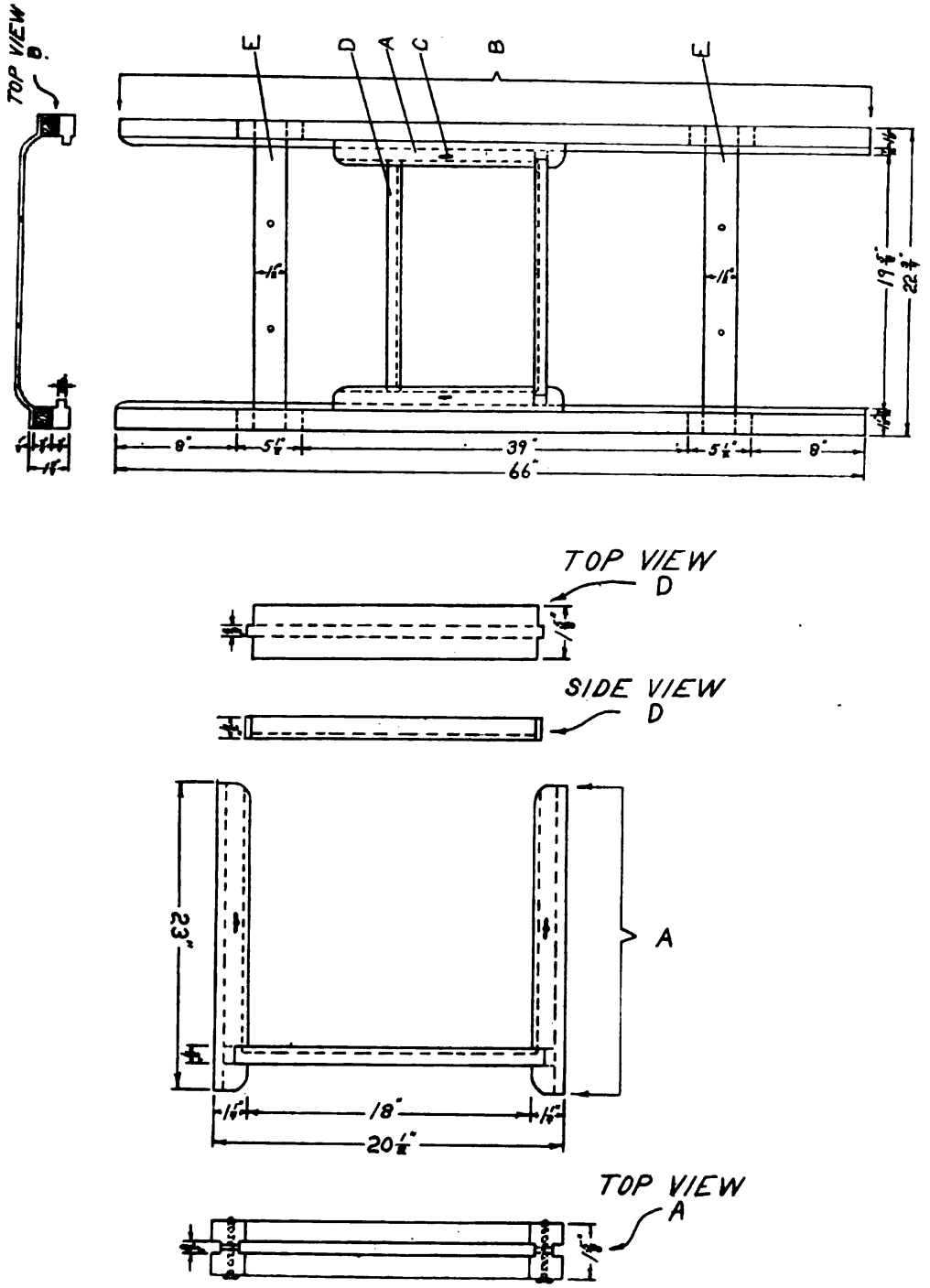
LESTER D. BIBLER
Lieutenant Commander (MC) U.S.N.R.
and
DOUGLAS W. WHITE
Lieutenant (DC) U.S.N.R.

In taking some of the larger films with the stock dental x-ray machine, it became apparent that the dental chair was inadequate for obtaining the proper position of the patient, and in certain instances operators were exposed to radiation when trying to steady the patient. In order to overcome these difficulties the illustrated cassette holder was designed (fig 1). The holder and frame are light, compact, and easy to manipulate, with a wide range of adjustment for short or tall patients, for the smallest films and even the large 14- by 17-inch cassettes. This frame can be set up on any wall and juts out only 3 inches from the wall.

A focusing cone, 3 by 7 inches, is attached to the x-ray machine to cut out secondary rays when greater contrast, particularly in bone pictures, is desired.



1. Cassette holder, 14 by 17 inches, in position.



2. (1) A slides in B; (2) D slides in A; (3) A is secured in position by lockscrews C; (4) cassette fits in A; D fits on top of cassette; and (5) E is crosspiece of metal by which the whole frame is fixed to the wall.

PENICILLIN ALLERGY

Penicillium spores constitute 11 percent of the fungus spore content of the air in midwestern United States. Since about 20 percent of allergic patients in the same area are sensitive to fungi and about 30 percent of the latter react to Penicillium, approximately 6 percent of allergic persons are sensitive to the antigen of the Penicillium family. Species specificity is not to be expected. Those sensitive to one Penicillium have reacted to other species of this genus.

As a preliminary experiment it was decided to make skin tests with penicillin on Penicillium-sensitive persons. Ten patients who were clinically mold-sensitive and who gave positive reactions with extracts of various Penicillia, such as P. rubrum and P. digitatum, were chosen for the experiment. All of these subjects also gave positive scratch reactions with extracts of P. notatum.

Scratch tests with the solid penicillin as well as a freshly prepared solution containing 5,000 units per cc. had negative results. Intracutaneous tests showed that with extracts of all three species positive reactions could be obtained in these patients to dilutions as high as 1:1,000,000 or higher. In our intracutaneous testing we therefore employed the following concentrations: 5, 50, and 500 units per cc. Reactions were negative in all cases.

The results cited might be interpreted as an indication that Penicillium-sensitive persons are definitely safe from allergic reactions to penicillin. However, certain quantitative factors must be considered. A probably safe dose of the Penicillium extract would be 1,000 times the minimal amount (0.02 cc. of 1,000) required to give a skin test. On the other hand, a normal daily therapeutic administration of penicillin would be about 200,000 units, or 20,000 times the maximum dose (0.02 cc. of 500 units per cc.) used in these tests. This fact, coupled with the greater likelihood of systemic allergic reactions from intravenous administration, makes it impossible to say at the present time that the probability of allergic reactions can be totally ignored.

Tests with more recently prepared penicillin of higher potency (630 units per mg.) and greater purity, a solution containing 25,000 units per cc. tested intracutaneously, gave negative reactions in control subjects and in Penicillium-sensitive individuals. According to these results, this particular preparation could be tolerated by an average Penicillium-sensitive patient in doses of at least 500,000 units.—FEINBERG, S. M.: Penicillin allergy on probability of allergic reactions in fungus-sensitive individuals. J. Allergy 15: 271-273, July 1944.

EDITORIALS

FUNDAMENTAL REPLACEMENT THERAPY

Until recently it was accepted that a 50-percent body surface burn would prove fatal. Today patients with 85-percent body burns have lived. The reason for this improved mortality cannot be found in any new and revolutionary topical therapy. It is well known that local burn therapy has been notoriously inadequate and a cycle of on-and-off commitments ultimately resolved to simple application of plain petrolatum pressure dressing. During this empirical period, however, medical attention was directed to the burn patient as a whole, to his biochemical and physiologic properties, and to the need of substituting lost body elements. Here apparently is the answer to the encouraging mortality figures.

But keeping the patient in physiologic balance, particularly under extensive burn conditions, frequently challenges medical ingenuity and presupposes of the surgeon a thorough knowledge of the biochemistry of body fluids.

The surgeon-physiologist and the surgeon-biochemist now complement the surgeon-anatomist and the surgeon-pathologist. No longer can the operator tacitly write off his obligation once the patient is removed from the operating table, nor delegate to subordinates the postoperative management of his surgical patient.

Recent advances in the biochemistry of body fluids make imperative precise knowledge and skillful appraisal of the replacement needs of the patient undergoing operative procedures.

To order "force fluids" and leave to attendants the quantity and method of administration without scientific appraisal of the individual patient's needs is now culpable and may be grounds in the future for medicolegal regress, particularly since the work of Coller, Maddock, Wangensteen, Elman, Brunschwig, Moyer, Rosenberg and others on replacement therapy.

The day of guessing about these matters is passed. The promiscuous venoclysis of physiologic saline and even plasma may eventuate into anything but physiologic response.

Unwise and uncontrolled administration of fluids postoperatively is fraught with grave danger and accounts for many complications more serious than the surgically eradicated disease process.

Many disruptions of abdominal incisions and leakages of suture lines with resultant fatal peritonitis which were attributed to soiling at the time of operation may be traced to factors producing tissue edema.[1,2,3] Too vigorous unphysiologic parenteral therapy, unphysiologic in substances selected and quantity administered, results in faulty electrolyte balance, distortion of serum protein, alteration of colloid osmotic pressure of the blood and ultimately in water intoxication, which is equally as harmful as any alcoholic supersaturation of a very sick person.

From the urologists much can be learned of the importance of having the surgical patient in blood chemistry optimum. The care with which the urologic patient is worked up and appraised by means of careful laboratory data before subjecting him to surgical procedure is worth emulating.

No longer are blood chemistry determinations considered unusual laboratory procedures nor is expense a prohibition to their use. Their particular value on the other hand is obvious in enabling the adoption of the best measures to put the patient in water, salt, protein, fat, carbohydrate and vitamin balance.

Determination of the oxygen-carrying capacity of the blood and its coagulability will do much toward appraisal of the patient's need of transfusion and the type to employ, a subject so important that men like Wangensteen resort to unusual methods for determining the quality and quantity of replacement therapy.

The weighing of a patient before and after operation, as well as weighing of the blood soaked sponges, and replacement of fluid, quantity for quantity, may appear troublesome and time consuming but it is more logical than drowning the patient with an unneeded transfusion before operation or overloading a competent heart purely on the assumption that fluids prevent shock or because the proposed operation is to be a long drawn out procedure.

The syndrome of hypochloremia is well established but no less so than that of hypoproteinemia. Actual surgical practice seems directed for the most part toward rectifying the one but gives little concern about correcting the other.

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[1] BARNES, H. A.: Biochemical approach to modern surgical methods. Arizona Med. 1: 250-254, September 1944.

[2] THOMPSON, W. D.; RAVDIN, I. S.; and FRANK, I. L.: Effect of hypoproteinemia on wound disruption. Arch. Surg. 36: 500-508, March 1938.

[3] THOMPSON, W. D.; RAVDIN, I. S.; RHOADS, J. E.; and FRANK, I. L.: Use of lyophile plasma in correction of hypoproteinemia and prevention of wound disruption. Arch. Surg. 36: 509-518, March 1938.

However, as Elman[4] has pointed out, even when a healthy well-nourished person sustains a serious injury or undergoes a severe operation, there follows an unusually large breakdown of protein tissue which leads to protein depletion and this, despite the intake of a well-balanced diet. What occurs when nutrition is dependent upon parenteral administration is apparent unless special provision is made for protein replacement.

Much of the postoperative weakness, lassitude, hypoglycemia and loss of weight can be directly traced to a lack of protein content of the diet. These are readily offset, however, even in patients who are unable to take anything by mouth, by the simple expediency of intravenous injection of hydrolyzed protein.[5,6]

Deprivation of protein is serious. The pernicious habit of restricting the ingestion of food to fruit juices, broth, and hot tea after an operation is tantamount to an imposed starvation, however well-meaning the surgeon. Such procedure leads to wastage of tissue and plasma protein, the effects of which are difficult to overcome but easily prevented.

Fluid therapy is now fundamental. Although its application has been emphasized in the immediate treatment of the burned and scalded person it is recognized however of no less importance in the surgical patient. The interrelationship of various fluids and foods to the immediate recovery from injury, the prolongation of life and the stimulation of the reparative forces of the body have been discussed in previous issues of the BULLETIN.[7,8] What is here emphasized is that it does make a difference whether sodium chloride, dextrose, Ringer's solution, sodium bicarbonate, plasma, defibrinated blood, whole blood, protein hydrolysates, exogenous colloids such as gelatin, isinglass, gum arabic, pectin, polyvinyl alcohol, methyl cellulose, and others are used and whether they are employed singly or in combination, enterally or parenterally.

Despite the experimental aspect of some of these substances, their import is apparent and necessitates precise knowledge of their indication and use.

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[4] ELMAN, R.: Acute starvation following operation or injury; with special reference to caloric and protein needs. Ann. Surg. 120: 350-361, September 1944.

[5] IDEM: Symposium on fluid and electrolyte needs of surgical patient; parenteral replacement of protein with amino-acids of hydrolyzed casein. Ann. Surg. 112: 594-602, October 1940.

[6] ELMAN, R.; WEINER, D. O.; and BRADLEY, E.: Intravenous injections of amino-acids (hydrolyzed casein) in postoperative patients. Ann. Surg. 115: 1160-1165, June 1942.

[7] Editorial: Wound healing. U. S. Nav. M. Bull. 42: 959-960, April 1944.

[8] Editorial: Food and wound healing. U. S. Nav. M. Bull. 43: 1051-1052, November 1944.

CARCINOMA EX ULCERE (?)

The silent character of carcinoma of the stomach makes it one of the most sinister diseases a surgeon is called upon to manage. Unfortunately during the operable stage, gastric carcinoma produces insignificant symptoms and in a large percentage of patients the tumor progresses to a stage beyond a reasonable surgical expectancy. It has been estimated that from 30 to 35 percent of all deaths from cancer are attributable to gastric carcinoma.

Aside from the unknown factor regarding the cause of cancer in general, the relationship between gastric carcinoma and ulcer of the stomach is variously affirmed. It is stated[1] that 20 to 25 percent of the cases develop upon a preexisting ulcer and that 35 to 45 percent of benign gastric polyps become malignant.

The incidence of ulcer in the Navy has been repeatedly discussed but its relationship to gastric carcinoma is not apparent. Assuredly no better opportunity is afforded for the study of this aspect of cancer than that found in Naval medical records. These permit the close scrutiny of the patient's health status year by year throughout a Naval career extending frequently unto several decades.

In 1942 there were eight cases of gastric cancer in the Navy, whereas in 1943 there were seventeen. In 1942 there were 202 stomach ulcers reported and 357 in 1943.

Analysis of the 25 cancer cases revealed that the youngest patient was 33 years (3 cases), the oldest sixty-nine. Twelve of the patients were within the age group 40 to 50 years, and in length of service 13 had 14 years and over (14 to 37 years). Fourteen died, 4 went back to duty, and 7 are still on the sick list.

Only in four case histories was there found any reference to gastro-intestinal symptoms prior to the diagnosis of carcinoma, and in these four patients, owing to the time interval, evidence of a previous gastric ulcer is apparently precluded.

The complaint of a dull epigastric pain progressively growing worse during 2 years prior to hospitalization and death, was the first recorded manifestation in one case, and in another, the diagnosis of duodenal ulcer 17 months before his terminal illness, confined a 60-year-old officer to the hospital for 46 days. In two other cases, the history of ulcerlike pain for a few months in one patient 7 years prior to his present illness, and that of poor health without specific complaint in another for 4 years previous to the gastro-intestinal symptoms which resulted in the present diagnosis of

[1] RITCHIE, W. P.: Essentials of General Surgery. The C. V. Mosby Co., St. Louis, Mo., 1941. p. 572.

carcinoma of the stomach, are at best only circumstantial evidence of a precancerous ulcer. The temporary and unspecific character of these early references make unlikely the presence of a dormant and subclinical peptic ulcer.

Since transformation of peptic ulcer into carcinoma is without experimental evidence the answer must be based upon clinical and pathologic data. Lacking these, the onset of cancer cannot be traced to changes in the affected organ before the tumor appears, and hence an early diagnosis in patients with subclinical symptoms is nearly impossible.

The clinical and pathologic evidence adduced in support of the concept of carcinomatous transformation of benign ulcer is inconclusive. There is no evidence that carcinoma develops more frequently in a stomach with a healed ulcer, or even occasionally in an unhealed ulcer, than in one in which the ulcer has been excised. It is fallacious to ascribe transformation into a cancer on the basis of finding carcinomatous cells upon an ulcer substratum. The stimulating influence provocative of the ulcer may equally be productive of carcinoma.

Both acute and chronic ulcer occur in all ages. In the newborn, acute ulcer is not uncommon; its recognition however is difficult unless serious complications follow. These facts appear to gainsay carcinoma transformation, because cancer of the stomach, under the circumstances, should be more prevalent in early age groups. However, to restrict carcinoma to an age bracket is misleading and may seriously influence its diagnosis and management. The finding, in the Naval series, of carcinoma in three patients who were 33 years of age, substantially lowers the expectant age group and demands a more vigorous therapeutic approach to cancer of the stomach whatever may be one's tenets regarding carcinoma ex ulcere.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

THE TREATMENT OF PEPTIC ULCER, Based Upon Ten Years' Experience at the New York Hospital, by *George J. Heuer, M.D., Professor of Surgery of Cornell University Medical College and Surgeon-in-Chief of the New York Hospital;* assisted by *Cranston Holman, M.D., Assistant Professor of Clinical Surgery, Cornell University Medical College;* and *William A. Cooper, M.D., Assistant Professor of Clinical Surgery, Cornell University Medical College.* 118 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1944. Price $3.

This very readable small book is in no sense a textbook and does not profess to be one, and yet in the many observations and comments of the author there is revealed a knowledge of the ulcer problems that is both wide and deep and very, very sane. It first contains a complete report of the results obtained in the medical treatment of peptic ulcer, and incorporates rational suggestions as to when medical methods should be abandoned and surgery considered. As mentioned in the book, had these cases been selected from office clientele of patients more able mentally and financially to cooperate fully, a much higher percentage of satisfactory results could reasonably be expected. There follow a number of chapters, each of which is devoted to a discussion of one of the various operative procedures for primary ulcer conditions and for secondary operations necessitated by unsatisfactory primary operations. In each type of operation illuminating statistics are provided that set forth the number of cases covered, percentage of satisfactory results, unsatisfactory results, complications, immediate mortality and subsequent fatalities.

Finally there comes a summation of the combined case studies

with a comparison of results obtained by various operations, in which comparison the older surgeon with older methods will derive some consolation, and it is to be hoped that the younger surgeon will learn that the newer, more radical operations are not cure-alls and are not simple and are not free of dangers, mortalities, recurrences and difficult future complications.

The results from gastro-enterostomy apparently were reported from cases earlier in the series extending over the past ten years, and possibly would have appeared better had the operations been performed under more modern pre- and postoperative technic. The partial gastrectomy cases that were handled during the later years of the series, received this benefit.

This reviewer gleans the impression that the authors feels that the pendulum swung too far toward the sacrifice of excessive amounts of gastric tissue and is now swinging back to a more conservative realm.

The impressions of this reviewer, who perhaps deserves his reputation of being at times unreasonably anti-surgical in his thinking and ultra-conservative in his recommendations, are that the surgical attempt to make the needs of all peptic ulcers, regardless of location, fit one operation, is pursued too energetically; and that resorting, at least for the first surgical effort, to gastro-enterostomy for benign obstructive cases, for some pyloroplastic procedure (not forgetting Finney) for duodenal and pyloric ulcers, and reserving partial gastrectomies for lesions higher in the stomach or those in which there is a question of malignancy, would save tissue and in the long run reflect favor on our results. It is gratifying to realize that by medical efforts at first (which relieve over 50 percent) and then surgery for medical failures (which relieves 80 percent or more), the combination can offer eventually over 90-percent satisfactory results.

One looks in vain for reports of anemias secondary to the loss of tissues which secrete hydrochloric acid and the intrinsic factor of Castle, and one is not informed as to the type or duration of the still important postoperative medical treatment instituted. However it is to be realized that too wide a discussion would defeat the purpose of the book, which is intended as simply a statistical report of the results obtained by various methods of treating several thousand ulcers from outpatient dispensary cases at one of our better institutions. These statistics, however, revealing as they are, must take second place to the comments and conclusions of the author.

It is a solid, readable and very honest report.

PSYCHIATRY AND THE WAR, A Survey of the Significance of Psychiatry and Its Relation to Disturbances in Human Behavior to Help Provide for the Present War Effort and for Post War Needs, edited by *Frank J. Sladen, M.D., Physician in Chief, Henry Ford Hospital, Detroit, Trustee, McGregor Fund.* 505 pages. Charles C Thomas, Springfield, Ill., publisher, 1944. Price $5.

This volume has as its sub-title: "A survey of the significance of psychiatry and its relation to disturbances in human behavior to help provide for the present war effort and for post war needs." Actually it is a record of the conference on psychiatry which was held at Ann Arbor, Michigan, in the fall of 1942, under the auspices of the University of Michigan and the McGregor Fund. It constitutes a report of thirty papers and two symposia and represents the contributions of approximately forty leaders in the field of psychiatry and its closely allied branches.

Part 1 deals with the philosophy of psychiatry and is discussed by Adolf Meyer, Oskar Diethelm, Percival Bailey, and others. It would repay all surgeons to read Percival Bailey's excellent discussion of "Psychiatry—Its Significance in General Surgery." I quote one of the many arresting paragraphs in his discussion:

> We have all seen these patients with their abdomens looking like well-ploughed fields. They go from surgeon to surgeon until they find someone to make another operation. If rebuffed, they may become paranoid and be a great nuisance to the doctor. These patients have anxiety neurosis. They have found that it is a relief to substitute an actual danger for the constant apprehension, and for a time at least are better.

Part 2 concerns itself with research in psychiatry. In this part is an excellent article by the late C. Macfie Campbell entitled "The Controversy in Psychiatry."

Part 3 concerns itself with psychiatry in the training, experience, and education of the individual, and Part 4 with psychiatry and the war. The articles "Psychiatry in the Army" and "Psychiatry in the Navy" by Colonel William Porter and Captain Forrest Harrison, respectively, will repay one for the reading.

Part 5 consists of a review of the subjects of the papers in Parts 1, 2, and 3, and of two symposia in which the various leaders take part. They are all interesting reading, and in view of the fact that two of the men on the symposia have since died, namely, C. Macfie Campbell and Colonel Roy Halloran, their words seem almost prophetic.

There is nothing particularly new in the volume, but the various angles from which it is written are indicative of the fact that psychiatry has come a long way since the stone wall and iron bar days of the old mental hospitals.

THE AMERICAN ILLUSTRATED MEDICAL DICTIONARY, A Complete Dictionary of the Terms Used in Medicine, Surgery, Dentistry, Pharmacy, Chemistry, Nursing, Veterinary Science, Biology, Medical Biography, Etc., With the Pronuciation, Derivation, and Definition, by *W. A. Newman Dorland, A.M., M.D., F.A.C.S., Lieut. Colonel, M.R.C., U. S. Army; with the collaboration of E. C. L. Miller, M.D., Medical College of Virginia.* 20th edition, revised and enlarged with 885 illustrations, including 240 portraits. 1668 pages. W. B. Saunders Co., Philadelphia, Pa., publishers, 1944. Price $7.50, thumb indexed; $7.00, plain.

Since 1900 the American Illustrated Medical Dictionary by W. A. Newman Dorland has been a standard of authenticity. The 20th edition brings this scholarly, accurate, and comprehensive work up to the minute on new words in every department of medicine, especially war medicine and surgery, and the names of new synthetic drugs, while bringing the terminology into conformity with the American Medical Association's "Standard Nomenclature of Diseases and Operations" (edited by E. O. Jordan) and making changes which usage has decreed since the nineteenth edition appeared.

Dr. Dorland, himself a member of the A.M.A. Committee on Nomenclature and Classification of Diseases, has again collaborated with Dr. E. C. L. Miller, and in this edition has obtained extensive lists of new terms in particular fields from a number of authorities to whom full credit is given. There is but one suggestion which it is believed would greatly improve future editions. There should be no points of dispute between Webster and Dorland on words common to both, as for example "artefact" which does not appear in Webster but is the preferred spelling in Dorland.

The twentieth edition is but 21 pages thicker than its predecessor, a fact which attests to the careful culling and pruning that has been done in the editorial revision, for a good deal has been added, so much that no one who has recourse to a medical dictionary can afford to be without the new Dorland. The edition is sold in flexible or stiff binding, with or without a thumb index, the latter being, in this reviewer's opinion, essential if the dictionary is to be used extensively.

MINOR SURGERY, edited by *Humphry Rolleston* and *Alan Moncrieff*. 174 pages; illustrated. Philosophical Library, New York, publishers, 1944. Price $5.

This rather small handbook of Minor Surgery written by a group of British authors and edited by Rolleston and Moncrieff is both pleasant and instructive reading on the many commonplace minor surgical conditions.

The book is divided into 18 chapters each covering a complete subject such as the hand, feet, ear, nose and throat, minor wounds, sprains, the eye, benign tumors and cysts, varicose ulcers, phlebitis, etc.

The basic principles emphasized by each of the authors are so fundamental, concise, earthy, and to the point that one feels as if the book should be essential for all students, internes, and internists coming into the Naval or military medical service. When one discovers, however, how antedated certain phases are, such as the treatment of minor wounds, discussion of sulfonamides, absence of any mention of penicillin, the bizarre indications for operation on varicose veins, and the type of operations advocated, one wonders as to the advisability of recommending this book to the inexperienced. However there is one chapter alone which makes the book worth its price to anyone interested in a handbook of minor surgery and that is the brilliant chapter on the surgery of the hand. The discussion on the essential anatomic features of the hand and their relation to trauma, infections, and surgical procedures is excellent and sufficiently brief to be read in its entirety by all interested.

The book is brief. The print is clear and pleasing to the eye. Drawings and pictures are grouped together to save paper. This is a minor annoyance. The bibliography is inadequate and incomplete. The style is excellent, as is so characteristic of British medical texts.

THE DENTAL TREATMENT OF MAXILLO-FACIAL INJURIES, With Supplementary Material on Cases and Techniques, by *W. Kelsey Fry, M.C., M.R.C.S., L.R.C.P., L.D.S., R.C.S. (Eng.), Consulting Dental Surgeon to the Royal Air Force; P. Rae Shepherd, L.D.S., R.C.S. (Eng.), Dental Surgeon, East Grinstead Maxillo-facial Unit; Alan C. McLeod, D.D.S. (Penn.), B.Sc. (Dent.), Toronto, L.D.S., R.C.S. (Eng.), Dental Surgeon, East Grinstead Maxillo-facial Unit; and Gilbert J. Parfitt, M.R.C.S., L.R.C.P., L.D.S., R.C.S. (Eng.), Dental Surgeon, East Grinstead Maxillo-facial Unit.* 434 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1944. Price $6.50.

This book is without a doubt the most practical, concise, and easily understood treatise on maxillo-facial injuries available today. It covers so many necessary aspects of the surgical treatment of facial injuries and correlates the theoretical with the practical so perfectly that even the most inexperienced dental officer has a workable guide at his finger tips.

The wide experience and excellent training of the authors make this book probably the most valuable of its kind yet published. Their clear diagnoses, selection of means of treatment, and pre-

cise case supervision are described simply but with amazing accuracy, so that the text can act as a guide for any practitioner, be he an expert or novice.

Deserving particular mention is the excellent diagrammatic description of fractures of the mandible which involve malposition of the posterior fragment. To classify such an injury by their scheme is a great step toward ultimately correct treatment of the part, and it reassures the operator that his procedure is on a sound surgical basis.

The chapter on radiology is most satisfying, because it explains many of the previously unexplained shadows which add to the difficulty of correct interpretation.

The use of cap splints is thoroughly discussed and the false theory of the open bite which results is refuted.

Much space wisely is given the treatment of the edentulous posterior fragment and a broad variety of means of management is outlined.

In the discussion of the use of Roger Anderson pins, the surgeon is warned that it is preferable to maintain inter-maxillary fixation because the pins tend to loosen, and that "with any pin driven into the bone from the facial surface, there is danger of infection along the track, which may result in a localized osteomyelitis."

The prosthetic approach and technic is clearly described and shows the result of much experience in surgical prosthetic appliances as well as prosthetic restorations.

The book should be available for every dental officer in the Navy.

TECHNIQUE IN TRAUMA, Planned Timing in the Treatment of Wounds Including Burns, From the Montreal General Hospital and McGill University, by *Fraser B. Gurd, M.D., C.M.;* and *F. Douglas Ackman, M.D., C.M.;* in collaboration with *John W. Gerrie, M.D., C.M.; Joseph E. Pritchard, M.D.; Edward S. Mills, M.D., C.M.;* and *Frederick Smith, M.D.* Preface by *John S. Lockwood, M.D., University of Pennsylvania;* with commentary by Ralph *R. Fitzgerald, M. D., C. M., McGill University.* 68 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1944. Price $2.

In this monograph made up of three previously published papers, the authors have endeavored to give a method of treating burns and wounds which is simple and safe and which in their hands has proven successful. They particularly stress timing. They use a 5-percent sulfathiazole oil-in-water emulsion on a mesh after frosting the tissues with sulfathiazole. Their figures on the concentration of sulfathiazole in local tissues when dressings are not changed are interesting.

Their charts on both burns and wounds involve far too much

work, especially laboratory work, in war areas as well as in civilian hospitals.

Their adherence to sound surgical and physiologic principles is to be commended as well as the manner in which they conducted their work.

THE PRINCIPLES AND PRACTICE OF OPHTHALMIC SURGERY, by *Edmund B. Spaeth, M.D., Professor of Ophthalmology in the Graduate School of Medicine of the University of Pennsylvania, Philadelphia.* 3d edition, thoroughly revised, 934 pages; illustrated with 556 engravings, containing 798 figures and 6 colored plates. Lea & Febiger, Philadelphia, Pa., publishers, 1944. Price $11.

The third edition of this excellent textbook has been prepared with the same detail and completeness as have the preceding editions.

The innumerable surgical procedures are most adequately illustrated by drawings and photographs. It is to be regretted that the reproduction of many of the photographs in color would at the present time be prohibitive.

All the classical operations of the eye as well as the more recently accepted operations of corneal grafting, goniotomy and surgery for separation of the retina are most suitably presented.

Several excellent tabulations classifying the operation indicated under various conditions cannot but be helpful to the student.

The author's great interest in plastic surgery is no doubt largely responsible for highly condensed and remarkably complete text with accompanying illustrations on the surgery of the lids.

THE NEUROSURGICAL PATIENT, His Problems of Diagnosis and Care, by *Carl W. Rand, Clinical Professor of Neurological Surgery, University of Southern California, School of Medicine, Los Angeles, California.* 576 pages; illustrated. Charles C Thomas, Springfield, Ill., publisher, 1944. Price $4.

Dr. Rand has produced the only complete text on clinical neurosurgery. The book is divided into four sections covering the spine, head injuries, the brain, and miscellaneous conditions. Fifty-four subdivisional chapters deal with separate entities, each one of which stands by itself as a miniature monograph, introduced by an eponymic quotation and appended by a short bibliography.

The material is derived from many years of teaching and is presented in clinic form. Discussion of subject matter is developed from case presentation. The problems of diagnosis are perhaps overstressed; and although peripatetic and occasionally repetitious (intentionally so for emphasis), the conversational style is fresh and interesting.

Considerable space is devoted to the physiologic pathology of

brain injury with excellent histologic reproductions from the author's own research. Unfortunately the recent contributions of Denny-Brown and others to the mechanics of acceleration in cerebral concussion and contusion are not included. The newer aspects of sulfonamide and penicillin therapy, which were progressing rapidly during preparation of the volume, are also missing.

Certainly this book will be of value to anyone interested in neurosurgery. Superbly illustrated throughout, the typography and page format maintain the high standard of its publisher.

PHYSICAL MEDICINE IN GENERAL PRACTICE, *by William Bierman, M.D., Attending Physical Therapist, Mount Sinai Hospital; Assistant Clinical Professor of Therapeutics, New York University Medical College, New York.* 654 pages; 310 illustrations. Paul B. Hoeber, Inc., New York, publishers, 1944. Price $7.50.

This book, as its title would indicate, was intended for the general practitioner. While it is well for general practitioners to have knowledge of all that is contained in its pages, many of the procedures should be left to experts. It may be stressed that knowledge of an accepted procedure, whether one is capable of administering such treatment or not, is highly desirable.

As should be the case with any technical volume, this book is well illustrated and the field is well covered.

It makes a good reference book and probably is as useful as any for that purpose.

PRINCIPLES AND PRACTICES OF INHALATIONAL THERAPY, by *Alvan L. Barach, M.D., Associate Professor of Clinical Medicine, Columbia College of Physicians and Surgeons; Assistant Attending Physician, Presbyterian Hospital.* 315 pages; 59 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1944. Price $4.

This handbook should prove valuable both to physicians interested in inhalational therapy and to nurses and technicians responsible for administering this type of therapy. It would be a useful addition to any hospital library.

The author discusses the therapeutic use of oxygen, carbon dioxide, helium, positive pressure, respirators, equalizing chest pressure, and vaporized solutions of various drugs such as epinephrine, neosynephrin, and some of the sulfonamides. He covers methods of administration and indications for their use in various clinical entities based on a consideration of the pathologic physiology of each condition.

The section on the methods of inhalation therapy provides a description of the various types of equipment with suggestions as to their operation and care.

The sections most interesting to Naval medical officers are those on altitude sickness, shock, hemorrhage, war gas poisoning, blast injuries of the lungs, and submarine medicine.

A MANUAL OF PHYSICAL THERAPY, *by Richard Kovács, M.D., Professor of Physical Therapy, New York Polyclinic Medical School and Hospital.* 3d edition, thoroughly revised. Formerly published under the title "Physical Therapy for Nurses". 309 pages; illustrated with 118 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1944. Price $3.25.

There is a rapidly growing interest being displayed by all medical officers in all phases of physical therapy. This is due, in part, to the emphasis placed on this field by the recent Report of the Baruch Committee on Physical Medicine, in part to the development of the broad field of rehabilitation, and in part to a belated realization of the benefit that may be expected from the use of various physical agents as adjuncts to other medical and surgical measures. For this reason this book fills an urgent need for a concise, authoritative source of information concerning the various methods commonly used in the physical therapy department.

Because the book is concise, most controversial subjects and theoretical considerations have been left out. This does not detract from the value of the book, since all views given can be accepted as sound and based on the author's long experience and reputation in this field of medicine. In the short space of 300 pages, Dr. Kovács has included a systematic presentation of the elementary physics, physical and physiologic effects, clinical uses, technique and application, indications, dangers and contraindication of each of the principal physical treatment methods. In addition there is a very good chapter on the organization and management of a department of physical therapy.

Every medical officer who ever has reason to prescribe physical therapy should find this elementary treatise extremely worthwhile. In addition it should prove very valuable as a reference book for all physical therapy technicians and student technicians. The book's value is enhanced by the many excellent illustrations.

THE MANAGEMENT OF NEUROSYPHILIS, by *Bernhard Dattner, M.D., Jur.D., Associate Clinical Professor of Neurology, New York University Medical College;* with the collaboration of *Evan W. Thomas, M.D., Assistant Professor of Medicine* and *Assistant Professor of Dermatology and Syphilology, New York University Medical College;* and *Gertrude Wexler, M.D., Instructor in Dermatology and Syphilology, New York University Medical College.* Foreword by *Joseph Earle Moore, M.D., Associate Professor of Medicine and Adjunct Professor of Public Health Administration, Johns Hopkins University.* 420 pages; 40 figures, charts and tables. Grune & Stratton, New York, publishers, 1944. Price $5.50.

The authors have presented in this book the major points in the

management of neurosyphilis. Many of the controversial subjects, such as cisternal puncture versus spinal puncture and the varied methods of fever therapy, are discussed frankly. Definite opinions have been given where indicated. In an apparent effort to achieve completeness, some of the older and more or less outmoded methods of therapy are included. The section on the "Significance of Spinal Fluid Changes" is especially well discussed and should be an aid to anyone attempting to interpret spinal examinations.

There is throughout this work evidence of a wealth of experience and background. Perhaps there is an excess of detail and an overabundance of cases cited as examples but these generally add rather than detract from the text. While the present knowledge of penicillin therapy of neurosyphilis is at best incomplete, no discussion of this drug is included in the subject volume. Obviously this is due to the date of publishing. The book, therefore, is incomplete in that respect.

THE BLOOD PRESSURE AND ITS DISORDERS INCLUDING ANGINA PECTORIS, by *John Plesch, M.D., Budapest; M.D., Berlin; L.R.C.P. and S. Edin. and Glas.; Formerly Professor of Internal Medicine in the University of Berlin.* 149 pages; 61 illustrations. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price $5.25.

This volume is printed on poor quality paper in an involved style, lacking clarity. Confusing terms such as minimal pressure hypertonia, capillaritis generalis, angioatonia, and word repetition take away much interest. This work is not recommended.

The author's ingenious aneroid manometer (called a Tonoscillogram) graphically records the amplitude of the pulsating artery as the pressure is gradually reduced from above systolic. From this tracing, normal and abnormal reading are discussed, the elasticity of vessels considered, and pathologic changes postulated. This method does not appear practical for general use.

The physiologic effect of normal and abnormal venous pressure is discussed in a logical manner.

Angina pectoris is considered as a generalized disease of the blood vessels. The author states that atony of the vessel is followed by sclerosis if sufficient stress is present. Cramp is attributed to extreme constriction of the affected artery in an effort to reduce the pulsation of the weakened area. The therapy is that in general use.

THE HOSPITAL HEAD NURSE, *Junior Executive and Clinical Instructor,* by *Mary Marvin Wayland, A.M., R.N., Formerly Instructor, Lakeside Hospital School of Nursing, Cleveland, Simmons College, Boston; R. Louise Metcalfe McManus, A.M., R.N., Instructor, Division of Nursing Education, Teachers College, Columbia University, New York City;* and *Margene O. Faddis, A.M., R.N., Associate Professor of Medical Nursing, Frances Payne*

Bolton School of Nursing, Western Reserve University, Cleveland, Ohio. Edited by *Isabel M. Stewart, A.M., R.N., Professor of Nursing Education, Teachers College, Columbia University, New York City.* 2d edition. 574 pages. The Macmillan Co., New York, publishers, 1944. Price $3.50.

Nurses exist in the Navy for three purposes, administration, teaching, and to a lesser extent, bedside nursing. Comparatively few nurses enter the service qualified in any but the third. Administrative and teaching abilities are gained only by waste of time and effort on the part of the nurse. During the nurse's period of adjustment, the hospital corpsmen are deprived of direction they should have in order to give proper care to the sick and injured in the field.

The Cadet Nurses now in Naval hospitals remind us that student nurses are alert to new ideas and eager to improve their professional equipment. Graduate nurses, as well as students, would respond to a program of administrative and teaching principles which met their needs. There is probably no better guide than Mrs. Wayland's "The Hospital Head Nurse." With directed reading, study, and discussion, it should be possible for nurses new in the Navy to adapt the principles to their own ward situations and avoid the usual period of confusion.

As a text, the new edition is much improved over the first, especially in emphasis on responsibilities of the head nurse as a teacher. Principles of management are clearly brought out. There are separate chapters on ward housekeeping and care of equipment, big factors in any Naval hospital. The bibliography is extensive and usable, if somewhat lacking in recent periodical references. It could well be used as enrichment of a ward nurse's training course. The index is adequate. Naval hospital patients and administration would both profit if "The Hospital Head Nurse" were read and digested by every member of the nursing staff.

PRE-STERNAL EDEMA IN MUMPS

Pre-sternal edema is not a rare complication of mumps. The edematous tissues pit easily, and apparently this is due to obstruction of lymphatic drainage by the swollen glands. The edema begins shortly after the involvement of submaxillary glands and usually lasts 5 days.—GELLIS, S. S., and PETERS, M.: Mumps with pre-sternal edema. Bull. Johns Hopkins Hosp. 75: 241-250, October 1944.

PREVENTIVE MEDICINE

Captain T. J. Carter, Medical Corps, United States Navy, in Charge

FISH POISONING BY BARRACUDA IN THE MARIANAS

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and
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Thirty cases of food poisoning were observed among Naval personnel following the eating of a large barracuda.

The barracuda, a fish of the family Sphyraenidae, of which about 20 species inhabit the world's warm seas, is in some places valued as an important food fish, particularly the slender California barracuda or "barracouta" and the European barracuda. In the tropics this fish is in most cases eaten without ill effects but has occasionally been reported as poisonous (*1*). Whether this is caused by its feeding on certain medusae, or whether toxicity occurs at a certain stage of its life cycle, is speculative.

Stitt (*2*) states that the local fishermen in the West Indian waters surrounding Puerto Rico warned against the eating of very large barracuda. Gilman (*3*) described as unsafe all barracuda in the Caribbean weighing 20 pounds or over, and believes there is a seasonal or spawning period during which the fish becomes more dangerous, as evidenced by a higher seasonal incidence in poisoning.

There is no mention in the available literature (*4*) concerning the barracuda to be found in the islands of the Japanese mandated groups. The only inherently poisonous fishes mentioned are of the Plectognathi group, the flesh of certain species of which is poisonous, the venomous fishes of the Scorpaenidae, and certain other families of reef fishes which have poisonous spines but the flesh of which is not poisonous.

The crew of a small Naval landing craft operating in the Marianas area had often eaten small barracuda as an important supplement to their diet. On 15 September 1944 a large barracuda weighing 50 pounds was caught in the same area by this crew.

Of 31 members of the crew eating this fish, all but one man became acutely ill. This man had eaten only a tiny portion of the fish.

The fish was caught at 1130, cleaned at 1400, and hung over the side of the ship in sea water. There it remained until about 2100 that night, when it was prepared for eating by rolling in cornmeal and frying in hot grease. It was served immediately. All hands had eaten an adequate evening meal consisting of freshly cooked potatoes and carrots, tinned roast beef, canned tomatoes, string beans, cherries, and orange juice. The 24 men who did not eat any of the barracuda remained perfectly well.

All who ate of the fish stated that the taste was "peppery-like" and gave an immediate tingling and burning sensation about the mouth. This was followed in from 5 to 15 minutes by a slight burning sensation in the stomach, causing some of the men to become nauseated and to vomit. After from 4 to 5 hours, symptoms which were primarily referable to the nervous system were manifested.

Included among symptoms were sweating and flushing, paresthesia and numbness about the mouth, face, neck, tongue, and the upper and lower extremities. Symptoms referable to the third nerve, such as dilatation of the pupils, ptosis, and divergent strabismus also were exhibited. Pallor, dizziness, and restlessness were noted. There were vague neuralgic pains about the temporofrontal, orbital, and intra-oral regions. Also complained of were pains of the extremities, joints, and lumbar areas, and in some instances, of the abdomen. Unusual symptoms developing within the first hour and continuing for more than 72 hours were the recurrence of paresthesia following a cold shower and a craving for cold water but inability to drink it because it "burned and stuck," apparently constricting the throat.

Physical examination revealed that the majority of those affected had blood pressures ranging from 90/50 to 60/40, with a slow pulse varying from 70 to 50, and slightly elevated temperatures. Deep reflexes were absent in 50 percent. Urinalysis and blood laboratory examinations yielded essentially normal results. Laboratory facilities for cultures of stools were not available. The head of the offending barracuda had been saved, but was inadvertently thrown away, consequently an item of possible value in determining the exact nature of the poison is lacking.

The symptoms of poisoning in the order of occurrence, and the number of men affected by each, are listed in table 1.

Treatment was symptomatic, consisting of (1) emptying of the digestive tract by means of gastric lavage, emetics, saline purgatives and enemas, (2) supportive treatment to prevent collapse,

TABLE 1.—*Symptomatology*

Symptoms in order of occurrence	Hours after eating	No. of men affected
Burning sensation of mouth while eating fish	1 to 24	31
	24 to 48	0
	48 to 72	0
Nausea and vomiting	1 to 24	5
	24 to 48	0
	48 to 72	0
Pallor, cold sweating, intermittent dizziness, nervousness, excitability	1 to 24	25
	24 to 48	10
	48 to 72	4
Recurring numbness beginning around the mouth, fingertips and progressing medially up the arm; numbness of the feet.	1 to 24	4
	24 to 48	30
	48 to 72	22
Dilatation of pupils	1 to 24	12
	24 to 48	14
	48 to 72	0
Ptosis of eyelids	1 to 24	8
	24 to 48	5
	48 to 72	2
Divergent squint	1 to 24	5
	24 to 48	2
	48 to 72	0
One to two watery stools	1 to 24	28
	24 to 48	5
	48 to 72	0
Swelling of face	1 to 24	10
	24 to 48	4
	48 to 72	3
Inability to urinate	1 to 24	18
	24 to 48	0
	48 to 72	0
Constipation	1 to 24	0
	24 to 48	24
	48 to 72	14
Frontotemporal, orbital, and intra-oral pains	1 to 24	0
	24 to 48	20
	48 to 72	0
Inability to drink cold water	1 to 24	30
	24 to 48	18
	48 to 72	24
Dull pain in lumbar region or gastric pain	1 to 24	0
	24 to 48	5
	48 to 72	23
Hemiplegia	1 to 24	0
	24 to 48	1
	48 to 72	0
Return of paresthesia following cold shower	1 to 24	0
	24 to 48	0
	48 to 72	24

(3) administration of stimulating fluids in the form of hot tea or coffee, and (4) intravenous administration of normal saline and dextrose solutions.

A typical case report follows.

Case report.—A motor machinist's mate, third class, aged 21, ate four small pieces of fish at 2130. He complained of the first mouthful burning his mouth and the tip of his tongue, as though it were too highly seasoned with pepper. He retired at 2300 feeling well. At 2400 he awoke and passed a foul-smelling watery stool. He did not feel ill at this time but noticed that he had numb sensations all over his body. Two hours later he had double vision. As the numbness increased, he became restless and hysterical. There was then noted a pallor and cold sweating followed by burning and chilling sensations of the skin and a low-grade fever (101° F.).

His face was slightly puffed, the pupils of the eyes were unequally dilated and divergent, the pulse 56 and weak, and the blood pressure 80/40. He was given 10 gm. of sodium bicarbonate in 400 cc. of warm water, following which he became nauseated and vomited. This treatment was repeated. At 0400,

his vision was almost normal except for slight blurring, and numbness persisted in the face, hands, and lower extremities.

He was given 500 cc. of strong, hot tea and shortly afterward passed another foul-smelling liquid stool. He then slept fitfully and awoke at 0800 complaining of a frontal headache which lasted about 2 hours. At 1100 he had vague neuralgic pains about the teeth and a dull pain in the extremities and lumbar region. He also complained of numbness about the lips and tongue, and a marked inability to drink cold water, which he said "burns and sticks in my throat." This last group of neuralgic and paresthetic complaints disappeared after 72 hours, after which the patient made an uneventful recovery and returned to full duty in 6 days.

Conversations with a native Chamorran who had been trained as a sanitary officer during the German occupation confirmed the above treatment as that established by them following their research. They found a mortality rate of from 8 to 10 percent from eating the pike-like barracuda. The native name for this fish was given as "alo" and the German name as "hecht." It was further stated that many other poisonous fish in this area produce symptoms similar to those described for the barracuda. The Marianas and Marshall Islands are the areas in which the barracuda become poisonous, according to his information, the same species in the Caroline Islands being considered nonpoisonous. It was learned that the Germans spent much time upon such research; the Japanese spent much time also, but kept most of their work secret.

SUMMARY AND CONCLUSIONS

1. A recent case of poisoning following the eating of a large barracuda by the crew of a small Navy landing craft incapacitated 55 percent of the crew and necessitated the taking over of the vessel by a relief crew.

2. The fish toxin was obviously quite potent and elicited symptoms largely referable to the nervous system and to a lesser extent to the gastro-intestinal tract.

3. Further cases of poisoning by barracuda are apt to occur among Naval personnel, especially on vessels to which no medical officer is assigned, unless warning is given of the dangers associated with the eating of tropical fish.

4. As it was here demonstrated by taste that the fish was unusual, it should have served as a deterrent to further ingestion, especially as this crew had partaken of the same kind of fish previously.

5. Because even the natives cannot tell whether an ordinarily good fish is edible, the utmost care should be taken in selection and preparation of any fresh tropical fish.

6. Since the crew of this vessel had eaten smaller barracuda with impunity, it follows that perhaps the large barracuda (over 20 pounds) is the malefactor, and should be rejected as a food fish until its habits are further studied.

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4. NavMed 211, Compilation of the Diseases of Naval Importance of Micronesia. Bureau of Medicine and Surgery, U. S. Navy, 1944.
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At the request of the Editor, the following comments on this article have been made by Dr. Leonard P. Schultz, Curator of Fishes, U. S. National Museum.

"The leaving of any fish two and one half hours before cleaning in the tropics is too long. According to my experience, decomposition is well under way at the end of two hours. Leaving the fish stand another nine hours (for a total of eleven and a half hours) before cooking is highly dangerous. Fish that I have collected in the tropics where the temperature ran about 85° F. have become tainted within two or three hours if they were not iced; thus this poison might have been a decomposition product.

"During the spawning season the gonads (ovaries or testes) in certain species of fishes are said by some to be poisonous. A definite observation should be made in the future to determine the presence and size of these organs; also whether the lining of the body cavity or the kidneys were removed. Suspicion has been directed toward all of these organs, especially the ovaries.

"Good food fish will be lost to the Army and Navy unless answers to the above problems are investigated. Perhaps only barracuda of twenty pounds or over contain mature ovaries."

PENICILLIN IN PNEUMONIA

Penicillin is an effective therapeutic agent in pneumonia of either the lobar or bronchial type when the etiologic agent is the pneumococcus, staphylococcus, hemolytic streptococcus, or a combination of these organisms. It is of doubtful value when the causative agent is a virus, tubercle bacillus or Friedländer's bacillus.—Commission for the Study of Pneumonia Control of the Medical Society of the State of Pennsylvania. Up-to-date facts on pneumonia. Pennsylvania M. J. 48: 265-268, December 1944.

USE OF SODIUM ARSENITE IN FLY CONTROL

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Observations following a recent amphibious assault in the Central Pacific, made it apparent that some adjunct to routine sanitary measures was necessary if a reasonably early return to normal conditions was to prevail. The terrific destruction of bodies, food dumps, and enemy sanitary installations, as well as all kinds of debris wrought by intense air and sea bombardment created a fly problem beyond the control of the battle-exhausted assault troops. As a result, several generations of flies were afforded excellent breeding places before garrison forces could bring the situation under control.

With the hope of finding some method of controlling large breeding areas, which method could be quickly administered by a small group of trained men, a survey of available agents was made. A statement in Herm's "Entomology" regarding the effectiveness of arsenical solutions against flies and maggots, suggested the inclusion of sodium arsenite in the program of proposed experiments. The experiments were conducted by Captain Sherman, Sanitary Corps, A.U.S., and Lieutenant Mains, Hospital Corps, U.S.N.

Six shoulders of mutton were hung in an abandoned latrine for ten days, until they were thoroughly fly blown. Four were then sprayed with solutions of creosote, paris green, oil, and 2-percent sodium arsenite, respectively. Two shoulders were used as controls. With the exception of the oil, all but a negligible number of maggots were killed by the other chemicals. The two controls, which were teeming with maggots, were then put in a screened box and sprayed with 2-percent sodium arsenite and over a period of a week, no mature flies developed.

Because of the demands of amphibious warfare, every foot of shipping space is at a premium. Sodium arsenite consequently was chosen as the most adaptable product to our needs; its commercial powder permits dilutions of 1:40 to be effective.

Sodium arsenite is a poison, hence must be used only by trained personnel. In the concentration, however, at which it is used, there is no danger to personnel except in food supply contamination. The water from island wells will not be affected by the dilutions employed.

INSTRUCTIONS FOR USE OF SODIUM ARSENITE

1. Sodium arsenite is available in a commercial solution known as "Penite" which contains 54 percent of the chemical. Penite is taken ashore in the concentrated solution and diluted 1 to 40 with either fresh or salt water. If salt water is used, approximately 33 percent of the arsenite precipitates, but agitation of the hand sprayer at frequent intervals will give an effective suspension. The baffles in the power sprayer will help to prevent precipitation.

2. Hand sprayers of either 3½- or 5-gallon capacity are used for each fly breeding space and a power sprayer known as "Chemical Decontaminator, Model 3-A1" is used where there is a large area.

3. Bodies which are not immediately buried are thoroughly sprayed and the ground on which they lie is subject to a drenching spraying. Large areas such as block houses, gun citadels and dugouts containing many dead are thoroughly treated by the power sprayer. Other flybreeding areas, such as food dumps, latrines, casual feces, straddle trenches, garbage dumps or decayed fruit and coconuts are similarly sprayed.

4. Just before covering, all bodies are subjected to further spraying, on the theory that maggots can make their way up through as much as four feet of loosely packed earth and develop into mature flies.

5. Respraying of fly breeding areas is undertaken as needed according to the facilities available.

6. Fly traps consisting of pans of sweetened water, sake, or other substance attractive to flies, to which a small amount of sodium arsenite has been added, are placed around galleys, mess halls, or other places of fly concentration.

Reports of the field use of sodium arsenite after the Marshall Islands engagements were forwarded to the author by Captain Sherman and Commander Hoffman, who were very enthusiastic regarding the degree of early fly control obtained. It was not until the Saipan operation that a personal observation could be made. At this date, 27 days after the initial landing, it can be stated that the fly problem has never been severe and no epidemics attributable to flies have appeared. It must be remembered, however, that all other aids to fly control, such as prefabricated latrines and fly traps were used in conjunction with sodium arsenite. A brief account of our method follows.

During the training period, a sanitary detail of three men in each battalion was trained and equipped with knapsack sprayers and arsenite loaded on a small two-wheel cart, such as used by the signal department. The Malaria and Epidemiological Unit were

equipped with 25 hand sprayers and two 400-gallon power sprayers mounted on trucks. Twelve members of the Seabee battalion were trained to operate these vehicles and use them where directed by the epidemic control officer.

Because our transports were forced to leave the area on D-plus-two day for a period of five days, only a few of the hand units got ashore. It was not until D-plus-seven day that any organized control by the use of arsenite could be inaugurated. Fortunately the period needed for the development of mature flies is at least 10 days and by working from sunrise to sunset, a great part of the area then occupied by the assault forces was covered. One truck made a regular run each day, spraying the heads, straddle trenches, destroyed food dumps and similar locations that were in the vicinity of more or less stable installations. The other truck was given a daily assignment as more area was captured and more sanitary hazards developed. A total of 450 gallons of Penite diluted to make 18,000 gallons of spray was used in 20 days.

RESULTS

The results achieved can be judged only in a comparative manner. There is no questioning the fact that there are infinitely fewer flies in the areas sprayed and that no diseases due to flies have developed in this division. Probably the best example of the effectiveness of sodium arsenite was in the civilian internee camp where sanitary facilities for the 3,000 or more inmates were unavoidably inadequate. The Garrison Force Surgeon requested a supply of arsenite as an epidemic of approximately 140 cases of Flexner-type dysentery was underway. The epidemic was brought to a halt almost at once and full credit was given to this fly control method.

Perhaps one of the most helpful features in this method of control is the destruction of adult flies after feeding on previously sprayed material. This was graphically portrayed in one instance where 6 enemy bodies were found in a fairly intact room. The burial squads could not keep up with the situation at that time and the next morning after the bodies had been sprayed there were literally thousands of dead flies on the floor of the room. On the other hand it was found that latrines and garbage pits that are in use must be sprayed at least once a day if adequate control is to be achieved. It is concluded that sodium arsenite spray in a concentration of 2 percent is an excellent means of fly control until adequate screening facilities are available.

NITROUS AND NITRIC GAS CASUALTIES

DURANT K. CHARLEROY
Lieutenant (MC) U.S.N.R.

The effects of nitrous and nitric gases on 23 men is believed worth reporting. The gases were caused by a fire which was adjacent to a supply of blasting gelatine used for boosters in hand depth charges. The blasting gelatine caught fire and gave off the characteristic pungent, thick, yellowish-green fumes.

Of the 23 men affected by the fumes, 9 were seriously affected, with 2 deaths. One of the deaths occurred aboard this ship and the other aboard a hospital ship in transit to a hospital.

The gases did not cause any of the immediate effects that would be expected, such as coughing or sneezing, lacrimation or choking sensations. Symptoms developed from 4 to 24 hours after exposure to the gas. These symptoms were predominantly respiratory.

All patients had the same prodromal symptoms of headache, a sensation of fullness in the head, a sense of tightness in the chest and a slight cough. The 14 who were least affected by the gas presented no other symptoms.

The 9 most seriously affected complained of these symptoms for a few hours and then in a very short time became dyspneic, nauseated, and cyanotic in varying degrees. They complained of extreme weakness, and of pain just under the sternum which was aggravated by exertion or by deep respiration. Respirations were shallow and labored. A dry, nonproductive cough was present to a moderate degree.

Two of the 9 showed signs of circulatory collapse from 15 to 16 hours after exposure to the gas. One of these died aboard ship; the other recovered.

The one patient who died while in transit on a hospital ship was apparently the least affected of the nine. However he became suddenly markedly worse and died within a few hours.

A striking feature about the group of gas casualties was that they all had essentially the same prodromal symptoms. Exactly which patient would become seriously ill could not be determined. These symptoms, in the ones who became seriously ill, lasted 3 to 4 hours and then suddenly within 15 to 30 minutes the patients would become dyspneic and cyanotic in varying degrees, with nau-

sea and with pain in the chest. A few vomited and coughing was present to a moderate degree.

The physical examination of all patients revealed very little. The most seriously affected presented physical signs of pulmonary edema, while in the others no physical signs could be elicited. None showed any visible irritation of the eyes, nose or throat.

The treatment aboard this ship consisted of oxygen as necessary for cyanosis, codeine, bed rest and routine measures.

All the patients who reached the hospital approximately 48 hours after exposure to the gas showed a bronchopneumonia, mild hemoconcentration, increased sedimentation rate, and leukocytosis. Penicillin was given in massive doses. The patients returned to duty approximately six weeks after exposure to gas.

Of the 14 least affected all were on limited duty the day after exposure to the gas. Several cases are herewith reported.

CASE REPORTS

Case 1.—This patient reported to the sickbay approximately seven hours after exposure to nitrous fumes, complaining of headache, weakness, pain under the sternum, and slight shortness of breath. These symptoms became worse, the patient becoming quite dyspneic and restless 4 hours later. Codeine was given in an effort to allay increased pain in the chest and restlessness. Nausea and vomiting developed approximately ten hours after exposure. The dyspnea became very marked, and associated cyanosis developed 14 hours after exposure to the gas. Oxygen was administered intranasally, and cyanosis cleared but the dyspnea was not alleviated. At about fifteen hours after exposure (1 hour after instituting oxygen) the patient showed signs of circulatory collapse. Two units of blood plasma and 1,000 cc. of 5-percent dextrose in saline were administered intravenously. The patient reacted well to this therapy.

The patient's temperature varied from 100° to 101° F., pulse rate from 110 to 160, and respirations from 30 to 60 per minute. The throat showed no signs of irritation. Direct auscultation of the chest revealed a few fine râles over the entire lung area. Approximately twenty-one hours after exposure to the gas the patient coughed up blood-streaked clear fluid and died.

Case 2.—This patient was first seen 8 hours after exposure to the gas. At that time the complaints were headache, a sense of fullness in the head, and extreme weakness. Later the patient had a chill which lasted about five minutes. Symptoms became gradually worse, with some shortness of breath. About the same time he developed a slight productive cough. The patient rested comfortably throughout the night. The following morning the only symptom the patient complained of was weakness. He improved rapidly and 2 days after exposure to the gas he resumed his duties.

Case 3.—This patient first reported to the sickbay 13 hours after exposure to the gas, complaining of nausea, vomiting, cough, shortness of breath, and pain under the sternum.

Nausea and vomiting were the predominant symptoms in this case. After

about an hour they subsided and the patient was fairly comfortable.

The following morning the symptoms had practically all disappeared. There was some slight pain in the chest and slight dyspnea on exertion. This patient appeared to be least affected of any of the ones who were transferred to the hospital. At no time while aboard this vessel did his condition cause any alarm. While aboard the hospital ship in transit to a Naval hospital his condition became markedly worse, death occurring 38 hours after inhaling the gas.

SUMMARY

1. A report is presented of 23 cases of gas poisoning caused by nitrous and nitric gases. Nine men were seriously affected. There were 2 deaths.

2. It was noted that there were no symptoms immediately after exposure.

3. Symptoms developed from 4 to 24 hours after exposure.

4. All cases presented similar prodromal symptoms.

5. The suddenness of the appearance of serious symptoms and complications was a striking feature.

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EGGS FOR BURNS

A new method of treatment for burns consists of an application of egg yolk and white, beaten up together with sulfanilamide powder, which sets in the form of a dry crust, and peels off when epithelization is complete. Healing occurs earlier, infection is rare, and in third degree burns there results a soft supple scar with no contractures. In none of nine select cases was skin-grafting necessary.—RAJASINGHAM, A. S.: Brief survey of pathology and treatment of burns with account of new method adopted by author. J. Ceylon Br., Br. M. A. 40: 136-146, April 1944.

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TYPHOID FEVER FROM EATING CHEDDAR CHEESE

Painstaking and diligent epidemiologic inquiries into the various articles of food which could have acted as vehicles for the infective agent causing 77 cases of typhoid fever disclosed that common to all cases was the consumption of unpasteurized Cheddar cheese of the unripened variety (Romano-dolce, Teleme, or high moisture (57 percent water) Monterey Jack). Inductive evidence incriminated the uncooked cheese, since invariably the members of the families who were consumers of large quantities were affected, while those who consumed it in the cooked form were not attacked.—MEYER, K. F.: Cheese-borne epidemics of typhoid fever. California & West. Med. 61: 137-139, September 1944.

TOXICITY OF CRESYLIC ACID-CONTAINING SOLVENT

A CASE REPORT

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Cresylic acid is an oily liquid with a density of 1.005, and an odor similar to that of creosote; it is slightly soluble in water, colorless but darkening on exposure to light. It is obtained by the fractional distillation of phenolic tar oils coming off between 180° and 204° Centigrade. In commercial solvents it is used principally to remove dirt, grease, carbon, and other undesirable agents from metallic parts. The particular solvent under discussion, known as "Solvent 261" is a dark, viscous liquid with the following components:

Cresylic acid	30 percent
Vegetable oils	45 percent
Water	25 percent

Cresylic acid is a parent substance of cresol and as such has general toxic properties in common with it. Thus the great propensity of cresol for causing acute and chronic dermatitis is shared by cresylic acid. This is generally appreciated and commonly met with in industrial practice. Absorption of cresol and similar compounds may give rise to hepatitis, nephritis, and hemolytic blood reactions. However selective toxicity for a single nerve has, to our knowledge, not hitherto been recorded. The following case report is therefore submitted for the interest it may have, and also for the purpose of sounding a note of caution because of the widespread industrial use of these solvents.

Case report.—A man, aged 41, white, employed as a helper in the research department of the station was assigned the job of cleaning some torpedo gear trains with the aforementioned solvent diluted five times. The objects were to be dipped into the solution. The work required approximately five to six hours, during much of which time the patient's hands, unprotected, were covered with the solution up to the wrists. Following the work he noted pronounced dryness and stiffness of the skin of both hands, and an annoying tendency of the right eye to water a good deal. Early the next day the skin had acquired a yellowish discoloration, and began to crack and peel off. In addition he noted some pain on the right side of his face and behind and

above the right ear. He also noted that the watering of the eye continued unabated. Late in the same day he complained of difficulty in expectorating, a drooping of the right lower eyelid, and a retraction of the left corner of the mouth. All symptoms were progressive to the time of admission. No other symptoms referable to the central or peripheral nervous systems were noted. He gave no history of alcholism, diabetes, syphilis, current infection, or exposure to cold.

His past history was completely negative and his family history was not pertinent.

The physical findings were generally negative except for the following: There was a well marked facial paralysis on the right side with ptosis and with eversion of the right lower eyelid, flattening of the creases on the right side of the forehead, sagging of the right corner of the mouth with elevation and retraction of the left. Attempted voluntary movements of the frontal and other muscles of the face only served to increase the asymmetry. Articulation was distorted. There was profuse watering from the right eye. All signs pointed to a facial neuritis of the peripheral type.

The skin of the hands to the wrists, both volar and dorsal surfaces, was dry and markedly fissured. Large plaques of superficial tissue were seen to be exfoliating. The underlying tissue displayed marked erythema. Widespread death of the upper layers of the skin had evidently taken place.

Blood studies disclosed normal red, white, and differential counts. The hemoglobin value was normal. Urinalysis was negative.

Emollient ointments were applied for the skin lesion. This had completely healed at the time of writing. Anti-neuritic vitamin therapy and guided physiotherapy were instituted for the neurologic lesion. This is progressing satisfactorily and it would appear that complete recovery will take place.

COMMENT

It is well known fact that cresolic and phenolic derivatives may be absorbed through the skin. This is particularly so when the chemical and physical barriers of the skin are either depleted or destroyed. Such must evidently have been the case in this patient. The severe dermatitis is indicative of pronounced local chemical trauma. Prolonged subsequent contact with the noxious material, without protection, permitted the absorption of enough of the toxic agent to result in the clinical picture which followed. The sequence is far too suggestive to be entirely coincidental. The selectivity for the facial nerve in this case has its counterpart in that of lead for the radial nerve and arsenic for the peroneal nerve.

The indication for caution certainly exists. Individuals having occasion to employ solvents of the type discussed should be required to avail themselves of protective equipment. If any signs of dermatitis appear the person should be removed to other work and close scrutiny maintained over the nervous system to detect signs of early involvement should it occur.

A PORTABLE WELDING FUME EXHAUSTER

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Many situations arise in ship and submarine construction and repair where welders must have adequate ventilation in order to do their work. Often such ventilation is not available or impractical to supply, particularly if it is a rush job or one of short duration. Proper ventilation is necessary for the protection of the health of welders and workers and also for the promotion of increased production.

A new portable welding fume exhauster which is well suited for such ventilation has been developed at the Boston Navy Yard. It has been given a thorough tryout by many welders and results prove its practicability, particularly in confined spaces.

This device is complete and compact, cylindrical in shape, 10 by 34 inches, and weighs approximately 25 pounds. The portability and size permits use in the smallest confined spaces where welders have to work.

These specifications apply to the third model of this unit, two previous models being primarily experimental devices. The first model was used to determine the amounts of welding fume given off from different-size rods when operating at various voltage and current values. It was at this time that the merits of this device for the control of welding fumes were observed. A new and more powerful model was made specifically for use by the welder to control welding fumes. Figures 1 to 3 inclusive show this second model. The third model, now being produced in quantity and shown in figure 4, is essentially the same as model 2, but is easier to build and lighter in weight.

In contrast to other welding exhaust equipment, this device uses a small flexible metal hose 1.5 inches in diameter and from 8 to 10 feet long. The flexibility and weight of this hose allows the welder to move and adjust the hose with ease in difficult positions and if necessary to hold the hose in one hand while he welds with the other. With this unit a bead of at least 7 inches can be welded

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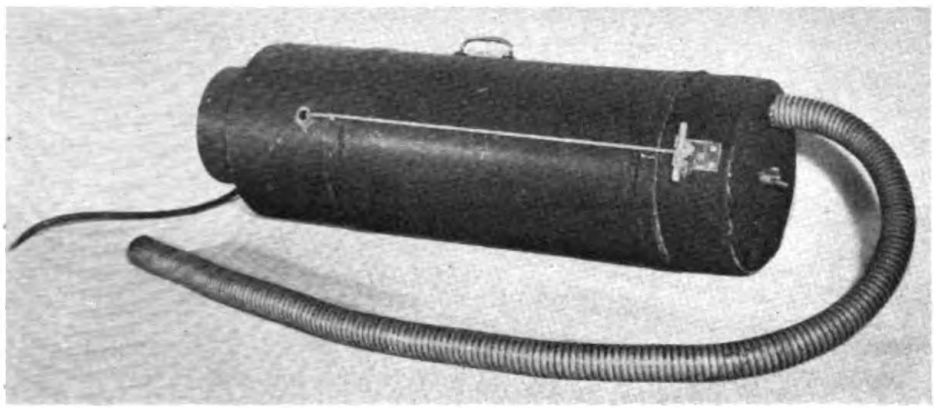
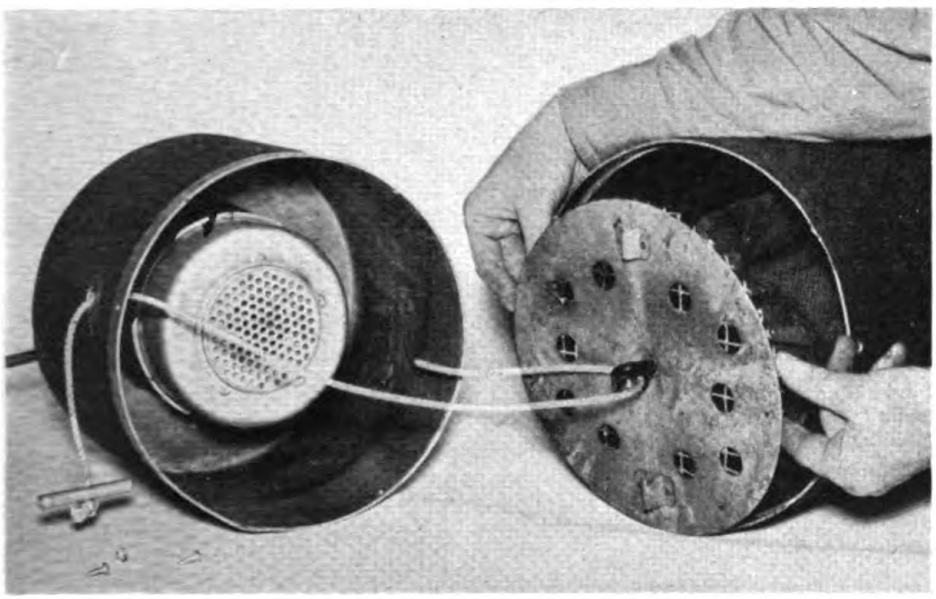


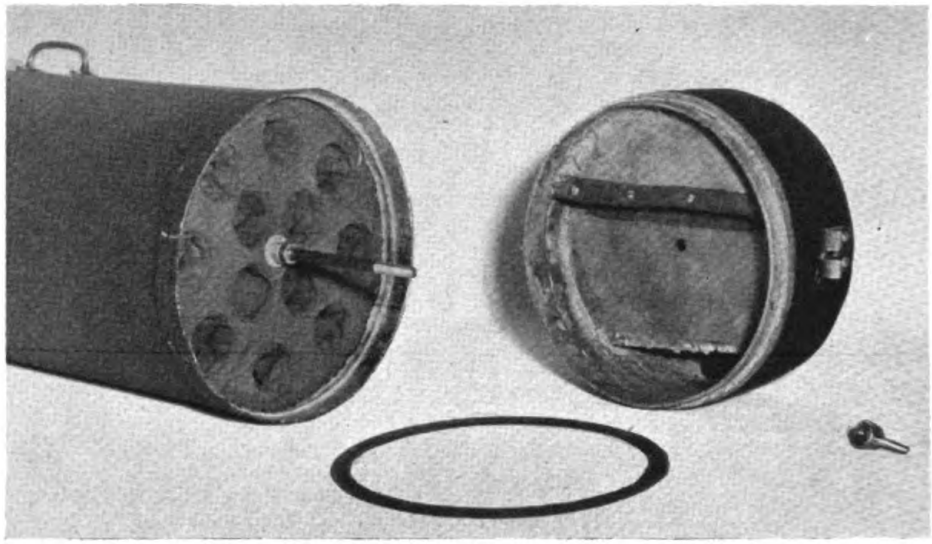
1. Complete unit showing separating chamber and removal wing nut. Blower discharge is at left.



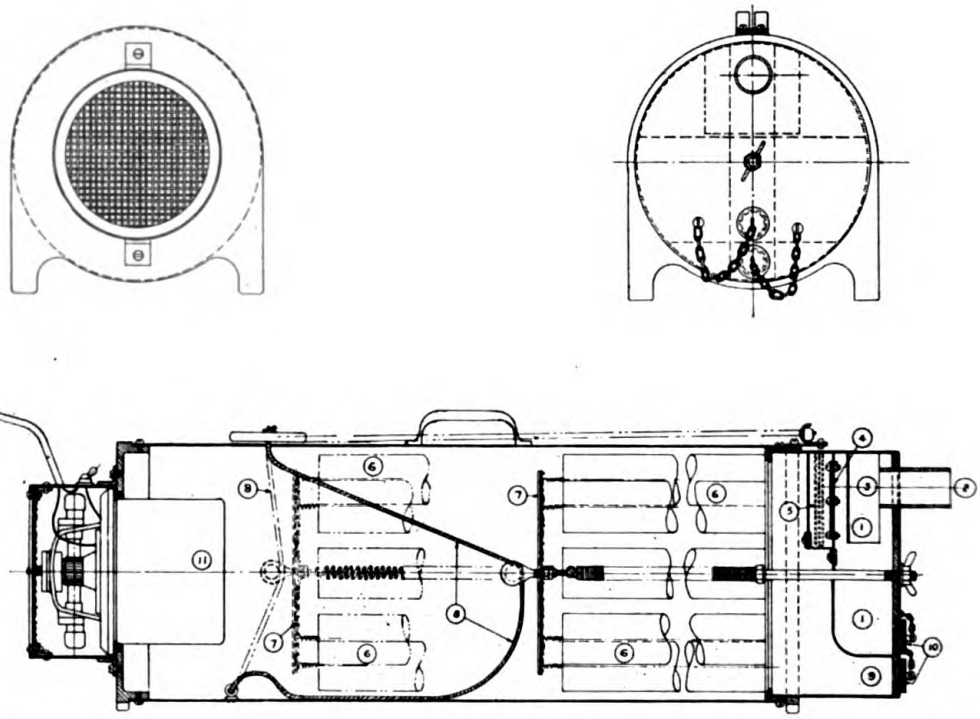
2. Internal components at discharge end of filters. The filter tubes can be seen behind their supporting plate. The shaking mechanism and blower inlet are also shown.

on flat, open work using 5/32-inch rods before it is necessary to move the hose to capture all the fumes from the welding arc.

An important feature of the device (fig. 4) is a separating chamber for removing slag and large fume particles by means of a specially designed trap (1) which incorporates impingement, centrifugal force and settling as separating forces. The air enters the device through the port (2) at a high velocity (6,200-4,900 feet per minute) striking (impingement) the curved baffle (3) which imparts a centrifugal force to the particles in the air. The air then attains a low velocity through the chamber (settling) and enters

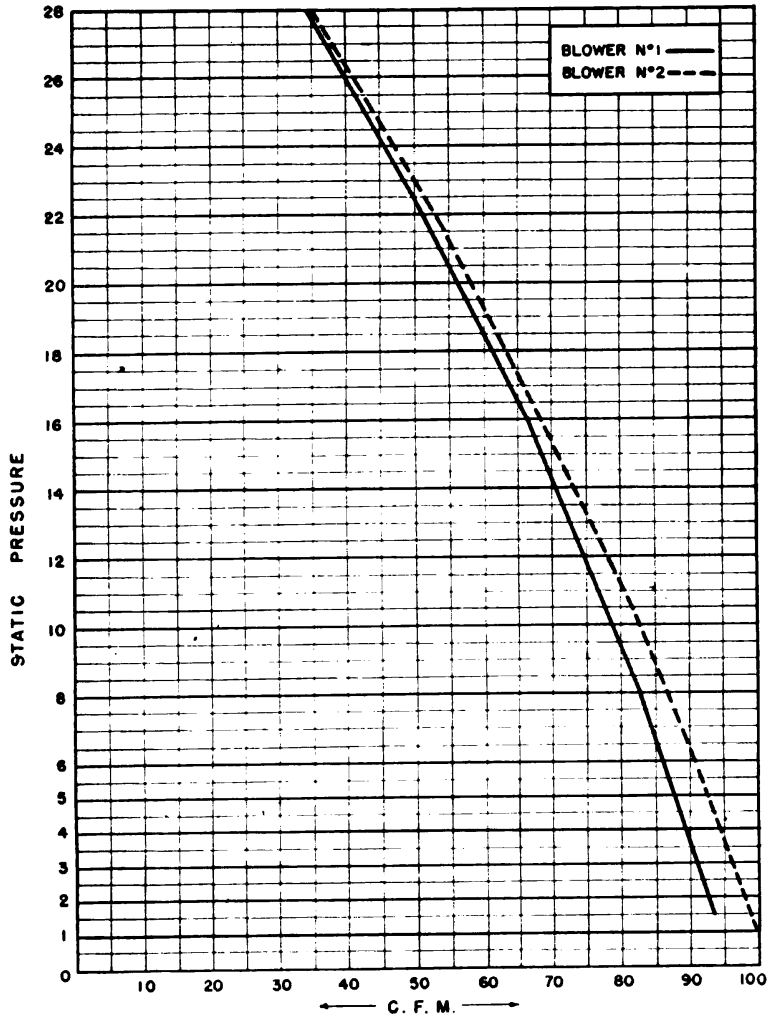


3. Showing internal components at inlet end of filters. Discharge outlet from separating chamber and inlet ports to tubes and gasket are evident.



4. Plan and end elevations of final model of exhauster. Numbers refer to components which are described in the text.

the opening (4). The filtering unit (6) is preceded by a spark arrester (5) which consists of two corrosion-resistant 18-mesh wire gauzes over the opening (4) and five 20-mesh copper wire gauzes in the spark arrester unit (5). The filter section con-



Graph 1. Blower characteristics of two similar blowers selected from a shipment of 20 units. Operating range of complete exhauster is between 65 and 50 cubic feet per minute.

tains a fireproofed fabric which is made into 12 filter tubes, each 2 inches in diameter and 18 inches long.

These tubes are connected to a spring-mounted frame (7) which is built so that the tubes can be collapsed by releasing a simple pull cord (8). The collapsing of the tubes is done with the motor off and the unit standing, blower end up, so that the dust shaken off the bags automatically falls into the filtering hopper (9). When the tubes are elongated to their operating position, the filtering surface allows maximum air flow. The filtering area is approximately 9.5 square feet.

This tubular bag filters out 95 percent or more of freshly generated iron oxide fume as proved by analytic tests. The unit can be used without shaking for at least 40 five-thirtyseconds-inch or

12 one-fourth-inch rods welded on black iron, or 20 five-thirty-seconds-inch rods welded on galvanized iron. At the end of welding this number of rods, the airflow is still great enough to capture all the fumes 4 inches or more away from the end of the exhaust tube when welding on flat, open work.

The filter and separating chamber need only be removed for repairs. Removal of the collected fume is readily accomplished by separate cleanout ports provided in the hoppers for the separating chambers and filter unit (10).

The blower (11) is a commercial household vacuum unit equipped with three sets of fan blades, one set stationary, and a universal motor rated 535 watts, 110 volts. This unit is still in production and can be obtained in quantity. The fan characteristics of the fan unit are presented in the graph. The operating capacities of the exhauster are from 65 cubic feet per minute at 17 inches static pressure to 50 cubic feet per minute at 23 inches static pressure. The filtering velocity, therefore, varies from 6.8 feet per minute to 5.3 feet per minute over the welding cycle described above.

The principal advantages of the unit are as follows:

1. Simplicity of construction, lightness of weight and complete portability. Operation is simple and requires very little instruction.
2. Effective welding-fume control, particularly for welding in confined spaces and welding on galvanized surfaces.
3. Ease of handling and control obtained by small lightweight hose.
4. Unit will completely remove welding fume, and discharged air from blower may be recirculated.
5. Fumes are easily removed from the device, and a convenient and simply-operated shaking device obviates the need of removing the filter unit.
6. A separating chamber is provided to remove slag and heavy fumes, thus preventing damage to the filter and blower unit.
7. A fire-retardant filter and a spark arrester are incorporated in the unit, making it entirely fireproof.
8. The unit uses a small compact blower of high capacity and static pressure with a universal motor. This unit is commercially available at a reasonable price.

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Palmer, David W., Lieutenant (MC) USNR (*A "Seagoing" First-Aid Kit*, p. 406). M.D., University of Maryland School of Medicine and College of Physicians and Surgeons, 1939. Intern: St. Agnes' Hospital, July 1939–July 1940, and Baltimore City Hospitals, July 1940–July 1941, Baltimore, Md.; private practice, Wheeling, W. Va., July 1941–June 1942.

Rosenblum, Harold H., Lieutenant Commander (MC) USNR (*So-Called Reiter's Disease*, p. 375). A.B., University of California, 1926; M.D., University of California Medical School, 1930. Intern, Mount Zion Hospital, San Francisco, 1929–30; graduate assistant in medicine, Boston Dispensary, 1930–31; research fellow in medicine, Harvard Medical School, 1931–32; voluntary assistant in medicine, Peter Bent Brigham Hospital, Boston, 1931–32; assistant clinical professor in medicine, University of California Medical School, 1938–; associate chief of medicine, Mount Zion Hospital, San Francisco, 1938. Fellow American Medical Association; member: California Heart Association (president, 1942–44); California Academy of Medicine; American Heart Association; American Federation for Clinical Research. Diplomate American Board of Internal Medicine.

Salman, Irving, Lieutenant Commander (DC) USNR (*Sclerosing Agent in Treatment of Subluxation of Mandible and of Hemangiomas of Mouth*, p. 361). D.D.S., New York University College of Dentistry, 1923. Instructor in oral surgery, 1923–30, chief of oral surgery clinic, 1930–35, and assistant professor in oral surgery, 1935–42, New York University College of Dentistry; consultant dental surgeon, Harlem Hospital, New York City, 1930–42; associate visiting oral surgeon, Bellevue Hospital; oral surgeon, Montefiore Hospital for Chronic Diseases, New York City, 1928–42.

Seelig, Charles A., Lieutenant (MC) USNR (*Gonorrheal Ophthalmia*, p. 389). B.S., Lafayette College, 1928; M.D., Long Island College of Medicine, 1935. Intern, New York City Hospital, 1935–37; resident, Manhattan Eye, Ear and Throat Hospital, 1937–39; private practice, New York City; associate otolaryngologist and bronchoscopist, New York City Hospital and French

Hospital, New York City; Municipal Sanatorium, Otisville, New York. Fellow: American College of Surgeons; American Academy of Ophthalmology and Otolaryngology; American College of Chest Physicians; New York Academy of Medicine; member: American Medical Association; New York County Medical Society; Medical Society of the State of New York. Diplomate American Board of Otolaryngology.

Smiley, Dean F., Lieutenant Commander (MC) USNR (*Diarrheal Diseases in the Navy*, p. 267). A.B., Cornell University, 1916; M.D., Cornell University Medical College, 1919. Instructor in hygiene and preventive medicine and medical adviser, 1920–21, assistant professor of hygiene and preventive medicine and medical adviser, 1922–28, professor of hygiene and preventive medicine and health officer, 1929–42, Cornell University, Ithaca, N. Y.; formerly field investigator for Carnegie Foundation for the Advancement of Teaching; acting director, Division of Health and Physical Education, New York State Department of Education; president, American Student Health Association. Fellow: American Public Health Association (former councilor); American Medical Association. Author of college textbooks in field of hygiene and preventive medicine.

Smiley, Leonard V., Lieutenant (MC) USNR (*Suppression of Urine Complicating Sulfadiazine Therapy*, p. 328). B.S., New York University, 1933; M.D., New York University College of Medicine, 1937. Intern, New York City Hospital, 1937–39; assistant in pathology, 1939, and resident in urology, 1940–41, Morrisania City Hospital, New York City. Diplomate National Board of Medical Examiners.

Town, Arno E., Lieutenant Commander (MC) USNR (*Gonorrheal Ophthalmia*, p. 387). B.S., University of Akron, 1922; M.D., Jefferson Medical College of Philadelphia, 1926; M.M.Sc., University of Pennsylvania, 1930. Intern, St. Mary's Hospital, Philadelphia, 1926–27; visiting surgeon and chief of clinic, Bellevue Hospital and St. Vincent's Hospital, New York City; junior surgeon, New York Eye and Ear Infirmary, New York City; assistant clinical professor in ophthalmology, New York University College of Medicine. Fellow: American College of Surgeons; American Medical Association; member American Academy of Ophthalmology and Oto–Laryngology. Diplomate American Board of Ophthalmology.

Turner, Henry B., Lieutenant (MC) USNR (*Stabilized Staining Rack*, p. 405). M.D., University of Tennessee College of Medicine, 1942. Intern, Gorgas Hospital, Ancon, C. Z., 1942–43.

Viles, Frederick J., Jr., Lieutenant H(S) USNR (*A Portable Welding Fume Exhauster*, p. 440). B.S., Massachusetts Institute of Technology, 1938. Industrial hygienist, Liberty Mutual Insurance Company, Boston, Mass., 1938–41. Member: American Industrial Hygiene Association; American Chemical Society.

Vonfraenkel, Philip H., Lieutenant (MC) USNR (*Fish Poisoning by Barracuda in the Marianas*, p. 427). B.S., Loyola University, 1936; M.D., Loyola University School of Medicine, 1940. Member Chicago Medical Society.

White, Douglas W., Lieutenant (DC) USNR (*Improvised Cassette Holder for Chest X-rays*, p. 408). D.D.S., Northwestern University School of Dentistry, 1932. Private practice, Chicago, Ill., 1932–42. Member: American Dental Association; Illinois Dental Association; Chicago Dental Association.

Yaguda, Asher, Lieutenant Commander (MC) USNR (*Pathology of Immersion Blast Injury*, p. 232). M.D., Albany Medical College, 1920. Intern and resident in pathology, 1920–23, and associate attending physician, 1924–, Newark City Hospital; director of laboratories, Newark Beth Israel Hospital, 1923–35; pathologist, Bayonne Hospital and Dispensary, 1941–, and Community Hospital, 1941–, Newark, N. J. Fellow: American College of Physicians; American Medical Association; New York Academy of Medicine; member: Academy of Medicine of Northern New Jersey; New Jersey Society of Clinical Pathologists (president, 1937–39); American Society of Clinical Pathologists; Essex County Anatomical and Pathological Society (president, 1938). Diplomate American Board of Pathology.

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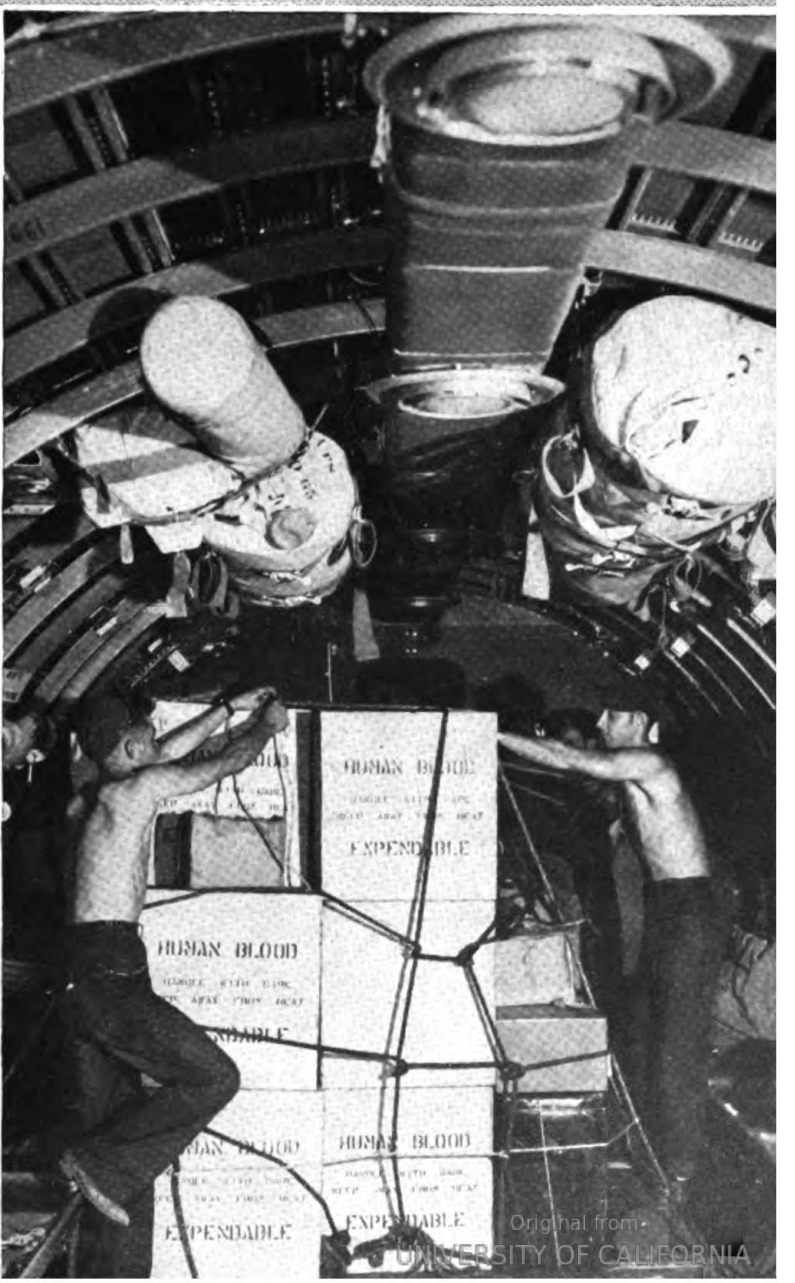

MARCH 1945

BUREAU OF
MEDICINE AND SURGERY
NAVY DEPARTMENT
WASHINGTON, D. C

NAVMED 112

COVER PHOTOGRAPH

Inaugurated last November, aerial transportation of whole blood into Pacific Ocean areas is being carried out on regular schedules. This picture depicts the unloading of refrigerated cases from a Naval Air Transport Service "Skymaster" on Guam. Donors are processed at West Coast centers operated by the American Red Cross.

—Official U. S. Navy Photo.

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See page II for prices

NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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Volume 20, 1924, Nos. 2, 5 and 6.
Volume 24, 1926, Nos. 1, 2 and 4.
Volume 25, 1927, Nos. 1 and 4.
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PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

The editors are not responsible for the safe return of manuscripts and pictures. All materials supplied for illustration, if not original, should be accompanied by reference to the source and a statement as to whether or not reproduction has been authorized. Recognizable photographs of patients should carry with them permission to publish.

All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

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United States Naval Reserve.

TABLE OF CONTENTS

U. S. NAVAL MEDICAL BULLETIN

VOL. 44 MARCH 1945 NO. 3

SPECIAL ARTICLES

PENICILLIN

A PROGRESS REPORT BASED ON 1,455 CASES TREATED AT THE NATIONAL NAVAL MEDICAL CENTER BETHESDA, MARYLAND

PREPARED BY THE PENICILLIN COMMITTEE[1]

A comprehensive program for the use of penicillin at the National Naval Medical Center was outlined in July 1943 and the administration of the program was left to an advisory committee composed of representatives of the medical, surgical, urologic and dermatologic services, the department of bacteriology, and the Research Institute. It was hoped that through this plan of management information could be accumulated rapidly, a maximum of clinical benefit obtained, and yet, with the actual care of the patient remaining in their hands, staff physicians would become familiar with the use of the drug. Under this arrangement some 1,455 patients have been treated and form the basis of this report.

Despite the widespread use of this antibiotic and the appearance of a large volume of literature, we remain largely in the dark with respect to such basic facts as its chemistry and mode of action against susceptive organisms. Enough fundamental data are available to allow intelligent clinical use of penicillin, and these are summarized briefly.

[1] The Penicillin Committee of the National Naval Medical Center is composed of Captain Winchell M. Craig (Surgery); Commander Gershom J. Thompson (Urology); Lieutenant Commander Adolph M. Hutter (Medicine); Lieutenant Commander Edwin E. Barksdale (Dermatology and Syphilology); Lieutenant Carl C. Pfeiffer (Research Institute); and Lieutenant Paul V. Woolley, Jr. (Bacteriology); all Medical Corps, U. S. Naval Reserve.

Chemistry.—Penicillin is composed of carbon, hydrogen, oxygen, and at least one atom of nitrogen. The molecular weight is small, probably under one thousand, and no stable ring structure is present. Penicillin behaves as an organic acid and as such forms salts with ammonium, sodium, calcium, barium, and strontium, and esters with a number of hydroxyl-containing substances. The free acid and several salts are used in therapy and, since potency is defined in units rather than weight, these have been used interchangeably. A majority of the patients in this series received penicillin sodium. There is no general agreement on either empiric or structural formulas nor has synthesis of the drug been reported.

Physical properties.—Most highly refined penicillin is a powder varying in color from yellow to orange; it is readily soluble in water and a number of organic solvents. Heating results in decomposition while deterioration takes place at either extreme of pH. The salts, when kept in a dry state, retain their potency for months, but when in solution deteriorate at a speed varying directly with the temperature. Penicillin is incompatible with primary alcohols, heavy metals, and oxidizing agents. Certain enzymes are also capable of breaking it down, but fortunately these do not appear to be of practical importance.

Penicillin is relatively stable in such diluents as saline, dextrose, plasma, and amino-acid solutions. Body fluids and exudates do not detract from the antibacterial power in other than mechanical manners, and natural inhibitors have not been described.

Mechanism of action.—It is questionable whether penicillin should be classed as a bacteriostat or bactericide and reports are confused because of the variety of test conditions under which proof has been obtained for one contention or the other. When susceptible organisms are suspended in an effective concentration of the drug, diluted in a medium capable of sustaining bacterial growth, the immediate result is a loss of the ability of the organisms to proliferate in logarithmic progression. Usually at the beginning of this change there is merely a slowing of the rate of division, but, as the process continues, a period is reached when the actual number of organisms decreases. The rate of this change, within certain limits, can be modified by increasing or decreasing the concentration of the drug. Which system of vital metabolism is inhibited to bring about these events has not been elucidated but the entire process proceeds without dissipation of the original amount of penicillin.

Probably much the same reaction takes place when the drug is used therapeutically and it should be stressed that since infection is a struggle between *proliferation* of the invading strain and the

defense mechanisms of the host, a mere slowing of the rate of cell division is sufficient to lead to recovery in most instances. Penicillin therapy retards or stops proliferation and whether this results through bacteriostatic or bactericidal action is of little clinical import.

The concentration of penicillin necessary to impair proliferation varies considerably both between and within species. For many pyogenic forms 0.02 unit per cc. has been shown to be an effective level while for other species ten times this amount is necessary to accomplish the same effect. Fair agreement can be found for division of organisms based on susceptibility to penicillin. In table 1 are listed some common pathogens under three categories: (a) Those known to be susceptible with penicillin treatment definitely indicated; (b) those for which there is evidence that penicillin may be of value but where variations in susceptibility among strains or lack of clinical experience prevent positive commitment; and (c) those for which there is little or no evidence of effectiveness.

TABLE 1.—*Classification of pathogens*

Penicillin treatment definitely indicated	Penicillin treatment controversial	Penicillin treatment apparently ineffective
Diplococcus pneumoniæ	Brucella	Entire genus hemophilus
Streptococcus haemolyticus	Other groups of streptococci	Tubercle bacillus
Streptococcus viridans	C. diphtheriae**	Gram-negative enteric group
Staphylococcus	Vibrio comma	Typhoid bacillus
Gonococcus	Leptospira	Salmonella
Meningococcus	Spirillum minus	Shigella
Treponema pallidum	Actinomyces	Pseudomonas
B. anthracis	Streptothrix	Proteus
Borrelia	Rickettsia	Colon bacillus
Clostridia (majority)*	Some larger viruses	Genus klebsiella
	Psitticosis	Trypanosoma
	Ornithosis	Plasmodium

* Require higher concentrations for effective control.

** Obviously the ability to prevent proliferation of organisms does not minimize the importance of antitoxin treatment.

Behavior of penicillin within the body.—Penicillin rapidly passes into the blood when injected intramuscularly or subcutaneously but is poorly absorbed when given rectally. It is destroyed by normal gastric secretions but appreciable absorption has been demonstrated in persons with achlorhydria and in instances in which administration was by duodenal tube. Diffusion throughout the tissues would appear to be rapid, although such normal barriers as synovia and the choroid plexus are not easily passed. During periods of infection, when the blood-brain barrier breaks down to other substances, penicillin can be demonstrated to pass into the cerebrospinal fluid (see section on treatment of meningitis). The placenta at term is permeable to the drug in most instances.

Penicillin behaves as a nonthreshold substance and as such is eliminated rapidly in the urine, over 50 percent of a single dose being excreted within 1 or 2 hours. Some is also present in the bile, while the remainder is apparently destroyed in the body.

So far as side reactions and toxicity are concerned it seems fair to say that penicillin is innocuous when used in recommended therapeutic amounts. Acute allergic phenomena, such as transient urticaria and contact dermatitis, were observed with the early preparations; a finding to be expected, because these molds are powerful and widely distributed allergins. Some individuals experienced pain at the site of intramuscular injections but this has become less common as more highly purified preparations have been used. From our experience it would appear that the venous thromboses, reported as common with the use of penicillin by constant drip, were due more to careless technic than to the drug per se. A number of our syphilitic patients have had febrile episodes resembling the Herxheimer reactions to arsenotherapy but these can hardly be classed with drug toxicities. There has been no suggestion that leukocytes or other body components are depressed or damaged through the use of penicillin.

GENERAL PRINCIPLES OF THERAPY WITH PENICILLIN

Selection of cases.—This series is composed of Naval personnel of both sexes ranging upward in age from 18 years. It has been our conviction that, with the supply of penicillin limited, only those individuals presenting definite evidence of disease due to susceptible organisms should receive treatment. Therefore each person for whom penicillin was requested has been studied completely from the bacteriologic standpoint, and therapy withheld until satisfactory evidence was obtained. Three minor groups are excepted: (1) Those with surgical or traumatic wounds for which penicillin was given prophylactically; (2) a few in whom it was desired to determine the efficacy of the drug; and (3) an occasional patient whose clinical condition was so critical that therapy was started without laboratory confirmation of the diagnosis.

Laboratory control of treatment.—In addition to procedures necessary for diagnosis, all patients treated early in the program received complete hematologic study, with investigation of chemical blood constituents before and during therapy. As it became apparent that side reactions, such as depression of the bone marrow and reduction of kidney function, were not part of penicillin therapy, tests were limited to those suggested by the individual condition. Thorough investigation was made of blood components

that reflect deficiency of daily dietary, fluid, or electrolytic requirements.

The level of penicillin in the blood during treatment was determined under various conditions of administration but this was largely abandoned as our knowledge of the drug increased. All determinations were made by the comparison of known and unknown in serial dilutions. A Staphylococcus aureus was used as the test strain and the dilution at which acidity was first produced in phenol red base broth was taken as the endpoint. Susceptibility of a given strain to penicillin was determined by direct testing on blood agar plates upon which a strip of filter paper saturated with the solution had been placed across the lines of inoculation or, when growth in liquid medium was desired, by incorporating the drug directly into the matrix.

Dosage and methods of administration.—Basic ideas of dosage were available at the beginning of this program through the investigations of the Oxford group in England and the recommendations of the National Research Council in this country. As experience increased these were modified to conform with our findings. Two general policies have been supported: (1) Rigid standardization of dosage has been avoided and the individual patient has been treated in accordance with his needs; and (2) strenuous treatment for a short interval has been encouraged rather than the doling out of homeopathic amounts over an extended period. It is our belief that divergence from these principles has done inestimable harm and contributed to the confusion which exists with respect to the results of sulfonamide therapy. Certainly toxic reactions and the development of "drug fastness" would be expected more with protracted suboptimal therapy than with adequate amounts for short periods.

Doses have ranged from 60,000 to 360,000 units in a 24-hour period and when given by a route allowing full utilization this range has been entirely satisfactory for the control of most infectious processes. The length of time over which treatment is continued has varied more than the daily dose, and both factors are considered in some detail under the individual clinical categories.

Three methods of administration have been followed for the parenteral use of penicillin in this series, i.e., continuous intravenous drip, intramuscular injection, and continuous intramuscular drip. With the intravenous technic a uniform blood level is obtained and the patient is subjected to a minimum of disturbance. Penicillin is dissolved in saline, dextrose solution, plasma, or amino-acid solution, in a concentration of 20,000 to 80,000 units per liter, and this is allowed to run into the vein at the rate

of 30 to 40 drops per minute. During the course of 24 hours the patient can thus receive from 60,000 to 240,000 units. With 20,000 units per liter at the rate of 40 drops per minute, a constant blood level between 0.1 and 0.2 unit per cc. is maintained. This schedule has been varied to suit the individual case and, when indicated, more rapid delivery has been utilized at the outset to assure an immediate effective level. When plasma or amino acids are not indicated the drug is given in liter amounts of saline alternated with the same amount of 5-percent dextrose solution in order to minimize the load of sodium and chloride ions. This method has been used when intravenous fluids must be given anyway, when frequent intramuscular injections are undesirable, and when accurate control of the blood level is important. Intravenous drip is unsatisfactory when physical and nursing facilities are limited, when an increased fluid intake is contraindicated, and when cooperation of the patient cannot be obtained.

A solution of 5,000 or 10,000 units per cc. of saline is used for intramuscular injection and the total amount given in 24 hours has ranged from 80,000 to 360,000 units. The interval between injections varied from 2 to 4 hours. The shorter periods were generally preferred because a blood penicillin level constantly over 0.02 unit per cc. appeared, theoretically, to be more desirable than the peak and valley levels which characterized the longer intervals. Little difference has been noted in clinical results between groups treated by the several schedules. In acute severe infections the 2-hour interval was used initially, after which, with clinical improvement, the interval was prolonged to 3 hours. The majority of patients covered by this report received their medication intramuscularly because of the simplicity with which it can be administered and the generally satisfactory results obtained. Attempts to slow up the absorption of the drug, and thus provide a stable level from a single injection, have been made by incorporating the substance into a variety of matrices but none has proved satisfactory.

Recently we have used penicillin by constant intramuscular infusion and the method deserves further trial. A solution of 2,000 units per cc. of saline is allowed to run into the quadriceps at a rate of four or five drops per minute. Blood levels are comparable to those obtained by the same dose given intravenously while the patients apparently experience little discomfort.

For topical application and as a collyrium, penicillin has been dissolved in saline to a concentration of 250 to 500 units per cc. The adaptation of this to the problems of the various specialties is considered under the individual clinical topics. Topical penicillin solution can be trapped at the site of a lesion for a minimum

TABLE 2.—*Summary of penicillin-treated cases—U. S. Naval Hospital, Bethesda, Md., 12 April 1943 to 1 September 1944*

Diagnosis	No.	Success	Failure	Indeterminable
Gonococcic infection—male	711	709	2	0
Gonococcic infection—female	29	23	2	4
Syphilis	324	311	7	6
Cellulitis	17	16	0	1
Infected wounds	15	11	2	2
Gas gangrene	1	1	0	0
Septicemia	2	1	1	0
Osteomyelitis	29	24	3	2
Acute otitis media and mastoiditis	36	36	0	0
Pharyngeal and tonsillar infections	8	7	1	0
Sinusitis	6	5	0	1
Meningococcic meningitis	4	4	0	0
Meningococcemia	2	2	0	0
Pneumonia	26	22	2	2
Lung abscess	4	3	0	1
Acute pleurisy	1	1	0	0
Primary atypical pneumonia	1	0	1	0
Pleural effusion	3	0	3	0
Empyema	5	5	0	0
Bronchiectasis	2	0	0	2
Bronchogenic carcinoma	3	0	3	0
Abscess, thigh, breast, epidural	4	4	0	0
Peritonitis with ruptured appendix	7	7	0	0
Peritonitis with intestinal obstruction	2	0	1	1
Peritonitis, pelvic	1	1	0	0
Urethritis other than gonococcal	58	56	1	1
Epididymitis	8	7	1	0
Prostatitis	30	29	1	0
Cystitis and pyelitis	11	8	1	2
Stomatitis and Vincent's angina	8	7	0	1
Scarlet fever	14	12	0	2
Erysipelas	3	3	0	0
Pyoderma and furunculosis	13	11	1	1
Iritis, iridocyclitis	9	7	2	0
Choroiditis	2	0	2	0
Corneal ulcer	2	2	0	0
Purulent conjunctivitis	1	1	0	0
Tuberculosis	2	0	2	0
Malaria	2	0	2	0
Carcinoma, lymphosarcoma	3	0	3	0
Leukemia	1	0	1	0
Infectious mononucleosis	3	0	3	0
Rheumatic fever	1	0	1	0
Filariasis	2	0	2	0
Lymphangitis with filariasis	1	1	0	0
Infectious arthritis	1	1	0	0
Vaginitis, nonspecific	2	0	2	0
Chronic ulcerative colitis	1	0	1	0
Mumps	1	0	1	0
Prophylaxis: Multiple wounds, compound fractures, surgical procedures	33	29	0	4
Total	1,455	1,367	55	33

of 6 to 8 hours and additional amounts of the solution can be injected through small Dakin tubes every 6 to 8 hours. Because of the necessity for constant prolonged contact to maintain its effective antibacterial action, penicillin was not used as an irrigant. Ointment bases were used for the application of penicillin to skin surfaces; both "hydrosorb" and a glycerin-tragacanth lubricating jelly formed stable mixtures when 500 units per gm. of base were added. One of the most useful substances for local therapy has been dried blood plasma, which was originally suggested in the treatment of burns. To each gram of plasma is added 10,000 units of penicillin and this is applied to infected areas by dusting or insufflation. Penicillin in concentration of

10,000 units per gm. of sulfanilamide powder has also been used with satisfactory results.

Surgical drainage.—Penicillin therapy has altered the treatment and prognosis of conditions characterized by the formation of pus or infected sequestra. It does not bring about resolution of large volumes of inflammatory exudate nor is it capable of maintaining permanent sterility of sequestra and foreign bodies. Evacuation of pus or removal of sequestra is still essential but the conditions under which this is done have undergone considerable change. Our experience is still too limited to allow rigid formulizing but several trends should be emphasized.

1. With the use of bacteriostats, drainage of pyogenic collections can safely be delayed until the patient is in ideal condition. Deficiencies of blood volume and nutrition can be corrected during the period of grace and the natural defenses of the body improved.

2. The risk of metastatic dissemination or septicemia is minimized, once effective penicillin therapy is established.

3. Local progression of pyogenic processes is usually halted and the total area of involvement is kept to a minimum. This has been noted especially in infections of the hand and in breast abscess. When the initial process is not too extensive and the causative organism is highly susceptible, liquefaction can often be prevented completely.

4. The flora of abscesses is often changed by penicillin therapy so that with mixed infections the more dangerous cocci are frequently eliminated and only the relatively benign forms remain. In a number of pyogenic processes treated here the pus finally evacuated has been sterile.

5. The danger of dissemination at the time of surgical intervention is greatly reduced by the use of penicillin. This allows for the safe performance of more radical procedures than were formerly possible, an important consideration in the treatment of osteomyelitis.

6. The use of penicillin parenterally and topically often permits the use of conservative surgical technics which previously were unsatisfactory or unsafe. From our experience it would seem that this will prove true for both empyema and brain abscess.

Strict attention to the daily caloric, protein, and vitamin intake of patients with infectious diseases greatly augments the success of specific therapy. This is especially true in patients whose disease is characterized by fever, chronicity, toxicity, loss of appetite, or impaired absorption. Such individuals not only have an increased requirement for food but also are often handicapped in utilizing completely such elements as are provided.

With the exception of individuals whose diseases were not debilitating and who required therapy only over short periods of time (such as acute urethritis and primary syphilis), all patients were given a diet calculated to provide from 2,500 to 3,000 calories and from 130 to 150 gm. of protein daily. The daily requirement of accessory substances was included in such a diet but additional vitamin factors were provided as concentrates when indicated. When, for any reason, enough protein to maintain a positive nitrogen balance could not be taken by mouth, recourse was had to parenteral administrations. Pooled plasma contains around 6.5 gm. percent of protein and was used freely not only to correct plasma and tissue deficiencies but as a ready source of dietary protein. The entire daily protein intake can be obtained through the use of 2,000 cc. of plasma daily.[2] Whole blood, which contains approximately 18 percent of protein, was administered when an increase in the hemoglobin was also desirable. Another source of protein has been hydrolyzed casein (amigens), administered in a concentration of 50 gm. per liter of 5-percent dextrose. Such amino-acid preparations alone are apparently capable of maintaining the patient in positive nitrogen balance and penicillin can be incorporated into the solution as it is in dextrose or saline.

In order to realize fully the potentialities of penicillin treatment, advantage should be taken of all accessory and supportive aids. The use of sulfonamides in conjunction with penicillin will often prove of benefit in mixed infections, especially since there is considerable evidence that these two therapeutics are often synergistic. The possible usefulness of biologics should be kept in mind and it should be remembered that penicillin in no way affects bacterial toxins which are already formed, nor does it contribute to the development of immunity by the patient.

CLINICAL APPLICATION OF PENICILLIN

PENICILLIN IN PNEUMONIA, LUNG ABSCESS, BRONCHIECTASIS, EMPYEMA, ACUTE PLEURISY AND PLEURAL EFFUSION.

Penicillin has proved highly effective in treatment of pneumococcal, streptococcal, and staphylococcal pneumonia. It has been of no value in primary atypical pneumonia and was ineffective in two instances of fulminating bilateral bronchopneumonia of undetermined cause. The administration of penicillin early in the course of lobar pneumonia was attended by dramatic improvement with marked decline of fever in from 12 to 48 hours. When peni-

[2] It must be stressed that the usual liquid plasma contains enough organic mercurials to be toxic and when the use of large amounts of plasma is contemplated this danger should be eliminated by providing a freshly prepared or lyophilized product.

cillin was started late in the disease the febrile course declined by lysis within from 4 to 13 days. Subjective improvement was noted within 24 hours, the cough, dyspnea, and signs of toxemia lessened and the appetite improved, although little change was observed in the chest findings even after the fever and toxicity were controlled. Resolution of the pneumonia proceeded independent of the action of penicillin. Therapy was maintained for an average of from 7 to 10 days, 20,000 or 30,000 units being given every 2 hours until improvement was unquestionable and then 20,000 every 3 hours during the remainder of the period. Twenty-two cases of pneumonia have been handled by this method with uniformly good results. Penicillin is as effective as sulfadiazine and is less toxic.

In three cases of streptococcic pneumonia, one case of staphylococcic pneumonia, and one case of pneumococcic pneumonia, all complicated by empyema, penicillin was administered intramuscularly in dosage of 20,000 to 30,000 units every 3 hours and intrapleurally in dosage of 40,000 to 100,000 units daily. All recovered but only after surgical drainage. In two of the streptococcic empyemas the pus became sterile, while in the remaining instances organisms persisted. Empyema complicating pneumonia necessitates early aspiration of pleural contents with injection of sufficient penicillin solution in concentration of from 250 to 500 units per cc. to contact all parts of the infected cavity. The amount injected should be slightly less than the amount of fluid previously aspirated. Initial pleural injection may be made once daily, as the absorption of penicillin from the infected cavity is slow and adequate bacteriostatic concentration can be maintained for from 22 to 24 hours after injection.

The recognition of chest fluid during pneumonia calls for immediate diagnostic puncture and the use of intrapleural penicillin when organisms are present. The recognition and treatment of empyema before the development of frank pus, will probably allow control without surgical interference. In our experience, after the development of frank pus, there is need for surgical drainage to control the disease. The fundamental principles of surgical drainage have not been altered by chemotherapeutic measures, and delay in surgical intervention for empyema, beyond the time necessary to saturate with penicillin, cannot be justified on the basis of results seen to date. The institution of penicillin, with adequate nutrition through the use of blood, plasma, or amino acids, reduces the morbidity and toxemia, providing a greater margin of safety in the early establishment of surgical drainage.

Penicillin was effective in treatment of four cases of lung abscess. Two of these responded to intramuscular penicillin alone

while the others required surgical drainage in addition. In lung abscess penicillin is administered for a period of 2 or 3 weeks. If response is not satisfactory, surgical drainage is instituted and penicillin therapy is maintained for an additional 2 or 3 weeks thereafter. Penicillin shortens the course and reduces the toxemia of the disease.

One case of acute fibrinous pleurisy in which the cause was not determined responded promptly to penicillin within 48 hours. In two cases of bronchiectasis indeterminable results were obtained. Penicillin was used in one case as an adjunct to lobectomy. No effect was noted in three cases of pleural effusion. In one of these the pleural effusion developed after primary atypical pneumonia, while no cause was determined in the others.

PENICILLIN IN MENINGITIS AND MENINGOCOCCEMIA.

Penicillin was found to be highly effective in infections due to Neisseria meningitidis. Four cases of meningitis, one case of meningococcemia with meningococcic arthritis, and one case of purpura fulminans with meningococcemia were treated with recovery in all cases. The purpura fulminans was complicated by gangrene of fingers and toes which led to residual deformities of the terminal phalanges of three fingers. In the first cases penicillin was administered both intrathecally and systemically. The intramuscular dose was 30,000 units every 2 or 3 hours. The intrathecal dose was 10,000 units in concentration of 1,000 units per cc. every 12 hours. Pentothal anesthesia was used to facilitate administration of intrathecal penicillin and to eliminate possible injury to the patient during lumbar puncture. As the patients responded to therapy the interval between doses was extended to 24 hours. Intramuscular penicillin was used for from 5 to 10 days and intrathecal penicillin for 3 or 4 days. No untoward effects were noted. Within 12 to 48 hours of penicillin therapy, definite improvement with recovery of consciousness, decreased rigidity of neck, and sharp decline in fever were noted. The initial spinal fluid cell count, ranging from 8,000 to 13,300 cells, decreased rapidly in 3 to 6 days.

In the case of meningococcemia with arthritis, penicillin therapy was instituted 14 days after intensive sulfadiazine therapy. The patient, a male, age 58 years, had recovered from severe meningitis under sulfadiazine but had persistent meningococcemia with acute arthritis of both knees. A Type I meningococcus was isolated from blood culture and from fluid aspirated from both knee joints. Penicillin was given intramuscularly in dosage of 15,000 units every 3 hours for 10 days. The fever of from 101° to 102.6° F. declined by lysis and the arthritis subsided after initial

aspiration. The blood culture remained positive for the first 7 days and then became negative. Recovery was complete although arthritic manifestations persisted for an additional 6 weeks.

Recently in the treatment of acute meningococcic meningitis the spinal fluid penicillin level was determined 1 hour after initial intramuscular injection of 30,000 units and prior to the institution of intrathecal penicillin therapy. The spinal fluid penicillin level was 0.312 unit per cubic centimeter. The spinal fluid yielded a cell count of 11,500 and contained Type I meningococci. This case demonstrated that the barrier for passage of chemotherapeutic agents from blood into spinal fluid is diminished in the presence of severe meningitis.[3] Penicillin administered systemically can diffuse into spinal fluid in adequate concentration during the course of severe meningitis.

In the treatment of meningococcic infections, either penicillin or sulfadiazine can be recommended. If sulfadiazine is used, the initial dose may be given intravenously as sodium sulfadiazine (5 to 8 gm. in sterile distilled water to make a 5-percent solution) and followed by 2 gm. every 6 hours if given intravenously and every 4 hours if given orally. The blood level should be maintained between 15 and 25 mg. per cubic centimeter. Because when death ensues during the first three or four days, it is from the septicemia rather than from the meningitis, it is imperative that prompt adequate blood sulfadiazine level be maintained. Fluids are forced in order to maintain a urinary output of at least 1,500 cc., and are given parenterally if needed. Paraldehyde or barbiturates given intravenously, orally or rectally are indicated to control intense irritability and restlessness. Urinary output is maintained in excess of 1,500 cc. per day. Failure of response to adequate sulfadiazine therapy within forty-eight to seventy-two hours is indication for penicillin therapy. The initial dose of 30,000 units is given intravenously and immediately followed by intramuscular injection of 30,000 units every 2 hours for from 5 to 7 days. It is questionable whether intrathecal penicillin is necessary in treatment of meningococcic meningitis.

From our limited experience it is not possible to decide categorically between penicillin and sulfadiazine for the treatment of meningococcal infections; both are highly successful. Failure of response to either one within 48 hours, as demonstrated by spinal fluid findings, is an indication for change to the other. In the severe fulminating meningococcal infection with bacteriemia, col-

[3] ROSENBERG, D. H., and SYLVESTER, J. C.: Excretion of penicillin in spinal fluid in meningitis. Science 100: 132-133, August 11, 1944. —— From a practical standpoint the question of interest is primarily how early in a meningeal infection this barrier is overcome. Is penicillin the drug of choice in treating patients before a frank purulent fluid is present? The answer must await further experience.

lapse, and purpura, both sulfadiazine and penicillin should be administered at the earliest possible time. In meningitis due to streptococci, staphylococci, and pneumococci, penicillin is the drug of choice. In pneumococcal meningitis, with its high incidence of disabling sequelae in the recovered cases, penicillin and sulfadiazine should be administered simultaneously, and if adequate levels of the former cannot be demonstrated in the cerebrospinal fluid within from 4 to 6 hours after intravenous or intramuscular administration, recourse to cisternal or ventricular routes should be considered.

PENICILLIN IN SCARLET FEVER, ERYSIPELAS AND STOMATITIS.

Fourteen patients with scarlet fever, from whom hemolytic streptococci were isolated, were treated with penicillin. Initially 10,000 units of penicillin was given intramuscularly every 3 hours for 7 days, and more recently 20,000 units every 2 hours. The throat cultures became negative for hemolytic streptococci within from 2 to 5 days. Subjective improvement with relief of sore throat and malaise, and with decline in fever was noted in 2 or 3 days. Recovery was uneventful. One patient developed otitis media on the third day but this subsided under continued penicillin therapy. This series is too small to compare with those in which sulfonamide therapy was used. In theory the septic complications should be prevented or aborted by penicillin.

Three patients with erysipelas responded promptly to penicillin in doses of from 20,000 to 30,000 units every 3 hours for 5 days. In one case the erysipelas was superimposed upon a fulminating streptococcic pharyngitis and previous sulfadiazine therapy had been ineffective. On the second day marked subjective relief of symptoms was noted and there was complete recovery after 5 days.

Penicillin, administered for stomatitis and Vincent's angina, gave good results. The dosage of 20,000 units every 2 hours intramuscularly was maintained for 2 or 3 days. While the Vincent organism has been generally accepted as the etiologic agent, in the majority of cases either a hemolytic streptococcus or coagulase-positive Staphylococcus aureus is recovered from the cultures. Dental prophylaxis with adequate nutrition usually suffices to clear minor forms of these disorders but penicillin is justifiable as an adjunct to the treatment in severe cases.

PENICILLIN IN OTORHINOLARYNGOLOGY.

Penicillin has been used in 36 cases of acute otitis media and acute mastoiditis with satisfactory results. The bacteriologic study revealed infection chiefly due to hemolytic streptococci,

Staphylococcus aureus, Staphylococcus albus, pneumococcus, nonhemolytic streptococci and mixed infections. Initially penicillin was administered by continuous intravenous drip in doses of 20,000 units per liter of normal saline and intramuscularly in doses of 10,000 units every 3 hours for 7 days. The present method of treatment is 20,000 units every 2 hours for at least 7 days or the continuous intramuscular injection of 200,000 units per day for at least 5 to 7 days. Penicillin was used as an adjunct to the sulfonamides in the regular treatment of acute otitis media. Early cases responded in from 2 to 4 days while those of 1- to 2-week duration required more prolonged penicillin therapy for successful control of the infection. Some patients became afebrile within 24 hours and were ambulatory after the second day of treatment, with subjective improvement preceding objective improvement. All patients received a high protein diet to maintain a positive nitrogen balance.

The topical use of penicillin in chronic otitis media was of doubtful value. The use of penicillin–blood plasma powder is being investigated in otitis media.

In several cases of acute mastoiditis complicating otitis media, successful results were obtained with penicillin combined with surgical drainage. The procedure consisted of intramuscular penicillin 2 to 5 days prior to mastoidectomy. At time of surgery a simple mastoidectomy was performed. A small tube was trapped in the wound and penicillin solution, 250 units per cc., was injected through the tube every 6 to 8 hours. Intramuscular penicillin was continued for 5 to 7 days after surgery. Penicillin used in this manner brought about prompt healing of the middle ear and quickly returned the ear drum to normal. Complete healing of the mastoidectomy wound was noted within 8 days. These patients all received a high protein diet, repeated blood transfusions, and blood plasma infusions.

Sinusitis.—Penicillin has been used topically in maxillary sinusitis following irrigation. The bacterial flora was similar to that observed in otitis media and was susceptible to penicillin therapy. Approximately 5 cc. of penicillin solution, 250 units per cc., was instilled into the antrum after each irrigation. The cases of acute maxillary sinusitis containing foul, purulent, broken down material responded rapidly to this form of therapy and it was not unusual for the pus to become mucoid within 24 hours, with prompt cessation of local discomfort. The average case of acute sinusitis responded to topical penicillin within 4 or 5 days but occasionally dramatic results were noted with a single irrigation and 5-cc. instillation. In acute sinusitis with severe infection and

evidence of systemic reaction, penicillin was administered both systemically and topically.

The use of penicillin locally and systemically would seem to eliminate hesitancy in interfering with local inflammatory reactions. It was formerly considered a dangerous procedure to irrigate any sinus in the early stage of infection because of possible complications such as osteomyelitis, but from recent observation it would appear that topical application of penicillin to inflamed mucosa may be desirable in the early stage.

After the diagnostic irrigation of the sinuses has been done, a small amount of penicillin is instilled into the sinus as a safeguard against infection.

Pharyngitis, tonsillitis, suppurative pharyngeal and laryngeal lesions.—Penicillin is by far the drug of choice in the treatment of abscess complicating pharyngeal and laryngeal infections. The organisms producing these infections are in the main susceptible gram-positive cocci. The danger of these infections spreading into fascial planes of the neck is lessened when penicillin therapy is instituted. Cellulitis without collection of purulent material promptly responds to penicillin, and the failure to obtain a satisfactory response to adequate penicillin therapy within 24 to 48 hours necessitates careful search for pocketed pus, followed by prompt surgery. In acute cellulitis of the larynx it is possible with penicillin to stop the spread of the edema which in the past necessitated tracheotomy.

Prolonged penicillin therapy, combined with adequate surgical drainage and daily adequate nutrition, resulted in successful control of osteomyelitis complicating sinusitis. The average duration of penicillin therapy in these cases was 21 days. One patient with osteomyelitis of the frontal and parietal bones complicating frontal sinusitis received two courses of penicillin therapy with a 3-month interval prior to establishment of radical surgical drainage. Following surgery the patient received topical and intramuscular penicillin for an additional 10 days with complete recovery. The present procedure in cases of osteomyelitis of the skull is to administer intramuscular penicillin for a period of from 7 to 21 days prior to establishment of adequate surgical drainage, and to maintain penicillin therapy for from 7 to 20 days postoperatively. The daily nutritional requirements to maintain positive nitrogen balance are observed carefully.

PENICILLIN IN OPHTHALMOLOGY.

Penicillin was administered topically in two cases of corneal ulcer with healing of lesions within 6 days. The drug in concentra-

tion of 500 units per cc. was instilled into the eye every hour and was supplemented by penicillin ointment.

One case of purulent conjunctivitis due to hemolytic staphylococcus responded to topical penicillin instilled into the eye and applied locally as a continuous wet compress. In one case of gonorrheal ophthalmia, a complete recovery was noted following use of intramuscular penicillin for 3 days. The total dose was 480,000 units. A case of severe orbital cellulitis responded to systemic penicillin combined with surgical drainage. In severe eye infections such as gonorrheal ophthalmia, orbital cellulitis, and intraocular infections, systemic penicillin is indicated. For the mild conjunctivitis, blepharitis and superficial ulcer, topical penicillin is effective.

Penicillin was ineffective in choroiditis, iritis and iridocyclitis. In nine cases of iritis and iridocyclitis the immediate results of penicillin therapy were good in seven and ineffective in two. Continued observation revealed that penicillin did not alter the course of the disease.

PENICILLIN IN SURGICAL INFECTIONS.

Cellulitis, postoperative infected wounds, infected hematoma, infected surgical wounds, and bullet wounds.—In this group, 32 cases were treated with successful results in 27, failure in 2, and indeterminate result in three. The cases of cellulitis included infection of the face and neck secondary to dental extraction, Ludwig's angina, cellulitis with cervical adenitis, infection of pedicle graft, infection of the hand following human bite, and inflammation associated with hand and foot infections.

Bacterial studies revealed Staphylococcus aureus, Staphylococcus albus, hemolytic and nonhemolytic streptococci, Streptococcus viridans, and Pseudomonas aeruginosa. Frequently both staphylococci and hemolytic streptococci were isolated from the same infected wounds. Penicillin was administered by continuous intravenous drip in doses of 20,000 units per liter of normal saline, or by intramuscular administration of 15,000 to 30,000 units every 2 or 3 hours. All patients were placed on high protein intake of 130 to 150 gm. daily. The patients with severe infections received blood plasma and repeated whole blood transfusions. Surgical drainage with topical application of penicillin was established when indicated. Penicillin therapy was maintained for from 4 to 7 days in the acute infections and from 7 to 21 days in the subacute and chronic infections.

In acute cellulitis there was dramatic subjective relief of symptoms and sharp decline in fever and signs of toxemia within 24

to 48 hours. Subjective relief was followed by reduction of swelling and disappearance of purulent discharge. The response to therapy in the subacute and chronic infections was slower and fever declined by lysis. The patient who had Ludwig's angina with extensive cellulitis of the deep cervical fascia and the subpectoral region of the anterior part of the chest received extensive surgical drainage, systemic and topical penicillin, sulfadiazine and deep x-ray therapy.

Total penicillin dosage varied from 290,000 units for control of cellulitis of the face following dental extraction, to 2,141,050 units for the case of Ludwig's angina. In three cases Pseudomonas aeruginosa was cultured in addition to staphylococci and streptococci. The cellulitis was not affected by penicillin but was quickly controlled with applications of 2-percent acetic acid solution.

Penicillin–blood plasma powder applied directly to infected wounds has been observed to be highly effective in control of the susceptible bacteria. The purulent discharge quickly disappears, the wounds present a healthy appearance, and granulations appear more rapidly. In addition to bacteriostasis the penicillin–plasma powder provides excellent nutrients for the wound and promotes rapid healing. In plastic surgical wounds adequate surgical drainage plus use of local penicillin has been of great value, particularly in the preservation of tendons which would otherwise slough from infection. The local penicillin solution supplements systemic administration. For open wounds and ulcers, frequently changed dressings of normal saline solution, using fine mesh gauze, has been the procedure of choice, accompanied by systemic administration of penicillin during periods of active bacterial invasion.

Osteomyelitis.—The majority of the cases in this series were chronic osteomyelitis of the long bones. These cases had had recurrent episodes of drainage and surgical procedures. Penicillin therapy was combined with incision and drainage. Sequestrectomy was performed, with removal of all necrotic tissue and dead bone, and penicillin solution was administered topically to the wound through small Dakin tubes every 6 to 8 hours. All patients received intramuscular penicillin in dosage of 15,000 to 20,000 units every 3 hours for 21 days. The total intramuscular dose ranged from 2,520,000 to 3,360,000 units. Penicillin therapy was combined with maintenance of adequate nutrition by high protein intake, the use of whole blood transfusions to control secondary anemia, and use of blood plasma as intravenous amino acids to maintain positive nitrogen balance. The immediate results following penicillin therapy were good. There was sterilization of the wound, reduction of drainage and prompt healing of the tis-

sues. Recurrence was noted in one case of chronic osteomyelitis of the left ulna 6 months after penicillin therapy. In two cases of osteomyelitis of the tibia, penicillin therapy was unsuccessful. Because of the nature of the disease, final opinion as to the value of penicillin in chronic osteomyelitis must be postponed until a longer interval of observation has elapsed. The response in hematogenous osteomyelitis has been more prompt than in cases of osteomyelitis secondary to compound fractures.

The presence of recurrent chronic osteomyelitis presents a challenge to the surgeon for the development of newer and more radical methods of drainage, since it is known that recurrence will be the rule so long as any devitalized bone remains. With the advent of penicillin therapy and the maintenance of daily adequate nutrition, the surgeon is provided with a greater margin of safety for the development of more radical procedures. The present plan of therapy is to place these patients with chronic osteomyelitis on a course of intramuscular penicillin and a high protein diet for a period of from 14 to 21 days. The initial course is followed by incision and drainage with careful removal of all necrotic tissue and dead bone. Penicillin therapy is then continued for an additional 14 to 21 days, and topical penicillin, either in the form of penicillin solution, 250 units per cc., or as penicillin–blood plasma powder, is combined with systemic penicillin at the time of surgical drainage.

In osteomyelitis associated with fracture of the mandible and cellulitis of the face and neck, good results were obtained with penicillin therapy. These patients received early incision and drainage combined with daily topical application of penicillin–sulfanilamide powder containing 100,000 units of penicillin per 10 gm. of sulfanilamide. Intramuscular penicillin was maintained for 21 days. Initially the intramuscular dose was 15,000 units every 3 hours; at the present time it is 20,000 units every 2 hours. Within 4 to 7 days the purulent discharge changed to a serous drainage. The osteomyelitis lesions became dry, the mobility of the fragments decreased and definite callus formation rapidly developed. Penicillin was highly effective in controlling the infection. It prevented extension of the disease and further loss of tissue. These patients recovered rapidly, with no recurrences to the present time.

Gas Gangrene.—One case of gas gangrene of the right thigh as a result of a gunshot wound was treated successfully with penicillin. Shortly after admission of the patient careful debridement was performed. Crepitus was present and cultures of the infected wound revealed Clostridium welchii and hemolytic streptococci.

Penicillin solution in concentration of 1,000 units per cc. was trapped in the large wound, which was packed lightly with sterile gauze wound about a small Dakin tube. Additional penicillin solution in concentration of 250 units per cc. was injected through the tube every 6 hours for 3 days. Penicillin was administered intramuscularly in doses of 30,000 units every 3 hours for 4½ days. At the time of debridement, 100,000 units of antigas serum was administered intramuscularly and the patient received a blood transfusion. There was marked response to therapy with rapid control of the toxemia within 48 hours. Studies on this bacterial strain as on others showed them all to be susceptible to penicillin but only in concentration considerably higher than is effective for most pyogenic species. It is therefore suggested that in the control of gas gangrene, penicillin be employed locally and systemically in massive doses.

Breast abscess, carbuncle of thigh, abscess of thigh, epidural abscess, and brain abscess.—A case of breast abscess, which developed 1 week postpartum and was attended with severe toxemia and high fever (105° F.), was successfully treated with penicillin combined with surgical drainage. Initial penicillin therapy consisted of 30,000 units intramuscularly every 2 hours. Within 48 hours the temperature had reached normal and the marked tenderness and swelling of the breast subsided. On the third day a small fluctuating abscess was incised and drained. Culture of the evacuated pus revealed no growth. Penicillin therapy was maintained for a total of 6 days, with dosage reduced to 20,000 units every 3 hours after the second day. The patient received two blood transfusions and no sequelae were observed.

In the case of brain abscess systemic penicillin was instituted 2 days prior to incisions and drainage. Culture of evacuated pus revealed Staphylococcus aureus. A small tube was inserted into the abscess cavity and penicillin solution in a concentration of 1,000 units per cc. was injected through the tube every 8 hours. The intramuscular penicillin was discontinued after the fifth postoperative day but topical penicillin was continued until the eleventh day. Repeated cultures from the abscess cavity revealed no growth after the third postoperative day. There was complete recovery.

A case of epidural abscess following laminectomy responded to penicillin therapy. The abscess was incised and drained. Bacterial culture revealed Staphylococcus albus. Topical and systemic penicillin were administered for a period of seven days with rapid healing of the wound.

An abscess of the thigh similarly treated responded to therapy.

A case of extensive carbuncle of the thigh with ulceration responded to penicillin after previous therapy with sulfathiazole, x-rays, and zinc peroxide dressings was unsuccessful. Penicillin was administered intravenously, intramuscularly and topically. Systemic penicillin was maintained for 17 days and topical penicillin for 22 days. The total combined dose was 2,093,000 units. The severe malnutrition was combated by high protein diet, blood transfusions, and blood plasma infusion. There was slow but steady healing of the extensive ulcerated area without residual contracture.

Peritonitis associated with ruptured appendix, intestinal obstruction, and pelvic peritonitis.—Penicillin therapy has been used in seven cases of peritonitis associated with ruptured appendix. All recovered from this complaint although one patient died of a pulmonary embolus 10 days postoperatively. An autopsy showed the peritonitis to be well cleared. The bacterial flora in each case was a mixture of gram-positive and gram-negative organisms. Initially penicillin was administered by continuous intravenous method but at present intramuscular injections of 20,000 units every 2 hours for from 5 to 7 days are given. The postoperative course of these cases was uneventful, with a decline of fever and leukocytosis in from 2 to 4 days. The series of cases is too small from which to draw definite conclusions. With the good results obtained from administration of sulfonamides both locally and systemically, it is probable that penicillin will be combined with this therapy in the management of these infections. Where the bacterial flora is predominantly gram-positive, penicillin is of definite value. The natural body defenses and sulfonamides now control the gram-negative organisms.

In two cases of intestinal obstruction with peritonitis following rupture of the small intestine penicillin was unsuccessful in one and its action was indeterminate in the other. In both cases the intestinal flora was predominantly gram-negative.

A patient with pelvic peritonitis, secondary to prolonged difficult labor with severe postpartum hemorrhage, received penicillin therapy beginning 30 hours after delivery. The initial dosage of 30,000 units intramuscularly every 2 hours was reduced after 2 days to 20,000 units every 3 hours for an additional 3 days. Fever of 104° F., the severe abdominal pain and distention, and signs of shock promptly subsided and the patient was out of danger within 48 hours. In addition to penicillin, she received daily whole blood transfusions and a high protein diet. Penicillin therapy was discontinued after the fifth day.

Based on the experimental evidence with peritonitis in dogs,

penicillin has a beneficial effect. Clinically penicillin should never be used to take the place of surgery but may be used as an adjunct when operating facilities are not at hand and then only as a supportive measure.

Prophylactic penicillin in traumatic wounds, compound fractures, and surgical procedures.—With increasing supplies of penicillin available, penicillin is now being administered prophylactically in traumatic wounds to prevent the development of gram-positive infections. Penicillin has been used prophylactically in a series of 33 cases consisting of multiple wounds, compound fractures, open reduction of fractures, repair of radial nerve, skin grafting, repair of perforated peptic ulcer, colon resection, burns, and amputations.

Penicillin is administered intramuscularly immediately and in doses of 20,000 units every 2 hours for from 3 to 5 days. Debridement and removal of foreign bodies, dead bone and destroyed tissue are carried out and the wounds are closed by primary suture. When indicated, penicillin is used topically in concentration of 250 units per cubic centimeter. The topical dressings are discontinued usually within 48 to 72 hours. When drainage tubes are inserted into the wounds, care is exercised to aspirate any collected serum prior to injection of topical penicillin solution. The avoidance of pressure reduces the edema and allows for more rapid healing. Penicillin–blood plasma powder or penicillin–sulfonamide powder is applied locally in open wounds in place of topical penicillin solution. Penicillin–blood plasma powder is recommended because of its low toxicity.

If selected surgical procedures are contemplated, penicillin can be used prophylactically 2 days preoperatively and 3 days postoperatively. In preparation of chest cases for lobectomy or pneumonectomy penicillin is instituted from 7 to 14 days prior to surgery. At the time of surgery approximately 300 cc. of topical penicillin solution (500 units per cc.) is instilled in the pleural cavity. Penicillin is then maintained systemically for from 7 to 10 days postoperatively. These procedures have materially lessened the incidence of postoperative infections.

Prophylactically, intramuscular penicillin is of particular value in plastic surgical procedures involving the mouth and nose. Its use has resulted in a definite decrease in local tissue reaction, and even postoperative edema appears to be lessened. No serious infections have occurred since the penicillin has been used. For extensive granulating surfaces such as those produced by burns, nonadherent fine mesh gauze covered with parawax, and pressure dressings are favored, using systemic penicillin before and after

grafting, but avoiding local use of the drug. Cases thus treated have had an almost perfect percentage of graft takes.

PENICILLIN IN GENITO-URINARY INFECTIONS.

In this series of cases 711 male patients with gonococcus infection of the urethra were treated. A number of different schedules of dosage were followed as well as routes of administration. Initially the drug was given by continuous intravenous drip. Then intramuscular injection with or without coincidental local instillation of dilute penicillin solution into the urethra was employed. No advantage was found in the local administration, hence this method was discarded. The schedule found effective was 20,000 units given intramuscularly every 3 hours for five doses. This total dose of 100,000 units resulted in cure in 98 percent of the cases. Furthermore in the 2 percent which were recorded as initial failures, cure was obtained by administering an additional 100,000 or 200,000 units. No case was found in which the gonococcus was completely resistant to penicillin. Recently more effective results have been obtained with a dosage of 20,000 units intramuscularly every 2½ hours for seven doses (total 140,000 units). All cases failing to respond to the first course of treatment are given a second course within 7 days.

Studies of the purulent urethral secretion, the sediment from the centrifuged urine and the prostatic secretion by Gram's stain are very reliable methods of ascertaining clinical response to treatment. In a number of cases specimens stained by Gram's method were studied hourly after the first injection. In many cases within 2 hours the gonococci had disappeared from the urethral secretion. Within 4 to 6 hours no organisms could be found even by the most careful study. Before complete disappearance the gonococci gradually take on a deeper stain so that they appear quite red and become greatly swollen and irregular. Many seem fused together instead of diplococcal in shape. Later, stains of the urethral discharge or the centrifuged urine show a profusion of pus cells and some epithelial debris but no organisms.

The dramatic cessation of the purulent urethral discharge is the most impressive point in penicillin therapy. Within a few hours after the first injection the patient will usually note a great reduction of discharge. The following morning in most instances, the urethra appears dry. However in some cases a small mucopurulent or mucous drop can be expressed from the urethra each morning for several days, or even for as long as a week or ten days. Attention is invited particularly to this small group of cases in which a mucopurulent drop persists for a short time. Repeated

cultures in such cases have showed no evidence of gonococcus infection persisting. In all cases the small morning drop will clear up spontaneously and rehospitalization is advised against because of the waste of time involved. These cases are noninfectious.

One important point in considering results of therapy is that at present there is no great assurance that an ampule of penicillin contains the exact amount stated on the label. It is our impression that many of these patients received much more than 100,000 units.

In cases complicated by gonococcus epididymitis or acute prostatitis it has been our practice to give an additional 100,000 units. Rapid cessation of perineal or testicular pain and prompt reduction of swelling and other signs of inflammation were noted in all cases. Rectal examination disclosed rapid diminution in the size of the prostate gland, so that within 3 or 4 days it was practically normal in size.

In cases of arthritis coincidental with gonococcal infection of the urethra, no benefit was noted by aspiration of the swollen joint with injection of penicillin solution.

In the series of 29 female patients with gonococcic infection of the cervix and vagina, success was noted in 23, failure in 2, and indeterminate results in 4 cases. While the cervical smears became negative to gonococci, little or no effect was noted in the vaginal and cervical discharge. Dosage consisted of 20,000 units intramuscularly every 2 hours for 7 doses (total dose 140,000 units). The initial failures were re-treated with successful results.

Recent studies of penicillin concentration in cervical mucous plugs obtained from infected cervices under active therapy revealed no detectable amounts of penicillin. For the control of vaginal and cervical discharge, vaginal insufflation of penicillin–plasma powder is now being investigated; this procedure is combined with systemic penicillin. It is our impression that results from therapy may be improved by prolonging the dosage of 20,000 units intramuscularly every 2 or 3 hours for 2 or 3 days.

In genito-urinary tract infections in which one or more strains of bacteria other than gonococci were isolated by culture or identified by Gram's stain, the patients have been treated with penicillin and the results noted. In the majority of these cases, a mixture of organisms has been noted, some of which are sensitive to the action of penicillin while some of them are not. Study by Gram's stain of the urethral or prostatic secretions will reveal disappearance of gram-positive organisms while the gram-negative persist. It must be kept in mind, however, that resistance to penicillin may be relative rather than absolute. The use of peni-

cillin combined with other chemotherapeutic agents has, in our opinion, resulted in improvement of infections formerly not benefited by the use of one agent alone.

A series of cases in which the diagnosis was nonspecific urethritis, prostatitis, epididymitis, pyelonephritis, and infections such as wound infection and balanitis, have been improved by penicillin therapy in 85 percent of the cases.

Clinical evidence of response to treatment is quite definite if penicillin is of value in the particular type of organism, and the response comes about with use of comparatively small amounts of the drug. Total doses of from 100,000 to 200,000 units given during a period of from 12 to 24 hours are usually sufficient. Treatment with larger amounts over longer periods of time has not been employed because of the scarcity of the drug. It is possible that the percentage of cases in which improvement was noted might be increased by following schedules involving larger doses for more prolonged intervals.

It seems certain that clinical trial of penicillin in infections of the genito-urinary tract which have been resistant to other drugs is fully justified. Furthermore it seems best to do this on a clinical basis rather than to postpone treatment until bacteriologic study involving the penicillin sensitivity of the isolated organism has been completed. These methods are time-consuming, and more expensive than the small amount of penicillin necessary to determine whether it will be of value in the particular case. Response is usually prompt when the drug is of any value.

PENICILLIN IN DERMATOLOGY AND SYPHILOLOGY.

Of the 324 syphilis patients treated here, 250 have been early cases and 237 of these remain symptom-free. Of the remainder 7 have had either clinical or serologic evidence of relapse, while 6 have had what appear to be new infections. The other 87 have been instances of latent infection or individuals with central nervous system involvement.

The present routine for treatment can be summarized:

1. Early syphilis: 40,000 units every 3 hours for 60 doses. A total of 2,400,000 units during a period of 7½ days.

2. Latent syphilis: 40,000 units every 3 hours for 100 doses, or a total of 4,000,000 units in 12½ days.

3. Central nervous system syphilis: 40,000 units every 3 hours for 200 doses; a total of 8,000,000 units in 25 days. This is concluded with 10 units of artificial fever accompanied by 10 intravenous injections of 60,000 units each.

Constant intravenous drip was given a few of the early cases

but the simplicity of intramuscular therapy has led to its use in the majority of instances.

It is felt that the recommended doses, intervals between injections, and periods of treatment, represent the optima at the moment but that all or any of these constants may be modified when the ideal schedule is perfected.

Penicillin is certainly the best drug ever made available for the treatment of syphilis. It causes rapid disappearance of the treponema from surface lesions, rapid healing of gummatous processes, and reversal of serologic findings in both blood and spinal fluid, as quickly, if not more quickly, than other drugs. Furthermore, it is safer and better tolerated than any other satisfactory antisyphilitic.

About 200 patients[4] with various skin conditions have been treated with penicillin locally or systemically. The pyodermas, when caused by susceptible strains of organisms, respond nicely to the drug employed either systemically or locally. Furunculosis is controlled temporarily by systemic treatment while the following are not affected: Pustular acne, erythema multiforme, mycosis fungoides, dermatitis herpetiformis, eczema, fungus infections and scabies.

MISCELLANEOUS.

Penicillin was found to be ineffective in tuberculosis, lymphosarcoma, carcinoma, infectious mononucleosis, chronic ulcerative colitis, leukemia, brain tumor, primary atypical pneumonia, rheumatic fever, malaria, filariasis, and mumps.

Two cases of relapsing Plasmodium vivax malaria were treated with penicillin in dosage of 240,000 units per day for 7 days. The penicillin was administered by continuous intravenous drip. Each patient received 1,680,000 units. Throughout the period of penicillin therapy the parasites continued to circulate in the blood. In one patient, on the third, fifth, and seventh days, typical paroxysms with chill and fever developed. Penicillin in maximum dose with constant bacteriostatic blood level for 7 days had no effect on the circulating parasites and did not prevent a typical relapse.

Penicillin administered to one patient with rheumatic fever failed to alter the clinical course. On the fifth day of therapy the symptoms of the disease were increased and penicillin therapy was discontinued after the seventh day. There was prompt response to adequate salicylate therapy.

Penicillin was observed to have no effect in one case of chronic

[4] These do not appear in the condensation of cases.

ulcerative colitis, three cases of infectious mononucleosis, and three cases of carcinoma, one case of lymphosarcoma and one case of brain tumor.

Two patients with filariasis received intensive penicillin therapy for seven days without result. In one case of recurrent lymphangitis of the forearm associated with filariasis, there was marked improvement with reduction of swelling and soreness following 2 days of systemic penicillin. This observation again opens the argument as to whether the transitory cellulitis of filariasis is not primarily a pyogenic complication.

Penicillin had no effect in tuberculous psoas abscess, tuberculous meningitis, tuberculous pleural effusion, and leukemia. In one case of otitis media complicated by mumps, penicillin was highly effective in control of the otitis media but had no effect on the clinical course of the mumps.

SUMMARY AND CONCLUSIONS

1. Over 1,400 cases treated with penicillin at the National Naval Medical Center have been reviewed.

2. The importance of thorough bacteriologic study has been emphasized.

3. The role of such supportive measures as adequate nutrition, surgical drainage, and conjunctive therapy has been stressed.

4. Problems of dosage are discussed and it is concluded that rigid standardization is not justifiable at this time. In this series any error has been on the side of overtreatment.

5. The results with penicillin in gonorrhea, early syphilis, and infections due to the streptococcus and staphylococcus, are better than with any drug hitherto available and justify the use of penicillin to the exclusion of older agents.

6. Penicillin appears to be on a par with the better sulfonamides in the treatment of infections caused by the pneumococcus. The limited experience here does not justify a sharp distinction between the two agents.

7. The usefulness of penicillin in the treatment of meningococcus meningitis is not clearly defined and further observations will be necessary to determine its value in comparison to sulfadiazine.

8. Short summaries of the place of penicillin in the various specialties have been presented.

9. From this study several points would seem to require continued critical study.

a. The treatment of gonorrhea in the female.

b. The exact status of penicillin in prophylactic therapy of certain surgical conditions and its ultimate place in relation to early pyogenic conditions.

c. The value of penicillin in peritonitis due to perforation of the appendix or other abdominal viscera.

d. Penicillin in the various stages of syphilis, especially as it relates to dosage, duration and intervals of treatment.

e. The problem of fundamental pharmacology most deserving intensive investigation is that of slowing up absorption of the drug so that a single dose can be diffused slowly over a longer period of time.

f. Use of penicillin in a number of conditions where high levels may be of value, such as gas bacillus infection and undulant fever.

⚓ ⚓

ORIGIN OF CREATININE AND CREATINE

The amount of creatinine excreted in the urine by a normal individual on a meat-free diet is independent of either the amount of protein in the food or the total nitrogen in the urine, the amount excreted from day to day being practically constant, thus pointing conclusively to its endogenous origin. Creatinine is the anhydride of creatine which is the precursor of creatinine. The immediate precursor of creatine is glycocyamine. This is formed from glycine and arginine (also citrulline) in the kidney, while glycocyamine is methylated in the liver by methionine (or a derivative of methionine) to form creatine.—MYERS, V. C.: Prognostic significance of elevated blood creatinine. J. Lab. & Clin. Med. 29: 1001-1019, October 1944.

PENICILLIN IN PNEUMONIA

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and
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Since the advent of penicillin in the field of medical therapy, extensive investigation has been conducted to determine its effectiveness in infectious diseases. This study is an analysis of 589 cases of lobar and bronchopneumonia treated with penicillin in the U. S. Navy.

When penicillin was made available to the military services in limited quantities, it was required that Naval medical officers submit a report of each case in which it was used. A printed form was distributed to all hospitals using penicillin, thus assuring a reasonable uniformity of data. In this survey no reports are included unless the data is sufficiently complete to give a clear-cut concept as to type of pneumonia, substantiating laboratory studies, dosage of penicillin, and result obtained. Cases reported as Primary Atypical Pneumonia are omitted from this series because it was thought that such diagnoses were usually made on insufficient evidence for a critical analysis, and the form blank did not require information considered adequate for a positive diagnosis of this syndrome.

A stipulation imposed on the use of penicillin at the outset was that it be used only where sulfonamides had failed after adequate trial or were otherwise contraindicated. Many instances were submitted in which a sulfonamide had produced no clinical improvement in 24 hours, and a switch to penicillin was made because of this lack of response. This does not seem just cause for labeling sulfonamide therapy a failure, but these cases are grouped separately for reasons indicated later. Of particular interest are those patients who received penicillin from the beginning because of known intolerance to sulfonamides.

The "average total dosage" of penicillin includes both intramuscular and intravenous routes; most of it was administered intramuscularly. The equality of response made separation unnecessary. From 80,000 to 120,000 Oxford units daily, mostly in injections of from 10,000 to 15,000 units every 3 hours, was the usual

amount. Total dosage in unsuccessful cases was not estimated, because the course was seldom completed.

Ten patients were moribund when penicillin was started, and died shortly afterward, so that the value of the drug is considered indeterminate in these cases.

Lobar and bronchopneumonia are discussed separately.

LOBAR PNEUMONIA

A total of 397 patients received penicillin during an attack of lobar pneumonia; in 372 (93.7 percent), penicillin was considered a success. There were 25 failures (6.3 percent), including 11 deaths (2.8 percent); of the fatalities, 6 were moribund and died within a few hours after penicillin was started.

This series has been broken down into four classified groups:

TABLE 1.—*Group I. Uncomplicated lobar pneumonia*

Penicillin administration	No. of cases	Success	Average total dosage (units)	No effect	Died
Immediate	28	28	533,000	0	0
After less than 24 hours of sulfonamide	82	80	565,000	2	0
After failure of adequate sulfonamide	197	188	589,000	9	2
Total	307	296		11	2

This group includes a few cases with complications which did not perceptibly influence the course of the pneumonia, such as arthritis, malaria, syphilis, peptic ulcer, controlled cardiac disease, jaundice, and prostatic carcinoma. There are 307 cases in the group, 296 successes (96.4 percent) and 11 failures (3.6 percent) including 2 deaths (0.65 percent), both moribund before penicillin was started. Twenty-eight patients received penicillin promptly without a prior trial of a sulfonamide; all were considered successful responses to penicillin, and 14, or one-half, of the reports contained such additional remarks as "striking," "rapid," "amazing," "immediate," "remarkable," or "excellent." The average total dosage used was 533,000 Oxford units.

Eighty-two patients received penicillin after less than 24 hours of sulfonamide trial. Eighty (97.6 percent) responded well, using an average of 565,000 units of penicillin. Forty-four were labeled as a special response. Two failures occurred (2.4 percent) and no deaths. In the failures pneumonia ran its course unaffected by antibiotics.

One hundred ninety-seven patients were given penicillin after an adequate trial and failure of sulfonamides. There were 188 successes

(95.4 percent), and 9 failures (4.6 percent) including 2 deaths (1 percent), both from complications unrelated to the pneumonia. The average penicillin dose in successful cases was 589,000 units.

TABLE 2.—*Group II. Lobar pneumonia complicated by pleural effusion*

Penicillin administration	No. of cases	Success	Average total dosage (units)	No effect	Died
After effusion developed	33	31	974,000	2	0
Before effusion developed	3	3	723,000	0	0
Total	36	34		2	0

In 33 cases the effusion was present when penicillin therapy was instituted, practically all cases having responded unsatisfactorily to sulfonamides. Thirty-one successes were recorded, and thoracentesis was performed when indicated. The average successful case required 974,000 units of penicillin. Two patients did not respond to adequate penicillin dosage; there were no deaths.

In three instances, pleural effusion developed during penicillin administration, but continuation of the drug plus thoracentesis produced a good result in each.

TABLE 3.—*Group III. Lobar pneumonia complicated by empyema*

Pencillin administration	No. of cases	Success	Average total dosage (units)	No effect	Died	Required surgery	No surgery
After empyema developed	19	16	1,422,000	3	2	7	12
Before empyema developed	5	5	2,084,000	0	0	3	2
Total	24	21		3	2	10	14

There are 24 cases in this category, and in 19 the empyema was present before the use of penicillin. The drug was considered beneficial in 16, although surgery was necessary in 4; the remaining 12 responded to pleural instillations of penicillin in addition to the usual parenteral administration. The average total dosage, by all routes, was 1,422,000 units.

In five instances empyema developed during penicillin therapy, but two patients ultimately responded to the drug without surgery.

Three failures are reported for the group, each of whom had a thoracotomy. There were two deaths.

A variety of complications were encountered in group IV. It is worth noting that three patients had rheumatic fever complicating the pneumonia; in each instance the pneumonia proved penicillin sensitive, but no improvement was noted in the rheumatic fever,

TABLE 4.—*Group IV. Lobar pneumonia with miscellaneous complications*

Complication	No. of cases	Success	Average total dosage (units)	No effect	Died
Scarlet fever	6	4	758,000	2	1
Measles	2	2	665,000	0	0
Otitis media	8	8	642,000	0	0
Lung abscess	2	1	500,000	1	0
Rheumatic fever	3	3	583,000	0	0
Pericarditis	1	1	850,000	0	0
Chest injury	2	2	1,690,000	0	0
Miscellaneous	6	0		6	6
Total	30	21		9	7

a fact recorded by other observers.

Six fatalities appear in this group, the results of diabetic coma, coronary occlusion, uremia, paralytic ileus, tracheal obstruction, and leukopenia respectively.

BRONCHOPNEUMONIA

Reports were received on 192 patients given penicillin during an attack of bronchopneumonia; 173 were recorded as successful responses (90.1 percent); there were 19 failures (9.9 percent), and 9 deaths (4.7 percent). Two of the patients who died were probably beyond help at the time the drug was started. This series has been broken down into 4 groups in the same fashion as was lobar pneumonia:

TABLE 5.—*Group V. Uncomplicated bronchopneumonia*

Penicillin administration	No. of cases	Success	Average total dosage (units)	No effect	Died
Immediate	12	12	409,000	0	0
After less than 24 hours of sulfonamide	32	32	688,000	0	0
After failure of adequate sulfonamide	75	68	630,000	7	1
Total	119	112		7	1

Of the 119 patients in this group, 112 (94.1 percent) were successfully treated by penicillin; no effect was obtained in 7 (5.9 percent), one of whom died (0.8 percent).

Twelve patients were given penicillin without prior trial of sulfonamide, and an average of 409,000 units produced a good result in each.

Thirty-two patients had less than 24 hours of previous sulfonamide, and all responded to an average of 688,000 units of penicillin.

Seventy-five had failed to yield to adequate trial of a sulfonamide, and an average of 630,000 units of penicillin resulted in 68 successes (90.7 percent) and 7 failures (9.3 percent), including one death in a patient who was moribund at the time of change to penicillin.

TABLE 6.—*Group VI. Bronchopneumonia complicated by pleural effusion*

Pencillin administration	No. of cases	Success	Average total dosage (units)	No effect	Died
After effusion developed	13	13	1,365,000	0	0
Before effusion developed	0	.....	.....	.....	.....

The effusion was present before penicillin therapy in all 13 of the cases in this category, no instance of development of effusion after the start of penicillin being submitted. In addition to indicated thoracenteses, an average total of 1,365,000 units of penicillin was used, producing a successful result in each case.

TABLE 7.—*Group VII. Bronchopneumonia complicated by empyema*

Pencillin administration	No. of cases	Success	Average total dosage (units)	No effect	Died	Required surgery	No surgery
After empyema developed	19	18	1,109,000	1	0	11	8
Before empyema developed	0	.....	.....	.....	.....	.....	.....

All 19 patients in this group had empyema complicating pneumonia before penicillin was administered. Penicillin instillation intrapleurally, plus the usual parenteral administration, was responsible for 8 of the 18 successes, while the other 10 required surgery; an average of 1,109,000 units by all routes was used. The drug failed to produce an effect in one case, in which it was considered that surgery alone was responsible for recovery.

TABLE 8.—*Group VIII. Bronchopneumonia with miscellaneous complications*

Complication	No. of cases	Success	Average total dosage (units)	No effect	Died
Scarlet fever	8	6	445,000	2	1
Measles	27	18	786,000	9	7
Otitis media	3	3	717,000	0	0
Lung abscess	1	1	580,000	0	0
Rheumatic fever	1	1	1,140,000	0	0
Chest injury	1	1	1,000,000	0	0
Total	41	30		11	8

Another case of rheumatic fever is reported in this group, and again the pneumonia yielded to penicillin but the rheumatic fever did not.

Twenty-seven cases of measles complicated by bronchopneumonia are noteworthy for the fact that 9 patients (33 percent) did not respond; 7 died of overwhelming toxemia either in spite of the penicillin or before it could take effect. The average dose in these failures was 460,000 units.

REACTIONS

In the 589 cases included in this entire series, 6 urticarial reactions occurred (1 percent), and one instance of acute polyarthritis is recorded. Recovery from reaction was complete in each case. Both the sodium and calcium salts of penicillin were used without attempt to state the type in individual cases, hence no conclusion can be drawn as to which salt produced the most reactions.

SUMMARY

Five hundred eighty-nine cases of penicillin-treated lobar and bronchopneumonia are analysed. The average dose was minimal and success more consistent when penicillin was used immediately in uncomplicated pneumonia. When delay was incurred by the prior use of a sulfonamide, larger doses were needed and more failures were encountered. Though complications did occur during penicillin therapy, a tendency toward diminution in these seemed apparent. An appreciable number of complicating empyemas escaped surgery by intrapleural instillations of penicillin. Four pneumonias complicated by rheumatic fever responded without improvement in the status of the rheumatic fever. The usual 1 percent of cutaneous reactions, as noted by other observers, was reported.

GRAM-NEGATIVE BACILLI SUSCEPTIBILITY TO PENICILLIN

IN VITRO EXPERIMENTS[1]

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Since Fleming's (*1*) original paper on the susceptibility and resistance of bacterial strains to the action of penicillin, a number of reports have appeared in the literature on the resistance of gram-negative bacilli to this agent. All state that gram-negative bacilli of the colon-typhoid group are penicillin-resistant (*2*) (*3*) (*4*) (*5*) (*6*).

In January 1944, while treating a case of subphrenic abscess with penicillin, it was noticed that a coincidental urinary infection (pyuria) which had been present for 40 days cleared up after 24 hours of systemic penicillin therapy. The urinary infection had been due to Escherichia coli. This was considered an interesting finding inasmuch as Escherichia coli infections were said to be resistant to penicillin therapy.

In June 1944 in vitro experiments were undertaken to test the potency of one lot of penicillin. A strain of Staphylococcus aureus was used as the susceptible organism and a strain of Escherichia coli as a resistant organism control. The Staph. aureus had been isolated from a case of pharyngitis; in the accompanying tables it is designated as Staph. aureus (P). The Esch. coli organism, isolated from a case of peritonitis following a ruptured appendix. is designated as Esch. coli (McCoy).

Surprisingly, the Esch. coli appeared to have as much susceptibility to penicillin as did the test organism. The experiment was repeated and the same result obtained. Three other strains of Esch. coli were isolated from various sources and all showed the same susceptibility to penicillin (table 1). A strain of Proteus vulgaris likewise showed susceptibility, whereas one strain of Aerobacter aerogenes was completely resistant.

The technic employed was a modification of that described by Sherwood, Falco and de Beer (*7*). A 16-hour broth culture of the organism was transferred to a blood agar plate, and three sterile

[1] Received for publication 17 August 1944.

TABLE 1.—*Streaked blood agar plates—filter paper disks treated with penicillin*

Organism	0.04 cc. of penicillin (1 cc. =5,000 U.)	0.04 cc. of penicillin (1 cc. =500 U.)	0.04 cc. normal saline sol.
1. Staph. aureus (P) (isolated from culture of pharynx)	24 mm.*	Slight inhibition	0
2. Esch. coli (McCoy) (isolated from pus of peritonitis, following ruptured appendix)	26 mm.*	Slight inhibition	0
3. Esch. coli (Parish) (isolated from urine)	26 mm.*	Slight inhibition	0
4. Esch. coli (Taylor) (isolated from urine)	28 mm.*	Slight inhibition	0
5. A. aerogenes (Knitzer) (isolated from stool)	0	0	0
6. P. vulgaris (isolated from osteomyelitis of great toe)	30 mm.*	Slight inhibition	0

* = Diameter of zone of inhibition about filter paper disk measured in millimeters.
0 = No zone of inhibition.
Penicillin used was Merck—sodium salt—Lot No. SI-1130—100,000 Units in 20 cc. of normal saline solution.

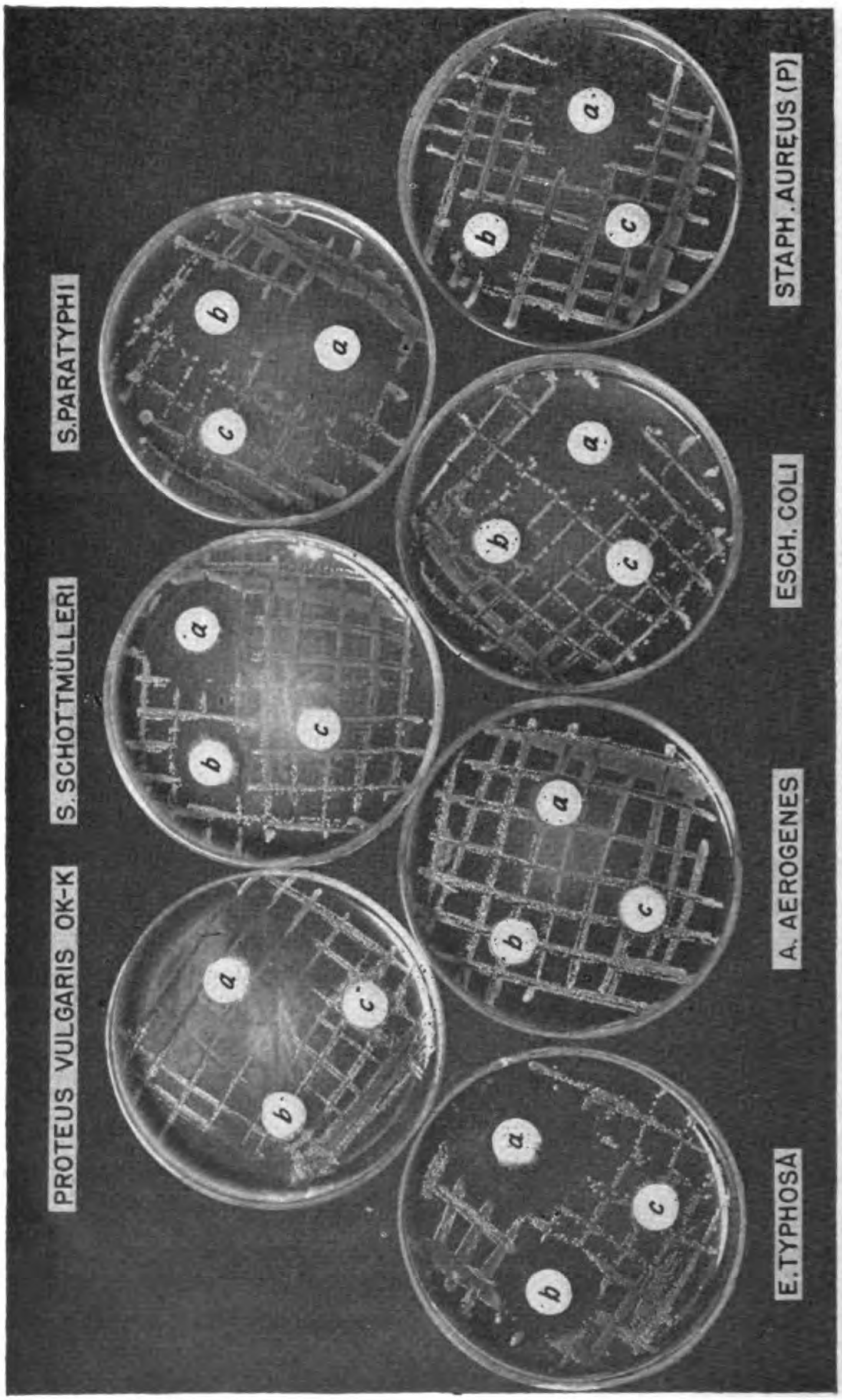
filter paper disks, 12 mm. in diameter, were evenly spaced on the agar. By means of a syringe and a 21-gage needle, 2 drops (0.04 cc.) of penicillin in concentration of 5,000 Oxford units to 1 cc. were placed on one disk, 2 drops (0.04 cc.) of penicillin in concentration of 500 Oxford units to 1 cc. on the second disk, and 2 drops (0.04 cc.) of normal saline solution on the third disk. These were incubated immediately at 37° C. for 24 hours. A zone of inhibition appearing about the penicillin-treated disk (fig. 1) indicated susceptibilty.

A check of these results was made by using nutrient broth cultures containing different amounts of penicillin. Test tubes containing 3 cc. each of nutrient broth were inoculated by means of a 4-mm. loop with a 16-hour broth culture of the organism to be tested. Various amounts of penicillin were added to the tubes and they were incubated for 24 hours. Growth as indicated by turbidity of the tubes was read against MacFarland standards and subcultures were streaked onto blood agar plates to determine whether the inhibition was complete (fig. 2).

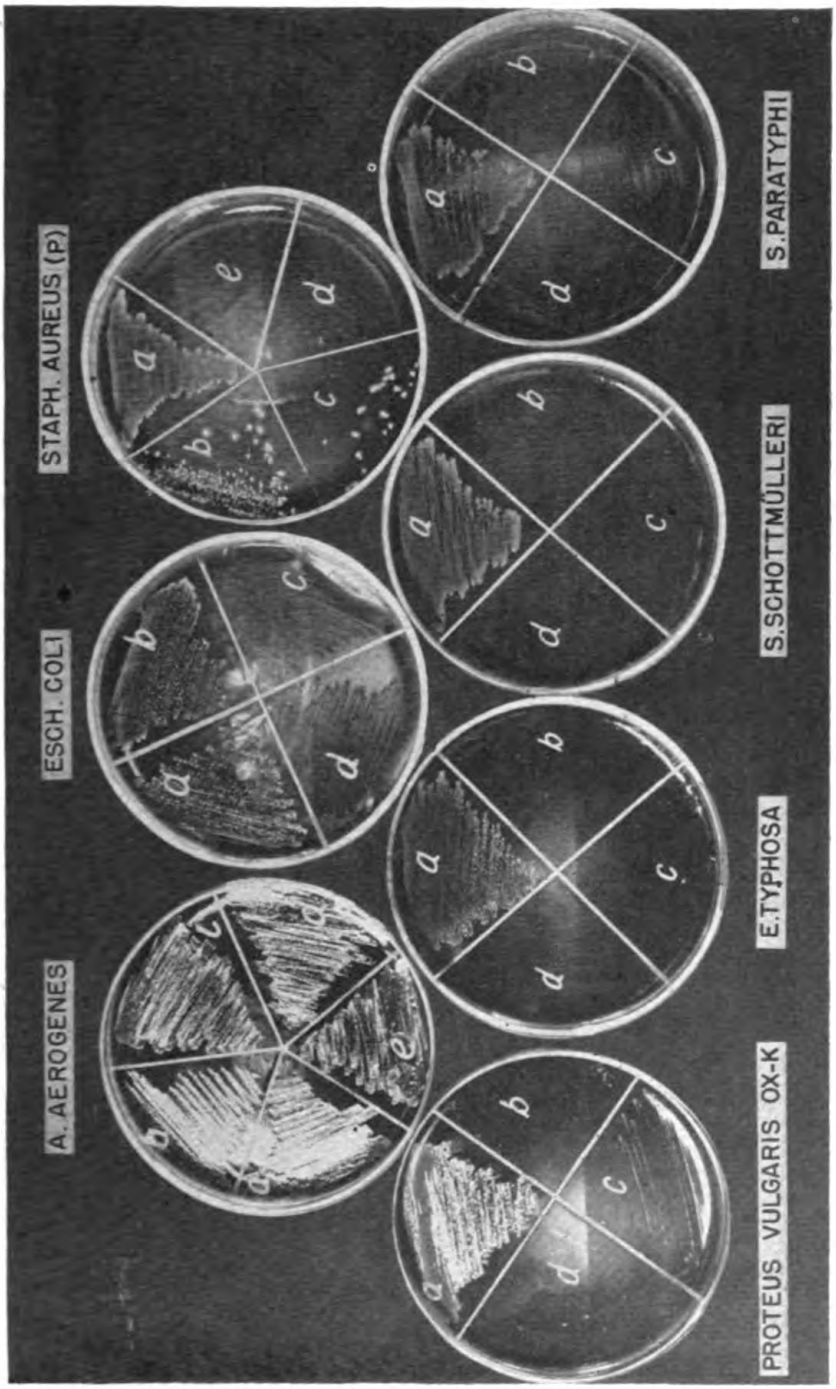
In table 2 are recorded the results of the tests with Staphylococcus aureus (P) and Escherichia coli (McCoy). Complete inhibition of growth was obtained in both the Esch. coli and the Staph. aureus tubes, but less penicillin was required for the Esch. coli organism than for the Staph. aureus (P) to attain this result. The A. aerogenes strain (K) (table 3) showed no inhibition of growth in concentrations up to 1.6 cc. of penicillin (1,000 Oxford units to 1 cc.).

It was apparent that the strain of Staphylococcus aureus (P) used as a control organism was considerably more resistant to penicillin than is usually reported in the literature.

Another strain of Staphylococcus aureus (F) isolated from a



1. Cultures streaked on blood agar plates. White disks are filter paper (E. & D. No. 613) 12 mm. in diameter: **a** Treated with 0.04 cc. of penicillin (5,000 U. to 1 cc.); **b** 0.04 cc. of penicillin (500 U. to 1 cc.); **c** 0.04 cc. of physiologic saline solution. Note zones of inhibition in the penicillin-treated disks in all but the A. aerogenes.



2. Subcultures on blood agar plates from penicillin-treated broth cultures after 24 hours' incubation: **a** Control, untreated; **b, c, d** and **e,** treated with various amounts of penicillin. Note growth in all the penicillin-treated cultures in the A. aerogenes; incomplete inhibition of growth in **b** and **c** in the Staph. aureus (P) culture, and in **b** in the Esch. coli culture; and complete inhibition of growth in all treated broth cultures in Proteus vulgaris OX-K, E. typhosa, S.paratyphi, and S. schottmülleri.

TABLE 2.—*Nutrient broth cultures treated with various amounts of penicillin*

Organism		Growth*	Subcultures on blood agar from broth
1. Staphylococcus aureus (P)	(a)	12,000 M	→ 4+
	(b)	9,000 M	→ 4+
	(c)	200 M	→ 4+
	(d)	100 M	→ 4+
	(e)	100 M	→ 4+
	(f)	Slight turbidity	→ +
	(g)	0	→ ±
	(h)	0	→ 0
	(i)	0	→ 0
2. Escherichia coli (McCoy)	(a)	15,000 M	→ 4+
	(b)	600 M	→ 4+
	(c)	600 M	→ 4+
	(d)	Slight turbidity	→ +
	(e)	0	→ ±
	(f)	0	→ 0
	(g)	0	→ 0
	(h)	0	→ 0
	(i)	0	→ 0

(a) Control, untreated. (e) 0.16 cc. (i) 0.32 cc.
(b) 0.04 cc. (f) 0.20 cc. * = Turbidity read against MacFarland standards.
(c) 0.08 cc. (g) 0.24 cc. + = Indicates degree of growth on subculture.
(d) 0.12 cc. (h) 0.28 cc. Penicillin sodium 1 cc. = 1,000 U.

TABLE 3.—*Streaked blood agar plates—filter paper disks treated with penicillin*

Organism	0.04 cc. penicillin (M)	0.04 cc. penicillin (L)	0.04 cc. normal saline sol.
(1) S. paratyphi	32 mm.*	38 mm.*	0
(2) S. schottmülleri	26 mm.*	36 mm.*	0
(3) E. typhosa	32 mm.*	32 mm.*	0
(4) S. enteritidis	33 mm.*	40 mm.*	0
(5) P. vulgaris OX-K	45 mm.*	50 mm.*	0
(6) S. hirschfeldii	35 mm.*	37 mm.*	0
(7) Staph. aureus (P)	25 mm.*	28 mm.*	0
(8) Esch. coli (McCoy)	25 mm.*	30 mm.*	0
(9) A. aerogenes	0	0	0

Penicillin (M)—Merck. Penicillin (L)—Lilly.
Sodium penicillin (5,000 U. to 1 cc.). 0 = No zone of inhibition.
* = Diameter of zone of inhibition about filter paper disk measured in millimeters.

patient with furunculosis proved to have approximately the same degree of resistance to penicillin as strain (P) (table 4). Two other strains of Staph. aureus were then tried. One obtained from the U. S. Naval Medical School proved to be very susceptible to penicillin activity, 0.04 cc. in dilution of 10 Oxford units to 1 cc. being required to produce complete inhibition of growth.

A fourth strain of Staphylococcus aureus (M) isolated from a patient with meningitis proved to be even more susceptible than the Medical School strain (table 4). Both the Medical School strain and the Staph. aureus (M) strain produced zones of inhibition on the filter-paper disks of approximately 50 mm., almost twice the diameter of the zones produced by Staphylococcus aureus strains (P) and (F), and the Escherichia coli strains.

Three additional strains of Escherichia coli and three of Aero-

TABLE 4.—*Comparative inhibition of various strains on broth cultures*

Organism	No. of units of penicillin per cc. of broth necessary for complete inhibition of growth
Staph. aureus (M)	0.054
Staph. aureus (Naval Medical School)	0.13
P. vulgaris OX-K	0.4
E. typhosa	4.0
S. hirschfeldii	5.3
S. enteritidis	9.1
S. paratyphi	9.1
S. schottmülleri	26.6
Staph. aureus (F)	40.0
Esch. coli (McCoy)	66.6
P. vulgaris (isolated from case of osteomyelitis)	66.6
Staph. aureus (P)	91.1

bacter aerogenes were isolated from stools. Of these, one Esch. coli strain showed complete resistance to penicillin on the filter-paper disks whereas all three A. aerogenes showed zones of inhibition of approximately 25 mm. Thus of six Esch. coli strains and four A. aerogenes tested, one of each showed no zone of inhibition on the penicillin-treated disks.

Since the strain Escherichia coli (McCoy) was susceptible to penicillin in large concentrations, it was decided to test it clinically on the patient from whom it had been isolated. The following is a brief résumé of this case.

Case report.—On 7 June 1944 the patient, 18 years old, was operated on for ruptured gangrenous appendicitis. Free pus was found in the peritoneal cavity and 2 Penrose drains were inserted and 4 gm. of sulfanilamide instilled. Cultures from the pus showed Esch. coli. Postoperatively, treatment consisted of administration of plasma, intravenous fluids and 5 gm. of sodium sulfadiazine intravenously. For 48 hours thereafter the patient was acutely ill, the temperature ranging between 102° and 103° F.

Penicillin was then given intramuscularly, 20,000 units every 3 hours for the first 24 hours and then cut down to 15,000 units every 3 hours for the second 24 hours, following which the patient appeared to be considerably improved. The dosage of penicillin was continued at this level for 3 days and then discontinued, the temperature having been normal for 48 hours. Drainage from the abdomen was moderate, but 5 days after discontinuing the penicillin, the discharge became more profuse and foul-smelling.

Penicillin was then instilled directly into the peritoneal cavity in daily doses of 25,000 Oxford units for the next 3 days. Within 24 hours there was considerable diminution in the discharge; the odor disappeared within 48 hours, and in the next 48 hours there was very slight drainage, after which there was no further drainage and cultures of the wound were negative for Esch. coli.

The impression obtained was that the discharge in this case ceased much sooner than would be anticipated without penicillin therapy.

Six other gram-negative organisms were studied. All showed

various degrees of susceptibility but none was completely resistant to penicillin (table 3, and figs. 1 and 2). One of the strains, Proteus vulgaris OX-K, showed considerable susceptibility to penicillin activity. Eberthella typhosa likewise showed much more susceptibility than two strains of staphylococcus used for comparative study. The order of susceptibility of the organisms studied, in terms of penicillin units per cubic centimeter of broth necessary for complete inhibition, is given in table 4.

COMMENT

In vitro studies indicate that not all gram-negative organisms are completely resistant to penicillin. Abraham and his coworkers (*8*), using crude extracts of penicillin, demonstrated that penicillin in large amounts was able to inhibit the growth of gram-negative organisms, and indeed suggested that, with purer extracts, Eberthella typhosa might come within the range of therapeutic use. In cases in which large amounts of penicillin can be instilled and a high concentration of the drug can be obtained at the site of the infection, as in the case cited, penicillin may be effective in vivo against infections due to gram-negative organisms.

Several cases of peritonitis due to ruptured appendicitis are now under study and will be the subject of a more comprehensive report later.

The filter-paper plating test described serves as a good screening test for completely resistant organisms (fig. 1). A zone of inhibition measuring over 50 mm. in diameter indicates marked susceptibility to penicillin activity, and smaller zones indicate lesser degrees of susceptibility. An absence of a zone of inhibition indicates complete resistance; when zones of inhibition of 25 mm. or more can be demonstrated, the cases are deemed suitable for therapeutic study.

SUMMARY

1. In vitro tests of penicillin action on certain strains of the colon-typhoid group indicate that not all of these organisms are completely resistant to penicillin.

2. The following gram-negative organisms showed different degrees of susceptibility in vitro to penicillin activity: Proteus vulgaris OX-K; Eberthella typhosa; Salmonella hirschfeldii; Salmonella enteritidis; Salmonella paratyphi; Salmonella schottmülleri; Escherichia coli (5 strains); and Aerobacter aerogenes (3 strains). One strain of Esch. coli and one of A. aerogenes were completely penicillin-resistant.

3. A crude screening test for determining in vitro susceptibility to penicillin is described.

4. A possible therapeutic application of penicillin to gram-negative bacillary infections is suggested.

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ACTION OF PENICILLIN ON GRAM-NEGATIVE ORGANISMS

Preliminary data are presented to demonstrate that penicillin produced by Penicillium notatum or Penicillium chrysogenum possesses an antibacterial action in vitro against other gram-negative organisms and is effective in the absence of glucose.

Experiments were carried out by the serial dilution method using a stock strain of E. typhosa and 117 crude liquors and 86 partially purified penicillin solutions. Each solution showed some degree of bacteriostatic activity against E. typhosa. Other gram-negative organisms, in addition to E. typhosa, were also tested for sensitivity. Only two strains, however, a strain of Esch. coli which produces large amounts of penicillinase and a freshly isolated strain of Ps. pyocyanea were completely resistant. The antibacterial action of penicillin is more apparent in high potency preparations. HOBBY, G. L.: Antibacterial action of penicillin against gram-negative organisms. Science 100: 500-501, December 1, 1944.

SALT WATER ULCERS OF THE EXTREMITIES

OCCURRENCE IN JAPANESE SURVIVORS

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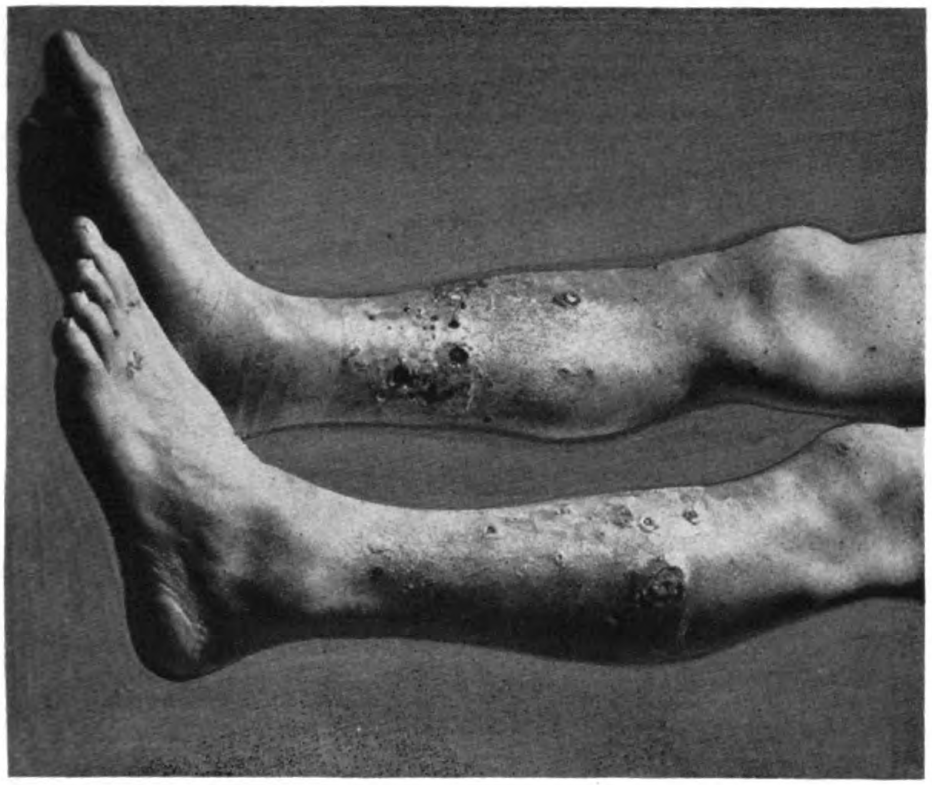
Lieutenant Commander (MC) U.S.N.R.
and
JAMES L. HOLLAND
Commander (MC) U.S.N.

During combat operations in the Pacific, 13 Japanese survivors were rescued by the destroyers of our Task Group and delivered to this ship as prisoners of war. These individuals were found in three groups of seven, five, and one lone survivor. The two larger groups were seamen and soldiers who had been adrift in life boats for 11 and 6 days since their vessels were sunk. The lone individual picked up in a life raft was a radioman from a scout bomber plane, who had been afloat for 7 days before his rescue.

With three exceptions, these men were in a fair general condition. Two had been wounded prior to abandoning ship, one sustaining a flesh wound of the thigh, and the other bilateral penetrating bullet wounds of both feet, producing multiple compound comminuted fractures of the metatarsal bones. The third prisoner, who was transferred to this ship by stretcher, was a seaman, 17 years of age, suffering from exposure and exhaustion after 11 days adrift.

All of these survivors had severe first-degree sunburn of all exposed surfaces of their bodies, but diffuse second-degree sunburn was not present in any individual, presumably because of pigmentation and tolerance to sunlight.

Identical skin lesions, however, were present on the forearms, legs, thighs, and buttocks of six of these survivors. These lesions in their early stages appeared as small vesicles or blisters, which were soon replaced by discoloration and gangrene of the skin. The discrete areas of cutaneous necrosis subsequently sloughed, leaving ulcers, varying in size from 0.5 to 3 cm. and tending to appear principally on the extensor surfaces of the extremities (figs. 1 and 2). Ultimately these lesions presented as deep circular or oval punched-out ulcers with precipitous edges and a pinkish gray granulating base. The skin surrounding these ulcers was free from any erythema or inflammatory reaction, but extreme sensitivity at



1. Multiple cutaneous ulcers of the lower extremities in a Japanese radioman afloat in a life raft for 11 days.

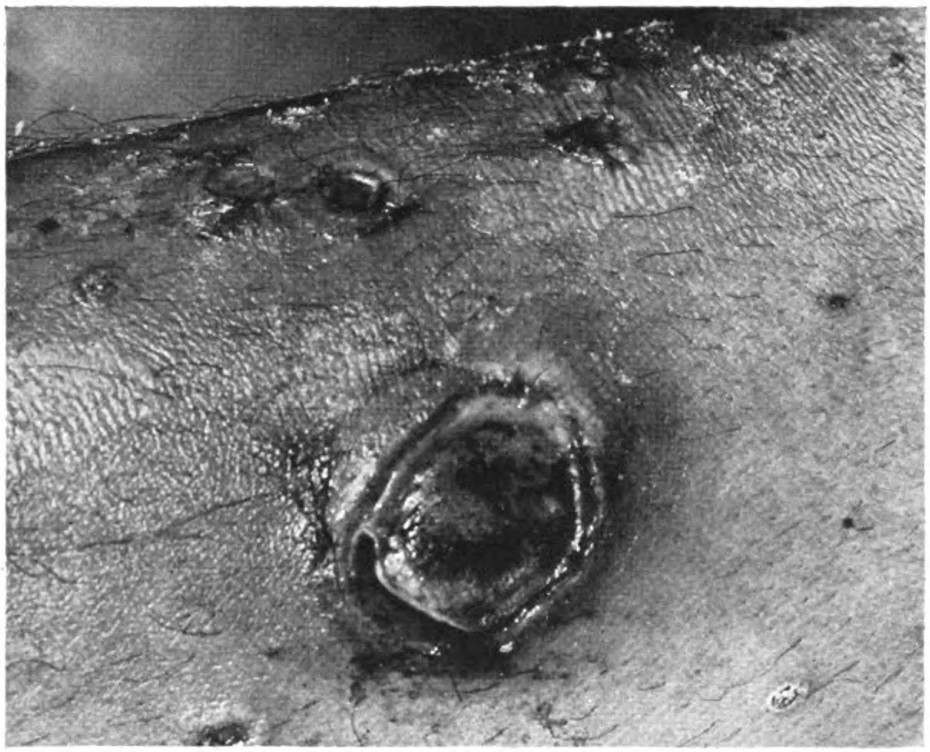
—Official U. S. Navy Photo.

the ulcer edges was a striking feature. When a number of lesions were present on the legs or forearms, a moderate degree of edema of the feet or hands was invariably present, with fever ranging from 99° to 101° Fahrenheit.

Similar lesions were observed on the palms of the hands of two survivors but none were seen on the soles of the feet, neck, or face. The ulcers on the buttocks were numerous and superficial with maceration of the intervening skin, but in no area was there any tendency for these ulcers to coalesce and spread. A few small lesions, particularly on the thighs, passed through the stages of vesication and gangrene but remained dry and ultimately healed without ulceration.

The initial treatment of these lesions prior to the patients' transfer to this ship had consisted of the application of sterile dressings, with and without the local use of merthiolate and sulfanilamide powder. The therapy aboard this ship consisted of careful cleansing of the extremities, the application of sterile boric acid ointment, and pressure dressings.

Healing during the period of observation was slow, particularly in those cases in which the necrotic skin overlying the ulcer had



2. Close-up view of ulcers. The necrotic skin has not yet separated from the larger ulcer. Absence of inflammation in the surrounding skin is apparent.
—Official U. S. Navy Photo.

not yet separated. Marked sensitivity persisted during the entire healing process, with the granulation tissue being scanty, of a dirty gray color, and exuding a small amount of thin purulent discharge. Repeated smears taken from the ulcers showed few organisms, these being predominately gram-positive cocci in pairs and clumps. No difference in healing time could be noted in those cases in which antiseptics or sulfanilamide powder had been used in the initial treatment in contrast with those in which only sterile dry dressings were applied. The local use of 5-percent sulfathiazole ointment in one individual seemed to have no advantage in hastening healing over the boric acid ointment used in all other cases.

In only one instance did a frank pyoderma develop. Multiple superficial purulent vesicles developed about the ulcers on the forearm of one patient and rapidly spread over the entire forearm, elbow, and lower arm. These promptly responded to local drainage and warm boric acid packs followed by sulfathiazole ointment.

COMMENT

These lesions seemed to correspond in many ways to the so-called "tropical ulcers" or "desert sores" reported from the African

theater during this war. These patients had in common, exposure to strong sunlight in tropical areas over a prolonged period of time, with inadequate protection of the exposed extremities. The role of trauma must be considered, as it has been in tropical ulcers, and it seems likely that with exposure to intense sunlight and repeated soaking with salt water it played a definite part in producing these lesions.

It is our impression that salt water was a most important etiologic factor in the production of these ulcers. These individuals while exposed to sunlight and trauma were almost constantly wet, bailing their life rafts and boats to keep afloat during their days adrift.

The element of vitamin deficiency and diet was not considered important. While none of these 13 survivors were obese, all had obviously been on an adequate diet prior to their being cast adrift. None of these individuals presented the picture of "immersion foot" as seen in Pacific areas, and considered the result of vitamin B deficiency and hypoproteinemia. These lesions were obviously not bacterial in origin, as evidenced by the lack of adjacent inflammatory reaction, minimum purulent discharge, and essentially negative smears.

All these survivors gratefully appreciated standard American rations aboard ship, with the exception of one 17-year-old seaman who refused to eat for 3 days. When finally given a bowl of unseasoned boiled rice and tinned salmon, he broke his fast and gradually became adjusted to regular Naval food.

It seems extremely likely that similar ulcerative lesions may be expected in Naval and flying personnel subjected to like exposure. While the darker skin and increased pigmentation of the Asiatic seems to offer some protection against second-degree sunburn, it did not prevent the development of skin lesions in 46 percent of the group of 13 Japanese survivors adrift for various periods.

The prevention of such lesions is undoubtedly dependent upon protection of all exposed surfaces in individuals adrift. While adequate clothing and covering of the head will do much to minimize the injury resultant from excessive sunlight and trauma, it will not prevent that incident to constant soaking with salt water. If available the application of some bland ointment to the skin of the extremities and buttocks might be a valuable prophylactic measure to be followed by those cast adrift.

TRANSVERSE INCISION FOR REPAIR OF INGUINAL HERNIA

PHILIP SHAMBAUGH
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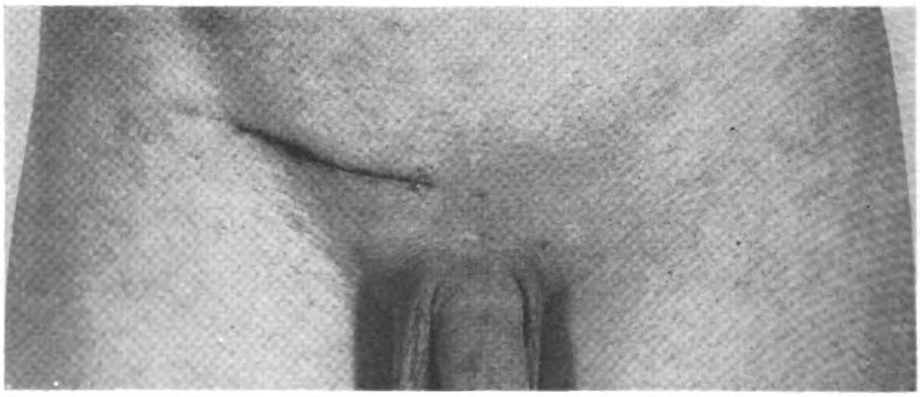
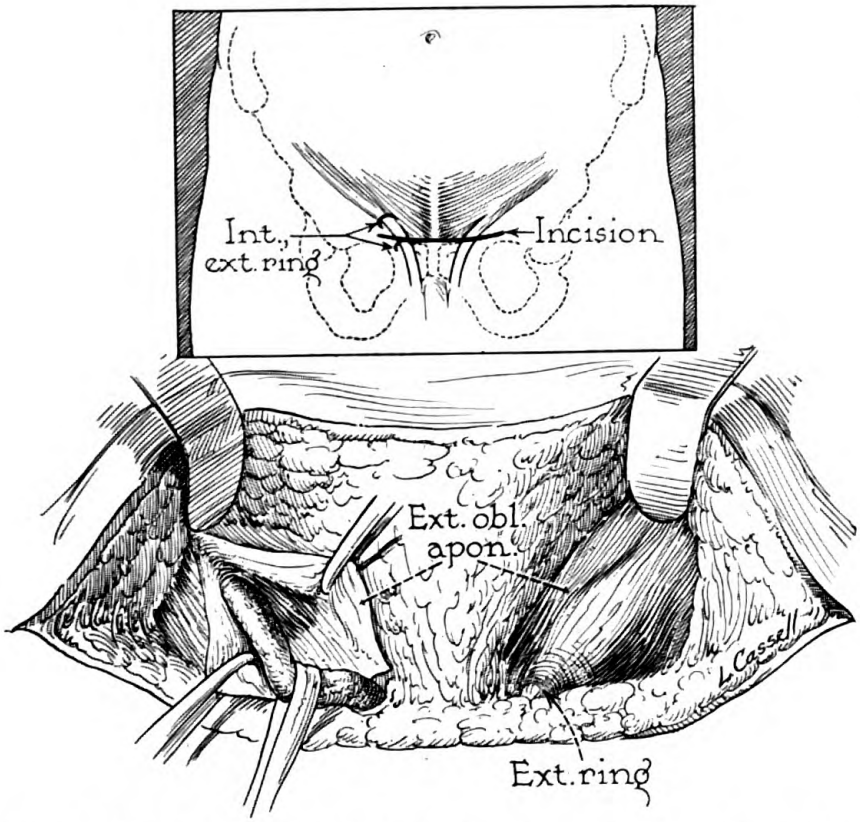
The incision for repair of inguinal hernia has become so standardized that variations from the usual technic are rarely practiced. It is apparently generally assumed that in following the course of the inguinal ligament the incision naturally is directed along the lines of skin cleavage. Moreover illustrations in textbooks of anatomy and surgery almost invariably depict these lines as following the direction of the inguinal ligament, despite the fact that actual inspection of the skin proves this to be false.

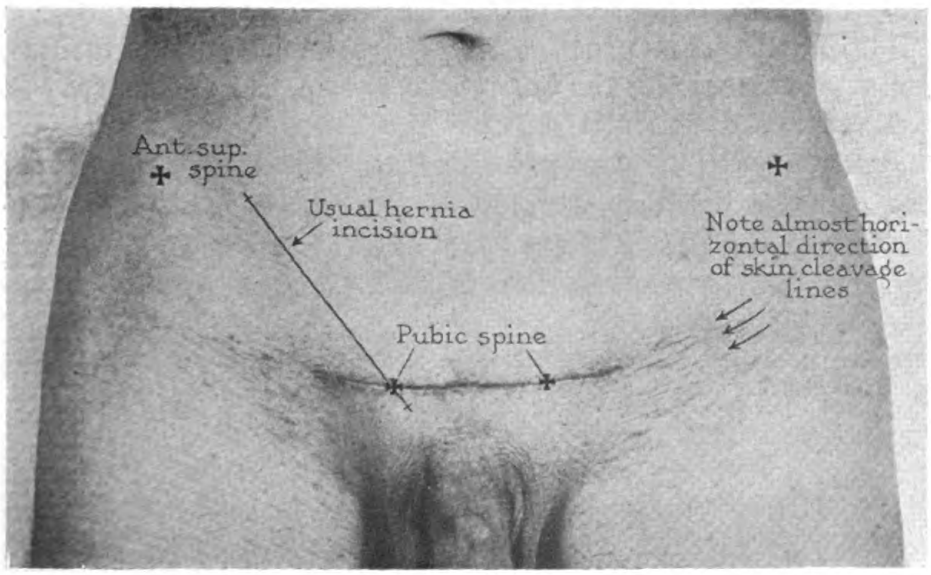
During the past 3 years, the author has utilized an incision which has advantage over the customary method. It is a transverse incision made directly over the inguinal canal and crossing the line of the inguinal ligament. The medial end overlies the spine of the pubis and laterally it follows the readily-visualized lines of cleavage of the skin. The resultant scar (fig. 1) is almost entirely hidden by the pubic hair and does not tend to widen as is the case where the skin cleavage lines are not followed. When the deep fascia is reached the skin and subcutaneous fat is walled off with moist gauze, the margins of the wound are retracted and the hernial repair is carried out in the usual fashion. The exposure is entirely adequate even though the length of the incision is only from 2 to 3 inches, depending upon the depth of the panniculus.



1. Unilateral repair on seventh postoperative day. Subcuticular suture was removed on the fourth day.



2. Diagram showing the placing of the incision over the pubic spines; lower drawing illustrating the exposure obtained.



3. Bilateral repair on the eleventh postoperative day.

The advantages of a transverse incision for inguinal herniorrhaphy have been emphasized by Maingot.[1] His incision, however, is placed considerably higher, and therefore must necessarily be

longer to provide adequate exposure. Instead of overlying the pubic spine, his incision is placed over the junction of the middle and outer thirds of the inguinal ligament.

Aside from the superior cosmetic result, the incision proposed here provides better exposure of the femoral region in cases where the hernia proves to be femoral rather than inguinal. Not infrequently the decision of whether or not to explore both sides awaits the findings on the first-operated side. The transverse incision (fig. 2) makes possible a repair of the contralateral inguinal region simply by extending the incision across the midline to the other side.

In bilateral hernial repair the incision is again made horizontally over the pubic spines, curving slightly to follow the skin cleavage lines. Here, however, excellent exposure is obtained with less lateral extension, due to the increased mobility provided by the longer incision. The incision for bilateral repair consequently need not be longer than from 4 to 5 inches in the average adult, or approximately the length of the conventional incision for a unilateral repair. Again the incision is concealed by the pubic hair and aside from cosmetic considerations, the utilization of a single incision reduces operating time by approximately one-third (fig. 3).

When the single transverse incision for bilateral repair was first employed it was made unnecessarily long and, following the method of Judd, it was carried down to the deep fascia throughout its length. This practice has since been found unnecessary and now after incising the superficial fascia, the deeper fat layers are separated downward only to the deep fascia over the two inguinal canals, thus saving considerable time in hemostasis.

The incision has been employed exclusively in all bilateral repairs during the past 2 years regardless of age (youngest patient aged 7 months), variety of hernia, or type of repair.

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[1] MAINGOT, R.: Abdominal Operations. Vol. 2. D. Appleton-Century Company, New York, 1940. p. 973.

EPICONDYLITIS OF THE HUMERUS

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The fact that two cases of epicondylitis of the humerus have occurred within a year aboard a small ship indicates that the condition is not infrequent. Epicondylitis is a painful, persistent affection of the periosteum and tendinous attachment of the external (lateral) or internal (median) humeral epicondyle. Its pathogenesis is obscure and the condition tends to eventual recovery. The pathogenesis will not be discussed, since on that subject there is already a voluminous although inconclusive literature. Suffice it to say that in some cases a radiohumeral bursa is present, and in those instances disease affecting the bursa seems to be responsible for the epicondylitis, but this article is concerned with that very much larger group of cases in which no such bursa is demonstrable. The condition affects the external epicondyle ten or twelve times as frequently as it does the internal. The reason for this may be that the external epicondyle is more often exposed to injury than is the internal one. In a very few instances both condyles may be affected simultaneously, usually following a crushing type of injury.

In only one of the two cases to be reported here is there a history of a single direct injury. The condition may be preceded either by such an injury or by repeated minimal indirect traumas. These latter are caused by constant repetition of a movement by one of the muscles taking its origin from the epicondyle. In my experience the former type has been somewhat more common, and it is my impression that such cases are more resistant to treatment than those due to indirect trauma, although that has not been true in the cases reported by others. When there is a history of indirect trauma it will usually be found that the patient has engaged in some unaccustomed activity requiring repetition of a movement without preparatory muscle training, or has returned to an accustomed activity after a long rest period.

EXTERNAL EPICONDYLITIS

In external epicondylitis due to indirect trauma a careful analysis of the mechanism will reveal that the initiating movement is

dorsiflexion, supination, or radial deviation of the hand. Most often it is dorsiflexion.

The patient complains of soreness, pain, and weakness of the grip. The soreness is located at the epicondyle. The pain is usually felt there also, radiating down the anterolateral aspect of the forearm. This pain is often bothersome at night and, while it tends to disappear by morning, it is often quite severe on starting work. After a short warming up period, it may disappear again, only to return and become gradually more marked during the day, reaching its peak about an hour after work is stopped.

It is always accentuated by certain movements, and usually by jarring. Picking up a cup, turning a doorknob, lifting something out of a confined space, and hammering are actions often accompanied by such a severe, lancinating pain that the patient will instantly drop whatever he has in his hand. Any attempt to grip an object strongly, particularly a small one, is accompanied by pain, and as a result the patient complains of weakness of the grip.

Inspection only rarely reveals swelling and never atrophy unless the part has been immobilized. The absence of atrophy is confirmed by measurements. Tenderness, usually marked, is always present. It is localized in a small area over the epicondyle, usually the anterolaterodistal aspect, and sometimes extends to the joint line or even to the head of the radius. Movements of the elbow, wrist and fingers are not diminished in range, although in a severe case dorsiflexion, supination, and radial and ulnar deviation may be somewhat painful. When the movements are carried out against resistance, dorsiflexion practically always causes pain, and it is usually more severe than that caused by other movements. Supination, radial deviation, and extension of the fingers often cause pain, but ulnar deviation does so only occasionally.

For some reason extension of the third and fourth fingers seems to cause more pain than does extension of the second and fifth. Gripping is also painful, because it is accompanied by dorsiflexion of the wrist. Ordinarily other movements are not painful unless there is a concomitant contraction of the muscles of dorsiflexion.

When examination is carried out with the elbow in full extension the pain is more severe than when the elbow is flexed. Measurement of the grip by comparison, or with the dynamometer, reveals marked weakness as a rule. There are no changes in skin sensation. In a minority of cases x-ray examination reveals a

small wisp-like area of calcification adjacent to the cortex in the common extensor tendon.

The muscles taking their origin from the external epicondyle are the supinator, the extensor carpi radialis brevis, the extensor digitorum communis, and the extensor carpi ulnaris. The supinator alone, of these muscles, brings about supination. The extensor carpi radialis brevis is one of the muscles responsible for radial deviation, as the extensor carpi ulnaris is for ulnar deviation, whereas the extensor digitorum communis extends the fingers. Dorsiflexion of the wrist is accomplished by the cooperation of all these muscles with the exception of the supinator. It is easy to understand, therefore, why dorsiflexion, supination, radial deviation, ulnar deviation, and extension of the fingers may be painful and why dorsiflexion is usually the worst offender.

Whatever the action may be that causes the patient pain, careful analysis will reveal that it is accomplished or accompanied by the action of one of these muscles. Thus a strong grip is impossible without dorsiflexion of the wrist. This accounts for the pain in lifting a cup, turning the knob of a door, or lifting an object out of a confined space as well as for the weakness of the grip which is a common complaint.

INTERNAL EPICONDYLITIS

This condition differs from the preceding one only in its anatomic site and the resulting physical signs. The patient complains of soreness, pain and weakness of the grip. The soreness is felt at the tip of the internal epicondyle. The pain is felt in the same area, tends to radiate down the forearm and behaves very much the same as in external epicondylitis. It is accentuated upon certain movements, of which those involving gripping are the most common. The weakness of the grip is usually marked.

Examination reveals essentially the same findings as in external epicondylitis except that the tenderness is over the internal epicondyle, and different movements cause pain when they are carried out against resistance. Of these, palmar flexion is the worst offender. Pronation, finger flexion, and ulnar deviation are usually next, with radial deviation the least bothersome. The pain is most severe when the examination is made with the elbow fully extended.

The muscles taking their origin from the internal epicondyle are the pronator teres, the flexor carpi radialis, the palmaris longus, the flexor carpi ulnaris, and part of the flexor digitorum sublimis. All these muscles except the pronator teres help to produce palmar flexion. It is not surprising, therefore, that palmar

flexion against resistance should be productive of the most pain, which, when found in conjunction with tenderness, is diagnostic of this condition.

TREATMENT

It should be borne in mind that epicondylitis tends to improve gradually, and to end in complete recovery, but the process may extend over months or years. It is essential, therefore, that whenever possible individuals so affected be kept at work. Encouragement and reassurance constitute an important part of the treatment. Those who continue with their work seem to fare much better, perhaps because they have a healthier mental outlook. In those instances in which there is continual indirect trauma the offending movement must be eliminated.

Certain treatments commonly employed are valueless or of only limited value. Immobilization, for example, is useless. While elimination of foci of infection is desirable from the point of view of general health, it does not seem to affect the local condition. Infiltration of procaine hydrochloride solution may be of some value in conjunction with other measures, particularly in those cases in which a radiohumeral bursa is present, but it is not usually effective, and is often followed by a severe reaction. Physiotherapy alone helps only temporarily, but it is useful in conjunction with other measures and is often of great value in maintaining morale.

There are other methods of treatment which seem definitely beneficial. The Cyriax maneuver is often helpful either alone or combined with procaine hydrochloride infiltration, particularly in the milder cases. X-ray therapy administered in four doses of about 150 r each at 4-day intervals is effective in a fairly high percentage of cases. It is sometimes, however, followed by a temporary intensification of the symptoms, and its effect cannot be appreciated until several weeks have passed. In one of the cases reported here it was used with excellent results, and is regarded as the treatment of choice.

After conservative measures have been given a fair, prolonged trial, there will remain a few cases in which improvement does not take place. In these instances operation is justified. It consists of careful search for a radiohumeral bursa, arthrotomy of the radiohumeral joint, with removal of the hypertrophied synovial fringe if one is present, and stripping the tendon from the epicondyle, which is then cauterized. No attempt is made to suture the tendon back in place. The wound is closed and the elbow is dressed with a compression dressing. In most instances

these patients can be returned to work after a convalescence of from 6 to 8 weeks.

CASE REPORTS

Case 1.—A machinist's mate, 37 years old, was sleeping on a cot topside on 23 June 1943, when his ship was torpedoed. He was thrown about 25 feet by the force of the explosion and struck a bulkhead in such a manner as to sustain a severe contusion of the left hip and a sharp blow on the external surface of the left elbow. About a week later he first noticed an aching pain in the region of the external epicondyle of the left elbow.

He reported to the sickbay on 20 August complaining that this pain bothered him at night and was made worse by certain movements, when it seemed to radiate through the outer portion of the elbow. He found hammering to be one of the most painful movements, and complained of weakness of the grip. He is left handed.

General examination, including a search for foci of infection, yielded negative results except for one crowned tooth, the health of which was in doubt.

Local examination disclosed no atrophy, no swelling and no limitation of motion of the elbow, wrist, or fingers. The left forearm was ¼ inch larger than the right, the difference being attributed to the patient's left handedness. There was moderate tenderness localized in a small area over the tip of the lateral epicondyle. Dorsiflexion of the wrist, carried out against resistance with the elbow flexed at a right angle, was slightly painful. Other movements were not attended by pain. When this phase of the examination was repeated with the elbow fully extended, dorsiflexion was moderately painful, and supination and radial deviation slightly so. The grip was decidedly weaker than that of the right hand. There was no change in sensation.

The condition was considered to be a mild epicondylitis. The patient was more worried than incapacitated, so he was reassured and kept under observation while continuing his duties. No other treatment was necessary. The condition gradually improved, and 2 months after his first visit he was symtom free. Follow-up examination on 1 June 1944, revealed no abnormalities and the patient stated that there had been no further symptoms.

Case 2.—A 40-year-old Filipino steward came to the sickbay on 14 January 1944, stating that he had awakened one morning about 3 weeks before and noticed pain in the outer side of the right elbow. He is right handed. This pain was located in the region of the external epicondyle, which he said was sore to the touch. The condition had gradually grown worse up to the time of his reporting for treatment, when he said that he couldn't lift things out of the back of the refrigerator because his elbow hurt so much he had to drop whatever he had grasped. Certain movements, such as turning on the water tap, also accentuated the pain, although lifting and gripping were the chief sources of trouble. He also complained of weakness of his grip. Past history was irrelevant.

General and laboratory examination, including a search for foci of infection, yielded essentially negative results.

Local examination revealed no swelling, no atrophy, and no limitation of any of the movements of the elbow, wrist, or fingers. On comparison the circumference of the right forearm was found to be ⅛ inch larger than that of the left. Tenderness was severe and localized in a small area over the tip of the external epicondyle. Movements, carried out against resistance with the

elbow flexed to a right angle, were accompanied by severe pain on dorsiflexion, with some pain on supination, radial deviation and extension of the fingers, more in the case of the third and fourth than the second and fifth fingers. Other movements were not painful.

When this phase of the examination was repeated with the elbow fully extended, dorsiflexion was extremely painful, and supination, radial deviation and extension of the fingers were moderately so. The grip of the right hand was much weaker than that of the left, and attempts to exert full gripping power were very painful. There was no change in sensation. X-ray examination 3 days later failed to disclose any abnormality.

The patient was treated by heat, methyl salicylate rubs, and reassurance while continuing on full duty until 1 March, by which time there was slight improvement. On that day fleet operations permitted taking the patient to a Naval hospital where x-ray therapy, consisting of 150 r, was administered. This was repeated on 5 March and again on 9 March. Following these three treatments there was rapid improvement, and on 10 April the patient was symptom free, although there was still slight tenderness and some pain on dorsiflexion of the wrist against resistance. When the patient was last seen on 1 June 1944 these findings had disappeared.

These two cases are considered typical examples of external epicondylitis, each one showing the cardinal signs of localized tenderness and of pain on dorsiflexion of the wrist, together with many of the less constant diagnostic criteria. No history of indirect trauma could be obtained in the second case despite careful questioning, although there must have been some causative mechanism which the patient failed to remember.

SUMMARY

1. Epicondylitis of the humerus may be preceded by a single, direct injury or by repeated minimal indirect traumas.

2. The two most characteristic signs of external epicondylitis are tenderness over the external epicondyle and pain on dorsiflexion of the wrist against resistance.

3. The two characteristic signs of internal epicondylitis are tenderness over the medial epicondyle and pain on palmar flexion of the wrist against resistance.

4. Treatment is carried out while the patient continues his work. X-ray therapy is probably the treatment of choice with operation reserved for the resistant cases.

5. Two cases illustrating the typical findings in external epicondylitis are presented.

REPAIR OF DIRECT HERNIA

EUGENE V. PARSONNET
Lieutenant Commander (MC) U.S.N.R.

The basis for practically all surgical repair of direct inguinal hernia is the utilization of the inguinal ligament which is brought into approximation with either the fascia of the external oblique muscle, internal oblique muscle, conjoined tendon, transversus abdominis muscle or transversalis fascia, by means of a variety of suture materials.

The primary reason for failures and recurrences lies in the basic procedure of the use of the inguinal ligament. This ligament can best be described as a taut line strung between the anterior superior iliac spine and the spine of the pubis. There is no firm structure posteriorly between these two points and only loose areolar tissue lies between the ligament, femoral vessels and pubic spine.

Consequently in the ordinary direct repair, especially when tension is required to approximate the parts, the inguinal ligament is weakened and pulled away from its loose posterior attachment and incorporated with one of the superior structures.

In the anatomic construction of this region there is, however, a fixed, strong tissue, the periosteal covering of the superior ramus of the pubis extending laterally and upward from the pubic spine to the ilium which can be used as a basis for repair. After the ordinary exposure of the structures of the canal, the isolation of the cord, and the treatment of the sac by simple reduction or opening and resection, the periosteal tissue is exposed by gauze and finger dissection, beginning at the spine and following the ramus to the femoral vessels. These are recognized by palpation. A small tributary of the femoral vein is occasionally encountered which, if injured, presents no difficulty in hemostasis.

After the fascia is exposed, the internal oblique muscle is retracted superiorly and medially and the fascia of the transversus abdominis muscle is demonstrated, with identification and finger-retraction of the femoral vessels laterally. While an assistant keeps the hernia depressed, the operator sutures the fascia of the transversus abdominis muscle to the periosteum. The sutures are first placed near the femoral vein in order to avoid trauma to the

vessel. It is helpful to pick up first the transversalis fascia in this stitch.

Accidental injury to the femoral vein is not fraught with danger. Pressure in most instances controls bleeding, although occasionally it may be necessary to use a fine ligature. Frequently the tying of the lateral suture causes sufficient pressure on the femoral vein to control any inadvertent minor trauma.

From experience it has been found that three sutures are usually all that are needed, although at times a fourth may be required. Interrupted chromicized catgut No. 1 suffices and tying is reserved until all are satisfactorily placed. The final suture incorporates the periosteal covering of the pubic spine. The ease with which the structures are approximated and the complete lack of tension on the suture line are surprising.

Upon completion of this step an ample overlying space is formed in which the cord may be replaced without the need of suturing the fascia of the external oblique muscle.

The same procedure for the same basic anatomic considerations can be used equally well in the repair of femoral hernias.

At this station, it has been possible to make follow-up studies on only 5 cases over a sufficiently long period to justify conclusions. These 5 patients were returned to their arduous duties as handlers of cargo after a convalescence of 10 weeks and have shown, 6 months to 1 year postoperatively, no evidence of recurrence and have no complaints referable to the operation.

It is believed that the operative procedure is a useful addition to the armamentarium of any surgeon and can be performed successfully and easily in any type of herniation occurring medial to the femoral vessel, with only a few additional minutes required for its performance.

SKIN COVER

Skin has more important functions than to delight the artist and the lover and offer a palette to Elizabeth Arden. It is the chief agent in regulating temperature. It is the one tissue that can stand up to mechanical, thermal and chemical trauma without suffering more than local damage quickly repaired. It is the Siegfried line between the systems of the body and the outside world; when it is breached, microbial invaders can enter, and must then be cast out by troops summoned from afar, and kept out by repair of the wall. A wound is a breach of continuity in the skin, with or without involvement of underlying tissues, and healing of the wound means a recovering of the breach.—Editorial: Skin cover. Lancet 2: 409–410, September 23, 1944.

THE EXTERNAL MALLEOLAR FRACTURE

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Well established fundamentals of fracture therapy are sometimes violated in treating simple fractures. This fact was emphasized after examining a number of service personnel with painful feet and unstable ankle joints, who had indefinite histories of sprained ankles, a number of which were actually external malleolar fractures. Because the initial x-ray examination shows an apparently benign, simple fracture, insufficient attention may be paid to the mechanism producing the fracture and the probability of permanent disabling sequelae. These fractures have often been treated without adequate x-ray study, with a resultant high percentage of casually and improperly reduced fractures in which complications become apparent with the stresses imposed by military duty.

Surgical anatomy.—The external malleolus is a fundamental structure in the compound joint called the ankle. The fibula is subcutaneous in its lower third, and its lower extremity is enlarged, projected downward, and is known as the external malleolus. The lateral surface of the external malleolus is rounded and subcutaneous, and its tip lies about one-half inch below and posterior to that of the internal malleolus. Its posterior border is grooved for the peroneal tendons, and its tip and anterior border are roughened for the attachment of ligaments. Its deep or inner surface presents an articular facet for the lateral surface of the body of the astragalus.

The lower ends of the tibia and fibula are firmly united by strong interosseous and anterior and posterior transverse ligaments, and the two malleoli project below the articulating surface of the talus forming a deep groove, or mortise into which the body of the astragalus fits. This mortising of the body of the astragalus into the groove formed by the malleoli is the ankle joint. A thin capsule surrounds the joint. The strength of the joint is increased by the addition of strong ligaments, which anchor the foot to the leg; of these ligaments the external lateral is weaker than its counterpart, the internal lateral ligament.

Pathogenesis of fracture.—According to Speed, ankle fracture

is the result of indirect violence and torsional strain and leverage, accompanied by compressive force from the body weight, plus the impact force of the slip and turn of the foot delivered through the ankle mortise. This strain is usually received by a twist of the foot in falling or slipping from a small height, such as a curbstone, or a fall from any height onto the foot in the position of adduction or abduction.

The results of inversion and eversion cause similar mechanical stresses. However, anatomically when the foot is turned inward the ankle gives way completely, due to the fact that the internal malleolus does not extend as low as the external malleolus, and the ligamentous strain results in a sprained ankle. On the other hand, the low hanging of the external malleolus does not permit the same degree of eversion, and fracture results. Rotation of the talus during inversion of the foot consequently breaks off the external malleolus. It is well to note that these fractures are never produced in pure abduction or pure adduction; there is always some degree of rotation of the talus.

The simplest type of fracture, with relatively little violence required to produce it, is the spiral fracture which begins with a fracture line at the front of the malleolus just below the point where the inferior tibiofibular ligament passes back across the joint to emerge on the posterior surface of the fibula. This fracture is produced by the external rotation of the leg with the foot fixed, thus spreading both malleoli apart, with the anterior surface of the astragalus hitting against the inner surface of the external malleolus, forcing it outward and backward. Because of the strength of the ligaments acting on a fulcrum, a spiral fracture is produced.

Fractures of the external malleolus are classified as:

1. Eversion fractures below the joint level. These are caused by mild eversion plus lateral pressure of the calcaneus or talus against the tip of the malleolus, usually with no torsion of the foot.
2. Fractures occurring at the joint level or above, with separation of the tibia and fibula resulting from rupture of the tibiofibular ligaments.
3. Fractures occurring above the joint level (rare unless associated with tibial fracture). Separation of the lower epiphysis of the fibula in itself is rare.

DIAGNOSIS

In severe fractures of the ankle with displacement of the foot on the leg, the diagnosis of fracture is made at a glance, but in the case of fractures of the external malleolus with little or no dis-

placement, the diagnosis between sprain and fracture is difficult, and in fact impossible without roentgenographic examination. A case history is most important for determining the mechanism of fracture and no reliance should be placed upon the degree of swelling. A fracture may be present with little swelling, and conversely in a severe sprain extensive swelling may be present. Points of acute tenderness are of some aid. Tenderness below the external malleolus usually means sprain, whereas tenderness around either malleolus is diagnostic of fracture.

It is sometimes possible during palpation to check the presence or absence of deformity as noted by inspection. If on manipulation, by direct pressure on the foot when the leg is fixed, pain is elicited, fracture is present. This as a rule is not true with sprain. Test for lateral mobility is done; if present it presupposes fracture of one of the malleoli or both, or tibial fracture. If inversion and eversion are painful, a fracture above the malleoli is present.

TREATMENT

The principles involved in the correction of any fracture about the ankle joint apply in these cases. They are: (1) Restoration of proper weight-bearing line; (2) restoration of normal anatomic relationship between the articular surfaces of the joint; and (3) obtaining a satisfactory range of painless motion in the joint.

Treatment is directed at restoring the astragalus to its normal position against the inferior articular surface of the tibia, and then pressing the malleolus so that it, together with the uninjured malleolus, will firmly ride the talus in a normal manner. Obviously fractures with no displacement need only immobilization. The ideal treatment is to reduce the fracture before swelling occurs.

The emergency treatment consists of early reduction plus immobilization. X-rays should be taken in the anteroposterior, lateral and postero-anterior positions. If fracture is diagnosed before swelling has occurred, plaster is applied, using very little padding, and maintaining the foot in dorsiflexion of 90 degrees, and in midposition with regard to abduction and adduction. In this position a line dropped from the center of the knee will pass between the first and second toes.

Immediate reduction reduces the possibility of bleb formation and pressure necrosis against the sharp bone edges of the fibula. Reduction is performed, using general, local or spinal anesthetic, by holding the astragalus well against the malleolus and then pulling the external malleolus to its proper position. The foot is placed at right angles to the leg with a slight degree of plantar

flexion. If the foot is dorsiflexed, the front part of the talus, which is wider than the back part, is jammed between the two malleoli, forcing them apart and destroying the joint mortise.

In fracture dislocations in which the malleolus is broken at the joint level, it is often impossible to correct dislocation and restore the socket of the ankle joint by pressure of the hand. In such cases a traction clamp or taut wire is favored by Böhler.[1] This strongly rotates the foot inward and holds it in position with a 20-kilogram weight until fixation can be applied with plaster. The unpadded plaster cast is applied, molded in stirrup fashion, to the sides of the leg and foot, and secured with a wet muslin bandage.

A second plaster splint is then applied to the back of the leg and the sole of the foot from the hollow of the knee to the tips of the toes. In the application of the plaster splint, firm pressure should be exerted on the malleoli. The cast should be of uniform strength throughout to prevent fresh lateral subluxation by the tension of the pronators or abductors. If the pressure is relaxed the foot may be displaced. After the cast has set, a post-reduction x-ray is taken.

If there is only a slight displacement the cast is removed, reduction is carried out a second time, and the cast is reapplied. If there is no displacement or swelling, a walking iron is applied 1 hour after the plaster has set, and the patient may walk immediately. Severe swelling is relatively rare because only bones, tendons, and skin are involved, there being as a rule no muscles torn. The cast is kept in place for 6 weeks in cases of fracture without dislocation, after which weight bearing is permitted. With dislocation it is left on for from 7 to 10 weeks. Too early weight bearing, even at 6 weeks, may cause a fresh subluxation in valgus position if the callus is still soft.

There are many advantages to the ambulatory treatment of ankle fractures, when this method is applicable to simple uncomplicated fractures.

They are:

1. Only four muscles are immobilized, the tibialis anterior and posterior and the peroneus longus and brevis.
2. The knee joint and toe joints are active from the first.
3. Circulation in the immobilized parts is good because the patient is ambulatory.
4. The morale of the patient is better.
5. There are no local or general complications such as thromboses or pulmonary or cardiac complication.

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[1] BÖHLER, L.: The Treatment of Fractures, 4th edition. Wm. Wood & Co., Baltimore, 1936. pp. 429-449.

6. Usually there is a full range of mobility in the joint after the cast has been removed. In older people approximately one-half range is possible. The skin is normal and the bones show little atrophy or demineralization from prolonged rest.

Compound malleolar fractures may be converted into closed fractures, the wound being carefully excised and dusted with sulfanilamide powder. The skin *only* is sutured, no suture of the ligaments being permitted. The open fracture, thus reduced to a closed fracture, is treated as previously outlined.

Greenslade[2] advocates the use of the Delbet splint in the absence of extensive bleb formation and compound fracture. The advantages claimed, in addition to those already mentioned, are minimum loss of time from work and freedom from vascular complications. Spinal analgesia is preferred in order to secure relaxation and painless manipulation. Attention is called to the fact at this time that the patient frequently experiences numbness of the injured limb, and places his weight upon it, whereupon a simple eversion and abduction fracture is changed to one of marked eversion and abduction, with an additional backward displacement of the foot on the leg.

Other proponents of the early ambulatory treatment of malleolar fractures base their reasons on the pathology of fracture, with sequelae of ecchymoses, hemorrhage, organization, formation of adhesions, or stiff joint. According to Krida[3] traumatic flat foot develops when the foot turns outward, gradually preventing complete voluntary or passive adduction and arch reconstruction. He believes in early movement. In the presence of displacement, reduction is done, followed by a short period of rest. If there is no displacement, a 2- to 3-day rest for the ankle in a sheet wadding compression bandage is advised. This procedure is open to criticism today.

The complications of this type of fracture are: (1) Malunion; (2) interposition of a strip of periosteum between the tibia and the broken malleolus; (3) outward dislocation of the foot; (4) infection; (5) traumatic flat foot; and (6) arthritis deformans.

PROGNOSIS

The prognosis is dependent upon (1) whether anatomic reposition of fragments is obtained and maintained over a sufficiently long period of time; (2) healing of the ligaments and reestablishment of the conformity of the tibio-astragaloid articulation; and

[2] GREENSLADE, C. M.: Ambulatory treatment of malleolar fractures. New Zealand M. J. 26: 76-83, April 1927.

[3] KRIDA, A.: Ambulatory treatment of malleolar fractures. Ann. Surg. 93: 998-1000, May 1931.

(3) whether there are (a) weakened calf muscles, (b) shortening of the tendo achillis, (c) loss of lateral ankle motion, and (d) incomplete restoration of the articular surfaces of the ankle mortise.

Among the listed errors in the treatment of malleolar fractures are:

1. Failure to make follow-up x-ray examinations.
2. Omission of local anesthesia before taking x-rays of fractures in those cases with doubtful subluxation.
3. Attempts to correct the position of the foot when the knee is extended. The tendo achillis may be so tense that backward displacement cannot be corrected. Another error is fixation of the foot in dorsiflexion; this widens the socket of the ankle and later produces instability.
4. Too early removal of the cast, especially in fractures with subluxation, with resultant fresh subluxation and lasting disability.
5. Too early use of massage in fractures with dislocation.
6. Fixation of the foot in abduction. The front part of the foot should be slightly abducted and the heel correspondingly abducted, so that the heads of the first and fifth metatarsals are on the same level.
7. Neglect of systematic walking exercises, which help to preserve the longitudinal arch of the foot.

In the event of malunion with valgus deformity, an osteotomy of the fibula followed by manipulation will usually effect a correction. Occasionally the space between the internal malleolus and the astragalus is filled with scar tissue, which must be excised before the astragalus can be approximated to the internal malleolus in the restoration of the joint mortise.

RUPTURE OF RECTUS ABDOMINIS MUSCLE

SIMULATING INTRA-ABDOMINAL TUMOR

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Injury of the rectus abdominis muscle is not often seen and a perusal of the reported cases tends to indicate that the pathologic changes in this area are seldom correctly diagnosed until the time of operation. The most common lesion is a strain or rupture of the muscle with hematoma formation and in some cases abscess. Since this condition may simulate many types of intra-abdominal tumor, the lesion must be borne in mind, especially in times of intense and strenuous activities which lead to direct and indirect trauma. This accident is more commonly found in young men but may be seen in the aged of both sexes and in those suffering from systemic disease.

The causes of rupture of the rectus abdominis muscle may be classified as:

1. Traumatic (young age group)
    a. Direct violence
    b. Indirect violence
2. Spontaneous rupture (weakened or atrophic from local or systemic disease)
    a. Infections
    b. Pregnancy
    c. Elderly patients (arteriosclerotic)

Rupture and strain of the rectus abdominis muscle may follow direct trauma, but is more frequently due to indirect violence. Indirect trauma is generally in the form of excessive strain, and direct trauma in the form of a blow. The direct or indirect trauma may so injure and devitalize the muscle fibers that rupture may be postponed until a similar injury or even the slightest strain causes complete rupture, as in one of the cases to be reported here.

When caused by indirect trauma, the ruptures are most commonly found at the musculotendinous junction, but in direct trauma they may occur directly through the belly of the muscle. The tears may be simple or multiple.

Bowers and Richards (*1*) cite eight cases of rectus muscle strain, with hematoma formation, at Camp Chaffee. Of these eight cases, only one was correctly diagnosed prior to admission, four were diagnosed as acute appendicitis, one as a possible ruptured viscus, and the other two patients were admitted without a diagnosis. The most frequent age of these patients was between 21 and 33 years. Four of their patients were injured by scaling a 7-foot obstacle wall. Treatment was nonoperative, consisting of bed rest and of heat to the affected muscle, together with sedation.

Culbertson (*2*) collected 41 cases in women, in which no fewer than 12 had been diagnosed as ovarian cyst and ectopic gestation. In only 3 of the 41 cases was hematoma recognized before operation, while in 2 it was suspected. This lesion may occur in women due to systemic disease and to pregnancy.

Maydl (*3*) as early as 1882, reported 14 cases of ruptured rectus abdominis muscle. McKim (*4*) in 1937 reported 1 case of ruptured rectus abdominis muscle as the result of a blow to the abdomen. Bulfamonte (*5*) in 1941 reported 2 cases, one in a man as the result of a severe strain, and one in a woman who had slipped and fallen to the floor. Robertson (*6*) in 1937 reported 1 case in an elderly patient in whom the left rectus abdominis muscle was ruptured by the effort of getting out of bed.

The diagnosis of ruptured rectus abdominis muscle with hematoma can be established from an anatomic understanding of the condition. The rectus abdominis is composed of two long, flat muscles, which extend the entire length of the anterior surface of the abdomen and are separated by the linea alba. The muscle is crossed transversely by three fibrous bands (the tendinous inscriptions). The superior band is at the extremity of the xiphoid process. The inferior one is opposite or just below the umbilicus, and the middle one is midway between these two. For this reason hemorrhage between these tendinous inscriptions will be limited to a great extent by them, as in many cases they course through the muscle substance and are always attached to the anterior rectus sheath.

The muscle itself is enclosed in a sheath formed by the aponeuroses of the external and internal oblique and transversalis. The internal oblique divides into two lamellae, one of which blends with the external oblique to form the anterior rectus sheath; the other blends with the transversalis to form the posterior rectus sheath. These join again at the medial border of the rectus and are inserted into the linea alba. This posterior sheath is present from the costal margin to midway between the

umbilicus and symphysis pubis, where the posterior wall of the sheath ends in a curved margin, the linea semicircularis. Below this level the aponeuroses of all three muscles pass in front of the rectus.

From a consideration of this known anatomy (the absence of a posterior rectus sheath in this area), it can readily be understood that a rupture or strain with hemorrhage, hematoma, or abscess may simulate an intra-abdominal tumor, whereas a lesion higher in the muscle will be limited to the sheath.

CASE REPORTS

Case 1.—This patient, 34 years old, hurt his right side while exercising on an overhead ladder during an authorized class of physical education. He developed a sharp, severe pain in the lower right side, but did not report to a medical officer. The pain persisted for approximately 72 hours, during which time the patient was nauseated but did not vomit.

One week later this man again injured himself and reported to the sickbay, complaining of severe pain in the lower right side of the abdomen. He gave a history of sudden severe pain, occurring when he attempted to scale a 7-foot wall on the obstacle course.

The patient's temperature on admission was normal, the leukocyte count was 18,950 and the differential count showed 52 percent polymorphonuclear leukocytes, 44 percent lymphocytes, 2 percent monocytes, and 2 percent eosinophils. The urine was normal. Physical examination disclosed a visible tumor mass on the right side, which was very tender, and the lower right portion of the abdomen was spastic. The neoplasm was 12 cm. in its long axis and 8 cm. wide and appeared to be confined to the rectus muscle sheath. Rectal examination failed to reveal the mass.

The patient was admitted to the hospital with a diagnosis of ruptured rectus muscle with hematoma. He was operated upon 2 hours after admission, using spinal anesthesia. A right pararectus incision was made, the anterior rectus sheath was seen to be dark and there was blood beneath it. The sheath was opened and the muscle was found to be ruptured transversely through two-thirds of its substance. The ends were frayed, discolored, and edematous, and a large clot was located posteriorly, displacing the transversalis fascia and peritoneum inward.

These tissues were hemorrhagic and boggy but were not perforated. The clot was removed and free bleeding from the torn muscle was controlled by approximating the muscle ends with mattress sutures of chromic catgut. The inferior epigastric vessel was seen to be intact and the free bleeding was from its intramuscular branches.

A rubber tissue drain was inserted, together with 2 gm. of sulfanilamide and the abdomen was closed. The patient had a fever of 101° to 102° F. for 72 hours. Since then his convalescence has been uneventful, and he left the hospital on the twelfth postoperative day.

Cases 2 and 3.—The next two cases seen were also due to indirect violence. One injury had been sustained by severe strain while the patient was chinning on a bar and the other while the patient was scaling the 7-foot wall on the obstacle course. Neither of these patients was operated upon. The first of these

cases was that of a 19-year-old boy who experienced severe pain in the lower left portion of the abdomen while he was chinning himself. The pain persisted, and he reported to sickbay the following day but was not admitted until 48 hours later, at which time he had marked tenderness and muscle rigidity over the lower portion of the left rectus abdominis muscle. The temperature on admission was 99° F., the leukocyte count 10,450, and the differential count within normal range.

The second of these patients, a man 31 years old, also injured himself scaling the 7-foot wall and reported to sickbay immediately after experiencing severe pain in the lower right portion of the abdomen. On admission the temperature was normal, the white blood cell count 10,250, and the differential count within normal range. On examination the area over the lower portion of his right rectus muscle was very spastic and tender.

Neither of these patients was nauseated, nor did they vomit. They were both treated conservatively with bed rest and application of an ice bag, and their convalescence was uneventful.

CONCLUSIONS

1. Strain and rupture of the rectus abdominis muscle is not uncommon in younger persons who participate in strenuous activities.

2. It is not uncommon in elderly people with systemic disease.

3. Rupture with hemorrhage, hematoma, or abscess formation may simulate an intra-abdominal tumor.

4. The diagnosis should be made after taking a careful history and with a thorough knowledge of the anatomy involved.

5. If tenderness and spasm are the only physical findings, the treatment should be conservative. If a tumor is found, surgical intervention is indicated.

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THE PLIGHT OF THE ULCER PATIENT IN MILITARY SERVICE

STUDY OF 306 ENLISTED PERSONNEL WITH DUODENAL ULCER

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A study of the available statistics dealing with the incidence of peptic ulcer indicates that well over 10 percent of all adult males have or have had an ulcer. The number of men in the armed forces who fall into this group is large, and no military unit can expect to remain free of the problem. With the marked increase in the military forces, this disease presents a huge potential source of men noneffective for combat service.

It has been said (*1*) that "only a certain type of individual will produce an ulcer." There is no question but that the similarity of personality pattern is quite evident; however, we must recognize multiple etiologic factors even though the psychosomatic relationship does appear striking.

The differences between the life cycle, clinical characteristics. and treatment of gastric and duodenal ulcer are well known. This study concerns patients entering the hospital with peptic ulcer, and, since the incidence of gastric ulcer was so low, deals almost exclusively with the problems of diagnosis, education, treatment, and disposition of duodenal ulcer.

INCIDENCE

Much has been written regarding the increase in peptic ulcer in military forces since the beginning of the war; that this is more apparent than real has been brought out by several writers. In speaking of the Royal Navy, Wade (*2*) states, "the expansion of the service and the inclusion of personnel from prewar civilian population account for any apparent increase in the incidence." Where sick call is available each day, and methods of investigation are at hand, the true incidence of this disease will assert itself.

This report covers a 12-month period at the U. S. Naval Hospital, Oakland, California, during which the hospital was growing rapidly. There were 14,989 admissions to the hospital, 928 of

which were studied thoroughly by the gastro-enterology department; of these, 631 were found to be strictly medical gastro-intestinal problems. A study of the records revealed an additional 37 patients who were discharged from the hospital with medical gastro-intestinal disease but who had not been seen on the gastro-intestinal service. Thus the majority of these patients came under the supervision of one department. They were enlisted men of the Navy and Marine Corps. Of the 631 patients, 317 (50 percent) were found to have duodenal ulcer. Eleven of these patients were transferred to other hospitals before all studies were completed and are excluded from this series. This study, therefore, deals with 306 patients upon whom a definite diagnosis of duodenal ulcer was made.

One hundred ninety-nine (65 percent) of the patients entered the hospital from foreign stations or ships; one hundred seven (35 percent) came from local stations. Enlisted men of the Navy made up 82.4 percent of this group, and the remainder were enlisted men of the Marine Corps.

Seventy-two percent of the enlisted Navy personnel were rated individuals; 13 percent had specialist ratings, and the remainder were equally divided between above- and below-deck ratings. Sixteen percent of those in the Marine Corps were rated sergeant or above. This series included one WAVE. No Negroes with duodenal ulcer were encountered, but this fact is of no significance as there were few colored patients in the hospital during that period; since this study was completed the diagnosis of duodenal ulcer has been made on two Negro patients.

The average age for onset of ulcer symptoms was 25.7 years. This is considerably earlier than the figure of 30 to 35 years as found by Bockus.

Approximately one-third gave a family history suggestive of ulcer. Body build was most often of the sthenic type; however one-third possessed an asthenic habitus, and there were sufficient numbers of hypersthenic individuals to upset any correlation of ulcer with body build. Physical examinations were essentially negative, except for the presence of a spastic, tender sigmoid in almost every patient and a mild superficial epigastric tenderness. Paradental infection was found in some, especially in the older patients. There was a surprisingly low incidence of vitamin deficiency states as denoted by objective clinical changes. Weight loss had been present in many, but on arrival at the hospital most of these patients were at or above their enlistment weights.

Gastric analyses revealed normal acids in a high percentage of the patients; the average was 30 units of free acid and 50 units

of total acid. Although the value of doing this procedure on all patients has been questioned, we feel it has been of some value (*3*) (*4*) (*5*) (*6*) (*7*). At the time of disposition of these patients we were not conscious that the results of gastric analyses were influencing us in any way in the final evaluation of the patients' ability to resume duty in the service. However in reviewing the individual records for this study, it was found that almost without exception those with readings of over 80 units were surveyed from the service.

The psychiatric aspects were uniform. Rorschach and Minnesota Polyphasic Personality Tests were run on a group of these men. Although the results were similar in all patients, the sample was not sufficiently large to be significant. This composite patient was of good, if not above average, intelligence. He was patriotic, ambitious, honest and alert. He often felt that his abilities were not being properly utilized. Resentment and insecurity were often present.

The majority of these patients were aware of the correlation between their digestive symptoms and nervous tension. The common complaint on entrance, however, was of greasy food or field rations. Some felt that the inability to have fresh milk had been the causative factor. Not one wondered why his fellows living under the same conditions were able to continue their duties without digestive disturbance.

Many of these men had been through the Guadalcanal campaign and its concomitant hardships. Many were survivors and had been in the water for hours and on rafts for days, or had endured comparable hardships. Very few had been wounded or suffered external violence. They suffered from a disability which was not externally visible, and they appeared therefore to be on the defensive. This was in sharp contrast to the patients with wounds. In the latter patients there was visible justification for their hospitalization. And the malaria and filariasis patients arrived in such large groups that their very numbers seemed to give them a sense of confidence.

CRITERIA FOR DIAGNOSIS

The presence of an active duodenal ulcer was determined by:

1. A recent history of a characteristic type of pain, punctual in its timing, and relieved by food, vomiting or adequate antacid therapy. Periodic exacerbations were searched for in the history and frequently found.

2. A history of recent perforation and closure of a duodenal ulcer.

3. The presence of an ulcer crater as demonstrated by x-ray examination, and the finding of free hydrochloric acid in the gastric content.

4. The finding of a duodenal deformity by x-ray study. In this type of case, it is important that gallbladder disease be excluded, that the patient's complaint be compatible with duodenal ulcer, and that free hydrochloric acid be present in the gastric content.

During the period of study these patients received a dental survey, gastro-intestinal x-ray examination, gastric analysis, and oral cholecystographic study. Stools were examined for parasites on all patients who had had overseas service, and routine blood, urine and serologic studies were made. The stools were examined for occult blood after 3 days on a meat-free diet and these were repeated until they became negative. Care was taken to examine the stool specimen for parasites before administration of gallbladder dye, barium, or liquid petrolatum.

In addition to the ordinary test meal, a standard technic for gastric analysis was established and utilized on all of these patients. On the morning following entrance, breakfast was withheld and 100 cc. of 7-percent alcohol was administered. Aspirations were done at the end of 15- and 30-minute periods. If no free acid was demonstrated with Töpfer's reagent, the patient was given 0.25 cc. of 1:1,000 histamine solution subcutaneously and aspirations were again done at 15- and 30-minute intervals. Hospital corpsmen performed this test quite expertly after a little practice. Determinations of the titer were made in the central laboratory.

MEDICAL THERAPY

Individual therapy tempered with practicability was the goal. In some cases a very strict regime over an 18-day period was necessary, but these cases were few and were found only after failure on the regular regime. The patient was placed at bed rest on entrance and given a moderately bland diet of 6 feedings daily interspersed with aluminum hydroxide gel. Antispasmodics, sedatives, and vitamins were administered. The minimum stay in the hospital was 6 weeks. During the first 3 weeks the patient was maintained at bed rest and was allowed up the last 3 weeks. Rest periods in the afternoon were established. There were many patients who exceeded the 6-weeks' hospitalization because of delay in survey reports and assignments. Those who were returned directly to duty were discharged at this time.

Patients with recent gross hemorrhage were placed on a feeding regime. After gross blood had disappeared from the stools,

the regular regime was started and diagnostic studies were delayed until occult blood had been absent in stool examinations for a period of 10 days.

A most pleasing response was found on group discussions. Instruction was given on the medical, surgical and psychosomatic aspects of peptic ulcer. Voluntary response on the part of the patient was noted at all meetings. The men seemed anxious to contribute their personal observations and experiences. Many questions brought forth were answered by the patients themselves. No one man felt that the discussion was aimed at his own personal problem. To have a burly, tough Marine tell the group that he would become so tense at times that he would burst into tears gave the listeners a feeling of adequacy and confidence. The attitude and cooperation of the patients improved in direct proportion to the number of discussion periods. These were held twice weekly during the first 6 months of this study but only sporadically during the last 6 months. Reduction in the number of medical officers per patient necessitated restriction in this part of the program.

Each patient on discharge from the hospital was informed that although x-ray showed a disappearance of this ulcer, it was not healed. He was given to understand that therapy must be maintained for 1 year. Whether he was returning to duty or civil life, he was given a booklet containing a diet list, instruction in the use of medicines, and the date of beginning and completion of treatment.

Patients returning to duty were instructed to choose their diet from the general mess and not to expect special diets. Medicines were to be obtained from the medical officer. Communications have been received from many of these men stating that excellent cooperation has been obtained and that they are well. Other patients have been returned to this hospital on first reporting for duty, because the medical officer felt that no patient with ulcer should remain in the service.

SURGICAL THERAPY

Surgical approach has been almost entirely confined to correction of postoperative surgical complications. A double gastro-enterostomy had been performed on one man prior to enlistment. He was found to have a jejunal ulcer and this was resected. Three patients had had gastro-enterostomies done elsewhere in the service; one had developed a jejuno-colic fistula, and subtotal gastric resection was done. Two patients had had subtotal gastric resections elsewhere and were discharged from the service because of

continued symptoms. Malignancy could not be excluded in one patient with an ulcer in the pyloric canal; biopsy revealed a benign peptic ulcer and a pyloroplasty was done.

Primary surgical measures on duodenal ulcer have been confined to those cases in which it was strictly indicated. In only 3 patients who had not had previous gastric surgery was surgical procedure used. Two subtotal gastric resections and one pyloroplasty were performed. It was agreed that surgical measures on young males with duodenal ulcer are rarely warranted. Surgery serves in most cases only to prolong the period of disability. This, however, does not hold for patients with ulcer in the older age groups.

COMPLICATIONS

The history of malaria was common, but the condition was rarely activated here. In only two instances was filariasis detected. Intestinal parasites were found often. These included amebas of all types, hookworm, giardia, trichuris, and strongyloides. Before the patients were discharged from the hospital these organisms were eliminated. No complication of antiparasitic therapy was encountered.

Anxiety states were present in most patients in varying degrees but tended to disappear rapidly under hospital treatment. Persistence of nervous tension was often a factor in the discharge of the patient from the service.

Pylorospasm with continued secretion and night distress was frequent in patients entering from local activities. This usually subsided after 2 or 3 days. In three cases intermittent suction and aluminum hydroxide drip was necessary to overcome spasm and gastric dilatation. By the end of the first week, in most cases by the third day, ulcer distress had disappeared. Colonic irritability was frequent, and it was necessary to instruct these patients in the differentiation of its symptoms from those of ulcer.

Gastroscopic examinations were done on a few patients who failed to respond quickly to treatment. Inflammation was sought for, but no correlation was found between this factor and failure to respond to treatment. In a sample group of 20 patients with duodenal ulcer no evidence of gastritis was found, except in those who had symptoms of gastric retention; in such cases a diffuse reddening was present which disappeared on ulcer therapy. Four patients with duodenal ulcer had associated gastric ulcers.

Although several patients entered with the history and clinical evidence of recent gross hemorrhage, none had gross bleeding during hospitalization here.

No perforations occurred in patients undergoing treatment for ulcer, but during this period there were two perforations in the hospital in patients undergoing treatment for other diseases. Two men in this series gave a history of perforation with surgical closure prior to enlistment. Two patients suffered perforations while in the South Pacific and one while on shipboard. Although they had been recorded as cases of perforated gastric ulcer, examination here revealed the presence of a duodenal ulcer.

DOES MILITARY SERVICE PRODUCE PEPTIC ULCER?

To answer this question, these patients will be divided into two main groups as follows:

1. *Cases existing prior to enlistment.*—Patients had a previous history of digestive distress characterized by typical, localized upper abdominal pain, punctual in timing. In many, x-ray findings had previously been positive. The patient would state that the recent distress was exactly similar to that suffered before enlistment. It was found that if these patients were not questioned soon after arrival, many would conceal all previous history in an attempt to get into a pensionable status. In several instances the patient returned after several days and gave his correct history.

One hundred ninety-four (63 percent) of the patients in this group had suffered from duodenal ulcer prior to enlistment. Their average age was 31 years, with 90 percent below the age of 43 years. Their total average service was 15 months, 12 days, and without exception this was the first entry on the sick list for digestive symptoms of ulcer nature. The shortest length of service was 63 days. The average age for onset of ulcer symptoms was 24 years, 6 months, or approximately six years prior to enlistment. Ulcer symptoms were present in most patients during the same year as enlistment.

Sixty-seven percent of these patients were admitted from foreign stations, and their average length of service was 17 months, 3 days. Most of these men had been on the sick list for from 30 to 60 days by the time they arrived on the mainland. At the time of arrival they were usually symptomless, even though they had had little or no treatment on the return trip.

The remainder of the group (33 percent) had seen only local duty; the average length of service of this group was 11 months, 9 days.

It is evident, therefore, that two of every three ulcer patients in this series had or may have had duodenal ulcer before enlistment. Most of these had never had adequate, prolonged therapy.

If they had been placed on a treatment regime they would follow it sporadically as symptoms occurred. It is evident, also, that the greater portion of these men were in combat duty during a very active period in the Pacific. Their ulcer symptoms were abating or had disappeared on arrival, and ulcer craters had begun to fill in or had disappeared. The duration of service of these men was equal to, or slightly greater than that of those who remained in the continental limits. To us this appears significant.

2. *Cases not existing prior to enlistment.*—One hundred twelve (37 percent) of the patients gave no history of ulcer symptoms prior to enlistment. Many had had previous digestive symptoms but these were not diagnostic. The average age of this group was 31 years, with 90 percent being below the age of 41 years. The average age at onset of ulcer symptoms was 26 years, 10 months. The average length of service was 6 years, 10 months.

Sixty-two percent of this group entered from ships or foreign stations. Most of them had seen the same type of service as the other group. The average length of service was 6 years, 1 month.

Thirty-eight percent entered from local activities and had an average service of 7 years, 7 months. Some of these men had been in the Navy for as long as 20 years. Others were new to the service, but the greater number had been in the Navy or Marine Corps previous to the present war. For some it was not the first admittance for ulcer symptoms. However patients were included who had not been on the sick list for from 2 to 4 years.

The similarity in the two groups as to age of onset is striking. The story is the same whether in military or civil life. Although factors provocative of ulcer symptoms and ulcer production are present in military life, they are no different than are the factors in civil life so far as they affect this age group of young males. Exacerbations and remissions are to be expected. One must grant that foreign service on the average presents many more problems than domestic service. Yet these patients were able to remain on active duty, a portion of which was abroad, as well or better than those within the continental limits of the United States.

It is concluded that there is no evidence to support the fact that military service, as such, is conducive to duodenal ulcer, but rather that ulcer is concurrent with military service. These findings agree with those of Wade in his study of dyspepsia in the Royal Navy (*2*).

DISPOSITION OF PATIENTS

Correlating the patients' Navy ratings, their length of service, nervous stability, willingness to cooperate, and the desire to re-

main in the service, as well as the duration of the ulcer and lack of complications, provided a measuring device which aided in determining the disposition of these men. Disposition could be determined rather early in the treatment. During the first half of this study practically all patients having ulcer prior to enlistment were discharged from the service.

When the manpower shortage became more acute, men who were suited for limited duty were retained. Rated men were retained when it was felt that they had a fairly good chance of remaining on a duty status after hospitalization.

Thirty-eight patients were transferred to other hospitals and their ultimate disposition is not known; twenty-three of these had had ulcer prior to enlistment and fifteen after entering the service.

One hundred twenty-four (40.5 percent) were discharged from the service. Of these, one hundred eleven had had ulcer prior to enlistment and in thirteen the ulcer occurred after enlistment. Of forty patients returned to general duty, in five the condition existed prior to enlistment and in thirty-five it was incident to service.

One hundred four patients were returned to limited duty within the continental limits of the United States. Of these, fifty-five had had ulcer prior to enlistment and in forty-nine the condition was incurred in the line of duty. Two patients included in this study were members of the Mexican Navy and were returned to their ships following therapy.

Thus we see that nearly 50 percent of the patients were discharged from the service. Most of these men had ulcer symptoms prior to entering the service. A large group was given limited duty. Many of these patients desired to remain in the service even though they knew that their chances for promotion were practically nil. A small number were returned to general duty.

Fifteen patients who had been discharged from the hospital were returned one or more times following their original discharge. Eight of these returned from general duty status. In the opinion of the medical officers with whom they had contact they were not fit for general duty. In some cases request for survey accompanied the patient.

Seven of the patients were returned from limited duty status soon after discharge from this hospital. How many were sent to other hospitals is problematic. These patients had been without complaint at the time of leaving the hospital, but their ulcers were not completely healed. It is not difficult to understand how the excitement associated with travel, new station, and change of duty might serve to produce in this type of man a digestive dis-

turbance that would require treatment. His greatest need, however, is for a sympathetic, understanding medical officer. Another factor is the tendency for some of these patients to utilize the diagnosis of duodenal ulcer to gain a more desirable type of duty.

COMMENT

The opportunity afforded of observing closely 306 men who had duodenal ulcer has disclosed certain factors of interest. Foremost has been the striking similarity with which these patients approach their everyday problems. It is an emotional approach far outweighing the problem at hand. These emotions are not outwardly displayed, unless severe, but appear to be diverted to the digestive tract with resultant hypersecretion, spasm, and ulceration. The typical patient is likable, intelligent, and ambitious. If the world about him is not satisfactory at all times, and his nature rebels at this, digestive symptoms will occur. These can be controlled by medication and understanding.

It is difficult to realize the great frequency of this disease. Even in this series the large number of patients entering with tropical diseases served to mask the true frequency of duodenal ulcer.

Today duodenal ulcer is a disease of mild nature and its complications are very infrequent. It is rather easily controlled, and if the patient is willing, he can be useful and productive. To discharge or label as unfit for promotion seems hardly fair to the man who displays a willingness and ability to maintain himself on active duty. In order to retain such an individual he must be treated under a well organized plan that includes educational factors. Prolonged hospitalization is unwise. If judged able to perform limited duty, the patient must be handled carefully. Medicines should be provided in amounts sufficient for treatment by the week. And the patient should be helped to maintain his confidence and sense of security.

SUMMARY AND CONCLUSIONS

1. A study was made of 306 enlisted men of the U. S. Navy and U. S. Marine Corps who had duodenal ulcer.

2. Two out of three of these patients had the disease prior to enlistment.

3. There is no evidence to justify the belief that military service is conducive to the production of ulcer.

4. Ulcer today is usually a disease of mild nature and few complications, and is easily brought under control.

5. Many of these patients are capable of doing regular duty

and the majority should be retained in the service in a limited duty status.

6. Those returned to a duty status must be handled with understanding and have the cooperation of their local medical activity in carrying through the curative and prophylactic regime which was instituted during the period of hospitalization.

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COMPATIBILITY AND BLOOD GROUPS

In speaking of compatibility and blood groups, it must be assumed that the plasma contains two agglutinins (a and b), and that the erythrocytes contain two corresponding agglutinogens (A and B). The blood type depends on the agglutinogen.

Some have been misled in thinking that as long as the donor and recipient are of the same blood grouping (O, A, B, AB) a compatibility exists which is sufficient to avoid transfusion reactions with whole blood. Such a generality is not the case with transfusions of whole blood, and more specific methods of compatibility must be employed.—TURNER, O. E.: Investigation of transfusion reactions. Pennsylvania M. J. 47: 1071-1076, August 1944.

VITAMINS ESSENTIAL IN NUTRITION

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This is not a clinical study; it is merely a review of some of the recent articles in the literature. Emphasis is placed upon those vitamins essential in human nutrition.

Nutrition as a science is new. Not many years have passed since our concept of adequate nutrition has changed from one of sufficient calories to one of calories, protein, fats, carbohydrates, minerals, and vitamins. As the science evolved, it necessarily became more complex.

The most recent addition to the science of nutrition has been the discovery and the study of those accessory food substances called vitamins. First the obvious marked deficiencies were described and treated successfully. Later, as our knowledge of these substances increased, it was realized that not only single deficiencies existed, but that usually there were inadequate quantities of several of the vitamins. Advanced cases of vitamin deficiencies are easily diagnosed, but the symptoms arising early in the development of a deficiency are neither marked nor pathognomonic.

In general, deficiencies arise in one of four ways: (1) Inadequate intake; (2) inadequate absorption; (3) inadequate utilization; and (4) increased demand.

Numerous factors lead to the development of inadequate intake of vitamins. Among these are poor food (qualitatively and quantitatively); poor dietary habits; faddism; gastro-intestinal diseases which lead to anorexia, pain, nausea, and vomiting; inadequate therapeutic diets; food allergy; and mental disorders. These factors are usually obvious in any carefully taken history.

Inadequate absorption of vitamins is brought about in many ways; for example by diarrhea, gastro-intestinal fistula, the steatorrheas, indiscriminate use of alkalies, and achlorhydria. After the vitamins have been ingested in adequate quantities and absorbed properly, they must be utilized. Utilization of vitamins is often interfered with in liver disease, chronic alcoholism, and diabetes mellitus. Increased demand for vitamins is present in increased physical activity, fever, hyperthyroidism, and in pregnancy and lactation. Many of the above factors, dietary, functional

or organic, may be combined to produce a vitamin deficiency.

The recommended values of various vitamins for a man weighing 70 kilograms on a diet of 3,000 calories are listed in the following table prepared by the Food and Nutrition Board of the National Research Council.[1]

Recommended values for 70-kilogram man on a 3,000-calory diet

Vitamin	Quantity
A	5,000 U.S.P. units
B_1	1.8 mg.
C	75 mg.
Riboflavin	2.7 mg.
Nicotinic acid	18 mg.
D	400 to 800 U.S.P. units for children. No recommended value for adults.

Early vitamin deficiencies are much more difficult to diagnose than are advanced deficiency states. Mild deficiency states are diagnosed on the basis of the following criteria:

1. History of a grossly inadequate diet.

2. Presence of symptoms. The symptoms often resemble those associated with neurasthenia, as lassitude, fatigue, anorexia, weakness and nervousness. In addition, symptoms and signs usually associated with specific advanced deficiencies are occasionally found.

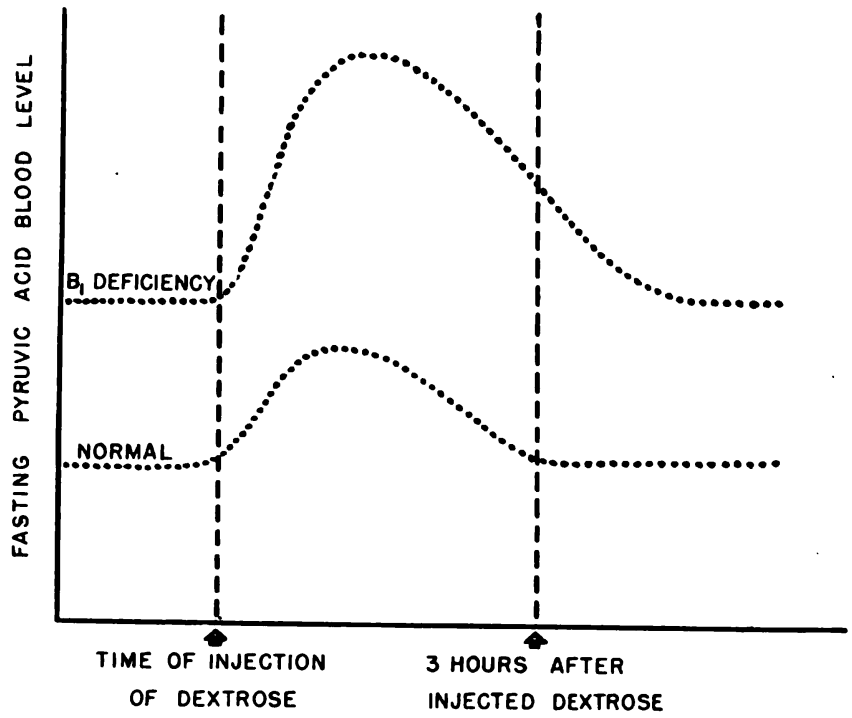
3. Presence of certain signs which may be indicative of early vitamin deficiencies. Mackie[2] describes the roentgenographic findings of delayed gastric emptying, reduced motility of the small intestine and increase in caliber of the jejunal loops as probably indicative of vitamin deficiency. Microscopic examination of a few cases demonstrated smooth-muscle degeneration of varying degree and va uolization of the submucosal and mesenteric plexuses.

4. Chemical quantitative evaluation of vitamin deficiencies. This is uncertain in most cases. The tests are difficult and are not too well standardized, and the results obtained are frequently of doubtful significance.

5. Actual administration of the vitamins. Adequate quantities of a preparation containing all the vitamins known to be of importance in human nutrition should be given. If the deficiency is in the water-soluble vitamins (largely the B complex), improvement should be apparent in 10 to 12 days. If the deficiency is in the oil-

[1] Proper use of vitamins in mixtures. J.A.M.A. 119: 948-949, July 18, 1942.

[2] MACKIE, T. T.: Vitamin deficiencies and small intestine. J.A.M.A. 117: 910-912, September 13, 1941.



soluble vitamins (mainly A, D, and K), improvement should be evident in at least 3 weeks. If no improvement occurs within these specified times, it is unlikely that a deficiency in the accessory food substances is accountable for the symptoms.

VITAMIN B_1

Physiology.—There is good evidence that thiamine has an important role in metabolism, probably as a constituent of an enzyme. When a definite deficiency of B_1 exists, the fasting blood level of pyruvic acid is higher than normal, and following the injection of dextrose the pyruvic acid blood level rises higher and returns to the fasting level more slowly than it does in a normal individual. Represented graphically a condition such as the above might be found.

Increase in the metabolic rate causes an increase in the demand for thiamine. With increased metabolic rate there is an increase in chemical activity and, therefore, activity of the enzyme systems. Consequently as the enzymes are used more rapidly, thiamine is needed in larger quantities.

Thiamine is excreted in the urine. Very little of it exists in the blood except as cocarboxylase in the red blood cells. In leukemia, Hodgkin's disease, and gastro-intestinal carcinoma, larger quantities than normally present may sometimes be detected in the blood.

Pathology of thiamine deficiency.—The presence of adequate amounts of thiamine seems necessary for the continued health of

the nervous system, both central and peripheral. In long-continued, severe thiamine deficiencies, extensive myelin degeneration may occur in the peripheral nerves and in the posterior columns. These are the pathologic findings in severe polyneuritis.

Clinical syndromes recognized as thiamine deficiencies.—Those clinical syndromes, clear-cut in nature, which seem to arise from thiamine deficiency are (1) beriberi, (2) thiamine polyneuritis, and (3) Wernicke's syndrome. A neurasthenia type of syndrome has also been described as arising from an early thiamine deficiency.

Thiamine polyneuritis in general is bilaterally symmetrical and involves first and mainly the lower extremities. Beriberi is an advanced stage of thiamine polyneuritis with cardiac failure often superimposed. A sense of heaviness and weakness in the legs, paresthesias, hyperesthesias, hypoesthesias, areas of anesthesia, foot drop, aching and burning, and tenderness along the nerve trunks are present. Also present is anorexia, which may be of a very severe grade.

RIBOFLAVIN (B_2, G)

Physiology.—Riboflavin, like thiamine, has an important role in enzyme systems. There is evidence that it is important in the utilization of glucose, and of lactic and d-amino acids. It is excreted in the urine.

Clinical syndromes recognized as riboflavin deficiency.—Numerous lesions are now recognized as aribоflavinous. The structures involved are (1) eyes, (2) skin, and (3) mucous membranes. The eye symptoms and signs consist of burning, lacrimation, photophobia, and a vascularizing keratitis. The skin findings are fissures at the angles of the mouth and seborrheic lesions in the nasolabial folds. The mucous membrane lesion is a glossitis (magenta tongue).

NIACIN (NICOTINIC ACID)

Physiology.—Like thiamine and riboflavin, niacin forms part of a co-enzyme in one of the important oxidation-reduction enzyme systems of the body.

Niacin is excreted as trigonelline, nicotinuric acid, and niacin. In niacin deficiency, the nicotinic acid level is low in the urine.

Pathology.—Pellagra is a syndrome which arises from niacin deficiency. It is manifested by skin, mucous membrane and nervous system changes. The skin changes are erythema, pigmentation, desquamation, acanthosis and parakeratosis. The mucous membrane alterations are similar pathologically to those of the

skin. Loss of ganglion cells of the central nervous system results after years of deficiency.

Clinical syndromes resulting from a deficiency of niacin.—When the diet is deficient in niacin, pellagra appears. It is characterized by the three "d's"—dermatitis, diarrhea, and dementia. The mental symptoms appearing in pellagra may simulate those of any organic reaction psychosis, such as memory defects, disorientation, confusion, and confabulation. The shorter the duration of the psychosis, the better the improvement upon treatment.

Jolliffe[3] described a syndrome he termed nicotinic acid deficiency encephalopathy. This is characterized by (1) sucking and gasping reflexes, (2) changing cogwheel rigidities, and (3) progressive clouding of consciousness. This syndrome, he claims, is associated also with senility, chronic alcoholism, and cirrhosis of the liver, and may be complicated by cerebral arteriosclerosis.

As in thiamine deficiency states, a syndrome simulating neurasthenia is said to appear in early niacin deficiency.

VITAMIN C

Physiology and pathology.—How cevitamic (ascorbic) acid plays its well known role in normal physiology is a moot question. Vitamin C, like many of the other vitamins, has a role in the enzyme systems of the body. It is related to an enzyme system which has a function in the oxidation of aromatic amino acids in the growing human organism. Vitamin C has an important role in the production of the intercellular connective tissue fibrils. Delayed wound healing necessarily results when collagen fails to form. Some investigators state that ascorbic acid must be completely absent from the blood and its component parts before delayed healing occurs.

A decrease in the vitamin C store of the body results in a lowered rate of osteoblastic activity. Large quantities of vitamin C are found in the pituitary and adrenal glands and in the intestinal wall. Infections, rheumatic fever, tuberculosis, pregnancy and lactation apparently increase the requirements of vitamin C.

Clinical syndrome produced by cevitamic acid deficiency.—Scurvy is the direct result of complete depletion of vitamin C from the tissues of the body.

VITAMIN A

Physiology.—Vitamin A is derived from carotene. Beta carotene gives rise to two molecules, while alpha and gamma carotene each

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[3] JOLLIFFE, N.: Treatment of neuropsychiatric disorders with vitamins. J.A.M.A. 117: 1496-1500, November 1, 1944.

are productive of only one molecule. Its primary functions seem to be two in number: (1) Maintenance of the health of epithelial structures, and (2) as an enzyme necessary in the photosensitive processes in the retina. Another function has been ascribed to the vitamin—the control of bone growth by aiding in the regulation of osteoblastic and osteoclastic activity.

Bile salts must be present to have efficient absorption; after being absorbed vitamin A is stored in the liver.

Pathology.—Vitamin A deficiency induces keratotic changes in the epithelial cells. The cornea becomes thickened, dry, wrinkled, and later ulcerated and infected. Hyperkeratotic patches occur in the skin. Squamous metaplasia occurs in the columnar epithelium lining the ducts of the pancreas, the bronchi, and other hollow viscera, but the basal layer is preserved. Long bones do not grow as rapidly in A deficiency as they do normally. Dark adaptation becomes prolonged.

Clinical syndromes.—The clinical syndromes of vitamin A deficiency are xerophthalmia and keratomalacia, and occasionally night blindness.

VITAMIN D

Physiology.—A large number of different substances possess antirachitic properties, probably most important among which is irradiated ergosterol (calciferol). This is probably the only vitamin which is endogenously produced in the human organism, from a provitamin D substance, probably cholesterol, and upon ultraviolet irradiation vitamin D is synthesized in the skin.

Like the other vitamins which are fat-soluble (A and K), bile salts are essential for absorption of vitamin D.

It is suggested that vitamin D acts by increasing the rate of tubular absorption of the phosphates in the kidneys. Thus when improper resorption of phosphates occurs in a normal kidney in a D-deficient person, an alteration of the normal calcium and phosphate relationship occurs, causing the excretion of excessive quantities of calcium and phosphorus. It is suggested that in refractory rickets, damaged renal tubules are present. Apparently vitamin D has a role in the rate of absorption of calcium and phosphorus by bones, as rachitic bones more readily give up and less readily absorb calcium and phosphorus than do normal bones.

Pathology.—The clinical syndrome produced by vitamin D deficiency are rickets and osteomalacia. In both of these there is an enlargement of the parathyroid glands. In rickets there is a deficient calcification at the epiphyseal lines. As a result the bones are weak, bend easily under stress, and are subject to pathologic

fractures and aberrant growth. In osteomalacia, the parallel disease in adults, the bones become soft through decalcification. In both of these diseases, the phosphatase activity of the blood is increased.

VITAMIN K

Physiology.—Menadione (vitamin K) is another fat-soluble vitamin which requires bile salts for its efficient absorption. Its primary function is its action in the liver in producing prothrombin, thus preventing hemorrhagic disease due to a prothrombin deficiency. An adequate maternal diet does not necessarily prevent hemorrhagic disease in the fetus. However administration of vitamin K shortly before delivery prevents the development of hemorrhagic disease to a large extent. It has been suggested that it is an oxidation-reduction catalyst.

Pathology.—The direct effect of K deficiency is prolongation of prothrombin time. In serious liver disease and in spite of adequate K administration and absorption, the prothombin time may still remain prolonged.

OTHER VITAMINS

Numerous other vitamins, such as vitamin E; para-aminobenzoic acid, the chromotrichial factor; pantothenic acid; pyridoxine (B_6); biotin; vitamin L; and vitamin P have been described. To the present time, there is no conclusive evidence that these are important in human nutrition.

SUMMARY

Many vitamins have been described but only the following are now known to be important in human nutrition: Thiamine, riboflavin, niacin, cevitamic acid, vitamin A, vitamin D, and menadione. Vitamin deficiencies arise in one of several ways: Inadequate intake, absorption or utilization, and increased demand, or through any combination of these. Vitamin deficiencies are usually multiple; the symptoms of early deficiency may simulate the psychiatric syndrome of neurasthenia. The results of therapy of early deficiencies are necessarily difficult to evaluate. Single isolated advanced deficiency states are marked by relatively distinctive syndromes. Most of the vitamins seem to form important constituents of enzyme systems. The relationship of their activities in the enzyme systems to the symptoms arising from a deficiency of the vitamin is problematical. Estimation of the degree of deficiency by chemic or biochemic means awaits further evaluation.

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EFFECTS OF TROPICAL HEAT ON METABOLISM

Whereas vasomotor adaptation to hot environments is usually complete after 3 to 5 days of exposure, all studies have tended to indicate that metabolic acclimatization takes place much more slowly. It begins late in the second week of continuous exposure and is largely accomplished by the end of the third week. New studies have shown that the heightened need for thiamine and choline continues even when the diets contain 0.5-percent sulfaguanidine; hence heat depression of intestinal synthesis cannot account for the findings.—MILLS, C. A.: Metabolic acclimatization to tropical heat. Proc. Cen. Soc. Clin. Research 17: 12-13, 1944.

GASTRO-INTESTINAL TRACT DISTURBANCES

FUNCTIONAL DISTURBANCES ON A PSYCHOGENIC BASIS

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With a rapidly expanding Navy and the problems inherent in recruiting, drafting, and inducting civilians into Naval life, it is not surprising that there should be a large increase in the number of patients with gastro-intestinal tract disturbances. What is surprising is the disproportionately large percentage of these patients, particularly those with functional derangement of secretion or motility (the dyspeptics), whose ailments are on a psychogenic basis. Peptic ulcer and gastritis might be included in this group, as they too are often caused by, or result from prolonged emotional tension. Case histories show that many "dyspeptics" and ulcer patients had their symptoms prior to enlistment.

There has been a tremendous number of "sick days" resulting from peptic ulcer, pseudo-ulcer, gastritis, dyspepsia, pylorospasm, irritable colon, and the like, and an increasingly large number of the patients are being separated from the service. It would seem wise to give this group of patients more attention in an effort to maintain as many of them as possible in a full duty status. In order to accomplish this, a greater understanding of psychogenic personality, and environmental factors must be attempted. It is entirely within the realm of possibility to achieve complete, or at least sufficient, therapeutic success in many such cases by psychotherapy, readjustment, and rehabilitation. With this in mind, it seems pertinent to review some of the mechanisms that operate to disable such a large number of officer and enlisted personnel.

This discussion will be primarily concerned with those conditions in which no demonstrable organic changes can be demonstrated, that is pseudo-ulcer, flatulence, pyrosis, pylorospasm, irritable colon, and the like. These truly functional disturbances may occur in conjunction with, or as an integral part of, a psychoneurosis, or they may occur in patients whose histories show no evidence of neurotic trend.

In the former group, while the mechanism of disturbed physiology is truly functional (psychogenic), it is conditioned by an underlying personality defect—the psychoneurosis. In the latter

group, the symptoms, which are on a functional basis and of psychogenic origin, are produced in a man previously physically and mentally normal. The distinction between the two groups is an important one, and has been well discussed by Harrison (*1*).

We are all familiar with physiologic reactions to emotions such as embarrassment (blushing), anticipation or fear (palpitation, urinary frequency, tenseness), and surprise or sudden fright (diarrhea), and we know that some people normally react more strongly to emotions than others. It is not difficult to understand how a prolonged state of emotional tension in some people can cause a prolongation of these physiologic reactions (adrenergic or cholinergic) to the extent that the resulting symptoms become distressing or disabling. The prognosis in this group is relatively good with proper psychotherapy, reassurance, rest, readjustment or rehabilitation, and it is to this group that our main efforts should be directed.

In the first group, one can expect to find various types of psychoneuroses, constitutional psychopathies of emotional instability or inadequate personality types, or psychotics. The prognosis in this group would seem to be poor, from the point of view of recovery and return to full duty status. The symptoms disappear soon after entry to the hospital, only to recur when the men return to their ships.

In the last 5 years, there has been a great increase in the study of psychosomatic problems, and with the application of the psycho-analytic technic to such conditions as peptic ulcer, mucous colitis, rumination, asthma, essential hypertension, and arthritis, there is no longer any doubt that a great many such conditions have a psychogenic basis. The development of the individual in childhood, his environmental conditions, relations to parents and siblings, and attitude toward religion and sex are matters of great importance in molding personality and character. Investigation along these lines may reveal interesting facts which could explain the patient's peculiar attitude toward something causing an unrecognized conflict.

Emotions that cannot be expressed outwardly through normal channels are likely to become the source of excessive energy, which centered in the hypothalamic area, overflows on the nuclei of the autonomic nervous system, thus giving rise to abnormal physiologic states. A state of nervous tension may rise in a normal (non-neurotic) person as a result of conscious conflict that apparently cannot be solved. Thus a man whose pride prevents him from outwardly revealing his hatred for his petty officer, develops nausea, heartburn, and headaches as a result of the nervous tension his predicament creates.

The nature of military life has imposed a considerable burden on enlisted men to which they must adjust. Many are away from home for the first time and have to fight homesickness; many cannot adjust easily to the change in living conditions; many find the food different from what they have been accustomed to and will blame this for their stomach complaints; many worry about financial matters at home; many find themselves in unhappy or intolerable circumstances from which escape seems impossible; and there are countless other situations that give rise to prolonged, unrelieved emotions of resentment, hatred, sadness, anxiety, hostility or fear.

When symptoms develop as a failure to adjust, it is the duty of the medical officer to help the patient understand the mechanism by which his symptoms are produced, not merely to tell him "there is nothing wrong with you; go back and stop 'gold bricking'." A great many of these patients, those previously not neurotic, will be freed of symptoms by careful history taking, interest in the patient, consideration for his problems, and by helping him to change or improve the situation which is causing his abnormal emotional tension.

In the neurotic or constitutional psychopathic states there is most likely a fundamental character defect that makes adjustment more difficult, and nervous tension develops with greater facility. In this group the element of fear is probably a greater factor, either consciously or unconsciously, in the creation of nervous tension. Fear is a normal emotion, but it is likely that abnormal fear occurs only in neurotics or psychopaths who cannot adjust to it.

From observations on patients, I do not believe that malingering from fear occurs in non-neurotic individuals. Similarly I do not believe malingering should be applied to true neurotics or psychopaths whose symptoms derive from the emotions associated with anxiety or abnormal, uncontrolled fear, because the very nature of their personality defect makes the fear uncontrollable, and thus they cannot help themselves. As Alvarez (*2*) points out in regard to these people, "Self-reformation can never be easy if only because a tired, defective, or unruly brain must be asked to discipline a tired, defective, or unruly brain." In this group, the treatment is more difficult, requires more time, and is often unsuccessful.

In the psychogenesis of symptoms, it is of tremendous importance to evaluate and understand the personality of each patient. The instinctive drives, behavior patterns, temperament and emotional content and character type (*3*) are factors that

have a great bearing on the way a man reacts to a new situation. Such things as a strong pride, a highly moral sense, overconscientiousness, or rigidity of thought may cause a dilemma for one man in a situation that would not phase another. And if symptoms develop as a result of tension created, he should not be labeled neurotic.

For example, a married man with a strong sex drive who will refrain from extramarital relations while away from his wife, because of a strong moral and religious code, might develop nervous tension with resulting "nervousness," anorexia, nausea, and fullness. Because the laboratory tests and x-rays show no pathosis, we must not tell this man there is nothing wrong with him, because there is; nor must we tell him he is neurotic, because he is not. We must help him understand through studying his personality, and with a minimum of psychotherapy he can be restored to full efficiency. There are hundreds of dyspeptics, in whom the psychogenic factor is as simple as in this last example, and we must recognize them and help them back to duty.

PATHOGENESIS

Disturbed physiology.—Functional conditions such as pseudoulcer, pylorospasm, pyrosis, nausea, flatulence, and irritable colon may occur frequently in individuals who are seemingly calm, though usually they occur in people who admit they are nervous or "high strung." Peptic ulcer and gastritis may result from prolonged psychogenic stimuli, and these stimuli seem to be localized in the region of the hypothalamus.

Cushing (*4*) in observations on peptic ulcer occurring in individuals with brain lesions, particularly those lesions near the hypothalamus, believed there must be a parasympathetic center in that area, and he produced characteristic vagal effects (hypermotility, hypersecretion, hypertonus, retching and vomiting) by direct electrical stimulation of the tuber cinereum. The same effects occurred following the intraventricular injection of pituitrin or pilocarpine, showing that this center was susceptible to the stimulus of the secretion of the nearby hypophysis. Alpers (*5*) cites cases in which stimulation of the hypothalamus in humans produced mania, euphoria, and other personality changes.

In the pathogenesis of functional disturbances it is only natural to seek the means by which emotions can act on the autonomic nervous system. Grinker (*6*) and Ingram (*7*) have reviewed the evidence that there are controlling nuclei for the sympathetic and parasympathetic nervous systems in the hypothalamus, and that these centers are not only under the controlling influence of the

hypothalamus, but also of the hypophysis and cortex. Stimulation of the hypothalamic region will cause various sympathetic or parasympathetic responses which will disappear when the vagus or sympathetic nerves are cut. It is postulated that the tonus of the two branches of the autonomic nervous system is regulated in this area and it is not difficult to understand how emotional tension can affect either one or the other separately or both systems simultaneously.

Hall and his coworkers (*8*) and Manning et al. (*9*) have shown unequivocally that prolonged stimulation of the vagus nerve in unanesthetized dogs causes salivation, retching, vomiting, diarrhea, and later on, hematemesis and melena. Autopsy examination of these dogs showed the gastric mucosa to be markedly engorged and considerable blood to be present throughout the lumen of the gastro-intestinal tract. These effects could be prevented by atropine and greatly accentuated by eserine. In fact, peptic ulceration resulted following the stimulation after eserine was given. They showed also that these effects were due to the liberation of acetylcholine.

Wolf and Wolff (*10*) have made somewhat similar observations on the human stomach. In their beautifully controlled experiments on a man with a large gastrostomy, they demonstrated the vagal and sympathetic changes in the stomach induced by various emotions, vestibular stimulation, prostigmine, atropine, and epinephrine. They found that the emotional tension associated with anxiety, resentment, hostility and guilt commonly exerted a parasympatheticomimetic effect, namely, increased gastric tonus, hyperemia, increased motility and secretion of hydrochloric acid. Prolongation of the stimulus caused the mucosa to become markedly injected, with engorgement of the rugae, which became friable and more susceptible to minor trauma.

This same picture was described by Banting and his associates in autopsied dogs following prolonged vagal stimulation, and it is very similar to the picture of hypertrophic gastritis as described by the gastroscopists. Abdominal discomfort and pain was common when the stomach was markedly engorged and hyperactive. The emotional tension resulting from sudden fright, sadness, or discouragement activated sympatheticomimetic responses, such as were also obtained by cold water vestibular stimulation (sympathetic) and epinephrine. These were anorexia and nausea, pallor of the mucous membrane, decreased tonus and motility and decreased hydrochloric acid secretion.

It should be emphasized that in these experiments of Wolf and Wolff the longer the gastric mucosa remained hyperemic, hyper-

active, and engorged (as a result of prolonged emotional tension), the more friable the rugae became, and minor trauma produced small hemorrhages and erosions. In addition the threshold of pain sensitivity was lowered. Contact of gastric acid with an erosion caused an increase in the secretion of hydrochloric acid, and if the normally protective mucus was kept off the erosion, a typical ulcer developed. In the normal stomach, mucus is highly protective, but in a constantly hyperactive stomach with repeated minor trauma (rough or irritating foods, alcohol, drugs) this normal protection may become less efficient, with resultant erosions leading to gastritis or peptic ulceration.

The implications of the experiments and observations cited leave no doubt that psychogenic stimuli can cause disturbed function through the sympathetic or parasympathetic nerves. Disturbed function leads to faulty cellular metabolism, which leads to cellular changes, which in turn lead to structural changes. Such a sequence of events can occur not only in the formation of peptic ulcer, but also in the development of essential hypertension, asthma, arthritis, neurodermatitis, possibly ulcerative colitis, thyrotoxicosis, and Raynaud's disease.

Symptomatology.—It has been pointed out that anorexia and nausea can be caused by sympathetic stimulation, and that vagal stimulation is followed by retching, vomiting, abdominal discomfort, and diarrhea. These vagal symptoms were accompanied by objective changes in the stomach, hyperemia, hypertonus, hypermotility, and hyperacidity. These things in themselves cause additional symptoms, such as the dull gnawing type of pain from spasm (similar to hunger pain), burning pain of the engorged, irritable mucosa, "sour stomach," heartburn, and "gas." Such symptoms are also frequently found in the hypertonic gallbladder and are associated with hyperacidity and spasm of the sphincter of Oddi (*16*), all a result of automatic imbalance.

It has been shown by Jones (*12*) that heartburn is due to temporary spasm of the cardiac end of the esophagus, whether from direct irritation or reflexly from lower down in the stomach or intestinal tract. Hyperacidity is probably the most frequent cause. Dysphagia and cardiospasm are conditions resulting from autonomic imbalance at the lower end of the esophagus, whether from overactivity of one system or inhibition of the other.

Patients frequently notice difficulty in swallowing after emotional upsets, which is a somatic expression of the difficulty of mentally "swallowing" a life situation. The sensation of fullness frequently occurs in these nervous people with hyperactive, rapidly emptying stomachs. This is due to the rapid filling and dis-

tention of the duodenum, or sometimes to functional inhibition of gastric tonus and motility. Persons with these changes feel "bloated" and soon find that belching relieves the distress.

The so-called spastic colon with constipation, cramps, and mucous stools is now recognized as parasympathetic overactivity. This has been suggested by White and Jones (*13*) who produced the typical sigmoidoscopic picture in normal students by repeated administration of mecholyl (acetyl-β-methylcholine chloride), a parasympathetic stimulant. The occurrence of this condition in nervous, tense individuals is now well recognized, and the psychoanalytic case studies in 60 cases of "mucous colitis" by White and his associates (*3*) leave little doubt of the functional nature and psychic cause of this condition.

Many nervous individuals have a great many of the symptoms described, so that at one time or another they are thought to have peptic ulcer, gallbladder disease, gastritis, appendicitis, or irritable colon (mucous colitis). These are the chronic dyspeptics. Annis (*14*) has recently reported that roughly 40 percent of 276 dyspeptic soldiers (with normal x-ray findings) had gastroscopic pictures of some form of gastritis. Of the 109 cases, 52 showed hypertrophic, 13 atrophic, and 44 superficial gastritis. Ruffin and Brown (*15*) gastroscoped 100 patients with gastric neuroses (functional symptoms), and found a normal mucosa in 63; hemorrhagic or pigment spots in 25; atrophy of the mucosa in 9; hypertrophy of the mucosa in 2; and 1 instance of erosions. They felt that pigment and hemorrhagic spots were due to local trauma, a fact that Wolf and Wolff showed to be true. This would give a nonpathologic mucosa of 88 percent.

The hypertrophy of the gastric mucosa occurring in dogs after vagal stimulation (*9*), and in man following induced emotions (*10*), is strikingly similar to the picture usually described as hypertrophic gastritis as seen through the gastroscope. It is postulated, therefore, that what the gastroscopists frequently report as hypertrophic gastritis is really nothing but the abnormal hypertonic, hypersensitive, and hyperemic, engorged mucosa of excessive parasympathetic activity. This is borne out in cases in which roentgenograms show hypertrophic rugae, and gastroscopy shows normal findings, or in those cases in which one day the gastroscopic appearance is that of hypertrophic gastritis, whereas on another day the gastric mucosa appears normal.

Experience here with gastroscopy in dyspeptic patients is more in line with the findings of Ruffin. It is possible that the large number of Annis' cases could be due to including those with temporary engorgement, or that undue importance was attached to

superficial changes such as hemorrhagic or pigment spots. In none of Ruffin's cases could the gastroscopic picture be correlated with the severity of symptoms, and he concluded that gastritis is rare in gastric neuroses.

Although gastritis is not a common sequela to gastric hyperacidity, it undoubtedly does occur in patients in whom there is prolonged nervous tension. When minor trauma in the form of condiments, coarse foods, alcohol, drugs, nicotine, bacteria, etc., is frequent, psychogenic stimuli may condition the stomach for the development of chronic hypertrophic gastritis. If it occurs in as many as 10 percent of gastric neuroses, it is important.

Not all functional symptoms are of psychogenic origin. Some result purely from bad habits, dietary indiscretion, mechanical factors, and autonomic reflexes. Constipation is a bad habit and is particularly common and troublesome on shipboard. Overeating and eating too rapidly or at odd times are factors of great importance in the production of dyspepsia, and are often not recognized. A proper dietary and symptom history will greatly aid in the diagnosis of both psychogenic and nonpsychogenic functional symptoms.

TREATMENT AND DISPOSITION

It is not the purpose of this paper to discuss or evaluate the various therapeutic regimens advocated for gastro-intestinal disturbances. One has recently been advocated as suitable for Naval hospitals (*11*). What is particularly pertinent to this discussion is the psychotherapeutic approach to these cases and the proper handling or disposition of them.

Hospitalization with proper treatment will almost always result in relief of symptoms in patients suffering from functional disturbances. Return to duty will frequently be accompanied by return of symptoms.

The following plan is suggested:

1. Organization of a gastro-intestinal service on which all the medical officers follow the same plan for treatment and disposition. Consistency is essential.

2. Complete diagnostic study of all patients is necessary to ascertain whether any pathologic condition is present and also to reassure the patient.

3. A personality study should be undertaken to some extent in all cases in which the symptoms are considered to be of functional origin. In this connection, it would be extremely beneficial to have the cooperation of a neuropsychiatrist. A simple life history of the patient with emphasis on the present situation will often

reveal some simple problem that can be remedied by readjustment, reassurance, and insight.

4. Constitutional psychopaths should be transferred to the neuropsychiatric service for medical survey, as they will never be useful to the Navy and will only bounce back again in some other hospital. A good many functional disturbances of digestion occur in psychopaths, and the Naval medical officer should not spend much time trying to "cure" or readjust these patients. It is, therefore, important to recognize them and separate them from the service.

5. Limited psychotherapy should be attempted in all cases of non-neurotic functional disturbances, and unpleasant situations should be corrected whenever possible.

This may require the aid of the patient's division officer, executive officer, or chaplain. For example, if a man's distaste for his duty is expressed in dyspeptic symptoms, a change of duty will be accompanied by relief of symptoms. One of the commonest problems encountered is the man who had no stomach trouble in his first 5 to 6 years in the Navy while on board a large ship, but a change to destroyers brings a multitude of complaints. Allocation of such men to duty compatible with their health should be possible.

6. Extended psychotherapy in true neurotics should be limited to selected cases and then carried out by the neuropsychiatrists. In general, it would be wise to survey from the service those men who have had only a few months of service, and those having a profound psychoneurotic disturbance. In milder cases the patients may be given a trial of duty and if there is a recurrence of symptoms, survey would then be advisable.

7. Patients having proved ulcers should be surveyed out of the Navy or to limited duty. There is no place on a ship for an ulcer patient.

A logical sequel of this plan would be the establishment of an advisory board of gastro-enterologists whose functions would be: (1) To establish policies for handling various types of patients so that these policies may be consistent from one hospital to another; (2) to correlate the results of treatment from one hospital to another; and (3) to determine the effectiveness of both treatment and disposition policies. There is such a tremendous wealth of material for clinical study that such a board could make exceedingly valuable contributions, not only to the Navy but also to the field of gastro-enterology.

In the field of psychosomatic medicine, a relatively new field, there are great opportunities for the gastro-enterologist who is

willing to devote time and interest to the functional disturbances of the digestive tract. Such an advisory board as suggested could be particularly useful in guiding and correlating treatment in this field.

The real effectiveness of psychotherapy will only be known after analysis of many cases, with follow-up studies which would be possible only through a fluid advisory board having access to the records of many hospitals. The information obtained would be of value in recruiting, treatment, policies regarding disposition, and, in the last analysis would result in a more effective manpower with fewer sick days and an accompanying decrease in cost to the government.

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POLYVINYL ALCOHOLS AS BLOOD SUBSTITUTES

The polyvinyl alcohols are a series of water-soluble colloids produced commercially in a number of grades. Each grade is a mixture of various sized macromolecules, the product of polymerization to various degrees, and the properties vary with the average molecule size.

Polyvinyl alcohol RH623 is a suitable colloid for a plasma substitute. Its essential physical properties closely resemble those of the plasma proteins, and it appears innocuous to the recipient. In tests of its effectiveness after acute hemorrhage in dogs, it maintained the blood pressure as well as did similar blood transfusions. It is lost from the blood stream in dogs at about the same rate as the plasma proteins regenerate. It did not appear antigenic.

Certain inherent disadvantages are: They do not promote wound healing, or act as foodstuffs, as a protein might. They do not contribute to hemostasis by clotting; large amounts would be expected to impede clotting, by diluting the fibrinogen. Their nonprotein nature is also an advantage, however, in lessening the likelihood of anaphylactic reactions. They obviously do not provide antibodies and erythrocytes, and hence are valueless in anemias and in infections, except to improve the peripheral circulation.

If limited to its proper field of usefulness, however, this type of polyvinyl alcohol would appear very desirable as a first treatment for hemorrhage or shock, assuming that hemostasis can be obtained or that direct bleeding is not a prominent feature. Its small cost, relative ease of preparation, and stability in storage, would permit keeping it available for emergency use, in amounts larger than can be economically kept in a blood or plasma bank. —ROOME, N. W.; RUTTLE, L.; WILLIAMS, L.; and SMITH, W.: Polyvinyl alcohols as blood substitutes. Canad. M. A. J. 51: 293–299, October 1944.

GROUP THERAPY OF PSYCHIATRIC WAR CASUALTIES

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In a previous report[1] in the BULLETIN a program for the rehabilitation of psychiatric war casualties returning to this country from overseas has been presented. It is our purpose in this article to deal more specifically with the results of this program as applied in a Naval convalescent hospital within the United States. For the first 3 months of its operation, this hospital received only psychiatric war casualties.

From the beginning, group therapy was employed as the cornerstone of the rehabilitation effort. By group therapy is meant not only group psychotherapy, but also group therapy of various types, with emphasis on work, recreation, and athletics. An effort was made to foster a spirit of competition and interest. It was found that the best results could be secured by granting rewards and privileges to those who showed a satisfactory performance of work assigned, and evidence of interest and cooperation in the athletic and recreational program, as well as in the group psychotherapy discussions. It is believed that group psychotherapy played an important role in coordinating the entire program, although in the individual patient it was often difficult to determine exactly which part of the program was most significant in producing improvement or recovery.

Within the first 3 months after the commissioning of this hospital the group therapy program had been applied to 200 neuropsychiatric war casualties. Detailed records were kept on each patient. An example of the history and examination record used is presented on page 550. We deemed it important to have a detailed record concerning the patient's symptoms, and made an effort to secure uniform information from all patients.

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[1] DYNES, J. B.; HAMILTON, F. J.; and COHEN, R. A.: Program for rehabilitation of psychiatric war casualties. U. S. Nav. M. Bull. 43: 628-633, October 1944.

HISTORY AND EXAMINATION

1. Name..... Rate..... Final Diagnosis.....
2. Date of enlistment..... Date of admission.....
3. Referring hospital..... Transfer diagnosis.....
4. Age..... Civil status..... Schooling.....
   Occupation..... Religion.....
5. *Family history.*
6. *Personal history.*
7. *Present illness*.....In combat or operations.....
   Dates ..... Symptoms.....
   Date of onset..... Unconscious.....
   Duration..... Dazed by blast.....Bleeding.....
   Headache..... Anorexia..... Amnesia.....
   Hysterical sensory..... Dizziness.....
   Weight loss..... Delirium..... Hysterical motor.....
   Palpitation..... Malaria..... Fainting.....
   Delusions..... Depression..... Dysentery.....
   Convulsions..... Hallucinations..... Fatigue.....
   Other diseases..... Crying.....
   Visual disturbances..... Nervousness.....
   Wounds..... Apathy..... Irritability.....
   Vomiting..... Indigestion..... Insomnia.....
   Climatic sensitivity..... Jumpy..... Suicidal.....
   Night terrors..... Vitamin deficiencies.....
   Diarrhea..... Constipation..... Panic reactions.....
   Alcoholic intolerance.....Sphincter loss.....
   Tremors..... Sweating..... Difficulty thinking.....
   Did you have confidence in your officers?.....
   Did you have confidence in your shipmates?.....
   What is the cause of your trouble?
8. *Physical* and neurologic examination.
   Pulse..... B. P..... Weight on admission..... On discharge.....
9. *Psychiatric.*
   Appearance and behavior..... Stream of talk.....
   Mood..... "How do you feel?".....
   Preoccupation..... fears, obsessions, delusions, hallucinations, etc.
   Memory..... Intelligence.....
   Insight, judgment, willingness to help himself.....
10. Patient's statement on leaving the hospital.....
    "How do you feel now?".....
11. Course..... Improved..... Unimproved..... Worse.....
12. Disposition..... Full duty..... Limited duty..... Discharge.....
13. *Summary.*

The patients usually arrived in drafts of from 20 to 50 men. On the original examination we attempted to screen out those patients who could not be adequately treated at a convalescent hospital. Within the next few days a detailed history was taken and a physical and psychiatric examination was recorded. In this intro-

ductory period the psychiatrist became acquainted with his patients, and the patient's history as already recorded was supplemented. From this preliminary examination it could be determined whether or not the patient might benefit from group therapy. No one was excluded from the program of work, recreation and athletic activities.

Very few were excluded from the group psychotherapy meetings, as we learned from experience that although the fixed symptoms of certain patients could not be altered, it was worthwhile to give each man an opportunity to express himself and obtain an outlet for his long-smoldering resentments. Rarely was a patient found whose attitude and behavior was definitely disturbing or had a harmful influence on the group. If such individuals failed to respond within the first week or two at the hospital, they were brought before a board of medical survey and recommendations were made to separate them from the service. They were segregated as much as possible from other men who were making a satisfactory adjustment to the program of group therapy.

The patients were organized into groups of from 10 to 20 men and a hospital corpsman was assigned to each group as a leader. It was the corpsman's responsibility to keep a record on each man in his group. This record was known as a progress chart. Each patient was rated daily on mental attitude, cooperation, initiative, appetite, sleep, work, activity, conduct on liberty, and reaction to group psychotherapy. Rating marks were from 1 to 5 (very poor, poor, fair, good, excellent).

An effort was made to stimulate competition and rivalry between these groups, particularly in regard to athletic and recreational activities. The progress chart gave information not readily available to the psychiatrist. The interest and capability of the corpsman was put to the test, and as would be expected, certain groups had much better supervision than others. It is believed that this system is of valuable assistance to the psychiatrist in any rehabilitation program.

Every patient who was physically able was required to perform light work about the hospital and grounds. Each man was assigned a certain job each morning and worked between the hours of 0900 and 1100. If the patient was, or claimed he was, unable to perform these minor tasks assigned to him, he was not granted certain privileges nor was he allowed evening liberty. This same principle applied to the patient's willingness to take part in athletic and recreational activities.

At 1330 all patients were mustered on the playing field (which incidentally had been built by the patients). No one was forced

to take up any specific sport, but we did insist that each man who was physically able choose one out of a variety (soft-ball, golf, tennis, swimming, touch football, horse shoe pitching, badminton, volley ball, croquet, or the cheering section at the ball game). Soft-ball teams were organized among patients, and exchange games were played with an Army unit near by or with the hospital corpsmen. It is believed that many patients were helped to a better adjustment and recovery who might have taken little spontaneous interest in these group activities.

The maintenance of military discipline was of definite value in this convalescent hospital. Rules and regulations were accepted if they were issued as orders. The psychiatrist has more complete control over the therapeutic environment in a military convalescent hospital than does the psychiatrist in civilian practice.

During the first 3 summer months that the hospital was in operation we had very little to offer the patients, and no recreational officer had been assigned. The National Park naturalists gave evening lectures accompanied by movies and lantern demonstrations. These talks were always enjoyed by the patients who attended. In addition groups of 20 or 30 patients were taken on all-day hikes along well-worn trails in the mountains. These hikes were not suggested until the patient had been at the hospital a few weeks, and each patient who went on these hikes was a volunteer. A nationally known photographer aided in our program by conducting lectures and demonstrations on the subject of photography, as well as field trips for those interested.

There were no activities commonly known as occupational therapy (no basket weaving, rug making, wood carving, and the like). However we did attempt to keep each patient busy and occupied with some work (manual labor), athletic activity, or group recreation. It is our belief that the type of activity is not as important as insisting that each patient be kept busy and occupied. Offering some reward, as suggested earlier, helps to insure more active participation.

Group psychotherapy discussions were held each forenoon. As mentioned in the previous article, the group discussions were opened with a general talk on the purpose of these meetings. The group was told that we were more interested in returning men to health than to duty, for we believed that those who regained their mental equilibrium would be eager to serve their country. Each patient was assured that he would not be sent into combat again unless he was fully recovered from his nervous disorder, and he himself requested active duty. This reassurance, plus the fact that the patient was far from combat zones, undoubtedly aided in pro-

ducing an atmosphere favorable for rehabilitation. The advantage of not having a medical (psychiatric) discharge from the service was pointed out.

After experimenting with larger groups (up to 60 men) it was learned that the best results could be obtained with a group of from 15 to 25 men. In the opening talk we outlined what would be expected of patients sent to this particular convalescent hospital. The separation of patients into groups and the role each of them was expected to play in his own rehabilitation was explained. We emphasized the fact that each man was a patient in a convalescent hospital because of some nervous disorder, and assured them that improvement and recovery from their disabling nervous symptoms depended largely on their own cooperation.

The patients were encouraged to ask questions. It was pointed out to the group that as individuals they could again become effective members of society and even of the armed forces, and that none of them need ever accept veterans' aid, although undoubtedly they were entitled to it. They were encouraged to believe that their particular nervous reactions were not abnormal and therefore not to be feared, but only the natural result of fatigue and the tension under which they had fought. They were encouraged to face their problems and assured that if they cooperated in the program recovery was certain.

The second group psychotherapy meeting was devoted to asking each patient to state his nervous symptoms before the group. The psychiatrist who led the discussion included only patients whom he had examined personally and whose histories and backgrounds were known to him. This enabled the psychiatrist to elicit information from the shy and passive members. The individual patient was not embarrassed, and personal problems or secrets were not paraded before the group. This second group meeting formed the background for subsequent meetings, as it seemed to create a feeling within the patient that he was a member of a group, each patient knowing the troubles and nervous symptoms of every other one.

In subsequent meetings a variety of topics, mentioned in the previous article, was brought up for discussion. Discussions of such topics as nervousness, tension, startle reaction, fear, worry, anger, love, resentment, frustration, depression, fatigue, sex, sleep, dreams, and pain were carried on from day to day. Simple talks on physiology and anatomy seemed to hold attention and elicited many questions. Topics such as heart trouble, gastrointestinal disorders, headache, backache, weakness, and the influence of disease on the total personality were discussed.

The great majority of our patients came from combat and operational zones in the South Pacific. In 98 patients (49 percent) there was a history of emotional instability existing prior to enlistment. Table 1 illustrates the distribution in age groups.

TABLE 1.—*Distribution in ages*

Age	No. patients
17–20	36
21–30	107
31–40	40
41–50	16
51–60	1
Total	200

More than 50 percent of the patients were in their twenties and a relatively small percentage of the total was under 20 or over 40 years of age. No patients were sent here whose mental symptoms had not existed for 2 or more months. Table 2 shows the duration of symptoms at the time the patients were admitted to the convalescent hospital, and the number of patients in each grouping.

TABLE 2.—*Duration of symptoms when admitted to the convalescent hospital*

	2 mo.	3 mo.	4 mo.	5 mo.	6 mo.	7 mo.	8 mo.	9 mo.	10 mo.	1 yr.	Over 1 yr.
No. of cases	14	31	21	25	38	6	2	3	17	7	36
Percentage of total	7	15	10	12	19	3	1	1.5	8.5	3.5	18

Those patients whose symptoms had been present for more than a year had a history of nervous disorder prior to enlistment and subsequent exacerbation of their symptoms under combat or operational conditions. Almost all of those patients who were unimproved by the rehabilitation program fall within this group.

The generally held view that those psychiatric war casualties not given immediate treatment are likely to remain chronic nervous invalids is not borne out by our experience. The duration of symptoms did not appear to be of any definite significance unless it was associated with a history of nervous disorder existing prior to enlistment.

Approximately 50 percent of all the patients were returned to either limited or full duty, and 164 (82 percent of the total) were definitely improved when discharged from the convalescent hospital. Included were a number of patients who had long histories of nervous disorders existing prior to enlistment. Many of these patients displayed a better understanding and control over their

nervous disorder than they had previously experienced, and indicated their appreciation of the help received at the convalescent hospital. They had hopes and plans for the future and returned to their own homes with an attitude which was no longer hostile.

Thirty-six patients (18 percent) were unimproved. Almost all of this latter group gave a history of nervous disorder existing prior to enlistment. One hundred seventy had been exposed to combat or Naval operations at sea, and 32 had not been exposed to any unusual nervous stress, although they had had duty at advance or isolated bases.

Much has been written concerning the role of disease, climate, cerebral concussion, diet, and fatigue in the production of emotional disorders, and a new classification, "fatigue, combat or operational," has been added to the nomenclature. The analysis of this case material supports such a classification.

Out of a total of 200 patients, 146 (73 percent) had a definite history either of disease or some other exogenous factor which played either a minor or major role in the development of nervous symptoms. Only 54 patients had no histories of such factors contributing to or influencing the nervous symptoms. This is not considered unusual in view of the fact that a majority of the patients had seen action in the South Pacific. It is of interest that 60 patients had a history of cerebral concussion with unconsciousness. Fifty-three had had malaria, dengue, or dysentery. Ten had a recurrence of malaria while at the convalescent hospital.

The most frequent symptom was fatigue. It was manifested as loss of energy or weakness and was present in 113 patients. Anxiety, nervousness, and increased startle reaction occurred in 74 patients. It must be remembered that these figures represent the symptoms most frequently encountered 2 months or more (the majority over 6 months) after the onset of acute nervous symptoms. From an analysis of these patients as well as personal interviews with many more, it is concluded that the most frequent initial symptom in men who have been in combat or under the prolonged stress of Naval operations at sea is an increased startle reaction, usually associated with feelings of inner tension, anxiety, trembling, sweating, and palpitation.

Although insomnia was a very frequently observed early symptom, nightmares were not as frequently observed in the early stages as were anxiety and increased startle reaction. In this series insomnia and catastrophic nightmares were observed in only 39 patients, and of these only 50 percent had the nightmares. It would appear that in this series the catastrophic nightmare was only one mode of response, and was by no means characteris-

tic or pathognomonic of this group of psychiatric war casualties. This does not necessarily invalidate the claim of others that the catastrophic nightmare is of frequent occurrence in the traumatic neuroses, and may persist for many years. In our series, however, it was not a frequently observed symptom either in the early history of the disorder or months after the onset of symptoms.

Headache was a fairly frequent and distressing symptom, occurring in 51 cases. This is not unusual in view of the number of patients who had sustained cerebral concussion. Gastro-intestinal symptoms (indigestion, abdominal pain, nausea, vomiting, diarrhea, constipation, etc.) were present in 30 patients. Only two of these had an ulcer shown by x-ray examination, and in these patients the disabling symptoms upon admission were chiefly related to emotional instability. It may be of interest to mention incidentally that in this series constipation and obstipation occurred more often than did diarrhea or fecal incontinence following the intense emotional experiences of combat.

Eighteen patients gave a history of hysterical disorder (paralysis, blindness, aphonia, anesthesia, panic, amnesia). Only two, however, continued to display hysterical symptoms, although all continued to exhibit emotional instability. These patients are poor risks for active military duty and it is our opinion that they should never be returned to full combat duty, although certain patients in this group may be used effectively in limited duty ashore.

Twelve patients were classified as having borderline intelligence. The symptoms of this group were far from uniform, although the hysterical and mixed psychoneurotic symptoms predominated. The nervous disorders in 9 instances were diagnosed as constitutional psychopathic state. All of these patients had a long history of emotional instability or irresponsibility. Two patients in the series were epileptic and 5 were enuretic. Nine patients were considered to be psychotic (7 with depressive, suicidal trends and 2 with schizophrenic trends).

It was observed that mental depression was a fairly common symptom, being present in 21 cases. However, this symptom was considered of serious proportions in only 7 patients. Those presenting less serious depressive reactions almost invariably recovered during their stay at the convalescent hospital.

Although lack of confidence in officers or shipmates is important in the production of nervous symptoms, only a few patients were seen whose nervous disorders could be traced directly to such lack of confidence. These patients are usually quite vocal in their resentment and do exert a disturbing influence upon any group of psychiatric war casualties. Such patients may be helped, and in

certain instances they may gain insight into the origin of their nervous symptoms and be able to return to duty.

The average period of hospitalization at the convalescent hospital was 6 weeks. Certain patients who could not be adequately treated at the convalescent hospital were returned to the referring hospital within a few days. A very few patients were held for a period of 3 months awaiting disposition. In general we were able to judge fairly accurately, after a period of 2 weeks' hospitalization, the disposition in an individual case. Although certain patients who had recovered were able to act as aids for only a brief period, we are convinced that such an arrangement if properly handled may exert a powerful influence upon other patients. These patients demonstrate by their presence and behavior in the group that recovery is possible. They take part in the group discussions and testify that recovery is possible if the patient will cooperate fully.

Follow-up studies were attempted by asking each patient to send in a report on his health after 6 months and again after 1 year from the day he left the convalescent hospital. This has proved unsatisfactory, as only about 5 percent of our patients have written to us. However those who did send in a report had returned to duty and were symptom free and appreciative of the help given them at the convalescent hospital.

The results of this program for the rehabilitation of psychiatric war casualties appear significant. Group therapy has proved to be an effective method of handling large groups of psychiatric war casualties. Good results may be secured also by other methods, but it is believed, after using both individual and group therapy, that the latter is an adequate and a more effective method of treating this type of patient, and is well worth a trial in any hospital treating psychiatric war casualties.

A PSYCHOLOGIC STUDY OF DESERTION AND OVERLEAVE IN THE NAVY

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The purpose of this paper is an attempt to evaluate the psychologic factors underlying the offenses of absence over leave and absence without leave among Naval personnel. The material on which this study is based comprises enlisted men sent to the U. S. Naval Receiving Station Disciplinary Barracks, Hart's Island, New York, referred for summary or general court-martial action. As shown in a previous article in the BULLETIN (*1*) it may be said that in a sampling of our material, 71.3 percent were for A.O.L.; 23.3 percent for A.W.O.L.; and the remaining 5.4 percent involved shooting and involuntary manslaughter, breaking arrest, bribery, theft, infraction of regulations, and sex cases. Thus it can be seen that the former group of offenders constitutes an important source of interference with planned Naval activity because of the large number of man-days lost.

In order to estimate the presence and frequency of mental disease among these cases, each summary and general court-martial admission was given a psychiatric and psychologic screening examination. Table 11 from the article (*1*) previously referred to analyzes the sampling in terms of psychiatric diagnoses. Our findings in the sample studied indicate that psychiatrically sick individuals are in the minority. This group comprises the psychotic and pre-psychotic, psychopathic, mental defective, chronic alcoholic and psychoneurotic individuals. These men are not salvageable and are of no value to the highly specialized services of the Navy. If they are not screened out in induction stations, training stations, special schools, or Naval hospitals, they can and should be screened out in the disciplinary barracks. We are left, therefore, with a large group of psychiatrically well individuals who although "normal" exhibit personality difficulties or emotional

and behavior reactions that bring them before court-martial boards. Since these men are theoretically salvageable, our practical interest in saving man-days in the military service lies in this direction.

As an aid in understanding the motivation for misbehavior in the Navy, the reasons given by the men themselves for their misconduct were studied and contrasted with what could be learned of the inner emotional sources of their behavior. The former are listed as "surface reasons;" the latter as "psychologic formulations."

The rationalizations offered by the men themselves cover a wide range of reasons. The diversity of reasons for overleave is indicated in the following list of responses:

No reason.
I did not like my present duty.
Sickness in the family.
I got drunk.
Not enough leave—no leave.
Trouble at home.
I objected to restriction.
Wanted to visit family.
Became nervous on the job.
Do not like the Navy.
Didn't get proper medical care.
I was homesick.
I wanted to have some fun.
I wanted to see wife and baby.
I wanted to get married.
I got sick while on leave.
Couldn't get along with officers on ship.
I felt like staying over.
Seasickness.
Fear of the sea.
I overslept.
I didn't like the ship I was on.
Train was delayed.
Can't stand work on the ship.
Wanted foreign duty.
Requested sea duty.
Didn't like Navy regulations.
I am a homosexual.
Trouble with shipmates.
Thought they were trying to frame me.
No opportunity for advancement.
Mother kept me home—under age.
Afraid of combat.
I am best suited for civilian work.
I thought I wouldn't get caught.
Detained by civil police.
To see girl friend.
Can't keep away from girls.
Didn't want foreign shore duty.

Some rationalizations observed are patently neurotic reactions as seen in the complaint that the officers on a ship "looked scared" (a projected anxiety), or a fear of the monotony of the sea (insecurity). Others are immature aims, as a wish to be in the Pacific theater rather than the Atlantic theater or the reverse; the wish to have some fun, and the like. In spite of the apparent heterogeneity of the surface reasons, a closer scrutiny indicates that the basic psychologic formulations are not so widely divergent as might at first appear.

In examining the emotional dynamics of the situation at the time of the offenses of this psychiatrically "normal" group, we find a somewhat different alinement of motivations for "going over the hill." In the following groups the formulations were based

on a reconstruction, from case histories and examination, of the emotional situations underlying the offenses in the same sampling of cases.

PSYCHOLOGIC FORMULATIONS FOR ABSENCE OVER LEAVE.

1. Reactions based on emotional problems:
   a. Anxiety producing (hidden) antagonism toward authority and discipline.
   b. Reaction to passive dependency—"separation anxiety."
      Displaced reaction to emotional deprivation with infantile elements, including panic reaction to sea, to ship, to combat.
   c. Displaced frustration from marital and home problems.
   d. Aggravation of feelings of inferiority.
   e. Psychic invalidism (malingering) and hysterical conversion symptoms.
   f. Anxiety reactive to homosexual impulses.
2. Reactions based on personality attitudes:
   a. Emotional and social immaturity.
   b. Willful, negative attitude toward Navy.
   c. Egocentric, narcissistic character.
   d. Open expression of antagonism toward authority.
   e. Adolescent rebelliousness—good prognosis.
   f. Accidental.
   g. Negative.
   h. Unascertained and incomplete.

The question to be answered was, what were the driving forces, envisaged in terms of emotionally toned impulses, that were responsible for desertions among these "psychiatrically well" individuals. At the outset it appeared that, with a knowledge of the requirements of war, with months or years of association with strict Naval discipline, and with pride in the uniform and traditions of the service, only impulses related to strong emotions could impel so many men into the act of desertion. However, strong effective motivations have not always been found in this series of cases. Frequently the mere discrepancy between the values that the immature or egocentric individuals have and those of the service, was the basic force making for disciplinary breaches. Reactions of antagonism toward authority springing from conscious attitudes of defiance, based on immature social values as well as on deeper personal, perhaps unconscious, emotional reactions, proved almost as frequent. These two classes of motivation will later be discussed in detail.

In general we could subsume these reactions under attitudinal or emotional reactive headings. The general conclusions to be drawn from these psychologic formulations are that the basic difficulty in desertion and similar offenses lies in (1) the overt and behavioral reaction to anxiety induced by frustration of some sort, and (2) an anti-authoritarian attitude.

Reactions based on emotional problems.—Although the emotional dynamics underlying the several behavior reactions which eventuate in seamen going A.O.L. are clear in most cases, it is not easy to demonstrate clear-cut clinical pictures. Thus group 1 a, "anxiety producing antagonism toward authority and discipline," is allied to group 2 e, "adolescent rebelliousness—good prognosis," with the exception that the display of antagonism arouses guilt feelings and hence anxiety in the former. Group 1 b, "separation anxiety," represents an important complex of dynamic situations which proves to be the nuclear emotional problem of many of these individuals. Group 1 c comprises displaced neurotic reactions with every sort of variation, similar to those gathered under group 1 b.

In group 1 d, previously unnoticed inferiority feelings become aggravated to the point of clinical entities; they partake also of some of the elements of group 1 b, but have their own specific psychologic causes. Group 1 e, "psychic invalidism," likewise gave neurotic reactions in men who previously considered themselves well and who then showed subclinical entities. Here again the separation anxiety described under group 1 b was frequently a factor. Group 1 f, "anxiety reactive to homosexual impulses," is self explanatory.

The highly individualistic character of reactions should be emphasized. These are based on emotional problems which nevertheless have enough consistency of underlying psychopathosis to be recognizable. Hence we have chosen for description the outstanding type of psychopathologic process encountered which is best described as *separation anxiety.*

It is not intended to rename the condition which has been variously called war neurosis, war hysteria, or combat fatigue. The phrase "separation anxiety" merely denotes a well-defined group of anxiety manifestations having a common psychopathologic basis. In this sense separation anxiety is a symptom, not a new disease. English military psychiatrists (*2*) have been particularly impressed by the appearance of separation anxiety among their fighting men during and after battle. Like many psychologic symptoms in response to emotional trauma, separation anxiety may appear at some distance in time following the trauma. Thus separation anxiety was noted by men in training stations, on the battle front, in active combat and in some areas far from the scene of aggressive activity.

In this study we have encountered its symptoms as anxiety attacks which have on occasion been prolonged and which were sometimes expressed in psychosomatic symptoms. Headache and dizziness were predominating symptoms. The headache varied

in type, usually frontal or temporal, and was increased by activity or bending. Often history of a former head injury which was quiescent for several years is held by the enlisted man to account for the headache. Medication with analgesics provided no relief, nor did placebos help the complaint. "Black-out" spells, and fainting attacks, occurring especially at night, were frequent symptoms. Careful examinations never revealed organic neurologic signs; the attacks were not epileptic. The fainting was always associated with dizziness which did not respond to medication. Often these cases are considered instances of malingering because there are no obvious medical causes and no positive medical or laboratory findings. Clinically these cases often occur in men of slight physique whose symptoms might be considered by some as being those of a constitutional psychopathic state.

Another psychosomatic symptom is back pain which suggests sacro-iliac sprain. It may last weeks to months without any history of injury or any clinical signs of spondylitis. The backaches are associated with headache and have the same general characteristics. Cardiac neurosis and symptoms of gastric neurosis were not especially common in our series. Only an occasional case of palpitation was noted, although abdominal pain without organic basis or serious bowel dysfunction has been observed.

Enuresis and preoccupation with sexual problems were fairly frequent occurrences. These subjects often were enuretic on shipboard only after they had been on the sea for awhile. The sexual problems were more pressing. Worry about masturbation and a fear of being impelled to homosexual attacks on shipmates while in the disciplinary barracks were prominent. The subjects insisted on bringing it to the medical officer's attention as a symptom of their illness.

Another symptom was the wish to be alone, added to an intolerance to the noise incident to barrack or shipboard life. Frequently this intolerance took the form of extreme irritability, a wish to fight those about them. Some of the subjects felt they could not tolerate any noise, and were in a state of agitation after a night in the dormitory, even requesting solitary confinement.

A corollary of this irritability with shipmates is an impulse to destroy objects, or to become "wild" and belligerent, though this latter was not always expressed in actual physical combat. Frequently they indulged in fantasies of a boyish type directed against officers or shipmates, boasting about what they would do to them. These mutilating, destructive fantasies came and went at intervals during the day and especially at night and were complained of as annoying to the patient who experienced them. As might be

expected the irritability was associated with anxiety attacks, which were especially irritating at night and were combined with insomnia. Nightmares were very frequent, the dreams having an almost constant element of injury and destruction to self and others.

Our experience has shown that the dynamic situation behind this condition is the inability to be away from home. The insecurity developed by separation from home—which appears as anxiety symptoms—can be tolerated for awhile but soon overwhelms the subject. The anxiety can be considered as a sign of the degree of insecurity experienced by the ego. When the emotional implication of the fact of separation from home breaks past the ordinary conscious defenses, such as promise of adventure, novelty of sea duty, pride in the service, or competitive spirit with shipmates, feelings of insecurity and often anxiety or panic ensue. The subject "cannot stand" being away from home at a station or at sea. Regression results in that the subjects behave as if they could not live and carry out their service responsibilities. The symptoms can be considered as a conversion mechanism, whether they be psychosomatic complaints or regressive behavior patterns.

Thus the spectrum of symptoms ranges from anxiety to enuresis, from dizziness and headache to childish irritability which "prevents" the proper performance of their duties. Why there is an inability of the ego to withstand feelings of insecurity in the face of emotional deprivation is a highly individual matter which depends upon the emotional conditioning by the parents of the individual during his early years.

Cases of intolerance to separation from mother and home were rarely found to be uncomplicated. There was almost always added some fraction of hostility against a parent. This hostility, we have learned, is a defense against deep dependency needs which the ego cannot express freely. Frequently this hostility is transferred to the Navy and its officers, or to an indifferent object such as the sea, the individual claiming intolerance of the monotony of sea life. The presence of hostility links persons with separation anxiety with those whose behavior was featured by anti-authoritarian attitudes. Seasickness often is a mask for hidden hostility. An example of a dependent youth who showed marked separation anxiety with a moderate accompanying hostility reaction is illustrated in the following case:

CASE REPORTS

Case 1.—An 18-year-old seaman was in the Navy 5½ months before he went A.W.O.L. for 59 days. During his first 7 weeks at training camp he adjusted, but at a specialty school during the next month he became nervous,

unable to concentrate and fell down in his work markedly. While in transit with a draft of men to a port, his train passed through the railroad station of his home town, and he was seized by an impulse to get off the train.

While at home he felt more comfortable, and spent his time with his mother and with girl friends. He said that he went home to straighten things out because he knew he would be going to sea. Underlying this rationalization was a strong wish to be with his mother and to "settle things" with his father, i.e., ameliorate his guilt toward the latter. He spoke constantly of his wish to become engaged to a girl, so he could have some tie when he went to sea.

On first examination, the subject described an episode of neurotic confusion with nervousness and uneasy feelings during his period in the specialty school, ending with his impulsively jumping off the train before his draft had reported to the new station. The subject was restless and talked with an overcompensating sense of self-confidence which soon passed, revealing a dependent, insecure youth. He gave a history of rages over little things, directed at both parents. He fights frequently and usually loses. He states that he is a great worrier about details. He is intelligent and has an interest in mechanical things.

His mother was described as an overprotecting individual; his father was apparently a neurotic person with whom the subject was constantly at odds over petty matters.

The subject was an only child. Both parents tried, one in an indulgent way and the other behind a screen of rivalry (father), to fashion his life. The interplay between father and son appeared to be due to the unconscious wish of the subject to taunt his father into giving him more love.

Three months after initial examination the subject presented a better picture of adjustment and seemed eager to return to sea. There were still symptoms of separation anxiety, such as occasional nightmares and an adolescent attitude of cocksureness which compensated for his inner insecurity. The immediate stimulus of his separation anxiety panic was the circumstance of his imminent sea duty. His great fondness for dogs and his almost obsessive drive for a fiancée are indicative of his great desire for love. The basic impulse to absent himself from service was based on deep emotional deprivation centering around the home. A few sessions during which this problem was thoroughly discussed, provided sufficient insight and emotional support to allow him to return to duty with the prospect of being able to adjust.

Reactions based on personality attitudes.—In the present state of psychiatric experience, the group featured by immaturity and aggressive feeling toward authority (2 a and 2 e), cannot be regarded as fixed personalities in the way we regard the psychopathic personality. The anti-authoritarian groups, 2 b and 2 d, are independent, self-willed, follow no orders, insist on "having fun" at their own convenience, and have an openly expressed hatred of their officers. The egocentric characters, group 2 c, shade off on the one side to so-called criminal psychopaths, and to rebellious, immature adolescents on the other. This behavior is motivated by a specific negative attitude toward authority, combined with an admixture of neurotic elements. Those men who "go over the hill"

because they strongly dislike the Navy, show on examination evidences of neurotic reaction toward their parents. Further probing demonstrates that underneath their uncooperative, arrogant attitude toward authority, dependency needs exist which are quite similar to those occurring in the first group discussed, namely, reactions based on emotional problems.

Submission to authority is considered to be a weakness, and antagonism toward authority is a reaction hiding from the individual the existence of passive, dependent elements in his makeup. In the psychopath, this aggressive component becomes fixed in the character; in the rebellious adolescent there is still enough elasticity of the ego to allow the aggressive defense against submissiveness to be neutralized under the pressure of contact with older men. The particular prognosis of each individual as far as the Naval service is concerned, depends on his ability to mature. From a psychologic point of view our finding is significant in that in these antagonistic men a deep current of insecurity exists. One piece of evidence is the frequent occurrence of aggressive impulses turned toward the self which appears in the form of self-destructive fantasies, suicidal attempts, existing along with truculence and hatred for the Navy.

The mixture of expressed anger against authority and introjected anger within the self, appears in various proportions in the case material. The emotional currents range in their expression from cases showing simple separation anxiety to persistent hatred against the Navy. Although the latter group appears to be psychopathic with a chronically anti-social attitude, closer scrutiny provides a key to the meaning of the psychopathy demonstrated. It becomes clear that hatred against the Navy masks deep anxieties. The following case will illustrate the point.

Case 2.—A 19-year-old enlisted man was brought to the disciplinary barracks after absence over leave of 5 days. He stated that he "hated the Navy," and "hated gold braid." He had been in the Navy more than 2 years, having served at sea most of that time. He had had 12 offenses in the Navy, some of them of a serious nature. At one time he was said to have struck a warrant officer and another time he attacked and "beat up" a commissioned officer while on shore. In civilian life he had been arrested six times for offenses ranging from vagrancy to suspicion of felony, but there were no prison sentences.

Upon arrival at the disciplinary barracks he stated clearly that he wished to be discharged from the Navy and therefore went out of his way to disobey regulations. He gave a story which, if true, indicated a severe psychopathic condition in which sadistic elements were prominent. He said his time was spent in thinking, plotting and planning to kill people with whom he had had even petty misunderstandings. He had a particular dislike for officers, and had already beaten up two of them unmercifully. He had numerous contacts with homosexuals in which he robbed them of their

money. He said that he felt like murdering anyone whose blood he saw shed. When he tried to stop the bleeding nose of his brother he became infuriated and a relative watching the episode pulled him away in alarm. There was a possibility that considerable fantasy admixture was present in his story. He was restored to duty aboard ship but was immediately A.W.O.L. for a period of 21 days after announcing that he wished to be discharged from the Navy.

In his daily contact with the examiner, he showed more depression as it became clear to him that his wish to be discharged from the Navy by breaking the rules would not be countenanced. He showed signs of depression, spoke about crushing his foot under a truck, of cutting off his fingers so that he would be disabled and hence be discharged from the Navy. He said that while on his last A.O.L. he had wandered around the streets, sleeping in railroad stations, and playing with the idea of jumping under a train to end his life. He wrote to his mother saying she would hear from him no more, and planned never to see his wife again.

Shortly before he was apprehended he met a girl who said she had syphilis, and he purposely had intercourse with her in order to contract the disease. During later interviews he expressed great feelings of debasement, refusing to be treated for a penile lesion in the hope that it was syphilis and it would invade his blood stream. He said he wanted to live a reckless life, devoted to doing what he pleased without regard to civil authority. He would rather lose a hand than stay in the service and obey the Naval authorities. During the later depressed period when he entertained self-destructive ideas, some of his antagonism toward the officers, expressed in speech and indicated in behavior, diminished.

COMMENT

The study of enlisted men who for varying periods have deserted the Navy in wartime has brought several factors into the foreground. The majority of these individuals go "over the hill" for two reasons. The first of these is the presence of an emotional conflict which is displaced onto the Navy. The second is the evoking of underlying antagonism toward authority by the regulations and discipline of the Navy.

Most military psychiatrists agree that fear is present in all normal fighting men. They also agree that the underlying personality of the soldier or sailor is a strong factor in determining whether the ego of the enlisted man will become so inundated by fear and neurosis as to become unusable in the service. As Raines and Kolb (*3*) have pointed out, no one has yet been able to formulate criteria for diagnosing neuroses in men, who though clinically well, are predisposed to war neurosis.

We found in this series that the basic problem in the personality of men who go overleave is a combination of dependence needs and antagonism toward authority on which fear reacts to produce untoward behavior. The finding is again repeated, that emotional immaturity, which dips into marked passive dependence on the parents and home, usually symbolized by the mother, provides the

neurotic background which turns normal fear into flight and dissatisfaction into desertion.

These cases have shown a wide range and combination of dependence needs and antagonisms in each individual offender. It can be said, from our experience, that no desertion occurs without an anti-authoritarian attitude, open or hidden, existing along with a need for protection and dependence, whether covered by anxiety or compensated for by toughness.

The problem which presents itself then is the mitigation of these two forces to the end that desertions and absence over leave will decrease. It is to be borne in mind in this discussion that we have excluded all types of disease which could be so diagnosed and deal solely with individuals who are "normal" psychiatrically. Emotional immaturity has two potent counterforces, i.e., time, and the emotional support of new figures in the environment. Naval experience agrees with that of Army observers who find that the military organization and war supply psychologic factors to temper men (*4*). The tempering of the average man, i.e., his adjustment to military service, goes on gradually during the first year or so of military life. Modifications of old values, supplanting of emotional ties by new bonds, and the gradual submerging of the individual's personality, become perceptible as the average recruit develops into a fighting man.

How can the process be aided in the immature youth in whom it does not occur spontaneously? It is best accomplished by minimizing the threat of danger evoked by the man's way of interpreting his leaving home for the service.

In this process a vital factor is the emotional tone of the officers, both line and staff, who are in contact with the man. It is the officers who act as therapists, whether they are aware of it or not, who furnish the emotional nourishment on which the enlisted man feeds. This is the only technic of treatment which is feasible in the present Naval setup. It has been our practice through firm yet understanding discussion with the men, to attempt to offer this emotional background. The contact should be brief, pointed, but not critical, and above all, must be persistent. At the same time that emotional support is given, rationalizations, excuses, incorrect emphasis and even the temporary paranoid projections present in any large organization must be swept aside.

Even in the case of men who are repeaters, and who avow that they do not like the Navy, it is felt that repeated therapeutic contacts—when backed by the authority of the Navy—will prove of value in time in immature individuals. But long before the maturing influence of military service can be brought to bear, the

more potent forces of his community in general and his parents in particular, have been operating on the dependent, immature, neurotic youth.

Reviewing the situation regarding youths with an outwardly anti-authoritarian attitude, the same considerations come to mind. It is interesting that adolescents in this country are emotionally toned against the war even at this time. Sherman (*5*), who surreptitiously examined 7,000 high school children in Chicago regarding their attitude toward the war, found that 53 percent were antagonistic, critical, indifferent or confused about this country's place in the war.

Since the exigencies of the war and the Naval service prevent starting any long-scale program, it becomes evident that more immediate measures should be instituted. From the standpoint of the present problem, a longer period of basic training and indoctrination appears to be the only method of enabling us to modify the noticeable dependence of so many recruits.

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FUNCTIONAL AMENORRHEA IN WAVES

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Functional amenorrhea is a cessation of menses in women who have previously menstruated, although the uterus and ovaries are apparently normal. The exact mechanism concerned with amenorrhea is not clear, but the focal point of the disturbance is always the ovaries, which fail to undergo a normal cycle. This may be due to some influence exerted on the gonads directly, or indirectly through interference with the gonadotropic function of the anterior lobe of the hypophysis.

This study is an analysis of 100 cases of so-called functional amenorrhea that occurred at a Naval training station (WR). Five thousand WAVES have been at this activity and 100 have reported to sick call with the complaint of absent menstruation.

Inasmuch as general physical factors as well as local gynecologic conditions may play a large role in this type of amenorrhea, every patient is given a thorough physical examination including blood and urine analyses. In this examination special attention is given to general disorders of menstruation, endocrine dysfunction, especially anterior pituitary disorders, wasting diseases, chronic intoxications and emotional disturbances. The examiner must look for such signs of endocrine imbalance as hypothyroidism and hypo-ovarianism, obesity, dry skin, acne, hypoplasia of the breasts and genital organs, and hirsutism.

In the various activities of Naval medical service little opportunity will be had for bio-assay of urinary steroids. Therefore the vaginal smear has been used as a simple and reliable procedure for determining the presence of normal ovarian activity or estrogenic deficiency.

The following methods were used in estimating ovarian function:

1. The single differential stain of Shorr (*1*), which is a simplified trichrome stain requiring but a single staining solution. It is specific and reliable for the detection of cornification in cells of the vaginal smear. It gives a sharp differentiation between cornified cells which are brilliant orange red, and the noncornified cells which are blue green.

The technic of preparing the vaginal smear for staining is as follows: Vaginal secretion is aspirated by means of a glass pipette to which is attached a rubber bulb. The glass pipette should have an external diameter of ¼ or ½ inch, a length of 6 inches, and the bore should be constricted at the tip to an opening of 1.5 millimeters. The pipette should be thoroughly dried before using, because contamination of vaginal secretion with water may distort the cells. With the bulb compressed, the pipette is inserted gently for a distance of about 3 inches into the vaginal vault. The bulb is then released and the pipette slowly withdrawn. The aspirated secretion is then expelled onto a clean glass slide. The slide is then immediately fixed for one or two minutes in a solution of equal parts of ether and 95-percent alcohol. Fixation of the slide while the secretion is moist is essential, because drying alters the secretion and the staining reaction sufficiently to make the interpretation of the smear completely unreliable. After fixation, the contents of the slide are stained for one minute. The slide is then blotted dry and carried through 70-percent alcohol, 95-percent alcohol, and absolute alcohol, dipping 10 times in each solution. The slide is then cleared well in xylol and mounted in dammar.

Interpreting the vaginal smear: Two types of cells are seen. The noncornified cells are small blue green cells with large nuclei. The cornified cells are of a large, flat type with small deeply stained nuclei, and staining brilliant orange red.

2. Vaginal glycogen index: Mack (*2*) has shown that vaginal cells of women with actively functioning ovaries have a high glycogen content; whereas in hypo-ovarianism these cells contain little or no glycogen.

Smears are obtained by lightly twirling a cotton applicator against the vaginal wall and then rolling the applicator lengthwise over the surface of a clean glass slide. By rolling rather than rubbing, a uniformly thin film of vaginal epithelial cells, with minimal clumping and cell distortion results. The film of cells dries almost immediately and may be stained at once. Staining is accomplished simply by laying the slide face down over a shallow dish containing a small amount of Lugol's solution. Iodine vapors which arise insensibly from the solution suffice to stain the glycogen-containing cells in 2 or 3 minutes. Microscopic examination is carried out immediately.

Glycogen-free cells are stained yellow. The smears are graded 1 (complete glycopenia) to grade 4 (presence of large, flat polygonal cells with a rich brown cytoplasm and pale unstained nuclei). Grade 4 represents maximal estrogenic effect. In partial ovarian hypofunction, the minimal glycogen content is discernible

by the presence of mottled cells which contain small irregularly distributed brown deposits at the cell margins and in the cytoplasm.

FINDINGS

The 100 WAVES studied were all in good health and were asymptomatic except for the complaint of absent menstruation. General physical examination exhibited no definite cause for the amenorrhea. All had had normally occurring menses. All patients when first seen had missed at least one menstruation. Both types of vaginal smears were made simultaneously on each patient. Follow-up vaginal smears were made at weekly intervals until the onset of menstruation occurred. In the 100 individuals, menses occurred in 30 following 8 weeks of amenorrhea, in 33 following 10 weeks of amenorrhea, in 30 following 11 weeks of amenorrhea; and in the remaining 7 no menses occurred during the entire time of observation, which was a period of 4 months.

During the entire period of amenorrhea the vaginal smears in 83 examinees showed a mixed cell type, approximately half cornified cells and half noncornified, and these same 83 exhibited a similar number of cells with partial ovarian hypofunction manifested by a minimal glycogen content.

Eleven of those examined exhibited noncornified cells and glycogen-free cells. The remaining 6 exhibited full cornified effect and brown cells, grade-4 type.

There was no relation of the length of amenorrhea to the type of vaginal epithelium.

TREATMENT

Since functional amenorrhea is a symptom rather than a disease, it probably does little harm if it is not long protracted.

There is no proof or even any strictly suggestive evidence based upon controlled clinical experimentation that menstrual regulation can be effected at will by the commercially available preparations of the allegedly specific hormones. The employment of estrogenic hormone for most cases of functional amenorrhea is not based on sound physiologic principles. The amenorrhea usually results from deficient ovarian function and this hormone cannot stimulate the gonads. It is merely substitutive therapy, and although uterine bleeding may be produced easily, it is not true menstruation, but an abnormal flow which does not necessarily recur in the months following cessation of the treatment (*3*).

The chorionic gonadotropin has had years of clinical application and recent reports record general disappointment in the treatment

of ovarian failure (*4*). There are no extracts of the anterior pituitary which are sufficiently free from toxic or reaction-producing materials for satisfactory clinical use and which combine potency and practicability for prolonged therapy (*5*).

The therapy used was psychotherapy, consisting of suggestion and assurance that no permanent harm could occur from the amenorrhea. In addition one grain of desiccated thyroid daily for a period of 1 month was prescribed. The calorigenic action of the thyroid is the principle reason for its use. The thyroid hormone stimulates metabolism of all body cells. This stimulation of oxidative reactions affects all cells and makes possible much of our higher mental and physical activity. The calorigenic activity of the thyroid serves as a gage of all its physiologic activities.

COMMENT

Actually the mere absence of menstruation is in itself nothing about which to be unduly concerned. Recently Whitacre and Barrera (*6*) have observed that 14.8 percent of Caucasian women in a Japanese internment camp developed sudden amenorrhea. Also in a group of 60 Army nurses who went through Bataan and Corregidor, 14 (23 percent) had amenorrhea and 16 had other menstrual disturbances, or a total of 50 percent with some type of menstrual dysfunction. It is believed that the amenorrhea was probably due to severe psychic shock, worry and fear, which, acting through the autonomic nervous system, caused a complete suppression of ovarian function.

In central Europe during and following World War I, several Polish, Russian, German, and Swedish observers commented on amenorrhea, and all considered that the most important cause was a deficiency in one or more of the essential food factors.

Although no psychiatric appraisals were made of the patients, probably the transient disturbing element of recent entrance into the Navy with its discipline, the nostalgia for home, and the rigors of a training school contribute to an effect on the psyche.

The effect of the psyche on the menses is by no means clear but there is no doubt whatever that there is a distinct connection between the two. Among the numerous examples are cases of pseudocyesis in which the prolonged amenorrhea and other symptoms are associated with an intense desire for children. Other examples are those of amenorrhea in unmarried girls who fear pregnancy. In animals the connection between the nervous system and ovulation has been proved. In the rabbit, ferret, squirrel, and cat, ovulation and luteinization never occur without the nervous excitation of mating. In fact, simple friction of the vulva or arti-

ficial stimulation of the cervix produces ovulation even when the ovaries are removed from their normal location and implanted elsewhere in the body. It has been shown that the ovulation and luteinization in these animals result from reflex stimulation of the anterior hypophysis. Therefore, in spite of the fact that the anterior pituitary gland is considered the regulator of the cycle, there is a center which in turn has a controlling effect on the pituitary gland.

In many women the menses continue with their usual degree of regularity in spite of mental upheavals, whereas in others a slight psychic shock upsets the menstrual schedule. The most likely explanation for disruption of the cycle is that the psychic disturbance affects the gonadotropic function of the anterior pituitary gland which in turn brings about a change in the time of ovulation, either by stimulating it prematurely or suppressing it temporarily. However there are instances in which this explanation cannot hold, as in cases of bleeding which occurs almost simultaneously with psychic trauma, and the sudden stoppage of the bleeding due to fright or anxiety (*7*).

SUMMARY

One hundred women with functional amenorrhea were studied by the vaginal smear method. Eighty-three percent exhibited ovarian hypofunction. It is suggested that psychic influences are important in the causation of this condition.

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EOSINOPHILIA CAUSED BY ATABRINE

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Two hundred eight men were studied in an attempt to find an explanation for the eosinophilia which often accompanies the taking of atabrine in the tropics. Five were dropped from the statistical analysis because hookworm ova were found in their feces, and it was considered that this may have contributed to the eosinophilia. The remaining 203 cases included 120 patients who were on atabrine therapy for treatment of malaria, 50 men who were on suppressive treatment with atabrine and who were clinically free from malaria, and a control group of 33 men who had not received atabrine and had no clinical evidence of malaria.

The eosinophil counts were made by blocking off a portion of the oil immersion field and counting the number of eosinophils in thick-drop preparations. These preparations were made thin enough so that the white cells were well separated and could thus be accurately counted.

ANALYSIS OF RESULTS

For purposes of analysis an eosinophilia of 6 percent or over was considered significant. Among the 124 patients on atabrine therapy for malaria who did not have hookworm disease, 95, or 79 percent, showed an eosinophilia of 6 percent or over; 34 had an eosinophilia of 10 percent or over.

Repeated examinations of the feces of these patients by the zinc sulfate concentration method showed five with hookworm ova, and these patients, as mentioned previously, were dropped from the study. The average eosinophil count for the remainder was 8.4 percent. The highest eosinophil count noted in this group was 27 percent.

Among the 50 men on suppressive treatment with atabrine who were free from clinical malaria, 36, or 70 percent, showed an eosinophilia of 6 percent or over; 9 had an eosinophilia of 10 percent or over. Repeated examination of the feces by the aforementioned method did not reveal any ova or parasites. The average eosinophilic count was 7.2 percent and the highest percentage for the group was twenty-two. Only men showing a distinct yel-

low coloring of the skin were accepted in this group, because it was considered that these men had been diligent in taking atabrine.

Among the 34 men who had never taken atabrine, and who were also clinically free from malaria, only 3 showed an eosinophilia of over 6 percent. One of these had an eosinophil count of 17 percent and was found to harbor hookworm. The remaining two had eosinophil counts of 6 percent and 7 percent respectively. The average length of stay in the tropics for the first group was 14 months, for the second group 10 months, and for the control group 8 months.

Bone marrow aspiration biopsies in 15 instances, representing 15 cases, showed marked hyperplasia of the eosinophilic cells.

SUMMARY AND CONCLUSION

One hundred twenty patients on atabrine therapy for malaria showed an average eosinophilic count of 8.4 percent. Fifty men on suppressive treatment with atabrine sufficient to produce a distinctly yellow color of the skin showed an average eosinophilia of 7.2 percent. Thirty-three men who had not taken atabrine and were clinically free from malaria showed an average eosinophilic count of 3 percent.

It seems probable that atabrine in sufficient amount to produce a yellow color of the skin will stimulate an eosinophilic hyperplasia of the bone marrow and a moderate eosinophilia in the peripheral blood.

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COMPOSITION OF WHOLE BLOOD

Whole blood is actually a complex suspension of cellular elements in plasma. The cellular elements consist of the erythrocytes, leukocytes, and thrombocytes, while the plasma is a yellowish-tinted transparent fluid containing proteins, nonprotein nitrogenous substances, inorganic salts, gases, enzymes, and antibodies. The proteins in the plasma are serum albumin, globulin, and fibrinogen; the principal nonprotein nitrogenous substances are urea, uric acid, creatinine, amino acids, and phosphatides; the nonnitrogenous organic compounds include dextrose, lipoids, and salts of lactic acid; the inorganic salts consist of compounds with sodium, potassium, calcium, and magnesium cations, and anions of chloride, bicarbonate, phosphate, and sulfate; among various types of antibodies are included antitoxins, precipitins, agglutinins, opsonins, bacteriolysins, and hemolysins.—TURNER, O. E.: Investigation of transfusion reactions. Pennsylvania M. J. 47: 1071–1076, August 1944.

FILARIASIS IN WEST INDIAN LABORERS

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In 33,970 blood smears on employees at a Naval base in Trinidad over a period of 21 months, 199 were found to demonstrate microfilariae. Many of the microfilariae were found during the course of night surveys. The laborers represent a cross-section of the working male population of the entire lesser Antilles, as much of the labor was from islands other than Trinidad. Seventy-three of the men in whom microfilariae were demonstrated in the blood stream were examined by clinical and laboratory methods for manifestations of the disease.

The microfilariae found were of both the sheathed and unsheathed types. No accurate differentiation between Mansonella ozzardi and Acanthocheilonema perstans could be made. The exact geographic distribution of these two species has never been determined because of the morphologic similarity of the microfilariae. Mansonella ozzardi has been reported in Panama, Colombia, the West Indies, Venezuela, Dutch Guiana, British Guiana, Argentina, and recently in Mexico. Acanthocheilonema perstans has been reported in West Africa, the West Indies and the northern coast of South America. Wuchereria bancrofti is the most disseminated of the filarial parasites and is prevalent in the West Indies and British Guiana. Since the geographic distribution and morphologic characteristics agree, the sheathed specimens are considered to be Wuchereria bancrofti.

Of the seventy-three men examined, 35 were from Trinidad (the majority never having left the island), 26 from St. Vincent, 3 from British Guiana, 3 from Dominica, 2 from Grenada, and one each from Montserrat, Tobago, Panama, and Cuba. In several cases the men were seamen who had traveled widely.

Physical examination revealed only three instances of elephantiasis (4.1 percent). Two men had bilateral edema of the legs, while the other had edema of the scrotum. Enlarged lymph nodes were present in 69.8 percent of the patients, but practically all of these could be explained on the basis of infections of the extremi-

ties or venereal disease. Sixteen and four-tenths percent of the men had open ulcers of the legs. Twenty-one and nine-tenths percent of the patients had subinguinal swellings, unilateral or bilateral. The nodes could be felt in the center of the soft masses. Similar tumors are described by O'Connor in his study of filariasis in Puerto Rico. These are not characteristic of filarial infection, but are suggestive of it. Eosinophilia of 5 percent or over was present in 43 percent of the patients, and anemia in 11 percent. Chyluria could not be demonstrated in any of the patients. No filariae were found in the urine.

Other pathologic conditions found were numerous, and were typical of the environment and race of the patients. Thirty-one and five-tenths percent had hypertensive cardiovascular disease with systolic pressure of over 150. Malarial parasites were found in 4.1 percent, and another 4.1 percent had palpable spleens without parasites being found in the blood. One patient had evidence of primary syphilis, and another of syphilitic heart disease. There was one patient with clinical evidence of pulmonary tuberculosis; another had marked hypertrophic arthritis. Of those from whom stool specimens could be obtained, 73.6 percent had hookworm, and 42.1 percent Trichuris trichiura infestation. Ascaris, strongyloides and Endamoeba coli were also found in the stools. Thirty-four and two-tenths percent of the patients demonstrated no evidence of disease other than the presence of microfilariae in their blood streams, and were apparently normal healthy males.

Repeated examinations of the blood revealed that 72.6 percent of the patients had no demonstrable microfilariae in the blood stream for all or part of the working day. Twenty-seven and four-tenths percent had consistently positive smears during the day. Many had parasites which could be found only in night smears, and repeated day smears were negative. However 75.3 percent revealed positive smears at some time of the day, when repeated frequent smears were taken. Only 24.6 percent had consistently negative day smears. Nocturnal periodicity in many cases does not demonstrate a complete clearing of the peripheral blood for the entire day. Periodicity probably depends on:

1. Species of filaria.
2. Periodic cyclic parturition by the adult female filaria.
3. Duration of the individual microfilariae in the blood stream, which has been shown to be more than 24 hours.
4. Habits of the human host.
5. Habits of the insect vector.
6. Status of the circulation in the peripheral capillaries, arterioles and venules.

7. Circulatory changes in the lungs and kidneys which might drive the microfilariae into the peripheral circulation.

Elephantiasis is not pathognomonic of filarial infestation, as has been pointed out by Osler and Manson, and it can be caused by many other pathologic states. The incidence of other diseases in filarial patients is high, as this study of a working population demonstrates. The general debility of these patients cannot be attributed to filariasis. Eosinophilia is not a reliable sign, as more than half of the patients with microfilariae in the blood stream do not have increased eosinophils, and filarial patients are apt to have intestinal parasites. Anemia likewise cannot be attributed to filariasis. Subinguinal tumors should lead one to suspect filariasis, but they may be caused by many other conditions.

 

THYROTOXIC SYMPTOMS ABOARD SHIP

Crew members during long periods at sea, especially in hot climates, present themselves at the sickbay with apparent symptoms of thyroid toxicity. These consist of nervousness, tremor, apprehension, and fatigability. The pulse is usually elevated, but returns to normal after rest. A slight-to-moderate enlargement of the thyroid gland is present. Basal metabolic rate when hospital facilities were at hand, varied between minus 10 and minus 15. Typical cases falling in this category have responded favorably to small doses of Lugol's solution and phenobarbital.

With the iodine concentration of sea water as high as it is, sufficient iodine to furnish an adequate supply for all body needs conceivably should pass through the ship's evaporators (water distilling apparatus). This, however, is apparently not the case, and iodine replenishment seems indicated.

It is fully realized that because of insufficient laboratory data it is impossible to make final conclusions. The clinical picture, nevertheless, is quite clear, and may assist in the evaluation of certain cases which might otherwise be difficult to explain.

The condition seems to be independent of low blood chlorides and calcium, and is not more widespread before combat.

For all practical considerations, men aboard ship are drinking distilled water, triple distilled in many cases. Many individuals are unable to take salt tablets because of the nausea produced, and despite repeated advice fail to use salt in amounts sufficient to maintain a balance in the body.

Probably the conditions due to mineral imbalance could be entirely prevented by the addition of a standard preparation to all ship's drinking water. This might include iodine, calcium, chlorides and even fluorine.—KELSEY, W. L., Lieutenant Commander (MC) U.S.N.R.

ROOT AMPUTATION

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The root amputation to be described here is a rapid procedure for treating abscessed anterior teeth. The technic was developed because in the urgency of the military situation immediate transfer of personnel was imminent, and a longer procedure, entailing several appointments, was not feasible.

The anesthetic for this operation should be profound, as the granulation tissue surrounding the apex will often be found extending deep into the maxillary bone. For this reason an infraorbital injection is preferable. In addition a small amount of procaine hydrochloride is deposited just distal to the cuspid, and if the tooth to be operated upon is a central incisor a small amount of the solution must also be deposited on the opposing side of the labium frenum to anesthetize the anastomosing fibers. On the lingual side the anterior palatine foramen is injected.

A rubber dam is then applied, and with a 37-mm. bur in the straight handpiece, the root canal is opened from the lingual side, the pulp remnants are removed, and the canal is enlarged and sterilized.

A gutta-percha point of the exact size to fit the canal is selected by comparing it with the roentgenograms, and the canal is filled. Zinc oxide and eugenol paste about the consistency of heavy cream, to which a small amount of balsam of Peru has been added, is used for the purpose. By means of a paper point on cotton pliers, the mixture is inserted into the canal, a little at a time, until the canal is pumped full. The selected gutta-percha point is then dipped into the paste, and inserted into the canal, driving it through the apex. The mixture sets to a hard consistency due to the action of the balsam. It is also radiopaque, showing up well in the roentgenograph taken for checking purposes after the operation.

The next step is to complete the filling of the tooth to the outer surface with either amalgam or cement silicate, the latter being preferable for esthetic reasons. Amalgam often tends to discolor or show through the thin labial surface.

This part of the procedure should not consume more than 20

minutes, after which the surgical aspect of the operation may be carried out.

An elliptical incision is made in the gum with the convexity toward the margin. This incision is extended from the buccal fold, distal to the approximating tooth, downward to within 2 or 3 mm. of the neck of the tooth to be amputated, and curving upward to the buccal fold, distal to the approximating tooth on the other side.

The flap is dissected loose with a periosteal elevator, exposing the labial plate of bone. The use of a wide periosteal elevator will enable one to hold the lip and entire flap out of the area, affording a clear vision to the operative field.

The root tip is easily located because in most cases the plate of bone over the apex will have been absorbed due to the infection, or will be thin and soft. The end of the root may be easily exposed in these cases by means of a bone chisel, employing finger pressure only. If, however, the bone is too hard and thick, a surgical bur may be used, by making one cut mesial and one distal to the root. The chisel is again employed, working from these starting points, until the root tip is entirely exposed.

The granulation tissue may still be sensitive at this stage of the operation, even though anesthesia may be profound throughout the rest of the area. This may often be overcome by inserting the hypodermic needle directly into the tissue surrounding the apex and injecting more of the anesthetic solution. No attempt is made as yet to remove any of the granulation tissue, as it usually lies around and under the root tip. The next step is the actual amputation.

The amount of tip to be removed is determined by the amount of abscessed area extending toward the crown. The ideal amputation should start at the margin of the abscess which extends toward the crown of the tooth.

A bone chisel is placed at right angles to the root, at the point of desired amputation, and a sharp, resilient blow is used to cleave the root. The advantages in using a chisel are (1) there is much less trauma, and (2) it is much cleaner, as the tip comes out in one piece and the area does not fill with debris as it does from the cuttings of the bur.

The loose root tip is removed and the area is thoroughly curetted to remove all granulation tissue. The cavity in the bone and the entire area is irrigated to remove any loose material, and the root stump is cauterized with an electrocautery point or a hot instrument. This insures a perfect seal of gutta-percha over the opening.

A paste of powdered sulfanilamide, butyn-metaphen ointment, and eugenol, which has previously been mixed, is then placed in the cavity in the bone. This method has proved to promote faster healing of the area than any other. The flap is pulled into place, sutured, and a roentgenograph is made.

The patient is told to rest, if possible, for 3 or 4 hours, keeping an ice pack continuously on the area. This reduces the probability of swelling and postoperative pain. The sutures may be removed as soon as feasible, usually in 3 days.

The technic outlined is based upon experience with 73 cases in military service. The patients have been transferred and it has been impossible to follow any of them for more than 6 months, so that a conclusion based upon end-results is impossible. However those that were followed for 6 months showed a definite regeneration of bone tissue.

 

IMPROVED STAINING TECHNIC FOR MALARIAL PARASITES

Considerable difficulty has been encountered in obtaining satisfactory differentiation of malarial parasites in thick blood films stained with Wright's stain. Good results may be obtained on thick blood films if: (1) The red blood cells are hemolyzed in a fixing solution rather than in water, and (2) an acid water is used to dilute the Wright's stain and to wash the slide.

An acid water, prepared by adding 0.06 cc. (2 drops) 0.1 N HCl to 100 cc. of distilled water gave excellent results. The fixing solution was made by adding 1 cc. of glacial acetic acid to 99 cc. of 5-percent formalin immediately prior to use. If the solution was kept in a covered staining jar, it was satisfactory for a large number of slides.

The dried thick blood film was immersed in the fixing solution for 10 minutes and then washed in two changes of distilled water for 5 minutes each time. After the slide had thoroughly dried in air, the film was covered with Wright's stain for 1 minute. An equal amount of acid water was then added and 10 minutes were allowed for staining. The slide was washed with acid water, dried, and examined.

With preparations treated in this manner, ring-form trophozoites show clearly against a dusky blue background. The cytoplasmic circle is a sky blue, while the chromatin dot is definitely red and easily detected under the microscope. Developing forms, schizonts, and gametocytes are also distinct.—GRAU, M. L.: Simple acid water solution for better visualization of malarial parasites using Wright's stain for thick blood films. J. Lab. & Clin. Med. 29: 1103, October 1944.

DENTAL OFFICER'S DUTY ABOARD NAVAL HOSPITAL SHIP

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A dental officer's duty aboard a hospital ship presents two distinct phases: (1) Emergency treatment and prosthesis; (2) oral surgery. The first phase comprises routine work while the ship is serving as a floating hospital in one of the harbors near the combat zones. Patients are flown in by plane or brought by ships and small craft from shore-based personnel. A fully equipped modern dental laboratory with well trained technicians is available, so that any type of appliance for the treatment of fractures may be constructed.

Fractures are a minor feature of the work of the dental officer aboard a hospital ship during this first phase. Prosthesis is more important because the prosthetic laboratory aboard is the only one locally available, the area being too far advanced for shore dental installations.

The second phase of duty aboard a hospital ship occurs during evacuation of combat casualties in amphibious warfare when urgent oral surgery is required. The conditions presented are different from those that occur in a floating hospital ship or those encountered in civil life. In this second phase the dental officer functions as a stepping stone in the treatment of casualties. His aim must be a service that will contribute to the best possible end-results. The time factor is limiting and he must continually work against time in his effort to gain results of a beneficial nature to the patient.

Most gunshot and fragment wounds about the neck and face produce jaw fractures and are accompanied by extensive destruction of the soft tissue. Close cooperation between the dental surgeon and general surgeon is necessary if *maximum* results are to be obtained. A plan of treatment must be correlated at that time, beginning with first aid, control of hemorrhage and shock, subsequent roentgenographic examination, diagnosis, and treatment.

The patient may have come directly from the beachhead; or he may have been subjected to hours on the beach before first aid could reach him. No two amphibious evacuations seem to present

the same problems, the time element being an all-important factor.

The average patient in civilian practice is in good health, and under usual conditions the treatment of the average fracture is a fairly simple matter. In amphibious warfare the reverse is true. The complicated fracture predominates. Extensive injury is done to the face and jaws by the velocity of high-caliber bullets, by shell fragments, hand grenades, and high explosives fired at close range. The point of entrance may be small, with a somewhat punched-out appearance, but owing to the velocity and tumbling of the missile or to its fragmentation the point of exit presents an explosive appearance. The amphibious casualty will have undergone a tremendous emotional strain; he will be in a state of nervous exhaustion; his ability to cope with his wounds will be immensely impaired. In many cases there is an accompanying injury of the head, neck, chest, or extremity.

A general anesthetic is contraindicated, but the patient may have to be subjected to this hazard on account of associated wounds. In that case the patient will have been made a better risk by the dental officer's conservative treatment, with reduction of swelling and edema, and the clearing of interference to airways. Local anesthesia is preferred, with 2-percent procaine hydrochloride for nerve block, and from 1-percent to 1.5-percent for infiltration as the choice. Infiltration, with supportive medication as indicated, has been successful in severe cases.

It is not unusual to have a patient fall asleep during the progress of treatment, as a result of the procaine in addition to the temporary anesthesia induced by the trauma to nerve endings and nerve trunks in their canals, and to complete exhaustion. Free manipulation without pain may often be possible.

TREATMENT

Debridement.—Debridement should be conservative. All easily accessible foreign bodies and all completely detached splinters of bone and teeth should be removed. Foreign bodies buried deeply or near vital tissues may remain until there is less danger of hemorrhage. Nature will eventually wall them off, making removal less hazardous. No attempt should be made at this time to hunt or probe for foreign bodies. There will be ample time and opportunity later. Let the decision to remove or not to remove a foreign body be made at the evacuating hospital.

Do not remove any fragment of bone having even partial soft tissue attachment.—A doubtful fragment had better be left and if necessary allowed to sequestrate. In so doing it may aid by causing an involucrum to develop or by providing a nucleus for

new development of bone to bridge the gap. Radical removal of these pieces is disastrous and retards and prolongs healing as well as increases materially the treatment to follow.

Extractions.—All irreparably loosened teeth and those involved in the line of fracture should be extracted. The exception to this is the presence of an only tooth in the posterior fragment. This should be retained as an aid in controlling such a fragment. Infection (usually the third molar) must be prevented if possible, as this presents a serious complication. The wisdom of retaining this lone tooth must be carefully evaluated, as other means of intra-oral control can be successfully instituted. If the tooth in the line of fracture is to be retained, a prophylactic through-and-through drain should be kept in place for 10 days to facilitate drainage of any suppuration.

Splints.—Arch-bar splints are prepared and applied. This is the method of choice for amphibious casualties. They are simple to apply; they can be easily removed for the application of a more suitable appliance later; they can be used in segments, and partial or complete immobilization may be maintained or changed as desired.

The usual operative time for application of fracture appliances is approximately an hour, seldom less than 40 or 50 minutes.

Reduction.—Reduction should be done by rubber bands and by slow, gradually increasing tension by additional rubber bands over a period of 24 hours. Slow reduction aids in eliminating discomfort and is less traumatic to surrounding tissues. It is less likely to light up infections and permits a gradual absorption and lessening of edema as it progresses. This is particularly important in maxillary fractures where venous circulation is conducive to complications.

Complete immobilization.—Application of secondary wires is advisable as soon as it is considered safe to make this change from rubber bands. Patients are more comfortable in complete immobilization while under way. The grating and sliding of fragments against one another which rubber elastics permit is eliminated. Mouth hygiene is improved immeasurably and the improved morale of the patient is immediately noticeable.

Three wires are placed, two laterals and one anterior. A pair of scissors is attached to the patient by a ribbon of bandage around his neck and the hospital corpsman and supervising nurse are notified and instructed accordingly.

The patient is attended at all times. This is essential. He has been aboard a sufficient number of hours to have accommodated himself to conditions at sea. He has been on a liquid diet at least

72 hours (usually a longer period), and is under close observation by the dental and ward hospital corpsmen. If digestive instability is reported, the wires are immediately replaced by rubber bands. The wires are never placed on a patient until he is out of the critical stage or if a throat wound is present necessitating oral treatment.

Conservative debridement of wounds is imperative in badly traumatized tissues of the face, particularly in those wounds of 12 hours' duration and longer.

The soft tissues of the face should not be sutured until splints have been applied and reduction is under way.

Soft tissues are thoroughly scrubbed with soap and water and irrigated with normal saline solution. The time element is vital. Results of suturing after 8 or 10 hours have been disappointing. Even earlier suturing with excellent operating technic has not been successful. To date a satisfactory set of rules has not been laid down for treating soft tissue wounds after a delay of 12 hours or more. The flaps are tacked lightly into place by sutures; sterile vaseline gauze strips are applied, and a butterfly stitch is made for additional aid in holding the flaps in position.

When the wound is large, communicating through-and-through with the oral cavity from the corner of the mouth back to the angle of the jaw, and when the all-important element of time has exceeded 8 to 12 hours, success is doubtful and only time may produce eventual union. Healing by first intention is seen only in wounds treated within 10 hours.

Moist saline packs seem to be beneficial to these inflamed areas, which suppurate and readily form a crust.

Prophylactic drains of rubber dam are placed in all badly comminuted areas and in areas with gross loss of bony tissue. If pus is allowed to collect in these areas, these fragments will not form a nucleus to aid healing. It is wiser to place an occasional unnecessary drain than to risk the damming up of pus in a comminuted area or to allow it to lie in contact with bone. The decision to remove these drains is left to the base officer at the evacuation point.

A Barton bandage is applied and pressure dressings are incorporated over areas of edema.

POSTOPERATIVE CARE

1. Patients are returned directly by stretcher to their respective wards. If allowed to walk they must always be accompanied by a hospital corpsman. A patient should never be permitted to walk alone even though he may feel perfectly well.

2. Bed rest for 48 hours is ordered.

3. Fluids are forced, a minimum intake of 3,500 cc. per day.

4. A high caloric liquid diet is prescribed.

5. Saline irrigations are done every 3 or 4 hours when the patient is awake. A tablespoonful of sodium bicarbonate is added to a quart of normal saline solution.

6. Morphine sulfate, ⅛ grain, is given as required.

7. Ice bags or moist saline packs are applied as indicated.

8. Sulfathiazole, 15 grains, is given at once, and 15 grains every 4 hours until a blood level within normal limits is reached; in case of bacteriemia, a higher level should be reached.

9. All drains and dressings are left undisturbed for 24 or 48 hours in order to reduce the possibility of hemorrhage. If necessary, the outer layer of the dressing and bandage may be changed for better appearance.

The accompanying reports of cases represent a comprehensive picture of the various problems that arise in the treatment of jaw fractures occurring during amphibious operations.

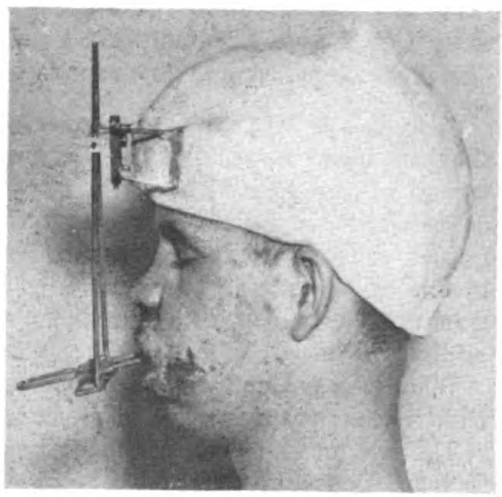
REPORT OF CASES

Case 1.—An Army private was received with a gunshot wound of the face. He was given emergency treatment aboard a transport standing off the beachhead. The wound was debrided and face wounds were sutured. The systolic blood pressure was 98 and the diastolic 49. The patient was in second degree shock. Plasma was administered. The next day the patient was unable to talk. One unit of plasma was administered and a pressure bandage was applied at 1415; at 1500, 2 units of plasma were administered; at 1600, 1,000 cc. of 5-percent dextrose in normal saline was given intravenously; at 2030, 0.5 cc. tetanus toxoid was injected as well as ¼ grain morphine sulfate. The following day at 0800 the blood pressure was 115/60. The patient was able to talk, although a degree of light shock was still present. Oral irrigation was done with 1 quart of warm saline solution, and he was taken to the dental office.

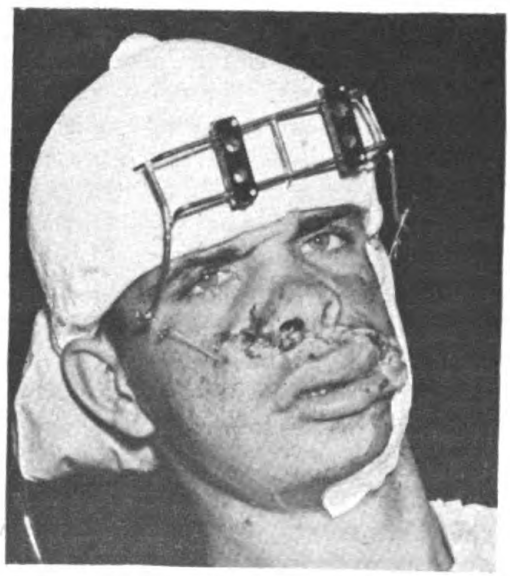
The patient reported, although in a minor degree of shock and unable to cooperate. The face and neck were extremely swollen. The point of entrance of the bullet was under the tip of the nose on the right side; there was gross laceration of tissues of the right cheek and upper lip. The missile had traveled across the roof of the mouth through the hard palate, carrying away all tissue and teeth from the left central to the left first molar inclusive, and exploding in exit through the left cheek, ripping the soft tissues through and through from the corner of the mouth to the angle of the jaw.

The entire maxilla was loose and fractured in three segments. There was a large gaping hole extending from the right central to the left second molar and extending into the maxillary sinus and floor of the nose. The anterior fragment, including the right central to the right first bicuspid, was driven forward and displaced downward, resting on the lower teeth and attached only by the soft tissue of the palate. The posterior fragment with the left

1. Case 1. Before treatment.



2. Case 1. Special head appliance. There was so much edema and swelling that penetration of infected areas was hazardous. A method had to be employed which would allow the advantages of early reduction and delay the wiring through the cheeks until a safer time. Such a method was used in the head cap appliance shown here.



3. Case 1. Fixed wires.

molar was displaced lingually and downward, and was impacted. The right posterior fragment was displaced inward and rested on the tongue.

A diagnosis was made of comminuted fracture of the maxilla with gross loss of tissue and displacement of fragments. A local anesthetic was used, 1,5-percent procaine, by infiltration only. An arch-bar splint for special head cap was applied, wired to the upper arch, and the fragments brought into fair alinement in relation to the arch. A lower arch-bar splint was applied.

Rubber bands were applied for slow reduction. When edema and swelling had been reduced, wire was passed through the cheeks and secured to the lower splint. Elastic traction was again instituted to elevate the lower jaw and establish proper vertical dimension. A hook was placed in the wires above the cheek for this purpose.

When reduction was completed and an apparently satisfactory vertical dimension established, the elastics were removed and wires made secure. An upper arch-bar was cut to permit reestablishing the arch contour and a compensating occlusion. The maxilla fragments were secured by brass wires to the lower teeth.

The next day swelling and suppuration occurred in the left cheek, which made it necessary to remove the sutures and substitute a butterfly stitch to control the flaps. Suturing of lip and cheek on the right side was successful. Ten days after he came aboard the patient was evacuated to an Army hospital.

Case 2.—A Marine Corps private was admitted to the ship direct from the beachhead approximately 6 hours from the time he received a gunshot wound of the face. The patient was treated in the surgery for shock, and debridement was done of the soft tissue wound of the right cheek, and the tissues were sutured. A pressure bandage was applied and the patient sent to one of the surgical wards. The medical officer observed that the patient was unable to separate his teeth, and referred the patient to the dental clinic.

When the patient was seen by the dental officer there was swelling of the right cheek; sutures were in place, and the entire maxilla was disarticulated.

The wound had been produced by a piece of shell fragment with entrance through the right cheek. No point of exit was evident. The maxilla dropped as the patient opened his mouth. He talked with difficulty and experienced pain in the region of the right condyloid process.

A roentgenogram revealed complete fracture, and a large fragment of metal in the soft tissues near the head of the condyle immediately below the floor of the sinus. The nasal bones were fractured.

A plaster head cap and appliance, and arch-bar splints to the upper and lower were applied. Wires were placed through the cheeks to the splint on the upper arch and elastic traction was applied. The patient was referred to the eye, ear, nose, and throat department for a nose fracture with spasmodic bleeding.

Wires were secured to the head cap. The position of the lower jaw indicated a possible fracture of the condyle, although a fracture in this area could not be demonstrated by roentgenographic examination. Rubber elastic was placed diagonally from the upper jaw back and down to the lower for reduction of the lower jaw.

Suturing of the cheek apparently was successful. Slight drainage occurred only from the upper part. Procaine hydrochloride, 1-percent, was used for soft tissues, and 2-percent for infiltration for wiring. Occlusion was good and the patient was evacuated.

Case 3.—A private in the Marine Corps reported with a gunshot wound of the face and fracture of the left clavicle. He was received from the beachhead at 1300 in a medical ward dressing room, apparently in shock. Two units of plasma were administered. Tetanus toxoid, 0.5 cc., gas gangrene antitoxin, and 2,000 cc. of 5-percent dextrose were given intravenously. A neck wound was ragged but relatively clean. The wound completely opened the face on the left side from the corner of the mouth to the neck exteriorly and down to the floor of the mouth internally. The mandible was badly shattered, with pieces of bone exposed. The wounds were cleansed and irrigated, sprayed with microcrystalline sulfathiazole, and packed with gauze. The patient was returned to bed. Three hours later, hemorrhage began in the soft tissues of the face. Suturing was done by the ward medical officer. Two units of plasma were given. The patient was placed on the critical list and referred to the dental clinic for treatment.

The patient had a temperature of 104° F., and was treated with penicillin, 100,000 units daily in 20,000-unit doses intravenously, then 15,000 units intramuscularly every 3 hours; after 3 days the temperature was normal.

The patient reported with a shell wound of the face, with the point of entrance through the neck, entering the mouth through the mandible and floor of the mouth from the submaxillary area. There was gross laceration. Tissues were sutured; there was gross loss of bone and teeth, with fragments badly displaced. The anterior fragment was impacted and driven downward. The posterior fragment was denuded of soft tissue back to the first molar area. Bone and teeth, including the left cuspid to the second molar, were carried away. Only the third molar was present. The chin deviated to the left and the arch was collapsed. Breathing was difficult. The patient had a temperature of 104° F. He was placed on the critical list.

The roentgenogram showed evidence of a comminuted fracture of the mandible on the right side of the symphysis, in addition to the badly injured left side.

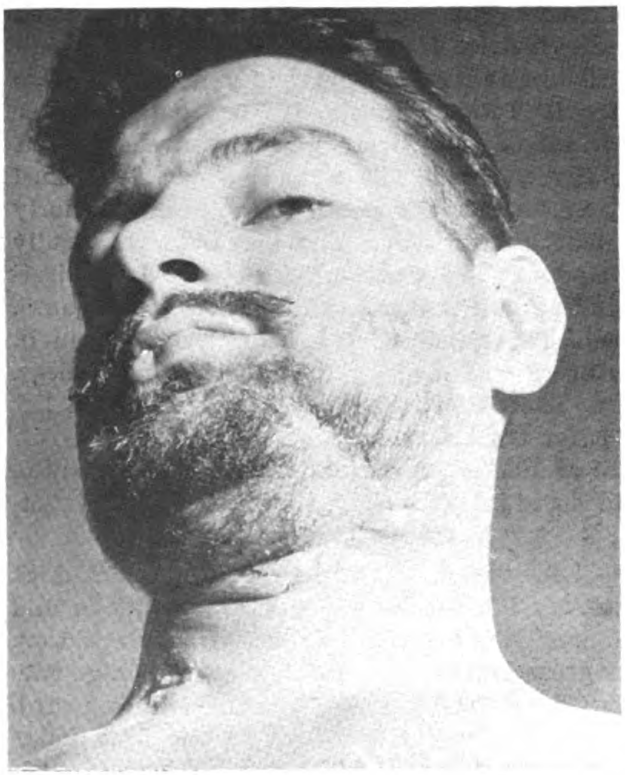
An arch-bar splint was applied to the upper arch; suturing had defeated the attempt to splint the lower arch. Local anesthesia by infiltration was employed. Ivy loops were used on the lower, and rubber elastics placed.

The left cheek was extremely swollen; the corner of the mouth was so tense that all attempts to correct alinement or to cover denuded bone failed. Two days later most sutures were removed. The area was draining freely, and the soft tissue suppurating. The remaining sutures were removed on the fourth day; a butterfly stitch was substituted to control the flaps, and a pressure bandage applied.

A week after he came aboard the patient was evacuated to a base. The rubber bands were replaced with secondary wires. Elastics would not hold the anterior fragment in position.

The left cheek remained badly swollen and access to the mouth was poor. All attempts to splint the lower arch failed, but it was necessary to evacuate the patient nevertheless.

Case 4.—A Marine Corps private with a gunshot wound of the neck was received aboard at the transport rendezvous, 72 hours after injury. The patient had been struck by a bullet in the right side of the chin, the missile passing out the left side of the neck. The patient was unable to swallow liquids because of pain, swelling in the floor of the mouth and edema of the throat. He had a temperature of 102.6° F. Fluids were forced intravenously; 1 gm. of sulfathiazole was given immediately and repeated every 4



4. Case 5.

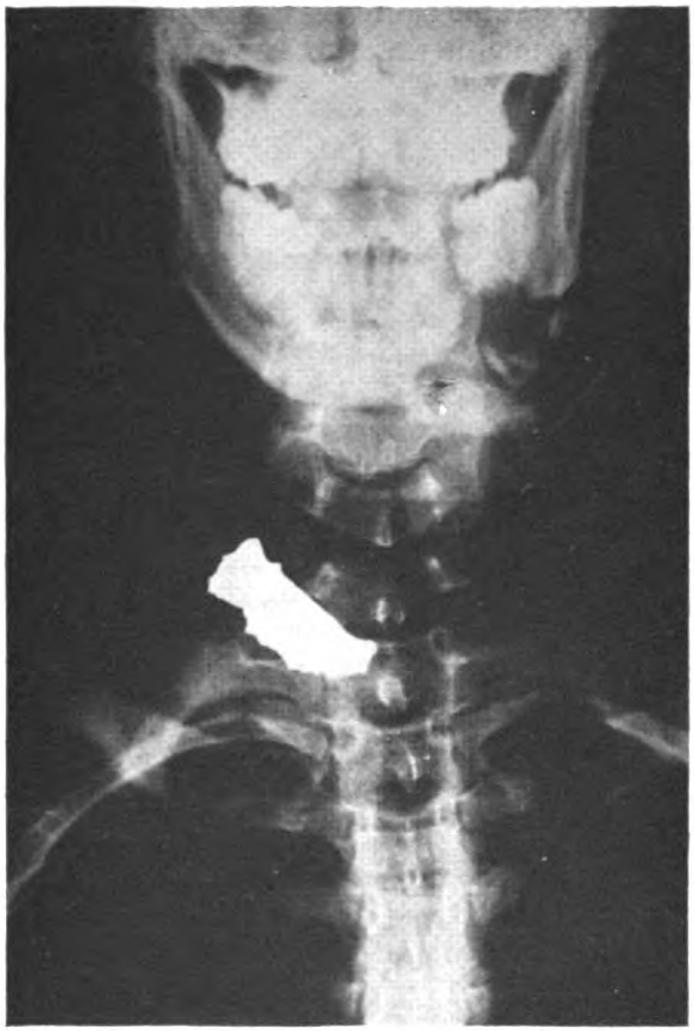
hours. Tetanus toxoid, 0.5 cc., was administered. The patient was obviously dehydrated. Pain was severe. There was a large hematoma of the floor of the mouth and apparently a complete fracture of the mandible near the entrance of the bullet. A foreign body was present at the site of entrance. There was a large gaping wound at the point of exit in the lateral aspect of the neck on the left side. A bloody, purulent discharge was present. The neck was extremely swollen.

The following day the patient was referred to the dental clinic for consultation. There was a complete comminuted fracture of the symphysis with separation between the left lateral and central, and marked displacement.

A soft iron wire, number 22, of the type used by florists, was used to braid around the molars and bicuspids. Brass ligature wire, 25-gage, was used to tie in each anterior tooth to the iron wire and fix reduction. The day of evacuation to the hospital, the temperature was 99° F. The patient was removed from the critical list. Complete immobilization was postponed to a later period.

Case 5.—A Marine Corps captain was received from a transport because of a gunshot wound and paralysis of the vocal chords. The wound was below the angle of the jaw on the left side. It had been partly sutured. There was a large fluctuating mass at the lower right side of the neck. The neck was red and inflamed. A foreign body was removed and drainage established.

The patient was referred to the dental clinic because of fracture of the mandible, which was comminuted on the left side. Arch-bar splints were wired to the upper and lower arches. Rubber elastics were employed for reduction. No fragments were removed at this time. Two days later the bands were increased, and on the third day reduction was good. Elastics were replaced by secondary wiring. A week after he came aboard, the patient was evacuated to a base hospital.



5. Case 5.

COMMENT

Various types of problems which confront a dental officer aboard a hospital ship in this phase of duty have been presented. Appliances have been largely improvised because equipment does not include special fracture appliances.

There were ten cases of severe mouth and lower jaw injuries during one action, in each case swelling interfering with treatment. The tongue was cut through fully a third of its thickness; it was protruding and swollen. The patients' jaws were severely comminuted with marked edema of the throat. Plaster head caps and chin cups with strong elastics were employed, with gauze placed in the cup to produce pressure over the swelling.

Care must be exercised with this treatment not to impair respiration or to interfere with breathing passages by displacing the fragments.

Edema and swelling were reduced enough in from 48 to 60

hours to permit splinting of the arches and subsequent reduction. Once the mouth was forced shut, the swelling of the tongue disappeared rapidly.

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LIFE CYCLE OF FUNGI CAN BE BROKEN

Fungus infections are so prevalent and frequently so severe that any suggestions on treatment should be reported. The acute dermatitis frequently observed and termed fungus infection should be treated like an infected second-degree burn and the fungus disregarded in this stage of its cyclic growth. The same sterile technic and drugs which are used in infected burns have a place at this time in the course of the disease.

The treatment is rest, hot compresses of boric acid in the daytime and at night 5-percent sulfathiazole ointment or sterile petrolatum, repeated daily until all redness and weeping disappears. The symbiosis of the gram-positive cocci and fungi must be destroyed. If cultures show streptococci, a course of sulfathiazole, 15 grains thrice daily for 5 days, is necessary. If the patient shows allergic response to the sulfonamide drugs, calamine ointment with zinc oxide 10-percent is used on the feet and sulfonamide orally discontinued. When the redness subsides the boric compresses are discontinued but the damaged skin is protected with the calamine ointment and 10-percent zinc oxide for 2 weeks.

The chronic stage is the only time to break in upon the life cycle of the fungus. After washing the feet, dry them thoroughly and immerse them in a solution of 25-percent ether in a 5-percent salicylic acid solution of merthiolate, covering in depth only the toes. The solution dries in from 3 to 5 minutes and socks and shoes are put on. Desquamation follows in 7 days and continues for about 7 days. Apply once a month thereafter. No recrudescence is found after 12 months. One case has remained well after 26 years' previous duration.—LORANCE, L. M., Lieutenant Commander (MC) U.S.N.R.

MILITARY DENTAL ESTHETICS AND PSYCHOLOGY

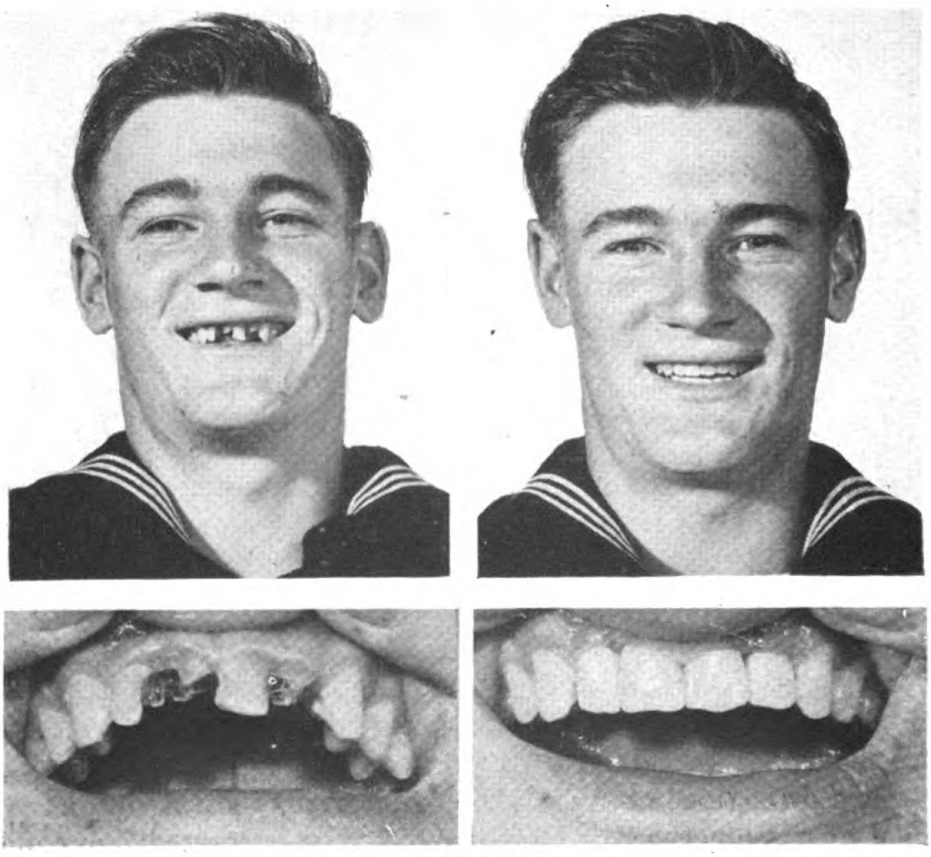
CURTISS W. SCHANTZ
Commander (DC) U.S.N.
and
CHARLES A. SCRIVENER
Lieutenant (DC) U.S.N.R.

The case illustrated here is an example of applied psychology in relation to esthetics in the practice of military dentistry. In order to understand the relation of psychology and esthetics between the dentist and the patient, and the patient and his associates, some fundamentals may be reviewed.

According to Darwin, in the lower simpler forms of animal life, existence depended on (a) self-defense against or escape from common enemies, (b) food, and (c) propagation of the race or species. These are still basic but are not the whole story. Through the development of these necessary purposes, nervous energy was expended and instincts were developed, impressing an emotional excitement of a particular quality. On perceiving any object, an individual is stimulated to act in regard to it in a particular manner, or at least he will experience an impulse to such action. Thus three distinct mental or psychologic processes were originated. These have been designated by McDougall as (a) taking cognizance of an object, (b) the specific emotion aroused, and (c) the mental attitude toward appropriate action.

To illustrate: A patient enters the dentist's office for diagnosis and treatment. He presents a malformity or advanced stage of oral disease which results in disintegration of the dental structures. The dentist's reaction is toward appropriate action. His reaction is normal and is so produced by his professional normal environment. The nonprofessional reaction to the patient's condition would be repulsion. The patient thus becomes a transmission point inciting to action or repulsion, and an acute awareness of the reaction produced on his asscciates develops into an individual mental complex.

A mental complex has been defined by Adami as a system of associated mental elements, the stimulation of any of which tends to call the rest into consciousness through the medium of a common effect. The entire mental life of a person in the military



Before and after.

service evokes inherent complexes which become magnified by circumstances that he may be forced to share with his fellow men.

For example the patient pictured above had led a normal existence, without having been the center of criticism because of his unsightly appearance. In his normal environment familiarity with his fellow men made his appearance a characteristic that was accepted without comment. When this man was projected into an association with men whose reactions were spontaneous regarding his appearance, he was forced into consciousness of disagreeable facts. In the service his abnormality procured for him a "handle," such as "Blue Tooth," "Horse Face," "Dog Face." The patient immediately showed an alteration of character and conduct. His smile was distorted; he frequently covered his mouth with his hand; his mental processes became retarded. In other words, a constant mental conflict was brought about by these shortcomings. Although from the circumstances of this case the mental perceptions cannot escape in their usual form, they are sometimes able to pass the censor in a disguised or symbolic form. Here the dentist as an experienced psychologist is enabled to see through these disguises and rid the person of his

conflict by practical removal of its cause. The dentist corrects the defects by restoring the person to a normal appearance.

Permanent deformity resulting from the loss and extraction of teeth, particularly the anterior teeth, and the subsequent drifting of adjacent teeth causes irreparable harm in the loss of contacts, gingival irritation, loss of masticating surface, and developmental malocclusion. Spaces close in a comparatively short time, making it difficult to construct satisfactory esthetic replacements, in harmony with the remainder of the dental arch.

The usual and most satisfactory method of tooth replacement involves laboratory processes that are not available in all military activities.

The all-porcelain crown with a dowel attachment provides a satisfactory replacement in a large percentage of patients presenting themselves with badly disintegrated or fractured anterior teeth. It is true that this type of restoration cannot be considered as "permanent dentistry" but it can be a satisfactory transitory replacement for disintegrated anteriors, which will prevent drifting of the adjacent teeth with accompanying complications. The esthetic effect is pleasing and a desirable psychologic effect on the patient is always the result.

The placement of porcelain crowns should be preceded by careful root canal treatment, and when evidence of infection is present, apicoectomy and removal of involved tissue should be done.

The teeth and crowns can be easily and quickly prepared in any unit equipped for ordinary operative procedures; thus such treatment has a place in the practice of military dentistry.

MYOCARDIAL INVOLVEMENT IN SUBACUTE BACTERIAL ENDOCARDITIS

Early reports dealing with subacute bacterial endocarditis gave the impression that the myocardium played an inconspicuous part in the disease. Clawson found inflammatory myocardial changes in 24 percent of the cases studied. Except in two cases, in which polymorphonuclear cells occurred, the changes consisted of inflammatory exudates composed of large or small mononuclear cells. The myocardial changes consist of minute emboli, infarcts, abscesses, diffuse inflammation, Aschoff nodules and perivascular fibrosis. These authors are convinced that the myocardial damage is so extensive that it is remarkable that heart failure does not occur more frequently and more severely than it does.—WILLIUS, F. A.: Cardiac clinics. CVIII. Subacute bacterial endocarditis: Pathology. Proc. Staff Meet., Mayo Clin. 19: 497–503, October 4, 1944.

SULFONAMIDE THERAPY IN GONORRHEA

RESULTS IN 210 CASES

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and
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Lieutenant, junior grade (MC) U.S.N.

The efficacy of penicillin therapy in gonorrhea makes it imperative to evaluate carefully the results obtained with sulfonamides. Of the numerous reports on sulfonamide therapy that have appeared in the literature to the present the great majority have been very optimistic, with cure rates ranging as high as 95 percent. Our failure to repeat the good response reported by others prompts this statistical analysis. In our experience sulfonamide therapy in gonorrhea has been unsatisfactory.

This series comprises 210 cases, representing 173 white patients and 37 Negroes treated with sulfathiazole and sulfadiazine. The great difference found between the two races in response to treatment necessitates keeping separate statistics, and leads to the conclusion that any figures resulting from a combination of white and colored patients cannot be accepted as representative for either group, and that any conclusions based on such a combination may be valueless.

The initial treatment was with sulfathiazole in 193 cases and with sulfadiazine in 17 cases. Of the larger group in which treatment was begun with sulfathiazole there were 41 patients who, following an unsuccessful trial with this drug, were given a course of sulfadiazine. Total dosages ranged from 35 to 50 grams. One hundred thirty patients were treated on a regimen of 2 gm. four times a day for the first day followed by 1 gm. four times a day on succeeding days. The remaining 80 patients received 1 gm. four times a day from the onset.

The 4-gm. per day dosage has been accepted as standard. Our experience confirms this opinion. The initial-day 8-gm. dosage gave no increase in the percentage of cures and has been abandoned. In addition it is believed that larger total dosage would not have altered the cure rates. Huge total doses, as high as 150 gm., were observed to be without effect on the disease. On the other hand only an occasional case was eventually cured by sul-

fonamide therapy when the urethral discharge remained positive after 72 hours.

Patients were treated for from 7 to 10 days. They were placed on a venereal restricted list and observed for 2 or 3 weeks following their course of therapy. The criterion of cure was absence of or a negative urethral discharge after 3 weeks. The inadequacy of this criterion of cure is realized, but it is emphasized that this makes comparison of our results with other series all the more striking, inasmuch as stricter criteria would naturally find more patients who did not respond to the sulfonamides.

Of the 173 white men treated an apparent cure was attained in 96, or 55.5 percent. The percentage of apparent cure in the 37 Negro patients was higher, 32, or 86.5 percent, responding to treatment.

TABLE 1.—*Percentage of cures in Whites and Negroes*

White		Negro	
Total 173		Total 37	
Cured	No response	Cured	No response
96 = 55.5%	77 = 44.5%	32 = 86.5%	5 = 13.5%

Some of the patients in this series have been hospitalized. A comparison of results in this group with those in the group receiving ambulatory treatment is of interest. Of the 131 white men hospitalized for treatment 84 (64 percent) were apparently cured. Forty-two white men were treated while on duty status; only 11 (26 percent) responded to treatment. Of the 17 Negroes treated in the hospital all recovered, a cure rate of 100 percent. Twenty colored patients received ambulatory treatment with an apparent cure attained in 15 instances (75 percent).

Of the 41 patients who were treated with sulfadiazine following an unsuccessful course of sulfathiazole, 11 (26.8 percent) were

TABLE 2.—*Comparison of ambulatory and hospital patients*

White				Negro			
Hospital (total 131)		Ambulatory (total 42)		Hospital (total 17)		Ambulatory (total 20)	
Cured	No response	Cured	No response	Cured	No response	Cured	No response
84 = 64.1%	47 = 35.9%	11 = 26.2%	31 = 73.8%	17 = 100%	0 0	15 = 75%	5 = 25%

apparently cured. As a result of the poor response to this sequence of therapy it has been discontinued.

The 17 patients started on sulfadiazine therapy constituted too small a number to warrant conclusions. However, the response was so poor (22 percent of the white men responding and 62.5 percent of the Negroes apparently cured) that the use of this drug in the treatment of gonorrhea has been discontinued at this activity.

CONCLUSIONS

1. Our experience with sulfonamide therapy in gonorrhea warrants far less optimism than is expressed by the majority of writers.

2. The Negro responds much more often to sulfonamide therapy than does the white man (86.5 percent as contrasted with 55.5 percent). By omitting the patients treated with sulfadiazine from the statistics, the percentage of cure in Negroes rises to 93.1 percent.

3. The results with sulfadiazine following an unsuccessful course of sulfathiazole were disappointing, only one out of four cases responding to the treatment.

4. From this experience the highest cure-rate in white men that can be expected from sulfonamide therapy in gonorrhea is 64 percent, and to attain this figure the patients must be hospitalized. With ambulatory treatment only 26 percent were cured. As unsatisfactory as these figures are, they are actually high due to the unrefined diagnostic criteria used.

The Negro responds so well to sulfonamide therapy that its continuation is warranted.

 

COLD AGGLUTININS IN DISEASE

Cold agglutinins may be associated with exposure to a variety of noxious stimuli: Drugs, bacterial toxins, parasites, viruses, and blood letting. Common coughs and colds may be associated with cold agglutinins. Atypical pneumonia is more often associated with the presence of serum cold agglutinins than other diseases studied. When interpreted with other findings, the cold agglutinin test is useful in clinical diagnosis.—FAVOUR, C. B.: Autohemagglutinins—"Cold agglutinins." J. Clin. Investigation 23: 891-897, November 1944.

TROPICAL OTITIS EXTERNA

EAR FUNGUS

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Tropical otitis externa is a more or less specific clinical entity often encountered among troops quartered in the Solomon Islands area. It is a peculiar inflammatory condition involving the external auditory canal, and in more severe cases the outer aspect of the tympanic membrane as well. This specific type of inflammation involving the ear became rampant among the troops soon after they landed.

The rivers originate in mountains several miles inland and in their seaward course they traverse jungle terrain little above sea level. For this reason the current is very sluggish, in some places almost imperceptible. Consequently this water is frequently coated with green scum, is stagnant and has a stinking odor. Many rivers are practically covered with dense tropical vegetation as they cross the jungle, and their bed consists of a heavy mass of black, decaying vegetation dropped from overhanging trees as well as luxuriant growth of indigenous grass and water plants. The high incidence of the ear condition associated with the obviously unwholesome character of the rivers suggested to early observers a fungus nature of the infection. Nevertheless, due to the exigency of the situation, the initial landing parties were forced to use these rivers for both bathing and laundry purposes.

Despite such preliminary observations, the true causative factor was not accurately or scientifically determined. Nor can it be said that we may be absolutely sure of the culprit in every instance even at the present time. Shortly after this division arrived in the tropics, a large number of cases of this specific type of inflammation appeared. The troops were admonished against bathing in the rivers, but many chose to ignore the warning. We promptly set about to ascertain the cause of infection, aided by the very competent staff of the attached field laboratory.

Sixty-nine individuals affected were thoroughly studied, and

cultures were taken from the inflamed ears. Cultures were made on a plain nutrient agar slant. In 65 cases a brilliant green growth resulted, and the organism proved morphologically to be the Pseudomonas pyocyanea (Pseudomonas aeruginosa). The identity of this organism was further substantiated by the National Naval Medical Center at Bethesda, Maryland. Of the four remaining cases, one showed a fungus growth, and three a mixed type of infection composed of streptococci, staphylococci and diphtheroids.

The question arose as to whether or not the external auditory canal was a natural habitat for the Ps. pyocyanea, and if so, whether or not the excessive humidity of the tropics plus the lowered resistance of the sojourner might favor its growth, thereby converting an innocuous or symbiotic organism into a pathogen. Cultures were made from 50 individuals in whom the ear was normal in every respect and who had no complaints. In no instance was the pseudomonas recovered. Cultures were then made from water taken from the rivers adjacent to the camp site, and also from sea water from the vicinity of the river mouth as well as at points remote from it. Since ground water from shallow wells (3 to 5 feet deep) is pumped into overhead gasoline barrels to be used as showers in this camp, this possible source of infection had to be ruled out. Cultures from it were made.

This research revealed the following:

1. River water teemed with Ps. pyocyanea.
2. Sea water taken in proximity to the river mouth also contained many Ps. pyocyanea. This pollution diminished in direct ratio to the distance from the mouth.
3. Cultures taken from sea water approximately 200 yards from the river mouth contained no Ps. pyocyanea.
4. In no instance was Ps. pyocyanea recovered from well water used for showers.

This investigation appeared to demonstrate that the chief source of infection was river water, or sea water directly in front of the river mouth. The latter point helps to explain why many early observers believed this specific infection of the ear might be due to sea water. The rivers, however, are not the only source of the infection in this area, because a few sufferers allege that they have not bathed in a river nor washed their clothes in it. It is quite possible in such instances that the infection comes from rain water frequently used for bathing, which has been impounded in the canvas folds of tents. Unfortunately no cultures of the rain water have been made.

Subjective complaints.—Pain in the ear is an almost constant complaint, and is described as varying from a slight itching or

burning sensation to a pain of considerable acuity. It is usually referred to the external auditory meatus. Generally hearing is impaired or there may be total deafness. Deafness may persist for a month or more, even after the inflammatory reaction has subsided. Pain on mastication is often complained of. Some patients have a serous discharge from the ear, but in no instance have we seen production of green, purulent material.

Objective findings.—Usually there is swelling of the soft tissues about the external auditory meatus, often including the periauricular soft tissues. This involvement is more conspicuous anteriorly, and frequently extends into the neck below and behind the angle of the jaw. Any type of manipulation applied to the external ear in such a manner as to distort manually the external auditory canal causes pain. This is especially noted when the pinna is pulled upward. In none of these cases have we elicited mastoid tenderness. The lymph vessels posterior to the angle of the jaw frequently are both enlarged and tender. Associated lymph nodes in the occipital triangle are likewise often palpable and tender. Inspection of the walls of the external auditory canal usually reveals extraordinarily marked injection. This inflammatory reaction is particularly conspicuous in the absence of swelling. In the presence of a rich hair endowment, the glistening mucoid deposition contrasts vividly with the red background. In some cases the canal is incrusted with dry serum; in others the canal may be partially or entirely occluded by inspissated secretion, cerumen, and epithelial debris. Commonly the inner half of the canal is implicated but the tympanum itself usually escapes.

Treatment.—This has always presented a difficult problem. Therapy based upon the usual fungicides proved quite ineffective. The method presented has been efficient in more than 100 cases.

1. Thoroughly cleanse the ear by lavaging gently with copious amounts of sterile warm water to which tincture of green soap has been added, and carefully dry the canal.

2. Insert deeply into the canal a small gauze wick which has been dipped in a saturated solution of boric acid in 70-percent alcohol. Leave in situ for 6 hours, keeping it moist in the interim.

3. Remove wick and withhold treatment for 12 hours.

4. Repeat above procedure daily for from 3 to 5 days. Prompt relief usually follows. Continue until signs of inflammation disappear completely. The index for persistent therapy hinges upon clinical findings. In very acute cases, hot compresses applied to the external ear may afford further relief.

From a prophylactic standpoint, it is important to avoid such

gross sources of pollution as have been mentioned. Care in keeping the ears dry appears to be of paramount importance.

SUMMARY

1. A more or less specific inflammatory entity involving the external auditory canal is almost endemic among troops quartered in the Solomon Islands area.

2. Cultural evidence establishes the Pseudomonas pyocyanea as the causative agent. Cultural evidence likewise establishes the river water in this area as a prolific source of this organism.

3. The symptom complex follows a monotonous pattern, with certain variations depending upon the degree, extent and site of the inflammatory reaction.

4. A simple, efficient and expeditious method of treatment consists of repeated insertion into the auditory canal of a gauze wick moistened in a saturated solution of boric acid in 70-percent alcohol. The avoidance of water polluted with Pseudomonas pyocyanea is of paramount importance in prophylaxis.

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PROGNOSIS IN ELEVATED BLOOD CREATININE

It would appear that the Van Slyke urea clearance test gives the most reliable measure of renal insufficiency, especially in the early stages of renal disease. When definite impairment in renal function has been established the level of the blood urea nitrogen should also be taken into consideration, since this is available from the data required for the calculation of urea clearance. With a definite elevation of the blood urea nitrogen, the creatinine should also be determined. Experience has conclusively demonstrated the superiority of the blood creatinine over the urea nitrogen as a prognostic sign in cases with markedly impaired renal function. While essentially the same prognosis might be given in many cases on the basis of figures for the urea nitrogen alone, there is a considerable number in which the creatinine may be elevated above the critical level without the presence of correspondingly high values for the urea nitrogen. It is on this account that the prognostic significance of an elevated blood creatinine is more dependable than that of urea.—MYERS, V. C.: Prognostic significance of elevated blood creatinine. J. Lab. & Clin. Med. 29: 1001–1019, October 1944.

PULMONARY TUBERCULOSIS

FLUOROSCOPIC SURVEY AMONG CIVILIAN EMPLOYEES AT AN ADVANCE BASE

PRELIMINARY REPORT

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Pulmonary tuberculosis is the outstanding public health problem in the communities from which this North Atlantic base draws its civilian employees, most of whom are of Irish descent. Various surveys have shown that between 4 and 5 percent of the local population have *active* tuberculosis, and the death rate is 200 per 100,000, four times that which occurs in the United States.

Construction of this base was carried out by American civilian contractors employing almost exclusively native labor. Hazard to the military population developed some time later as the Navy personnel increased. Many of the employees live in barracks on the base, and the families come into frequent close contact with both officer and enlisted Navy personnel. Some of the employees are foodhandlers, while others perform janitorial duties. The finding of far advanced, bilateral tuberculosis with cavitation in a girl employee, 20 years of age, made it imperative to carry out x-ray studies on her known contacts among Navy personnel. However, none of the contacts examined roentgenographically showed evidence of reinfection tuberculosis. Employing 14- by 17-inch films, a survey of all Navy personnel on the base is at present in progress, and all civilians applying for work are now subjected to fluoroscopic study of the chest as part of the routine medical examination.

Films were not available in sufficient quantity to permit a roentgenographic survey of the more than one thousand civilians employed. However the dispensary x-ray department is equipped with a good fluoroscope and it was thought that fluoroscopy, checked by roentgenograms in a relatively small number of doubtful cases, offered an adequate method of "screening," provided the criteria for rejection were rather strictly defined. The present report is based on the fluoroscopic study of all civilians employed on the base and also those applying for work since the institution of this program.

Method.—The fluoroscope employed in this study was equipped with a Patterson type B screen. The small focal spot (2.2 mm.) and the maximum target-screen distance (35 inches) were used. This afforded geometric unsharpness negligibly greater than that obtained with the chest radiographic equipment utilizing the large focal-spot (5.2 mm.) and a target-film distance of 6 feet.

Dark-adaptation was conveniently obtained with Navy aviation goggles, using the red nonpolarizing dark adapter filter; routine work, except film reading, could be carried out during an initial period of from 10 to 15 minutes, and an additional 5 minutes were spent in the darkened fluoroscopic room before examinations were undertaken.[1]

The subjects were rotated and their shoulders were moved during the roentgenoscopy, utilizing the only advantage which the method has over films, namely, that of displacing skeletal shadows from superimposition on those of the lung parenchyma. This was of particular value in visualizing the apices. The field was always shuttered down to small dimensions to minimize unsharpness due to scattering.

Results.—When this program was initiated it was realized that a small percentage of minimal lesions would inevitably be overlooked due to the inadequacies of the method. It was the aim to eliminate all potentially dangerous cases that could be detected by the means at hand. The medical department did not feel any responsibility to prove the activity of any lesion; if the roentgenographic appearance did not indicate with reasonable certainty that the lesion had been arrested, the worker was discharged. In only two instances was sputum examination carried out; acid-fast bacilli were demonstrated in one of these cases.

One male employee, 20 years of age, apparently in good health previously, experienced a moderately severe pulmonary hemorrhage shortly before he would have been examined fluoroscopically in the course of this survey; the chest roentgenogram showed bilateral cavitation and the sputum was loaded with tubercle bacilli.

No serious discrepancy was encountered between the fluoroscopic impression and the subsequent roentgenographic appearance of lesions in those cases in which a film record was deemed worth while. In the majority of instances, rejection was based solely on the fluoroscopic findings.

All those rejected were told that there were findings in the lungs which warranted consultation with a physician. The fluoroscopic and roentgenographic findings were made available to phy-

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[1] CHAMBERLAIN, W. E.: Fluoroscopes and fluoroscopy (Carman lecture). Radiology 38: 383-413, April 1942.

sicians of the various communities. The names of all those discharged were turned over to the civilian public health authorities for follow-up.

The results are tabulated below. It is to be understood that the analysis is based solely upon interpretation of the roentgenographic appearance of lesions. The policy throughout was to reject the employee when doubt of the absence of activity seemed well grounded. A rough breakdown of the lesions with respect to extent and to roentgenographic evidence suggestive of activity has been attempted for the sake of completeness. The cases with cavitation include two with single, small cavities and three with multiple large cavities.

The other cases classified as definitely active and extensive showed areas of parenchymal infiltration covering two interspaces or more. Instances of bilateral infiltration were placed in this category. Minimal active cases showed unilateral infiltration covering no more than one interspace. Considered possibly active were a number of cases in which the abnormal density in the roentgenogram, regardless of extent, suggested scarring, but in which activity could not well be ruled out. A number of persons with discrete apical scars or with apical calcifications were not discharged.

No record was made of the considerable number of cases showing calcified "primary complexes." One individual with severe dorsal kyphosis, evidently due to an old Pott's disease, showed no pulmonary lesion. One individual who had had a thoracoplasty (upper three right ribs) was observed 3 years after operation and the lungs showed no evidence suggestive of tuberculous activity.

Total examined fluoroscopically			1,038
Evidence of reinfection tuberculosis			82 (7.9 percent)
Discharged (active and possibly active lesions)			55 (5.2 percent)
	Males	46	
	Females	9	
Active:	Cavitation	7	
	Extensive infiltration	16	
	Minimal infiltration	8	
Possibly active		24	

SUMMARY AND CONCLUSIONS

1. On the basis of a fluoroscopic survey, approximately 5 percent of the civilian employees at an advance base were found to have lesions suggestive of active pulmonary tuberculosis.

2. A highly tuberculous native population is an obvious menace

to the health of military personnel. The only effective preventive measure is to eliminate active and potentially active cases by some screening procedure. Such a procedure, for purposes of prevention, should be instituted during the establishment of an advance base.

3. Where more ideal methods are not available, fluoroscopy may be used for this purpose.

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ENVIRONMENTAL AGENTS IN SCRUB TYPHUS

The number of cases of scrub typhus that occurred at first was high but as the area became denuded of scrub the incidence fell. It was observed that cases commonly occurred among those ratings who had been employed in scrub-clearing or who had occupied camps in recently or imperfectly cleared areas. Every effort was made to employ bulldozers instead of manual labor for scrub-clearing. It was essential to clear the scrub manually; it was burned after spraying with paraffin and the personnel ordered to wear long trousers and shirt sleeves. This the native troops did readily but the European found most uncomfortable. It was endeavored so far as possible to leave recently cleared sites for 6 weeks before using them for camps as it was noticed that the incidence of scrub typhus in recently arrived units was high only when they occupied new sites and not when they went into camps which had been in use for some time.

Rats abounded in the area and the question of their elimination was considered but it was thought premature and possibly dangerous to undertake any extensive anti-rat measures which might enforce a change of habits, especially the feeding and nesting habits, of rats. The only measure which could be undertaken with safety is the trapping of rats alive and their subsequent destruction by immersion in kerosene. Break-back traps and poison bait should not be employed at present in view of the probability of the mites leaving the rats after death, and becoming dispersed throughout the camps. The rats lived mainly in the coconut palms where they nested and fed on the green nuts. When the latter had been attacked by the rats they fell to the ground and there formed excellent breeding places for the aëdes mosquitoes. For this reason a systematic attack was made on the coconuts by regular cutting of the nuts and it was found that the rat population decreased noticeably and there was no increase in the number of cases of scrub typhus.—ZAIR, A. H.: Scrub typhus. J. Roy. Nav. M. Serv. 30: 135-137, July 1944.

CLINICAL NOTES

AN UNUSUAL CASE OF DECOMPRESSION SICKNESS

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During the past 10 years patients with experimentally induced decompression sickness, and cases incident to extensive training in deep sea diving, have been frequently treated at this activity. The following report describes certain unusual features of the bends, chief of which was the onset of symptoms prior to the first decompression stop at 20 feet.

Case report.—A diver was exposed to a depth of 125 feet for 30 minutes, during which period he did moderate work. His diving partner, whose situation was exactly parallel to his in time, depth, work, and rate of ascent, remained completely symptom-free.

Two hundred twelve other dives to this depth have been made during the past 2 years under practically the same conditions, with the occurrence of only 1 mild case of decompression sickness, the symptoms of which were undue fatigue and a late onset of slight joint pain which responded readily to treatment.

The injured diver, a young, lean, athletic type of man, had successfully passed the strictest physical requirements for deep sea diving training. He had made one previous uneventful dive to 112 feet for 3 minutes in the dry chamber. The subject dive was a pressure-tank wet dive in standard diving dress at 125 feet. After remaining on the bottom for 30 minutes doing moderate work, he began his ascent and at some point between the bottom and 20 feet, excess nitrogen presumably was released from solution, forming gas emboli. His symptoms just prior to the 20-foot stop were paresthesia, weakness in his left upper extremity, and inability to talk. After reaching 20 feet he collapsed and was removed from the tank and recompressed in the dry chamber. At 75-feet pressure-depth he regained consciousness but was taken to 165 feet in accordance with the routine practice. After 15 minutes at this depth the paresthesia and weakness began to clear and recovery was complete after 49 minutes.

At the end of 1 hour at 165 feet he was decompressed with stops at 110, 100, 90, 80, and 70 feet. At 60 feet pure oxygen was administered for 30 minutes, at 50 feet for 30 minutes, and at 40 feet for 34 minutes. At 30 feet air was breathed and compression was continued for 12 hours.

During this 12-hour period the diver was nauseated and vomited frequently and complained of a dull headache. Repeated blood pressure recordings were noteworthy because of their small pulse pressure. An average reading was 110/95 accompanied by a weak, rapid pulse varying between 100 and 130 per minute.

After 12 hours at 30 feet, ascent was made to 20 feet for 52 minutes, and then to 10 feet. After 59 minutes at 10 feet, the patient suffered a recurrence of paresthesia in the left upper extremity which was followed by a generalized epileptiform convulsion. The pressure was then increased to 30 feet and he was observed for 1 hour. During this period he recovered completely from the convulsion. Decompression was concluded by stops at 20 and 10 feet before reaching the surface.

The diver at this time was apparently symptom free except for weakness and a headache. He was quite lucid and seemed to have full use of his extremities. It was considered unlikely that the convulsion which occurred at 10 feet was due to recurrence of gas emboli, but rather a reaction to the original, severe nervous system ischemia caused by the previous gas emboli. However to insure against the possibility of a delayed recurrence of symptoms, he was again returned to 30 feet, where he remained for another 24 hours.

During this second exposure improvement in blood pressure, pulse rate and general condition was noted. Vomiting and headache, which were prominent during the original treatment, ceased. Such improvement when the pressure was increased suggests that small emboli were present prior to the second recompression.

Neurologic examination revealed an incomplete transverse myelopathy at the twelfth thoracic segment. The electroencephalogram recording was compatible with the clinical diagnosis of general brain injury.

At the present time the diver, although returned to duty with a good prognosis, has been disqualified for diving because of his apparently unusual degree of susceptibility to bends.

COMMENTS

In compressed-air diving the symptoms of decompression sickness practically never begin until after the completion of the dive, when the man has been at the surface for at least a few minutes, usually within the first hour after the dive or up to 12 hours following the dive. Rarely do symptoms occur while he is still under pressure decompressing from the dive.

In helium-oxygen diving, however, the condition is not unusual; occasionally symptoms occur while at a depth as great as 80 feet. Here we have a reasonable explanation in the fact that the physical and chemical properties of helium are such that the bulk of it is in solution in the rapidly saturating and desaturating tissues, and is readily released by only slight changes in the pressure differential. In compressed-air diving, the inert nitrogen component of the air by reason of its greater solubility in body fat and the slow circulation in fat tissue, is held by this tissue, and released only slowly on ascent and at the different decom-

pression stops. The remainder diffuses from the tissues through the lungs after the diver has been at the surface for the succeeding 8 to 12 hours.

It is thought that the treatment rendered this patient prevented permanent nerve damage or, because of the severe involvement of the brain and spinal cord, possibly death. Prolonged recompression over a period of 24 or more hours must be resorted to when signs and symptoms indicative of injury to the central nervous system are present.

CONCLUSIONS

1. All cases of decompression sickness involving the central nervous system require long periods under pressure to assure absorption of gas emboli and restoration of the circulation.

2. Any person developing symptoms while still under pressure during decompression from a dive should be considered in danger.

3. Most frequent errors in treatment are: (1) Failure to give treatment in doubtful cases; (2) delayed recompression; (3) failure to resort to 24-hour decompression in serious cases; and (4) failure to keep the treated patient near the recompression chamber for a 24-hour period.


MOLASSES VS. SOAPSUDS ENEMAS

The normal physiology of defecation would indicate 3 ounces as the normal daily evacuation from the patient in bed. To exceed this amount is to infringe on the normal bowel movement of the next day. A continuance of the use of the larger enemas or of the hit or miss laxatives also effectively upsets the normal daily bowel movement routine.

The use of 3- to 4-ounce enemas, starting with 50-percent molasses in water, dropping rapidly to 25- and 10-percent molasses as recovery occurs is advocated.

Molasses was chosen because: (1) It proved to be relatively nonirritant; (2) it is easily available; (3) it is cheaper than glycerin; (4) it is easily miscible in varying strengths; (5) it is not incompatible with any additional medicaments such as turpentine; (6) it is effective. Observations on 15,000 patients covering 25 years with 5,000 follow-up records has shown that 6 percent of the patients on the small enema give a history of rectal irritation or of faintness instead of the 33 percent on the haphazard soapsuds technic.—HICKS, E. S.: Observations regarding enemas. Canad. M. A. J. 51: 358-359, October 1944.

SPONTANEOUS MEDIASTINAL EMPHYSEMA

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Spontaneous mediastinal emphysema or spontaneous interstitial emphysema of the lung, described by Hamman in 1937, is important only because it is frequently confused with such serious organic diseases as pericarditis or acute coronary occlusion.

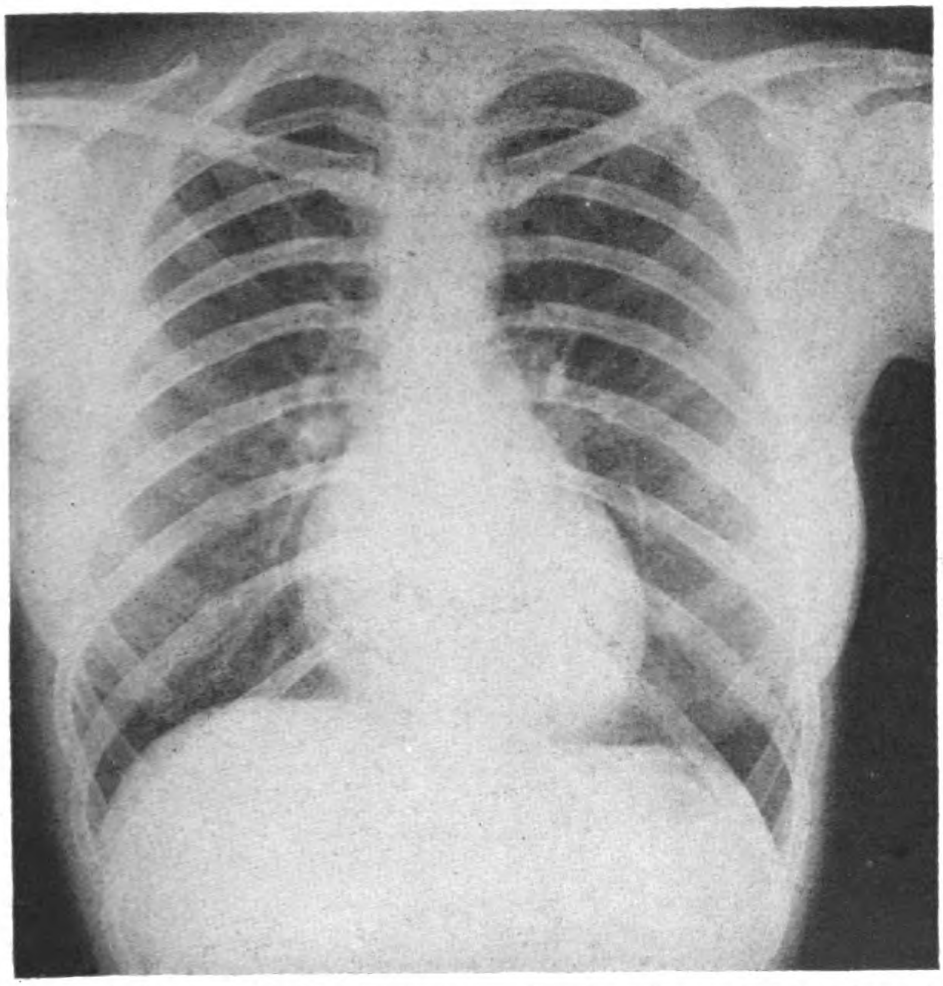
The syndrome is characterized by the sudden appearance, without previous injury or violent effort, of a severe pain over the heart and sternum. On physical examination an unusual crunching, crackling, bubbling sound is heard over the heart with each contraction. The sound is often mistaken for a pericardial or pleural friction rub. However on understanding that the sound is caused by interstitial air, it is easily differentiated from friction sounds.

The condition is unusual but not rare; Hamman (*1*) (*2*) described six cases. However although not more than 12 cases have appeared in the literature, doubtless since Hamman's classic description many have been recognized. The subject was reviewed in 1939 by McGuire and Bean (*3*) and again in 1944 by Greene (*4*) who discusses the possible causes of the sounds.

One of the two patients whose cases are described here was observed in 1939 in civil practice, and the other in the medical ward of a U. S. Naval hospital. Both cases were referred because the attending physicians thought the patients were suffering from acute pericarditis. The bizarre sounds, when heard for the first time in patient 1, were puzzling. However chance reading of Hamman's article clarified the diagnosis. The x-ray sign of a sharp line around the borders of the heart which disappeared in subsequent films confirmed the diagnosis.

CASE REPORTS

Case 1.—A 20-year-old unmarried female was seen in February 1939 complaining of a severe pain over her heart. The attack came on suddenly a few hours before when she was reaching up on a shelf for a book. She immediately lay down, and was surprised and frightened by hearing a crunching, bubbling sound in her chest. She walked into the office and on examination all the vital signs were normal and she appeared healthy. There was no cyanosis. On auscultation over the heart, a loud, crunching sound with each



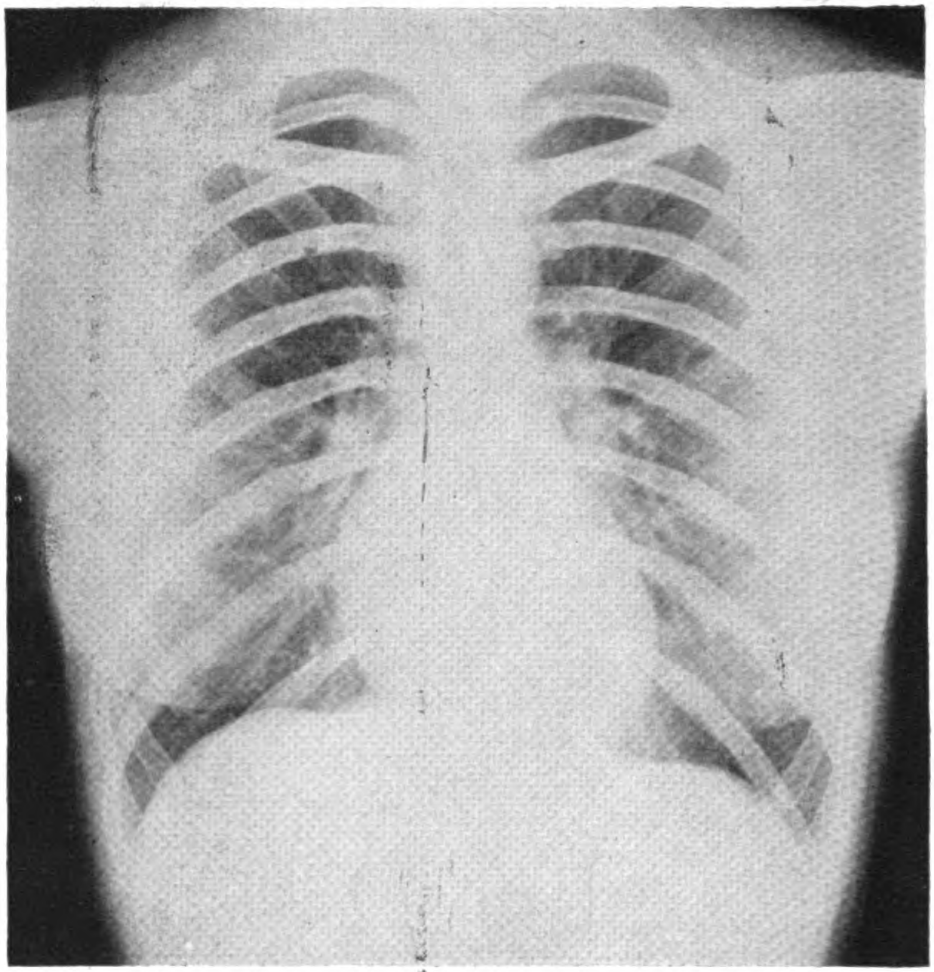
1. Film of chest made 16 March 1944, showing sharp demarcation of the borders of the heart.

—Official U. S. Navy Photo.

contraction of the heart could be heard. The sound was quite different from a pericardial or pleural friction rub. An x-ray film made immediately revealed a very sharp line around the left border of the heart. A later film revealed the usual fuzzy heart margin. An electrocardiogram was normal.

The patient was informed that she had no serious heart disease but was advised to remain in bed until the pain ceased. That night she was kept awake as much by her preoccupation with the peculiar noise in her chest as by the pain. Two days after the onset, the sound could not be heard and she was returned to her regular duties.

Case 2.—A 23-year-old WAVE yeoman, second class, was admitted to a U. S. Naval hospital, on 16 March 1944 with a diagnosis of probable acute pericarditis. She was complaining of a severe "clawing" pain in the chest. She was well until the evening before when she was suddenly seized with a severe pain beneath the lower part of the sternum as she sat writing a letter. The pain was not affected by position or swallowing. She went to bed but was unable to sleep except for brief periods. She was seen by the medical officer early in the morning who stated that the patient was in great pain, short of breath, cyanotic, and that upon auscultation of the heart a loud pericardial friction rub was heard over the pericardium. She was rushed to



2. Chest film made 5 days later, showing usual fuzzy heart borders.
—*Official U. S. Navy Photo.*

the hospital and on physical examination nothing abnormal was found except a to-and-fro sound heard over the lower sternum. It simulated the sound made when walking in boots containing water. The sound could not be mistaken for a pericardial friction rub.

X-ray film of the chest showed a very sharp demarcation of the right and left borders of the heart (fig. 1). The line of the border was almost as sharp as that seen in a calcified pericardium. A film made 2 days later showed the normal fuzzy borders of the heart. The difference in the two films was striking. The lateral films showed nothing characteristic.

The bizarre sound was heard throughout the day but the pain gradually disappeared. The temperature rose to 100.4° F. during the day. The next day the sound could not be heard and the patient was fever free and felt well. She was observed for 5 days and returned to duty.

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PATHOSIS IN SUBACUTE BACTERIAL ENDOCARDITIS

A previously damaged valve or a congenital cardiac defect is a prerequisite for the development of subacute bacterial endocarditis. Valves injured by previous rheumatic fever occur with greatest frequency, and the mitral and aortic valves, or both, are the seat of the disease far more commonly than are the valves of the right side of the heart. Numerous congenital defects have been found to permit the development of subacute bacterial endocarditis or endarteritis. Less common congenital cardiac defects which became complicated by subacute bacterial endocarditis are: The tetralogy of Fallot, pulmonary stenosis, patency of the ductus arteriosus associated with pulmonary stenosis, coarctation of the aorta (adult type) with bicuspid aortic valve, bicuspid aortic valve, and subaortic stenosis associated with a defective aortic valve. Syphilitic aortitis without involvement of the aortic valves is likewise occasionally the seat of subacute bacterial endocarditis. Arteriosclerotic valves only occasionally become the seat of subacute bacterial endocarditis.

Early in the course of the disease embolic detachment of the bacteria-bearing vegetations occurs. Their dissemination in the blood stream determines the site of their ultimate lodgment. Minute bacterial emboli are commonly transported to the arterioles of the skin, mucous membranes and retinae. They frequently occur in showers. Multiple emboli to tne spleen are common. In addition to gross infarction of the kidneys they invariably reveal a characteristic embolic form of glomerulonephritis. —WILLIUS, F. A.: Cardiac clinics. CVIII. Subacute bacterial endocarditis: Pathology. Proc. Staff Meet., Mayo Clin. 19: 497–503, October 4, 1944.

MONONUCLEOSIS ON BOARD A DESTROYER

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Mononucleosis is a benign acute infectious disease, the cause of which is unknown. Young adults are usually affected and the disease is characterized by cervical and often generalized lymphadenopathy, splenomegaly, and varying degree of tonsillar and pharyngeal inflammation. There is also fever, soreness of the neck, headache, and sore throat. The onset is often insidious, and the diagnosis is easily missed in mild cases. The disease usually runs its course in from 3 to 6 weeks. The diagnosis is made from the history, physical findings, variable white blood cell count, the distinctive blood smear and the Paul-Bunnell test[1] of the blood serum for heterophile antibodies. There appear to have been few if any true epidemics of this disease reported in the past,[2] and it has been assumed to have a low index of communicability, especially in adults.

A recent report by Halcrow, Owen, and Rodger[3] describing an epidemic of mononucleosis in the environs of a British Emergency Medical Service Hospital is therefore of great interest. The cases in question occurred mainly in the age group 20 to 45. There was evidence from blood smear and serologic study that there was a higher rate of subclinical infection than there was of infection with clinical manifestations. Of 296 persons who were investigated, 165 showed only hematoserologic signs of infection, 125 were classed as having clinical mononucleosis, and 6 cases were negative after both laboratory and clinical study.

In view of this epidemic arising in a well-localized community, the presence of mononucleosis on board a destroyer operating in forward areas was regarded with some uneasiness. The living conditions on board a destroyer are favorable to the progress of a true epidemic. The members of the crew live in necessarily congested quarters, with constant close contact with their bunk neigh-

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[1] PAUL, J. R., and BUNNELL, W. W.: Presence of heterophile antibodies in infectious mononucleosis. Am. J. M. Sc. 183: 90-101, January 1932.

[2] GORHAM, L. W.: Infectious Mononucleosis, in CECIL, R. L.: A Textbook of Medicine. W. B. Saunders Company, Philadelphia, 1943. pp. 462-464.

[3] HALCROW, J. P. A.; OWEN, L. M.; and RODGER, N. O.: Infectious mononucleosis with account of epidemic in an E.M.S. hospital. Brit. M. J. 2: 443-447, October 9, 1943.

bors. In the "chow line," mess hall, crew's head, gun mounts, engineering spaces, etc., they live and work shoulder to shoulder. The common cold and its variations characteristically run through the entire crew once introduced on board.

Despite the existence of these conditions favoring the spread of any infectious disease, only three cases of mononucleosis are known to have occurred on this destroyer, all of which were diagnosed within the period of one week. Two were treated on board in their own bunks throughout the entire course of their illness and the third was on board for the first 5 days. A careful check during the ensuing 3 months, as well as a review of the complaints of and findings on all men who had reported to the sickbay in the month previous, failed to give evidence of clinical involvement of any other members of the crew. Two of these patients were obviously in midcourse when the diagnosis was first made, and one was definitely early. The ship had visited a liberty port approximately 5 weeks before, but since that time had operated in an area which precluded the granting of any liberty. The only other possible source of infection could have been the occasional visits of members of the crew to neighboring vessels. These vessels however had no known mononucleosis patients aboard.

It is rather remarkable that the three cases reported should have been those of men with diametrically opposite duties, and with entirely different living quarters, offering the least opportunity for physical contact. The disease occurred successively in a fireman whose bunk and station lay aft, in the executive officer whose activities were almost entirely limited to the officers' country and forward deckhouse, and in a boatswain's mate whose bunk was situated in the forward living compartments and whose duties were largely restricted to the vicinity of the forecastle. It would have been hard to select deliberately any three people having less in common.

CASE REPORTS

Case 1.—A 20-year-old fireman, first class, reported to the sickbay on 15 March 1944, with a complaint of headache, and returned with the same complaint the following day. Examination both times was negative and his temperature was normal. He continued to feel a vague malaise and on 22 March reported with a mild sore throat. On 29 March, his throat became worse, he developed a stiff neck, and an increasingly severe headache. Examination showed a congested pharynx with enlarged tonsils spotted by a patchy gray membrane. There were bean-sized anterior and posterior cervical, axillary, inguinal, and femoral palpable lymph nodes, and a palpable spleen. The temperature was 101° F., pulse 96, and a white blood cell count of 13,000. A differential blood smear showed 39 percent polymorphonuclear neutrophils; 51 percent lymphocytes; 1 percent basophils; and 2 percent monocytes. There was a 7 percent atypical mononuclear count consisting of cells which varied

from moderate to large, round to oval, and frequently having uneven cell borders. The cytoplasm was characteristically foamy. The nucleus contained densely staining chromatin masses interspersed with vacuoles. A throat smear showed many Vincent's organisms. Heterophile agglutination done on the following day was strongly positive at 1:1,024; four days later it had fallen to 1:256. The temperature fluctuated, reaching 103° F. during the next 4 days, and then steadily improved under symptomatic therapy. The patient returned to duty 3 weeks after onset of the disease.

Case 2.—The 25-year-old executive officer of this vessel noted a dull persistent headache and slight general malaise starting about 16 March 1944. Physical examination during this period was negative and there was no fever. On 27 March he first complained of sore throat, and examination disclosed pharyngeal injection with several small patches of grayish membrane covering the fauces, enlargement of anterior and posterior cervical and femoral lymph nodes, and a palpable spleen. The temperature was 99.2° F., white blood cell count 14,600, and differential blood smear showed 35 percent polymorphonuclear neutrophils; 40 percent lymphocytes; 3 percent eosinophils; 2 percent basophils; 3 percent monocytes; and 17 percent atypical mononuclears. Heterophile agglutination done the following day was strongly positive at 1:1,024. During the next 8 days this patient ran a low grade fever, his axillary glands became palpable, and his white blood count rose to 15,000 cells after which it gradually declined. A throat smear showed a moderate number of Vincent's organisms. This officer returned to duty on 3 April 1944, despite a palpable adenopathy.

Case 3.—A 23-year-old boatswain's mate, second class, reported to the sickbay on 26 March 1944 with a 48-hour history of headache, soreness in his neck, and a sore throat. Examination showed definite faucial injection, bean-sized nodes in the anterior and posterior cervical, axillary, inguinal, and femoral regions, and a palpable spleen. Temperature was 101.2° F., pulse 90, white blood cell count 4,100 and the differential blood smear revealed 32 percent polymorphonuclear neutrophils; 35 percent lymphocytes; 1 percent eosinophils; 2 percent monocytes; 26 percent atypical mononuclear cells; and 4 percent normoblasts. Blood taken for heterophile agglutination 2 days later was reported as negative (1:8) undoubtedly due to the relatively early stage of the disease. The patient was transferred to a Naval dispensary on 26 March 1944, where the diagnosis was confirmed and where he remained for 19 days. At the time of transfer his white blood cell count had risen to 5,600.

Because of the reported finding that subclinical cases were common under such conditions, blood smears were done and blood samples were taken for heterophile agglutinations on 5 men having symptoms at this same time conceivably attributable to infectious mononucleosis. The clinical diagnoses of these cases included acute pharyngitis (2 cases), Vincent's angina, acute catarrhal fever, and pityriasis rosea. All of these patients complained of headache, slight sore throat, and a mild fever. Blood smears were not typical on any of these cases, and heterophile agglutinations were done from 7 to 10 days after the onset of the symptoms on 4 of these, all of which were reported as negative (1:8). An agglutination

test done on the fifth case was negative, but because the blood was taken only 2 days after the onset of symptoms, the results of the test were considered inconclusive.

Had the facilities permitted, blood smear and serologic studies of the entire crew might have revealed evidence of a more widespread epidemic than was apparent; but there are no data to support such a conclusion.

In view of the reported finding that infectious mononucleosis produces in many cases a temporary falsely positive serum reaction for syphilis, Kahn tests were performed on the blood during convalescence in cases 1 and 2. Both were reported as negative.

SUMMARY

1. Three cases of infectious mononucleosis occurring on board a destroyer are described.

2. It is of interest that despite the existence of living conditions favoring the spread of infectious diseases, no further cases were diagnosed.

3. The cases in question arose in one officer and two enlisted men having little occasion for physical contact with each other.

 

ABNORMAL CARBOHYDRATE METABOLISM IN BURNS

In 35 consecutive burned patients, a high incidence of hyperglycemia, lactacidemia and a moderate reduction in the carbon dioxide combining power of the plasma were found. There is a high degree of correlation between these abnormalities of carbohydrate metabolism and the severity of the burn. The glucose-tolerance tests that were made indicate that in some severely burned patients with hyperglycemia there remains a considerable ability to metabolize added glucose. There was no evidence of liver damage in these patients as a result of the burn injury. In the few cases in which liver damage was found, it was present before the injury, being for the most part an alcoholic cirrhosis. The abnormalities in carbohydrate metabolism that have been presented are not inconsistent with the presence of an increased glycogenolysis, together with a possible gluconeogenesis from protein. It is suggested that additional glucose be given early to burned patients.—TAYLOR, F. H. L.; LEVENSON, S. M.; and ADAMS, M. A.: Abnormal carbohydrate metabolism in human thermal burns; preliminary observations. New England J. Med. 231: 437–445, September 28, 1944.

AVULSION OF PARIETAL BONE

REPORT OF A CASE

STEPHEN H. TOLINS
Lieutenant (MC) U.S.N.

Compound fracture of the skull is, in time of war, a relatively common type of head injury. Often there is loss of bone substance. The loss of a major portion of a large bone of the cranial vault, however, is rare. In a recent review of the literature on head injuries by Merritt[1] no mention is made of such a case. The following case of loss of half the left parietal bone is believed worthy of review.

Case report.—The patient, a ship's cook, second class, age 21 years, was asleep in his bunk when his ship was torpedoed in the stern. Approximately 3 minutes later an officer who was going aft saw the patient walking forward. This officer stated that the patient's general appearance was so normal that he called to him to go back aft and assist in the rescue work. The patient walked past without acknowledging the greeting or appearing to notice the officer. When he had passed the officer, the latter saw that "the whole left back half of the skull was shot away."

Five minutes after the torpedo struck, the patient walked into the dressing station by himself. The pharmacist's mate noted that the patient was completely disoriented and that he did not recall anything of the torpedoing or of his injury. On examination of the patient's head the pharmacist's mate found the entire left posterior half of the scalp lifted up. He saw no bone beneath, but noted a "glistening membrane" which was intact. The scalp flap was turned back into place but no suturing was done. Sulfathiazole powder and a dry sterile dressing were applied. The patient was placed in bed.

Two hours after the torpedoing a medical officer was transferred from another ship. He found the patient in moderate shock, pulse 130, systolic pressure 100; and began the intravenous administration of plasma. It was then that the patient became aware of his surroundings for the first time. Seven units of plasma were administered, after which the patient's pulse ranged between 80 and 90, blood pressure 130/80. Examination at that time revealed the scalp laceration, and slight oozing of blood from the left ear. There were no reflex changes or other neurologic signs. The medical officer felt a bone defect beneath the scalp laceration, but did not attempt to determine its extent.

Sulfadiazine therapy was begun by mouth with an initial dose of 3 gm. and subsequent doses of 1 gm. every 4 hours. One gram of sodium bicar-

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[1] MERRITT, H. H.: Head injury; review of literature. War Med. 4: 61-82, July; 187-215, August 1943.

bonate was given with each dose of sulfadiazine. No other drugs were given except ½ grain of phenobarbital on the evening of the first and again on the second day.

The patient complained only of slight headache which continued for the first two days. He vomited once on the first day. He took light nourishment without difficulty. On the second day he was given 2 units of plasma. On the third day he was transferred by whaleboat to another ship. During this day and the following day he was comfortable and entirely asymptomatic.

The patient was received at our activity 4 days after his injury. He was alert, cooperative, pleasant, well oriented, and without discomfort or apprehension. He recalled nothing of the torpedoing of his ship or the subsequent 2 hours. His general condition was excellent, temperature 98.4° F., pulse 80, respirations 20, and blood pressure 125/70.

Examination of the head revealed an extensive scalp laceration in a reverse-L shape which started just above the left ear, extended horizontally backwards to midocciput and then upward to the vertex. The skin edges were separated throughout their extent by a distance of from 2 to 15 mm. Clotted blood and caked sulfathiazole powder filled this space between the skin edges. There was dried blood in the left external auditory canal. The remainder of the physical examination was negative. Neurologic examination was negative except for diminution of sensation of the scalp flap. No personality changes were elicited in conversations with the patient or with his shipmates, many of whom were in the same ward for several weeks.

Complete blood count revealed only moderate secondary anemia, hemoglobin 71 percent and red blood cells 3,500,000. Reports of urinalysis were all essentially negative.

Spinal puncture, performed on the fifth day following the injury, revealed a crystal clear spinal fluid. The initial pressure was 160 mm. of water; final pressure 140 mm. of water after removal of specimens. There was no xanthochromia of the fluid. Cell count showed one lymphocyte. There was no increase in globulin or total protein. Spinal fluid Kahn reaction was negative.

X-ray studies of the skull revealed absence of a large portion of the left parietal bone. There had been fracture of the midportion of the parietal bone with disarticulation along the posterior half of the sagittal suture and the entire lambdoidal suture except for the lateral corner. There was a defect measuring approximately 5 by 3½ inches.

The patient's course, until the day of his transfer to the United States, was entirely uneventful. He was asymptomatic throughout. The scalp laceration healed well after secondary suture. No neurologic symptoms or signs were elicited at any time during the patient's stay. At the time of his transfer the patient was up and about, with no complaints whatsoever.

COMMENT

This case is presented as unique because of the large extent of cranium lost, and the extremely slight amount of cerebral damage. The posterior half of the left parietal bone was avulsed, involving almost the entire lambdoidal suture and the posterior half of the sagittal suture. According to Cunningham's Anatomy the sutures do not obliterate until after the twenty fifth year, and they persist in the order of lambdoidal, sagittal, coronal. The pericranium and

the epidural tissues are loosely adherent to the bone except at the suture lines. These facts would help explain the loss of bone in this particular case, as well as the lack of damage to the dura.

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PNEUMONITIS FROM MUSKRAT VIRUS?

An epidemic of a severe pneumonitis which occurred in 6 scattered parishes of Louisiana was recognized as an entity only after an epidemiologic study of 3 cases was begun. This particular variety of pneumonitis was unusual in that it spread among nursing contacts of cases and had a high mortality—8 deaths in 19 recognized cases.

The initial case was the wife of a trapper living on the Little Chenier. This individual developed an acute febrile illness at her home, became progressively worse, and was transferred to a sanitarium where she expired 14 days after onset of disease. One nurse who had attended her became ill with a similar acute illness and died 12 days later. The husband who had remained in close attendance during her illness, returned to his home, where he became ill and died 4 weeks later. An elderly man who was hospitalized in a room adjacent to that occupied by the first patient developed a pneumonitis after leaving and recovered after a severe illness of long duration.

The nurse who attended the first patient was treated in the sanitarium, and gave rise to six secondary cases of the disease in nurses or in individuals who acted as nurses during her illness. One of these died, but not before giving the disease to four other persons, one of whom died and a secondary case from this infection likewise ended fatally.

The etiologic agent was isolated from three cases. The first patient lived in a well-constructed and well-maintained farm home in very isolated coastal marshes. She had not been away from this region for a month preceding her illness, which began during the trapping season when she helped her husband pelt animals, chiefly muskrats.

The only known epizootic in the area occurred in muskrats in the large marsh northwest of the home of case 1 a few months prior to her illness. The cause of the epizootic was not known, although it is known that the muskrats were heavily infested with mites.

The susceptibility of muskrats to the virus isolated from the pneumonitis cases was investigated. It did not produce a fatal disease in muskrats.—OLSON, B. J., and TREUTING, W. L.: Epidemic of severe pneumonitis in bayou region of Louisiana: I. Epidemiological study. Pub. Health Rep. 59: 1299–1311, October 1944.

GRANULOMA INGUINALE

REPORT OF AN ATYPICAL CASE

JOHN G. MENVILLE
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Granuloma inguinale is a granulomatous lesion which involves principally the inguinal region and the genitalia. The disease is also known as ulcerating granuloma, granuloma pudendi tropicum, sclerosing granuloma contagiosa, chronic venereal sore, and granuloma venereum.

It is indigenous in the United States, more commonly encountered in tropical and semitropical countries, but may be found in practically any part of the globe (*1*) (*2*) (*3*) (*4*) (*5*) (*6*).

The causative agent is believed to be the Donovan body; the incubation period varies from 8 days to 12 weeks (*2*).

The incidence among Negroes in the United States is high. The ratio between the colored and white races has been found (*7*) to be nine to one. Many of the infected whites have admitted sexual contacts with the colored race. It is interesting to note that the incidence among the Hindus has been found to be much higher than in the Mohammedans (*8*) (*9*).

Males are believed to be more frequently infected than females. The disease is not highly contagious and the sites of predilection are the moist contact surfaces of the genitalia.

The onset is frequently characterized by a vesicle or nodule which ulcerates and develops a smooth, beefy red, painless granular base which bleeds easily. The skin edges are raised, irregular, rolled, and sharply defined. The disease spreads by continuity, yet Greenblatt (*2*) is of the opinion that the lymphatics help to disseminate the disease. Recently Paggi and Hull (*10*) have shown that granuloma inguinale metastasizes by means of the blood stream. The extension may be slow or rapid; when it is rapid and the condition is untreated, the lesions become destructive and may eventually lead to the death of the patient. Not infrequently secondary infection is superimposed on granuloma inguinale, and in such instances the ulcers become very painful.

The clinical types of the disease are varied; Greenblatt recognizes the exuberant, ulcerative and cicatricial types, whereas D'Aunoy and von Haam (*7*) describe the nodular, serpiginous,

ulcerative, hypertrophic, and cicatricial types.

The diagnosis is usually made by the appearance of the lesion, but this should be verified by the finding of Donovan bodies and, when necessary, by a biopsy of the suspected tissue. Mature encapsulated Donovan bodies are found by staining the scrapings of a lesion with Wright or Giemsa stain. A biopsy of the lesions shows a uniform picture characterized by the presence of pathognomonic, large mononuclear cells (*11*). These cells are located in the midst of a dense cellular response comprising granulation tissue, many plasma cells, a moderate number of leukocytes, a few lymphocytes, and epithelial proliferation along the margins of the wound.

Treatment consists of tartar emetic administered intravenously or fuadin intramuscularly, and the response usually varies in inverse proportion to the chronicity of the lesion. Medication should be continued three times a week until the lesion has healed, and then once a week for 6 months.

In chronic chemoresistant cases in my experience best results were obtained by thoroughly excising the lesion with a loop electrode, using a high frequency cutting current and treating the resulting wound as a thermal burn.

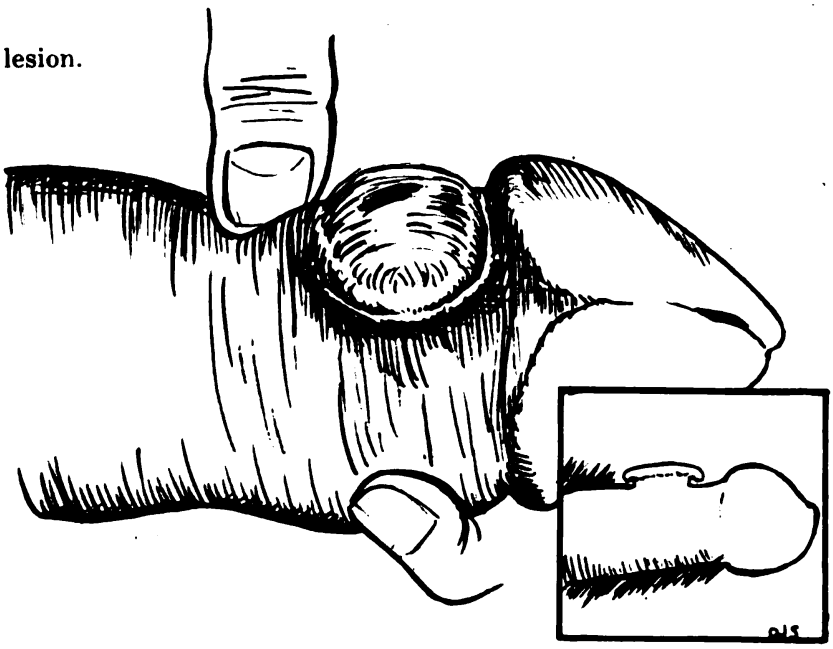
Previous experience had left the impression that granuloma inguinale occurred most frequently in the inguinal region, yet of four cases seen at a Naval hospital none presented lesions in the inguinal region. The following case is reported because the lesion was atypical.

Case report.—A colored male, age 17 years, was admitted to this hospital on 20 March, complaining of a penile lesion which had begun as a red "pimple" about 5 weeks previously, 1 week after sexual exposure. The "pimple" became larger, and in 3 weeks developed into a painless, button-shaped, moist, elevated lesion. For 2 weeks prior to admission, the lesion had not changed in size. Results of laboratory tests made prior to admission, including one blood Kahn test and five darkfield examinations were negative.

The patient's past history was irrelevant, and he denied any previous venereal disease. Physical examination revealed nothing pertinent except for the genitalia. The inguinal lymph nodes were palpable but not enlarged. An enlarged, rounded, button-shaped, flat, nontender, red lesion, 2.5 cm. in diameter, with no tendency to bleed was found adjacent to the coronal sulcus, to the right of the frenulum, as indicated in the accompanying drawing. The edges of this ulcer were smooth, regular and overhanging; the surface was clean, smooth, and velvety, and the base was not indurated.

Laboratory examinations, which included darkfield examinations, blood Kahn tests and microscopic examination of scrapings from the ulcer, yielded negative results. Ten days after admission the lesion was excised with a high frequency cutting current. Sections of the biopsy specimen were unavoidably delayed for 1 month and in that time the saucerized wound did not respond to conservative nonspecific treatment.

Sketch of the lesion.



Microscopic examination of the biopsy specimen showed red blood cells, fibroblasts, many plasma cells, occasional polymorphonuclear leukocytes, and the pathognomonic mononuclear cells (*10*).

The patient was placed on a treatment regime of intravenous administration of tartar emetic on the following schedule: 3 cc. of 1-percent solution the first day, increased 1 cc. every day until a dose of 8 cc. was reached. Following this the dose was increased 1 cc. every other day until 10 cc. was reached. This was followed by 10 cc. three times a week until the lesion was healed. The lesion showed improvement after four injections and was completely healed 18 days after the tartar emetic treatment had been started. The patient was discharged with the recommendation that he be given 10 cc. intravenously once a week for the following 6 months.

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IMPROVED FIRST-AID LIFE RAFT CANISTER

The usual first-aid box attached to life rafts consists of a wooden box with sliding top with sewed canvas cover. That this is not a watertight arrangement was discovered when a number of boxes were opened and found to be in very poor condition, with rusting and corrosion of all metal elements, staining and decomposition of bandages, and disintegration of pills and powders.

A trial packing of a 5-inch powder can, which can be hermetically sealed, demonstrated that all supplies listed in the Boat Box (2-185, Supply Catalog) plus the first-aid kit (S2-1056, Supply Catalog) and several other items such as malted milk tablets, quinine, matches and the like can be contained in it.

Available to nearly all ships which are large enough to carry life rafts, the powder cans are air- and watertight, noncorrosive, and preserve critical materials more effectively.

A small hammer is wired to the handle to facilitate opening of the can, and a 6-inch red cross is painted on after attachment to the raft.

In the above illustration the contents of first-aid boxes on life rafts (5-inch powder can) are shown.—BOYDEN, R. C., Commander (MC) U.S.N.

MEDICAL AND SURGICAL DEVICES

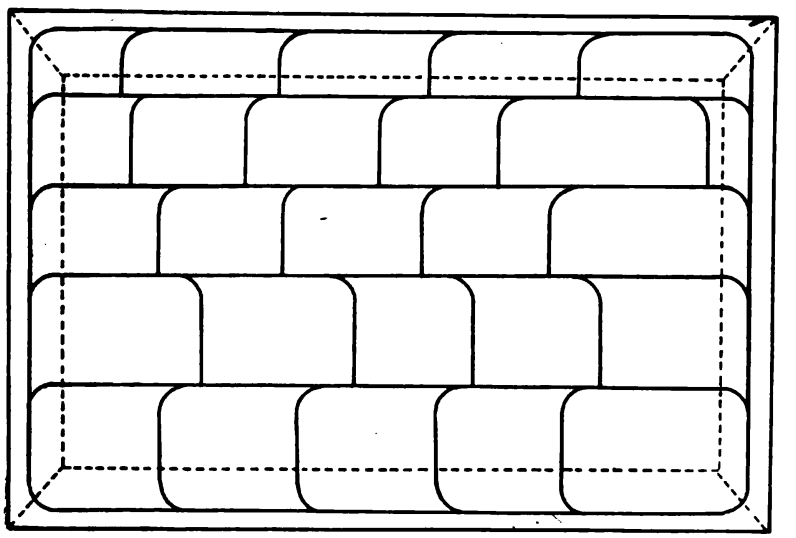
METHOD OF MAKING RADIOPAQUE SCREEN USED IN TAKING X-RAY FILMS

BERNARD I. RABIN
Lieutenant (DC) U.S.N.R.

Radiopaque screens which are used in making certain types of medical x-rays are not readily available at all Naval activities having x-ray facilities. A simple and efficient screen of this type may be easily constructed by using materials found wherever intra-oral dental x-rays are taken.

The leadfoil backing found on intra-oral dental x-ray films is used to make the radiopaque screen. Five layers of these leadfoil backings are placed on a piece of cardboard of the desired size, and overlapped in the same manner that roofing shingles are laid (fig. 1). A thin film of mucilage on the cardboard and on each layer of leadfoil will aid in placement. A second piece of cardboard of the same size is placed over the leadfoil and the edges are sealed with 1-inch adhesive tape.

To use the radiopaque screen, it is placed over the portion of the



1. Lead foil backing from intra-oral x-ray films in shingle arrangement five layers thick. The edges are bound with adhesive tape.

2. Lateral and anteroposterior view taken on one film with use of screen.

film that is to be shielded from the x-rays. The part to be x-rayed is then positioned on the remaining or unshielded portion of the film. The exposure is made and the screen is moved to cover that part of the film just exposed. The part to be x-rayed is then repositioned on the unexposed portion of the film and the second exposure is made.

This method allows a lateral and an anteroposterior view to be made on one film in certain cases, allowing greater ease in comparison of the two views for diagnostic purposes. It aids also in conserving x-ray film and lead sheeting.

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THYROIDECTOMY CRITERIA IN HYPERTHYROIDS

While awaiting further knowledge on thiouracil in thyrotoxic patients, it has been the plan to perform a thyroidectomy in the following situations: (1) In patients having a very large goiter; (2) in patients who live far away and cannot readily have frequent checkup examinations; (3) in patients who through ignorance or temperamental difficulties cannot be depended upon carefully to follow medical treatment; and (4) in the small number of patients who have undesirable reactions to thiouracil.—CLUTE, H. M., and WILLIAMS, R. H.: Thiouracil in preparation of thyrotoxic patients for surgery. Ann. Surg. **120**: 504-512, October 1944.

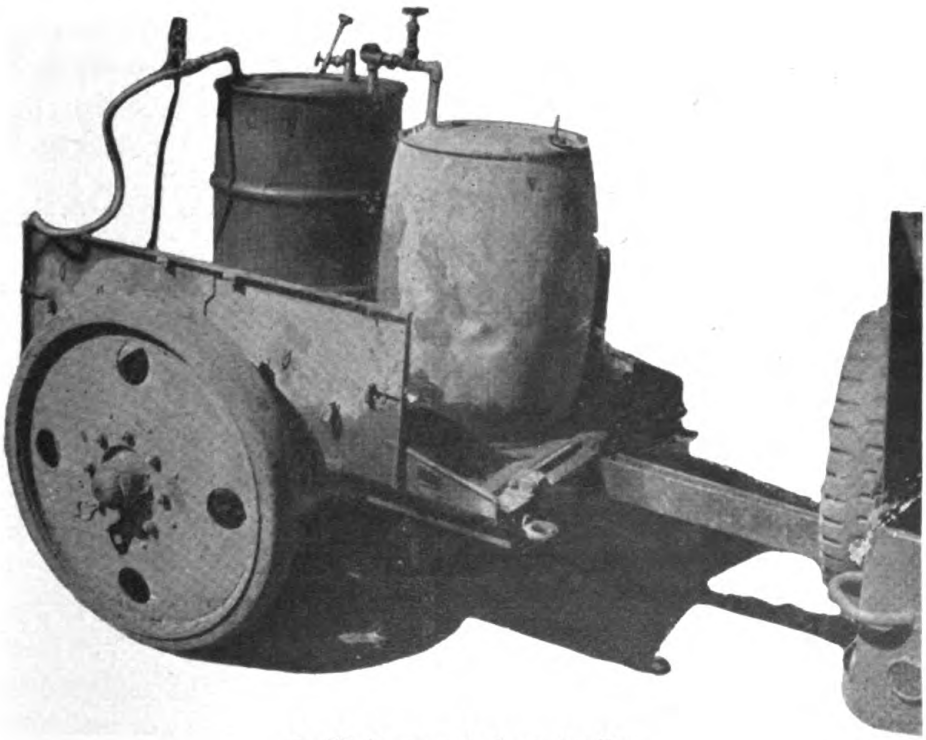
SIMPLE PRESSURE SPRAYER FOR MALARIA CONTROL

T. HAYNES HARVILL
Lieutenant (MC) U.S.N.

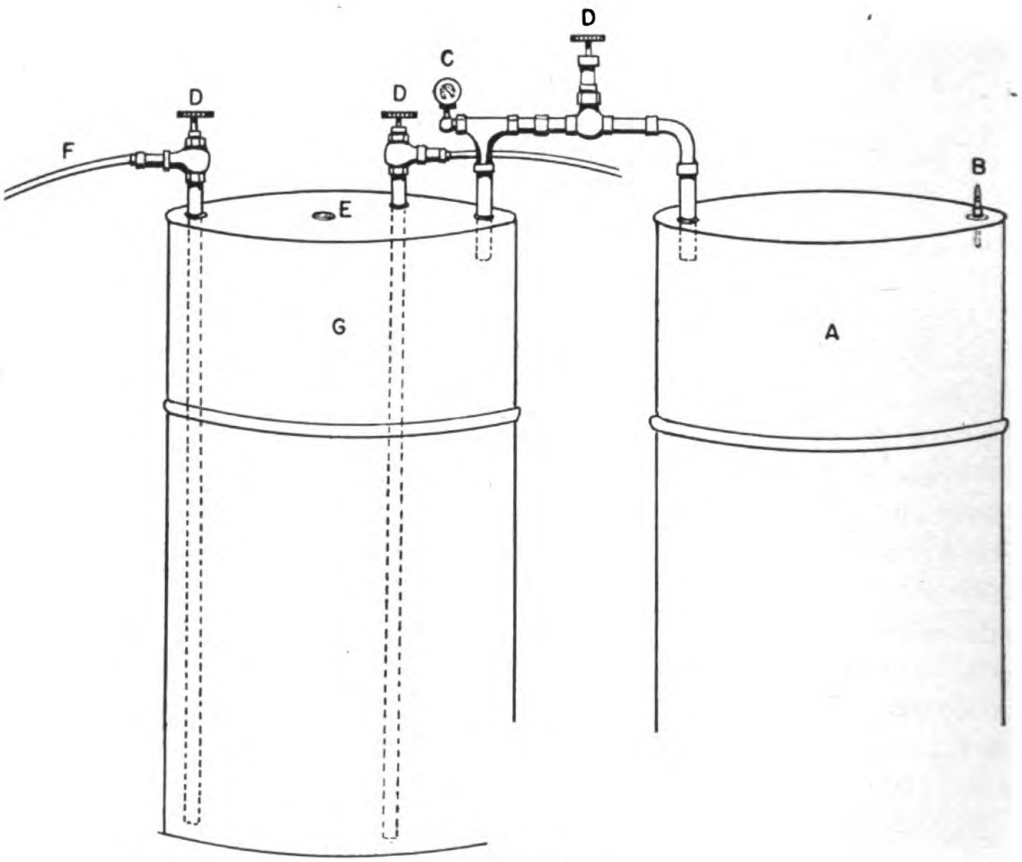
The weekly spraying with Diesel oil of mosquito breeding places constitutes a major task in malaria control in the South Pacific Islands. The described mobile pressure sprayer has proved efficacious in accomplishing 60 percent of the necessary oiling in a battalion semipermanent camp site. The remaining areas inaccessible to the unit are sprayed with the use of knapsack sprayers.

The unit consists of:

1. Two medium fuel drums each of 55-gallon capacity.
2. Two 5-feet lengths, four 6-inch lengths and several 2-inch length of ¾-inch pipe with three **L** joints and one **T** joint.
3. Three gate valves for ¾-inch pipe.
4. One valve from automobile tube.
5. Two 30-feet lengths of ⅜-inch pressure rubber tubing with hose clamps.



1. Unit mounted on trailer.



2. Diagram of unit.

A. Pressure drum.
B. Auto tube valve.
C. Pressure gage (optional).
D. Gate valves.
E. Fuel cap.
F. Pressure rubber tubing.
G. Oil drum.

6. Two sprayer nozzles.

7. A pressure gage registering up to 60 pounds pressure. This may be dispensed with if a tire pressure gage is available.

The drums are charged with an air compressor or regular garage compressor used for tire inflation.

The unit may be mounted on a platform and placed on the back end of a truck if the terrain is muddy and difficult to traverse.

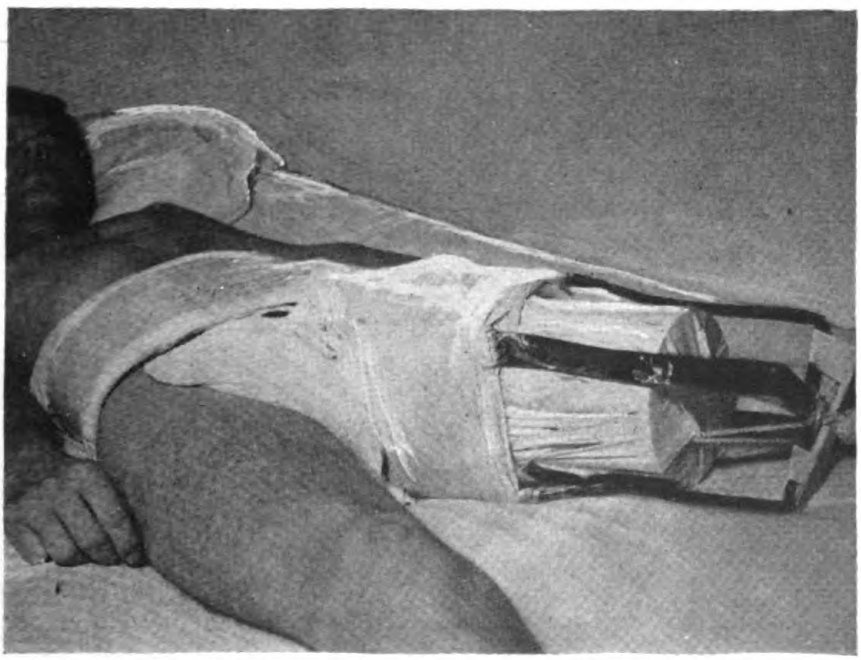
The fuel drum is filled through the fuel cap with about 50 gallons of Diesel oil, the gate valves at the hose connections closed, and the system filled with air from the compressor through the auto tube valve to a pressure of 50 pounds per square inch. The valves leading to the rubber tubing are opened and the spray controlled by the hand-operated shut-off on each nozzle. With two 30-feet lengths of tubing and spray of 20 feet, the effective spraying radius is 50 feet on each side of the unit.

SKIN TRACTION FOR THE AMPUTATION STUMP

EUGENE L. JEWETT
Commander (MC) U.S.N.R.

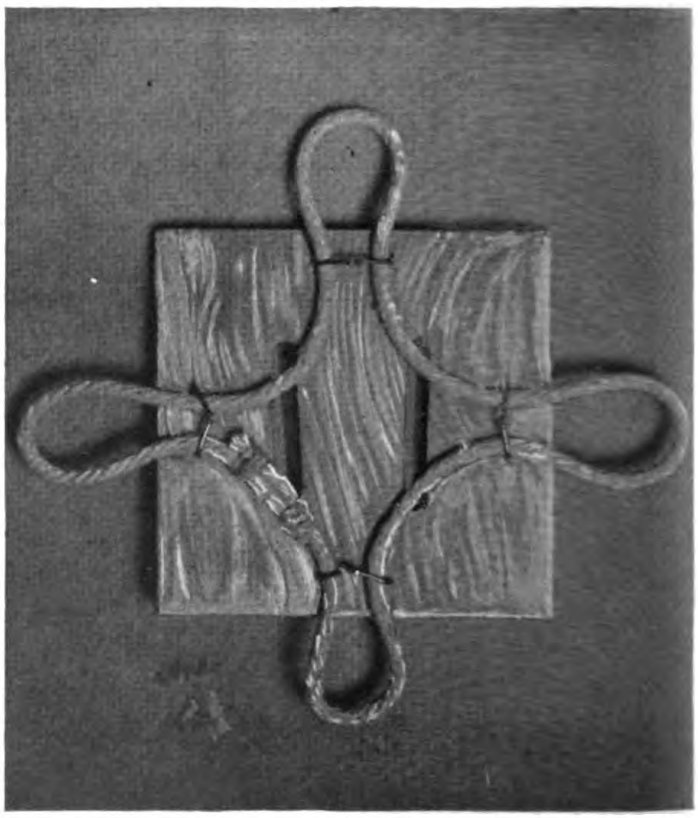
In war surgery the time interval between amputation and the application of skin traction is from 1 to 10 days. The main reason for this delay is the copious drainage from the stump, with the resultant need for frequent dressings, and the danger of soiling the traction device. If traction is applied immediately after the operation, not only is there a saving of an additional later operative procedure, but also a gain of a few days in the process of pulling the skin down over the stump. The patient, moreover, is relieved of a great deal of discomfort, requires less narcosis and sedation, and recovery from shock is much faster. However if the patient's condition will not allow the added strain of applying the traction device immediately following the amputation, it must be delayed until a more suitable time.

In either event provision must be made for frequent dressings of the stump without soaking or soiling of the plaster or loosening of the traction straps or tapes by seepage. These conditions are met by the following plan and its application.

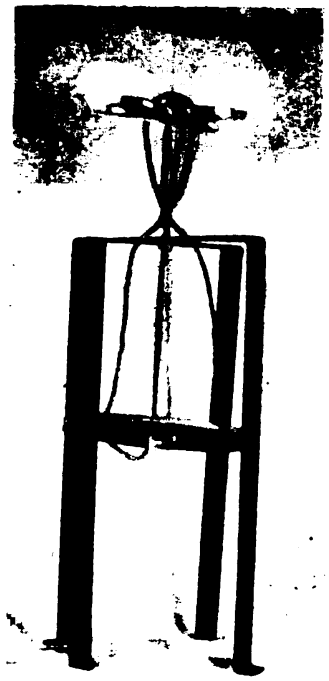


1. Short hip spica with traction device in place.

2. Arm cuff of plaster of paris with skin traction device, using a walking stirrup.



3. Spreader with sliding rope loops to equalize tendency for unequal tension on the traction straps.



4. Traction cage for thigh stump. A three- or even two-sided unit may be used, but the four-sided one gives more protection.

For amputations above the elbow and for those above the knee, a plaster-of-paris cuff is used for the upper extremity and a short plaster single spica for the lower (figs. 1 and 2). The skin on which the traction tapes are to be applied is cleaned, shaved, dried, and painted with compound tincture of benzoin. If sponge rubber is to be used, with canvas backing, rubber cement is usually first painted on the skin.

As many Montgomery straps as are necessary to hold the dressings in place are applied around the stump, and with adhesive or moleskin attached to the skin edge or to the edge of the postoperative dressing, the first postoperative dressings are snugly tied, using from four to eight single straps as deemed necessary.

Traction straps or tapes, using adhesive, moleskin, or sponge rubber are now applied alternately spaced with the Montgomery straps, or applied over them if most of the available skin is to be covered, and drawn down.

A sheet of any waterproof nonirritating material, about 1 foot by 1½ feet is placed on the posterior part of the thigh stump in such a manner as to leave about a 2-inch strip projecting distally over the stump end. This is incorporated into the plaster cast as a protection for the edge. If the patient is to be turned during the first weeks, this waterproof lining should be placed all around the stump. This measure against seepage is unnecessary in arm amputations.

The plaster cuff, spica, and the incorporated loops or "walking irons" are those in common use (fig. 4). The casts are applied snugly with plenty of padding or felt over the bony prominences and in the axilla. Reinforcement of the distal edge of the cast is done by incorporating tongue blades, pieces of basswood splints or heavy wire a few inches apart, extending out 6 or 8 inches beyond the end of the plaster cast.

The addition of alum to the plaster of paris is a necessity if a quick-setting, satisfactorily hard cast is to be obtained, the exact amount depending on the outside temperature and humidity. Alums other than sodium or potassium may color the solution.

Bivalving the cast permits inspection. Of the many methods of fastening the traction tapes to the spreader, the one illustrated (fig. 3) permits dressings of the stump at any time easily, quickly, and without the necessity of cutting or unwinding adhesive strapping or moleskin.

SUMMARY

This system of obtaining skin traction on the recently guillotined amputation stump has been used on about 18 stumps to date, most of which had the plaster cast and traction device applied on the operating table immediately following the amputation. Contractures are prevented, dressings facilitated, and the patient is made more comfortable, both in his bunk and when being moved.

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BREATHING EXERCISES FOR BRONCHIAL ASTHMA

Failure of the usual measures—such as specific and nonspecific desensitization—led to treatment of 29 children and 12 adults suffering from bronchial asthma by intensive breathing exercises only.

The aims were: To correct the physical deformities produced by the asthmatic attacks; to restore the elasticity of the thorax which is often fixed and distended in these cases; to develop and strengthen weak body muscles, especially those respiratory muscles which were not already hypertrophied; and to prevent such secondary effects of bronchial asthma as chronic bronchitis, bronchiectasis, pulmonary fibrosis, cardiac hypertrophy and myocardial damage. Breathing exercises also have a psychologic effect, and the increase in bodily fitness restores the patient's courage and self-confidence.

Vital capacity increased in all 29 children during treatment, and so did chest expansion. In all except 2 the initial vital capacity of the asthmatic children was considerably below the average for healthy children, but after 1 to 2 months' treatment the average was usually reached or surpassed, and only 6 experienced no change in the asthmatic condition. Of 12 adults treated, 4 have remained free from attacks. Of the remaining 8, 2 claimed considerable and 2 slight benefit; in 4 the attacks were unchanged.—WEISER, H. I.: Bronchial asthma; treated by breathing exercises. Lancet 2: 274-276, August 26, 1944.

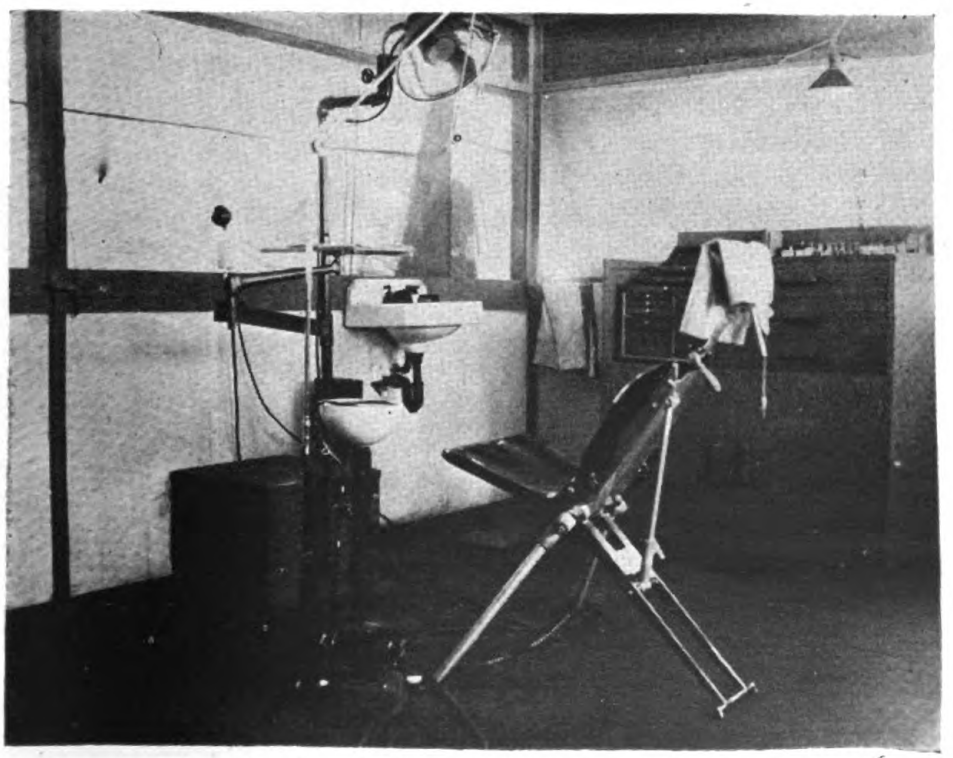
THE FIELD DENTAL OFFICE

KENNETH F. BLINDENBACHER
Lieutenant (DC) U.S.N.R.

The dental officer serving overseas is usually somewhat amazed when he first sees his field equipment inventory. His amazement turns to disappointment when he sets up this equipment on some island beyond the continental limits.

The immediate reaction is to try to make this equipment conform, as closely as possible, to the private practice operating room, with which he is so familiar. With this thought in mind, he naturally turns to the Seabees. As small an outfit as a Construction Battalion Maintenance Unit can make the field dental office a reality.

At the time of our arrival at a Pacific island, a fale had already been constructed. However for the purpose, a wall tent would have been satisfactory. The main disadvantage of the latter is in the inability properly to fly-proof a tent in which 20 or more persons will call each day.



The dental office with cabinet in use.

Primary consideration was given to running water. Because of the distance of the fale from the main distillation pipe, three gasoline drums were set up to catch rain water from the sloping roof of the hut. Water was piped from the barrels to a sink.

The spotlight, which was intended for use in the operating room, primarily, had three disadvantages when employed in the dental office. Depending upon the number of lengths of pipe used, the lamp was either too high or too low. The lamp itself, is more or less fixed and the light is too diffuse.

The height of the lamp was corrected by using only two of the spotlight's pieces of pipe and inserting between them a piece of pipe 22 inches long. The lamp was attached to an 8-inch swinging elbow which permits movement, from side to side, through a 180-degree arc. To obtain a more concentrated light, the typical dental spotlight was duplicated by placing an ordinary tin can over the bulb.

The can was cut out on two sides which permits the escape of light only on two sides of the reflector. Four feet from the lamp there is consequently an illuminated area of about 6 inches which is devoid of shadows.

The foot engine is easily converted if a motor can be obtained. Fortunately a 1/15-horsepower motor was available and this was attached to the engine arm. Speed is controlled by the use of various-size pulleys attached to the motor. For most operative procedures, only one pulley is used. The starting and stopping of the motor is governed by the use of a foot control.

A funnel-shaped cuspidor 8 inches in diameter was set up on a 1½-inch pipe forty inches long. The pipe was set upright through the deck with the cuspidor 30 inches high. This permitted drainage through the floor to the sand below. Water was piped from the rain barrels to a perforated copper tubing lip on the cuspidor. A tap 1 foot below flushes the cuspidor. Elimination of the cuspidor-bracket table stand was accomplished by attaching a 2-foot movable arm to the piece of pipe inserted in the lamp stem.

At the free end of this arm, the bracket table arm was attached, forming a movable elbow. This setup was found to be much more satisfactory than the old bracket table-cuspidor stand arrangement.

A cabinet was built, 44 by 46 inches high by 22 inches deep. The right side has a work top of mahogany 26 by 18 inches. To the rear of this is an enclosed medicine cabinet 4 by 4 by 26 inches. Beneath the work top are three 5- by 24- by 22-inch drawers. In the top drawers are kept filling materials, slabs, spatulas, etc.; the other drawers contain surgical and exodontia equipment. To the left of the drawers is an enclosed space large enough to contain

the field instrument cabinet. Placing the instrument cabinet in the large cabinet in this manner, saved the work of constructing several small drawers to contain these instruments.

The top and front of this space, like the top and front of the medical cabinet, is mortised and opens by folding upward and backward and dropping down behind the cabinet. The lower portion of the case consists of an area 25 by 22 by 44 inches divided by one shelf and enclosed by two 22- by 25-inch doors. This space, used to keep bulk supplies, contains a hot locker attachment.

The warm dry air circulates freely from this space to all portions of the cabinet with the exceptions of the top drawers and the medicine cabinet.

The accompanying photograph shows the various improvements which have been made. Not shown are a sterilizer and sterilization table which are kept in one corner of the room to minimize the heat.

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CONGENITAL MALARIA

A woman returned to England from India in August 1939, and was seen when 26 weeks pregnant and found to be healthy. She had had an attack of malaria without identification of the type in 1938. Early in October 1939, she developed a temperature after a slight rigor and this was repeated in 48 hours after a severe rigor. Blood examination revealed parasites suggestive of a benign tertian infection. Treatment was instituted and her condition remained satisfactory until 3 days before the onset of labor (1 December 1939) when she "felt malarial." On the day of the actual confinement—which was uneventful—she had a rigor and ran a temperature of 103° F. The infant weighed 7 pounds and although rather flabby and thin was active and seemingly healthy. Breast-feeding was possible for only 14 days. On 3 January 1940, the infant became very unwell and ran a temperature. Examination of the blood on 8 January revealed severe anemia and the presence of Plasmodium vivax. The spleen reached to the level of the iliac crest. Quinine sulfate grain ¼ twice daily was administered for 3 days, then increasing to grain ¼ four times daily until the end of the week, ferri et ammonii citras being given at the same time. Quinine grains 2½, was given in 8 ounces of water daily for 3 weeks. On 10 June the weight was 13 pounds, the anemia had disappeared, and the spleen was just palpable beneath the costal margin. Further progress to date has been entirely satisfactory.—GAMMIE, R. P.: Congenital malaria in England. Lancet 2: 375-376, September 16, 1944.

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PENICILLIN IN ANTHRAX INFECTIONS

Anthrax, in spite of an apparent decrease in its incidence and fatality among human beings in recent years, still remains an important disease problem in certain regions. Although antiserum, arsenicals and sulfonamides have proved of some value in its treatment, the use of these agents leaves something to be desired. The effectiveness of penicillin in the treatment of experimental infections owing to Bacillus anthracis was demonstrated in that 55 percent of animals treated with penicillin could be protected against 10,000 times the lethal dose of Bacillus anthracis, even when 16 hours had elapsed between the inoculation and the beginning of treatment. Of 40 other mice, 20 received treatment and 20 received no treatment. All of the treated mice survived. All of the untreated mice died within 96 hours after receiving the inoculation.—HEILMAN, F. R., and HERRELL, W. E.: Penicillin in treatment of experimental infections with Bacillus anthracis. Proc. Staff Meet., Mayo Clin. 19: 492–496, October 4, 1944.

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MYCOTIC ANEURYSMS

Mycotic or infective aneurysms of arteries and other vascular structures occur in both acute and subacute bacterial endocarditis. They are usually small, frequently involve more than one artery, and are rarely recognized during the life of the patient. Three essential modes of production have been suggested. The first concept states that the implantation of microorganisms on the intimal surface of an artery, particularly at a point of bifurcation or at the point of issuance of an arterial tributary (but not necessarily so), results in local destruction of the arterial wall, particularly of the elastic lamina. The second concept considers the mural damage to be the result of infected emboli gaining entrance by way of the vasa vasorum. Finally, it is also possible for mycotic aneurysms to occur in arteries or other vascular structures by the direct spread of the infectious process.—WILLIUS, F. A.: Cardiac clinics. CVIII. Subacute bacterial endocarditis: Pathology. Proc. Staff Meet., Mayo Clin. 19: 497-503, October 4, 1944.

EDITORIALS

PENICILLIN IN WAR WOUNDS

With the increasing availability of penicillin, the tendency to try it under every circumstance is apparent. Emphasis on response in certain diseases has fostered a belief in its powers as being a little short of the miraculous. Disappointment in its effectiveness is traceable to a disregard of certain fundamentals.

It is well known that not all bacteria are affected by the agent (p. 453 this BULLETIN), and the character of the wound may be such as to preclude the operation of any drug. Penicillin is not a surgeon's scalpel; it should not be expected to prune a wound or extirpate a piece of foreign matter, clothing, or devitalized tissue. Halsted long ago showed that the peritoneal cavity had potentialities of coping with even the most serious organism provided no devitalized stump remained to furnish nutriment for bacterial proliferation and growth.

Appropriately, considerable controversy[1,2,3,4,5] has arisen over conservative debridement. There are those who, in their enthusiasm based on experience with certain drugs, notably the sulfonamides and now penicillin, have left the impression, whether intended or otherwise, of minimizing the importance of surgery in the handling of war wounds. Casual reading leads to the interpretation that they seem to adhere to the opinion that it makes little difference how much surgery is done provided liberal quantities of the drug are incorporated into the wound.

Certainly such contention, if intended, is against every rule of good surgery. Rather it would seem that the purpose of these

[1] FERGUSON, L. K.; BROWN, R. B.; NICHOLSON, J. T.; and STEDMAN, H. E.: Observations on treatment of battle wounds aboard hospital ship. U. S. Nav. M. Bull. 41: 299-305, March 1943.

[2] CRILE, G., JR.: Experiences of surgical service of United States Naval Hospital, Auckland, New Zealand, with casualties from initial Solomon Islands engagement. U. S. Nav. M. Bull. 41: 306-324, March 1943.

[3] LITTLEJOHN, C. W. B.: Report on early treatment and results of penetrating wounds of chest. Australian & New Zealand J. Surg. 11: 147-152, January 1942.

[4] MONROE, C. W.: Debridement—when and how much? Comparative study of battle casualties. Bull. U. S. Army M. Dept. No. 77: 37-41, June 1944.

[5] ARCHIBALD, E. W.: Wound excision or débridement. What should they really mean? J. Canadian M. Serv. 1: 345-356, May 1944.

publications is directed at condemning wholesale sacrificing of tissue, unnecessary prodding into wounds and time-consuming meticulous pruning of flesh, procedures not infrequently as disastrous to the patient as complete disregard for all debridement.

The question rather resolves into what is considered accepted good surgical judgment and training—how much debridement, rather than no debridement.

The use of penicillin under these conditions must of necessity be circumscribed. It is an adjunct therapy, not a prophylaxis. It is not a test of the efficacy of penicillin to use it in the presence of large amounts of devitalized tissue or as a preventive particularly against gas gangrene when no wound excision has been performed.

It has been shown[6] that serum and blood have an inactivating effect upon penicillin, a circumstance that is not sufficiently appreciated in the computation of dosage or in the appraisal of the drug's success or failure. That devitalized tissue, blood clot, enzymes, pus, preformed bacterial exotoxins and the like have a positive effect on the neutralization of penicillin therapy should not be surprising. Rather in the light of serum inactivation it should be expected and appropriate steps instituted at the moment of therapeutic application to offset any antagonistic effects of wound detritus.

Furthermore it must be remembered that areas demonstrating the cardinal signs of infection extensive enough to preclude blood supply to the part will influence the action of any drug, penicillin not excepted. Absorption presupposes circulation.

The controversy over the value of local chemotherapy centers about this point. Those bent upon wound sterilization need only recall de Waal's observations[7] on air-borne bacterial dissemination and the many variables to control even under hospital conditions. Fortunately wound contamination is not synonymous with infection and the presence of bacteria in the wound need not be significant in wound repair.[8] Therapy based upon wound sterilization may lead to unnecessary wound manipulation, constant squirting of something into the wounded area to sterilize it; if failure occurs it is a drug failure. On the other hand, parenteral administration is founded upon surgical debridement, the application of an undisturbed pressure dressing and the neutralization of possible sys-

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[6] BIGGER, J. W.: Inactivation of penicillin by serum. Lancet 2: 400-403, September 23, 1944.

[7] DE WAAL, H. L.: Wound infection; preliminary note on combined clinical and bacteriological investigation of 708 wounds. Edinburgh M. J. 50: 577-588, October 1943.

[8] WILSON, H., and THREADGILL, F. D.: Secondary suture of war wounds. Bull. U. S. Army M. Dept. No. 72: 77-80, November 1944.

temic involvement. If failure occurs it is due to error in surgical technic or judgment.

In any evaluation of the efficacy of penicillin, the use of the agent must be fair, as is demonstrated in the early articles of this issue of the BULLETIN, pages 453 to 493. If the impossible is not expected, its efficacy assuredly is just a little short of miraculous.

TUBERCULOSIS IN THE NAVY

War and tuberculosis go hand in hand. After World War I there was an almost universal rise in the tuberculosis death rate.[1] World War II appears to be headed in the same direction. Conditions which make for the spread of the disease are prevalent; long working hours, crowded unsanitary living environs, difficulties in procurement of proper food, the many inadequacies of diet, and such situations as described elsewhere (p. 603 and p. 653) in this BULLETIN.

Undoubtedly the cold, dampness, lack of sunshine, poor housing and crowded facilities with inadequate ventilation because of the bleak long winters, account for the perpetuation and spread of tuberculosis in the community described by Stauffer despite any epidemiologic seeding factor and sanitation control measures.

Alert public health efforts, however, from a variety of organizations brought a rapid decline in tuberculosis in this country following the last conflict. This trend is reflected in the incidence of tuberculosis in the Navy during the past decade. There were 1.83 admissions to the sick list for all forms of tuberculosis per 1,000 average strength Navy and Marine Corps personnel in 1933 as compared with 0.47 in 1943, pulmonary tuberculosis constituting approximately 75 percent of this 1943 figure.

Although this precipitous drop in the Navy's tuberculosis rate is due partly to the general expanding program incident to the war and partly to the fact that any tuberculosis which might develop has not had time to become manifest, nevertheless it may be taken as an index of the prevalence of tuberculosis throughout the country in so far as the population figures are composed of elements from all sections of the United States. Selective Service data,[2] moreover, corroborate this observation; from a sample survey of

[1] SHIPMAN, S. J.: Tuberculosis in war time. California & West. Med. 61: 254-255, November 1944.

[2] Medical Statistics Bulletin No. 2. Causes of Rejection and Incidence of Defects, Local Board Examination of Selective Service Registrants in Peacetime. Analysis of Reports of Physical Examination from 21 Selective States. Natl. Hdqtrs. Selective Service System, Washington, D. C., August 1, 1943.

121,966 men examined, only 88 were rejected for military service because of active tuberculosis.

The establishment of the new Tuberculosis Control section in the Bureau of Medicine and Surgery expresses the determination of Naval medical authorities to see that this low incidence continues to prevail.

Development of miniature films makes practicable the present procedure of roentgenographing of all Naval personnel with repeat annual roentgenogram of all those under 30 years of age. Such general measures undoubtedly will ferret out many unsuspected reinfections and will form the single most important case-finding procedure ever devised.

A rise in tuberculosis incidence figures is anticipated directly as an outgrowth of this survey. Provision for the care of active and arrested cases however is an integral part of the program and should result in circumventing any widespread dissemination of the disease.

The cure of the patient and the prevention of infection are epidemiologic aspects of tuberculosis differing little in war or peace, unless it is that the current strife imposes the need of increased energy in their execution. Of prime importance in this regard is the sociologic aspect of proper examination and observation of contacts. This is accomplished in the Navy's program, by special x-ray examination and follow-up surveillance of contacts.

Certainly tuberculosis is not the health problem of several decades ago. The tuberculous glands of the neck, the cold abscesses and tuberculous skin lesions so commonly seen in the twenties are now rarely observed. By the same token pulmonary tuberculosis is proportionately less frequently encountered. This situation did not just happen. Relentless prosecution of public health measures by many agents has brought about these changes.

It is heartening to know, however, that the solution of the tuberculosis problem is not awaiting the return to peaceful conditions; that efforts to combat tuberculosis are apparent while the disease is diminishing in morbidity and mortality.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

EXPERIMENTAL BASIS FOR NEUROTIC BEHAVIOR, Origin and Development of Artificially Produced Disturbances of Behavior in Dogs, by *W. Horsley Gantt, M.D., Associate in Psychiatry and Head of the Pavlovian Laboratory, Johns Hopkins University.* Sponsored by the American Society for Research in Psychosomatic Problems. 211 pages; illustrated. Paul B. Hoeber, Inc., New York, publishers, 1944. Price $4.50.

This monograph reports the studies conducted in the Pavlovian Laboratory at the Phipps Psychiatric Clinic of the Johns Hopkins Hospital on disturbances of behavior produced in dogs by the conditioned reflex method over a period of 12 years. The presentation, by the author's own admission, is a biased one in that he makes no attempt to review the works of others or to correlate his to theirs; but this in no way detracts from its excellence. The observations are painstakingly detailed, very faithfully recorded, and just by themselves would make the volume a most valuable contribution to the subject.

Objective methods for the early detection and actual measurement of manifestations of nervous imbalance receive special emphasis. The author strikingly demonstrates the practicability and value of quantitative studies of various changes of objectively measureable functions such as heart rate, salivation, respiration, motor activity, and the rate of conditioned reflex formation. Such observations provide evidence of psychopathology considerably earlier than any other means of general observation can, and before a general disorder of behavior is manifest. The interrelationships between various body functions indicated by these measurements are, moreover, brought out and their significance discussed.

Rather convincing evidence is presented that individual personality variations exist and exercise the major role in determining both susceptibility to nervous disorder and the pattern of the pathologic responses which will make it up, the psychopathogenic influence of environmental factors being secondary and depending really upon this individual susceptibility and reaction type. To quote the author, "The stable animal remains stable and the labile animal who cracks under one kind of stress shows the same pattern of abnormality under other stresses." Some psychiatrists have long contended that this is true in humans. Indeed it would be a great step forward for military psychiatry, especially in regard to the selection and proper allocation of personnel, were some adaptation devised to render clinically applicable the author's apparently reliable methods for detecting susceptible types and their reaction patterns under controlled stresses. If this principle applies to humans, one additional thought in regard to military psychiatry immediately arises, namely, the prospects must be none too bright for returning, without fear of relapse, recovered psychiatric war casualties to conditions of stress, such as originally precipitated the nervous symptoms.

Another item worthy of special mention is the studies on the factors in therapy since they reveal results of great clinical interest and importance. The author finds that of all the therapeutic measures employed, a change of environment and certain social factors were almost the only effective ones excepting for a new procedure of transforming conditioned stimuli. The influence of social factors in humans is stressed by many psychiatrists, and the success of military facilities created to treat psychiatric war casualties will depend very largely upon how well these social factors are understood and managed. In any military establishment this aspect of psychotherapy must of necessity be difficult to deal with and will require very special attention.

All in all, studies in experimental neurosis have now reached a point where all clinical psychiatrists must take an interest in and get thoroughly acquainted with them if such investigations are ever to shed light upon the problems of abnormal human behavior. After all, that is their purpose. This volume, however, is not suited for the beginner. He will first have to renew his acquaintance with the nature of conditioned reflexes. Any standard physiology textbook will be adequate for this. Then he should read some review of the previous work in this field. The author gives references to such publications. Having such a background, every psychiatrist should read this volume with great benefit.

PRESCRIPTION FOR PERMANENT PEACE, by *William S. Sadler, M.D., F.A.P.A., Consulting Psychiatrist, Columbus Hospital.* 202 pages. Wilcox and Follett Co., Chicago, Ill., publishers, 1944. Price $2.50.

This book is one of a recent spate of pamphlets, articles, and books which have been written to prove that Germany as a nation has been and is at present suffering from a national form of paranoia, in the literal sense of the psychiatric diagnosis. The author, like his colleagues, has been wafted in all directions by a wind of metaphoric absurdities. When he tries to anchor his fanciful analogies by psychiatric terminology he succeeds only in revealing his untenable position. The result is grossly fallacious social psychiatry and pathetically incomplete history.

Allowing a generous discount for Dr. Sadler's historical naïveté and overlooking his pedantic attempt to write "straight from the shoulder," there is still a more grievous indictment to be charged. He and the others who write so glibly of "national character" and "racial disease" are propagating Nazi-like anthropologic nonsense.

It is indubitably true, as the author points out, that from Bismarck to Hitler, German nationalism has erupted periodically in anti-social directions. This is no more indicative of their national mental disease than was our pre-Pearl Harbor attitude of isolationism one of schizophrenia. Such conclusions are the inevitable result of any attempt to characterize political groups of people by all-encompassing terms even though they sound scientific.

"National paranoia" and "national schizophrenia" like "aryanization" are drugs of a pseudo-science which have to be omitted from prescriptions which purport to be a panacea for the social ills of mankind.

PSYCHIATRY FOR NURSES, by *Louis J. Karnosh, B.S., Sc.D., M.D., Associate Clinical Professor of Nervous Diseases, School of Medicine, Western Reserve University;* and *Edith B. Gage, R.N., Formerly Supervisor, Neuropsychiatric Division, City Hospital, Cleveland;* in collaboration with *Dorothy Mereness, A.B., M.N., R.N., Instructor of Psychiatric Nursing, Neuropsychiatric Division, City Hospital, Cleveland.* 2d edition. 339 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1944. Price $2.75.

"Psychiatry for Nurses" aims to present "the pith of the subject and very little more." It presents that pith in clear, logical steps. The first quarter of the book is devoted to background, historical review, discussion of heredity and mental disease with an introduction to the anatomy of the central nervous system, causes and classification of mental diseases, and an unusually good chapter on examination of the mental patient by physical, laboratory, and psychologic methods. The Rorschach test and encephalography are described. Management and observation of the mental patient are

confined to one brief but meaty chapter, with only scant suggestions accompanying later discussion of the specific conditions. The Johns Hopkins Behavior Sheet is reproduced and explained.

The middle half of the book goes through the effective and organic reaction types of mental deficiency, with the modern tests and measurements. The distinctions between the various psychopathic conditions are well brought out, and made more vivid by case histories and excellent photographs of patients in representative poses. The final quarter takes up therapies, including the shock treatments, and concludes with legal considerations and a chapter on mental hygiene devoted primarily to a thoughtful discussion of child guidance. Carefully selected chapter-end bibliographies help both teacher and student to delve further into questions which the brief text provokes.

In the Navy it is not a condition of specialty instruction curricula to follow civilian standards, yet it is a satisfaction to the Navy nurse teacher to plan her courses to include the requirements of the National League of Nursing Education. This is particularly true for those Naval hospitals in which Cadet Nurse programs are in effect. Karnosh and Gage have kept these requirements in mind, which makes their book of special value to teachers of such courses. Since "Psychiatry for Nurses" is concerned primarily with the medical and psychologic aspects of mental diseases, however, it can probably best be used in conjunction with one of the texts which emphasize nursing care. Each would profit from the other.

MOSQUITO CONTROL, Practical Methods for Abatement of Disease Vectors and Pests, by *William Brodbeck Herms, Sc.D.;* and *Harold Farnsworth Gray, Gr.P.H.* 2d edition, revised and enlarged. 419 pages; illustrated. The Commonwealth Fund, New York, publishers, 1944. Price $3.50.

When the first edition of "Mosquito Control" appeared in 1940, it was a pioneer attempt to summarize information on this extremely important subject. For the first time the various aspects of the problem—entomologic, medical, social, engineering, agricultural, chemical, biologic, legal, educational, and military—were analyzed and coordinated. Previous publications had dealt only with specific phases of the subject or with particular geographic areas.

The first edition was well received, and it was proved timely by the sudden expansion of mosquito control activities by the Army and Navy. Inevitable criticisms of the book were leveled at its somewhat local flavor and the absence of many details as to the "how" and particularly the "why" of many mosquito control measures.

In the revised edition these faults have been corrected to a large extent. The section on control has been expanded by 50 pages and up-to-date information has been included. The section on dynamite ditching is an especially valuable addition. However it appears to the reviewer that the section on drainage is still too meager, at least that part dealing with fresh water ditch construction. The revised charts on distribution and habits of disease vectors, and the discussion of mosquito identification will undoubtedly prove very useful.

It seems almost unnecessary to say that all Navy personnel connected in any way with mosquito and malaria control activities should read this, the only comprehensive textbook on the subject.

UROLOGICAL SURGERY, by *Austin Ingram Dodson, M.D., F.A.C.S., Richmond, Virginia, Professor of Urology, Medical College of Virginia;* with contributions by *7 prominent physicians.* 768 pages; 576 illustrations. The C. V. Mosby Co., St. Louis, Mo., publishers, 1944. Price $10.

This book correctly titled "Urological Surgery" is an excellent addition to the library of any urologist or general surgeon with a urologic bent. The author with the collaboration of 7 other physicians, who wrote 6 of the 46 chapters, quite clearly and concisely yet thoroughly presents his subject. The illustrations by Miss Helen Lorraine are very well done.

It should not be regarded nor was it intended as a complete treatise on diseases of the genito-urinary organs. Rather it is for the use of advanced students of urology or the practicing surgeon who might be called upon to do genito-urinary surgery. They will find it quite valuable for quickly locating important anatomic and surgical facts. The various incisions employed to approach the kidney, ureter or bladder and their relative advantages are discussed. In addition to many original technics, the author includes in the book, with proper credit, operative procedures which were previously described or popularized by others.

Chapters on diagnosis, preoperative and postoperative care, on excretory urography and cystography, on injuries of the bladder, and injuries of the male urethra are excellent. The chapter on nephroptosis and its treatment is quite thoroughly done and convincing throughout most of it. However the chapter on "Denervation of the Ureter for Painful Spasm" seems far fetched and of doubtful value.

As a supplement to the standard textbooks on urology this book by Dodson is excellent; he ably and thoroughly elaborates on surgical principles and technic, providing for those who are interested facts which cannot be easily gained from any other source.

CATARACT AND ANOMALIES OF THE LENS, Growth, Structure, Composition, Metabolism, Disorders and Treatment of the Crystalline Lens, by *John G. Bellows, M.D., Ph.D., Assistant Professor of Ophthalmology, Northwestern University Medical School, Chicago.* 624 pages; 208 text illustrations and 4 color plates. The C. V. Mosby Co., St. Louis, Mo., publishers, 1944. Price $12.

The literature of ophthalmology possesses many monographs on cataract, but the present contribution of Bellows is distinctive in being undoubtedly the most comprehensive, and in portraying in detail the remarkable advances recent years have added to our knowledge of the lens as well as to the technic of cataract surgery. At Northwestern University, Bellows continued the "Studies on the Biochemistry of the Lens" inaugurated by Gifford, Lebensohn, and Puntenny, and has personally devoted the last 10 years to research in this field. In this volume about 2,000 names are listed in the Authors' Index, which is indicative of the enormous amount of material digested and the intense fascination that the lens as an object of investigation possesses.

Bellows starts his account appropriately with a historical perspective, and then expatiates in turn on comparative and human embryology and anatomy (113 pages), biochemistry (110 pages), clinical pathology (288 pages), and surgical management (32 pages).

The book is replete with authoritative data, but for a deeper insight into the interpretation thereof the student must still consult the original literature. For instance the autolysis theory for the pathogenesis of cataract, championed by most modern investigators including Clapp, Burdon-Cooper, Krause, Lebensohn and Salit, is far less clearly stated than in the writings of these men. Nevertheless the book will be treasured by ophthalmologists, for in no other single volume is so much about the lens available.

THE PATHOGENESIS OF TUBERCULOSIS, by *Arnold R. Rich, M.D., Associate Professor of Pathology, The Johns Hopkins University School of Medicine, Baltimore.* 1,008 pages; 89 figures. Charles C Thomas, Springfield, Ill., publishers, 1944. Price $10.50.

The purpose of this book is to present the background for the interpretation of the pathogenesis of tuberculosis, i.e., the factors that determine the character of the lesions and the progression or arrest of the infection, and the principles that govern the action of those factors. The author states that, "It is not the purpose of this book to present a formal description of the pathology of tuberculosis in all the various organs and tissues. That information can be obtained in existing treatises on morphological pathology." He has clearly defined the present limits of our

knowledge regarding the influence of the above factors and has correlated into a unified whole the basic, independent, but at present, often isolated facts derived from bacteriology, immunology, pathology, clinical observation, experimental investigation, epidemiology, and genetics. To this reviewer's knowledge this is the only unified and analytic survey of its kind.

The length of this book does not permit a detailed review, but certain comments are deemed wise. First the author shows clearly that there exist many controversial matters relating to tuberculosis; he has brought out how little is actually known and the need of more thorough and conclusive studies of the problems.

Second, it is a rare opportunity to find a subject so completely covered. It shows extensive search of the literature and a complete knowledge by the author. The flow of language is smooth and the expression of ideas is clear, all of which makes for delightful, informative, and interesting reading.

Third, special attention is invited to the following subjects:

1. Influence of heredity.
2. Mechanics of native resistance.
3. Acquired resistance.
4. Factors influencing resistance.
5. Influence of the number of bacilli.
6. Factors responsible for tuberculosis lesions.
7. Exogenous or endogenous reinfection.
8. Is an arrested primary infection protective?
9. Application of the principles of the pathogenesis, as illustrated by tuberculosis of the lungs, meninges, and serous cavities.
10. Decline of the mortality from tuberculosis and the outlook for the future.

The above subjects and many others are well covered from all angles and should stimulate those interested in tuberculosis to carry out conclusive studies and experiments to settle many of the now controversial issues which are so clearly presented.

Fourth, this book finds its use as a reference book, highly valuable to those who are interested in tuberculosis and who already have a fairly complete knowledge of that subject.

SECRETORY MECHANISM OF THE DIGESTIVE GLANDS, by *B. P. Babkin, M.D., D.Sc., LL.D., F.R.S.C., Research Professor of Physiology, McGill University, Montreal, Canada; Formerly Professor of Physiology in the University of Odessa, Russia, and in Dalhousie University, Halifax, Nova Scotia, Canada.* 900 pages; 220 illustrations. Paul B. Hoeber, Inc., New York, publishers, 1944. Price $12.75.

This book is a highly scientific study that delves deeply into the digestive cytology and presents extensively the selectivity of the various cellular responses to neural, humoral, and chemical stimuli. The studies on histamine are exhaustive and reveal its significance to a degree not previously appreciated by this reviewer. After each discussion of the author's investigations of the several phases of digestive secretion, there are given the theories of the other recognized research investigators with pertinent comments of the author.

The summation in the final chapters is helpful in bringing the value of the book more nearly within the mental grasp of the average student.

A copy of this work will find a needful place in the hands of all teaching, experimental and research institutions, but if it is intended for the perusal of the profession in general, our scientific background and our capacity to appreciate have been paid a compliment that is perhaps undeserved.

The high quality of this writing, it would seem, merits a careful review by one of long laboratory and research training rather than by one whose experience is almost entirely clinical.

TECHNIC OF ELECTROTHERAPY And Its Physical and Physiological Basis, by *Stafford L. Osborne, M.S., Ph.D., Assistant Professor, Department of Physical Therapy, Northwestern University Medical School;* and *Harold J. Holmquest, B.S., B.S. (M.E.), Lecturer in Applied Physics, Department of Physical Therapy, Northwestern University Medical School, Chicago.* 780 pages; illustrated. Charles C Thomas, Springfield, Ill., publishers, 1944. Price $7.50.

This volume is the most interesting and inclusive treatise on the subject that the reviewer has ever read. The physics and electrodynamics have been presented in an interesting and instructive manner which can be understood by any physician or technician interested in this field of work, and the manner of application of these principles to therapy is very satisfactory and complete.

It has too long been a fact that the average physician who is using diathermy, infra-red, galvanic and faradic, or other electrical equipment knows no more about it than what the salesman has told him and what he has read in a pamphlet that goes with the equipment. This accounts for the poor results or negative results that often are obtained. There is no machine, as yet, into which a patient can be placed and come out cured. If the physician were to realize what he is trying to accomplish and what to expect from certain types of electrotherapy apparatus, and how to get the maximum aid from that apparatus, then results would be far in excess of what they are today. Too often good equipment is con-

demned or misused because there is no basic knowledge of how to use it. Ignorance in a field of this type can produce not only poor results, but can and often has resulted in damage and injury.

The high frequency current diathermy—"short wave diathermy"—is the most commonly used electrotherapy equipment employed today and the trend has been more and more toward the use of coil and away from the plate form. The chapters on the uses to which these can be put and the various technics of application for best results have been well covered.

The sections that have dealt with electrosurgery have been especially well handled and in view of the fact that such therapeutic agencies as fulguration, electrocoagulation, and electrosection are being used more and more, it is only reasonable to assume that the profession should have a firm basic knowledge of these devices and the electrodynamics and physics upon which they are based. How to use this apparatus is only part of the job—how to use it safely and effectively is most important.

COLLECTED PAPERS OF THE MAYO CLINIC AND THE MAYO FOUNDATION, Volume XXXV, 1943, edited by *Richard M. Hewitt, B.A., M.A., M.D.; A. B. Nevling, M.D.; John R. Miner, B.A., ScD.; James R. Eckman, A. B.;* and *M. Katharine Smith, B.A.* 875 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1944. Price $11.

This volume, like its predecessors, includes reprints, condensations, and titles of papers previously published during the year by members of the staff and fellows of the Mayo Clinic. It is not possible to review them in detail as they embrace such a wide variety of subjects. The authors of many of the articles are now on active duty in the Navy and others are serving in the Army.

While one may find articles reprinted or abstracted, dealing with most of the anatomic parts of the body and many of the ailments to which they are subject, there are at least 17 articles of special interest to medical officers of the Navy. These embrace such subjects as the management of ulcers among Naval personnel, amebiasis, effect of penicillin on venereal diseases, treatment of injuries about the face and neck, "jeep disease," wounds of the brain and peripheral nerves, war psychoneuroses, physical medicine in war injuries, anesthesia, the care of the injured, and aero-medical investigations.

For the most part articles are abridged and may therefore, in these busy times, be read rapidly; many illustrations make the volume attractive and useful. The book will be most valuable to those who are located in the larger Naval hospitals; however much of the material will be of interest to physicians isolated in small facilities.

LIPPINCOTT'S QUICK REFERENCE BOOK FOR MEDICINE AND NURSING, A Clinical, Diagnostic, and Therapeutic Digest of General Medicine, Surgery, and the Specialties, Compiled Systematically from Modern Literature, by *George E. Rehberger, A.B., M.D.* 12th edition. 1,460 pages; illustrated. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1944. Price $15.

This book has its subject matter conveniently arranged by covering general medicine and surgery, including nervous and children's diseases, in Part One. Diseases and conditions are arranged alphabetically. Wherever the condition warrants, it is conservatively but adequately discussed, covering definition, diagnosis, prognosis, etiology and treatment. References are made to preferred methods of treatment by leading authorities on the subject.

Extensive discussions cover the problems of diabetes mellitus, gastric and duodenal ulcers, infant feeding, malaria, thoracic and pulmonary diseases, and syphilis. Sketches and excellent color plates are helpfully distributed. The subject of roentgenology is discussed in the fields of physics, technic and diagnosis. This section is instructive but limited in its scope. The apparatus described is antiquated and the technics are empirical and do not give the range given on thickness of the part to be examined. Better discussions of this field are obtainable in other books available to anyone needing such information.

In the section on treatment of acute enteritis (infections) no mention is made of using any of the sulfonamide drugs and only dietary supervision along with purgation and sedation is recommended. However in the discussion of sulfaguanidine it is pointed out that it is indicated for bacillary dysentery.

In the discussion on the prophylaxis of tetanus, no mention is made of tetanus toxoid.

The majority of the prescriptions are written in apothecary system. A few have the metric equivalents with the apothecary measures.

The specific parts on gynecology, obstetrics, skin, eye, ear, nose, throat, and orthopedics are covered in good detail. Army Regulations No. 40-110 on standards for physical examination for flying is included in the appendix of eye diseases.

At the end of each part there is an appendix covering the schema for the history and examination of the particular organ system. Also the armamentarium is discussed. Internal drugs and local preparations mentioned in the text are listed.

The part on drugs gives an alphabetic list of drugs with their dosage, solubility, method of administration, physiologic and toxic action and uses. Dosages are given in the apothecary system.

The part on anesthesia is short and gives the general practitioner the salient facts which he may require for the administration of an anesthetic in an emergency.

The pharmacologic index is brief but comprehensive.

This edition is comprehensive in its scope, well illustrated and is conveniently indexed for ready reference. Some procedures developed prior to 1940 and accepted during the period since the previous publication are not included in this edition, but these omissions do not detract from its value to the general practitioner.

PHYSICS OF THE 20TH CENTURY, by *Pascual Jordan*. Translated by *Eleanor Oshry*. 185 pages. Philosophical Library, New York, publishers, 1944. Price $4.

This book presents a concise and systematic review of modern physics, starting with the mechanics of Galileo and Newton, passing through the theory of quantum mechanics and ending with a philosophic discussion of the relation of natural science and religion. Nearly every contributor to modern physics is mentioned by name, along with a short discussion of his contribution. Fortunately no mathematical formulations of theory are included.

To the average medical officer this volume would be of little value. To one who was interested in the historic aspects of modern physics and the relation of modern physical research to the religious question, this book might have some appeal.

FERTILITY IN MEN, A Clinical Study of the Causes, Diagnosis, and Treatment of Impaired Fertility in Men, by *Robert Sherman Hotchkiss, B.S., M.D., Lieutenant Commander, (MC), U.S.N.R. (on active duty); Assistant Professor of Urology, New York University Medical College;* with a foreword by *Nicholson J. Eastman, M.D., Chairman, Editorial Committee, National Committee on Maternal Health; Professor of Obstetrics in Johns Hopkins University*. 216 pages; 95 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1944. Price $3.50.

In general this follows the format of a concise textbook. The illustrations are excellent, and material is presented in a clear fashion. The writer presents the latest scientific work in the field, as attested by an adequate bibliography.

The author has simplified the anatomy, physiology, and pathology of the male genitalia, correlating the functions and endocrines.

The metabolism of the spermatozoa and chemical composition of semen as the nucleus of male fertility, needs much further study before such conclusion is justified. Normality of both the male and female secretions are essential to the life activity of the sperm.

The writer states that a semen analysis is too often concluded with a prostatic massage. It is, really, only the beginning of the study. Careful cell count and morphology are most important. The physi-

ology and pathology of spermatozoa are the most neglected fields in the study of human reproduction.

In conclusion, that a successful result is frequent enough to warrant continued trial, makes anyone doing sterility work appreciate the real value of this test.

FERTILITY IN WOMEN, Causes, Diagnosis and Treatment of Impaired Fertility, by *Samuel L. Siegler, M.D., F.A.C.S., Attending Obstetrician and Gynecologist, Brooklyn Women's Hospital;* with a foreword by *Robert Latou Dickinson, M.D.* 450 pages; 194 illustrations, including 40 subjects in full color on 7 plates. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1944. Price $4.50.

"Fertility in Women" attempts to show the association of biology and chemistry, the physiology and psychiatry of human reproduction and sex adjustment. The writer presents his extensive experience in simple, well outlined form, demonstrated with drawings, graphs, photomicrographs, and statistic tables.

He emphasizes that an accurate diagnosis can be concluded only after a definite and methodic plan of procedure is followed in the investigation of a sterile mating. This reviewer questions the high percentage of frigidity in women, which is given as 50 percent. That finding of non-patency may occur in cycles and at intervals, and that it does not respond to a single insufflation, is well brought out.

All factors have been covered, singularly and collectively, that may form the basis for infertility or sterility. The chapter of comparative female gonadology is well presented. Only one doing an extensive amount of work, with a background of years of experience on the subject, could have formulated such a simple and well organized outline.

The text should be used not only by the specialist but by the practitioner. The latter too often treats sterility with hormones and insufflations empirically, neglecting often an examination of the consort.

PREVENTIVE MEDICINE

Captain T. J. Carter, Medical Corps, United States Navy, in Charge

SILICOSIS

IN FOUNDRIES OF NAVAL GUN FACTORY

EDWARDS M. RILEY
Captain (MC) U.S.N.

ROBERT W. BUTLER
Lieutenant Commander (MC) U.S.N.R.
and
SIDNEY GOREN
Lieutenant H(S) U.S.N.R.

Silicosis is a chronic pulmonary disease resulting from the inhalation of dust high in concentrations of silica over a period of years. The length of exposure required to produce symptoms usually is from 5 to 25 years, but clinical evidence of the disease rarely is manifest in less than from 8 to 10 years. Furthermore it is well known that susceptibility is highly variable in different persons. Evidence of this is found in the present survey in which only 14 of 283 men (4.9 percent) who had been employed in dust-hazardous occupations for 20 years or more show evidence of the disease.

Foundry dusts contain from 20 to 60 percent free silica, and counts of from 5 to 10 million particles per cubic foot of air should be considered dangerous. For obvious reasons the size of the particles is important, those over 10μ in diameter playing little part in the production of the disease, the danger increasing with particles of decreasing diameter. Those under 3μ are most significant, and often are the only ones found in the lungs.

The general description and pathogenesis of silicosis has been described clearly by Gardner (*1*) (*2*) (*3*) (*4*). Inhaled silica particles which escape beyond the mucus and cilia of the nose, trachea and bronchi, are ingested by alveolar phagocytes which migrate to the lymphoid tissue within the lung and the tracheobronchial lymph nodes. This results in proliferation of connective tissue and a narrowing of the lymphatic channels. Subsequently the phagocytes accumulate along the lymphatic trunks and in the walls of

the air spaces. Proliferative changes take place which result in the formation of discrete nodules composed of hyaline fibrous tissue containing silica particles and which become distributed uniformly throughout all parts of the lung. As the disease advances, there may be massive conglomerate fibrosis, the pathogenesis of which is disputed.

The x-ray picture in early silicosis is that of a generalized perivascular thickening, the shadows of which so closely resemble those cast by other conditions that positive diagnosis is practically impossible. Hilar adenopathy at this stage is suggestive evidence but, unfortunately, is not always present. As the disease progresses, the film first shows pathognomonic generalized nodulation —discrete round shadows of increased density which ultimately attain a diameter of from 4 to 6 millimeters. Stages two and three show massive conglomerate fibrosis with or without nodulation, and in either of these there is often evidence of secondary infection.

The most important symptoms of uncomplicated silicosis are cough and dyspnea; but patients who show positive x-ray evidence of the disease are frequently symptom-free, or have only slight dyspnea on sudden and unaccustomed exertion. With diffuse conglomerate fibrosis, dyspnea is severe.

The usual complications of silicosis in its more advanced stages are emphysema, pleurisy, and, most important, tuberculosis. The fact that silicosis favors the development of tuberculosis, and that tubercle bacilli propagate rapidly in the fresh silicotic lesion, has been thoroughly established. Statistics have shown that the cause of death in from 50 to 75 percent of the advanced silicosis cases is tuberculosis (*1*).

SURVEY OF 1939

Purpose of the survey.—In February 1939, a medical survey was made of the personnel of the steel and nonferrous foundries of the Naval Gun Factory of the Navy Yard, Washington, D. C., to determine the incidence of silicosis and tuberculosis. The results were published in a previous issue of the BULLETIN (*5*). The principal objectives of that survey were: "(1) To determine whether additional protective measures against silicosis were indicated in the foundries; (2) to remove men with silicosis from further harmful exposure; and (3) to establish which cases, if any, were so disabled as to warrant special investigation for a status of compensation." In May 1944, another survey was conducted which had as its purpose the accumulation of similar information, and the determination of the efficiency of the protective measures subsequently instituted.

Summary of findings, 1939 survey.—In the survey of 1939, 454 employees were reported, with 43.7 percent in the 5- to 14-year, and 45.7 percent in the 14- to 40-plus-year duration exposure groups. Eleven cases of silicosis were reported, 10 first-stage and 1 second-stage, an incidence of 2.4 percent. One case in the 10- to 14-year exposure group was reported as being of shortest exposure duration, and one case occurred in the 40-year and over duration exposure group. Borderline cases showed an incidence of 3.7 percent (17 cases) with 82.3 percent of these having a history of exposure of 25 years or longer. Eleven cases of tuberculosis, an incidence of 2.4 percent about equally divided between active, and healed or arrested reinfection types, were found.

FOUNDRY CONDITIONS PRIOR TO 1939

In 1935, the United States Public Health Service made a study of dust conditions in the steel foundry. Since no major improvements in dust control were made between 1935 and 1939, and since the surveys cover approximately the same numbers of employees, it is assumed that conditions remained static throughout this period. At the time of this survey it was found that dust counts were generally low by comparison with those of other foundries. Table 3 shows dust exposures of the various occupational groups and will give a picture of conditions existing at that time.

No attempt was made by the Public Health Service to evaluate these conditions because it was thought that complete medical and occupational histories as well as carefully conducted medical examinations were essential to complete the picture.

As a result of this work the following recommendations were made:

1. That medical surveys be made on the entire foundry personnel periodically, including chest x-ray films and accurate medical and occupational histories.
2. That a good housekeeping detail be appointed in the foundry.
3. That shake-out during the day shift be eliminated.
4. That methods of dust control during shake-out be considered.

The 1939 medical survey, however, appears to have been the first full-scale study. Prior to that time, only sandblasters and small random groups had been examined.

In view of the findings of the 1939 survey a definite silicosis hazard assuredly existed despite the fact that the majority of employees who were found to have the disease had had much longer service in other foundries than in Navy yards.

The foundries of the Naval Gun Factory are classified as jobbing shops, and as such are constantly casting parts of the greatest

variety in form and weight. These castings vary from a fraction of a pound to 50 tons. Therefore corrective measures which are effective in most foundries on mass production work may not prove of benefit here.

PROTECTIVE MEASURES

Between 1939 and 1941 the number of men in the steel foundry almost tripled; with this increased activity the atmospheric dust was visibly increased. Since that time the following protective measures have been instituted:

1. In October 1941 the first major improvement was made in the steel foundry. This was the installation and commissioning of a hydroblast unit to replace the less efficient and far more hazardous process of dry sandblasting. Although no dust counts are available for a comparison of the atmosphere before and after this installation, numerous old employees have remarked on the now noticeably less atmospheric dust.

2. Instead of shaking-out inside the foundry as had been the custom, this operation was done outside of the foundry on the midnight shift. Thus the hazard to the foundrymen working near the shake-out operation was almost entirely eliminated.

3. To eliminate the dust hazard to the shake-out crew itself, a pneumatic vibrator was installed, replacing the older method of applying sledge hammer blows to the cope and drag suspended from a crane.

4. A large 3-h.p. vacuum cleaner was purchased for periodic cleaning. This has cut down that portion of the atmospheric dust which was avalanching from rafters and eyebeams when moving cranes produced vibrations. It is also used regularly on walls and walks which cannot be wet. No dry sweeping is permitted.

5. The hand-loading blending operation which previously had been a constant source of dust, has been eliminated by the use of proper storage bins and chutes which deliver correct quantities of ingredients directly into the machine. A large stack to carry off the dust raised within the mixer itself has also been put into commission so that dust from this operation is now practically nonexistent.

6. Mold-spraying with a wash consisting of pure silica flour and molasses water has been eliminated and the solution is applied by brush.

7. Air-supplied abrasive masks complete with heavy-duty hoods, modified by our safety department to suit local conditions, have been installed in the shot-blasting and hydro-blasting sections.

8. Another improvement of no small significance has been the

installation of considerable forced-draft ventilation equipment throughout all sections of the foundry.

To determine the effectiveness of the corrective measures taken within the past few years, 200 dust counts were made in the various sections and occupations in the plant. Counts were taken over a 5-week period at various times during the day. Eighty-four impinger samples were taken and the counts were made according to the modified method of Williams (*6*), using a hemocytometer as a counting chamber. The remainder of the counts were grab samples, using the Zeiss konometer (*7*) with a built-in microscope.

PRESENT SURVEY

The survey of May 1944 covered employees of the steel and nonferrous foundries of the Naval Gun Factory. Of 895 workers, 842 were examined by x-ray, using 4 by 5 stereoscopic films. Subsequently all those showing evidence of pathosis, however, slight, were recalled for further study. The procedure consisted of a detailed history by systems, physical examination, and the retaking of an x-ray on 14 by 17 film whenever it was considered desirable.

The distribution of employees according to duration of dust exposure is shown in table 1.

TABLE 1.—*Distribution of employees as to duration of dust exposure*

Duration of exposure (years)	Number	Percent
Less than two	124	14.5
2 to 4	153	18.5
5 to 9	84	10.0
10 to 14	110	13.0
15 to 19	88	10.5
20 to 24	83	10.0
25 to 29	57	6.5
30 to 34	63	7.5
35 to 39	44	5.2
40 and over	36	4.3
Total	842	100

These figures bear out the point previously made regarding individual differences in susceptibility. It will be seen that 565 men, or 63.7 percent of the total, have been exposed to dust for a period sufficient to fall within the time limit normally considered necessary for the development of silicosis. However the number of men (18) who actually have evidence of the disease represent but 3.2 percent of the total so exposed.

This survey revealed the existence of 18 cases of silicosis in our foundries, many of which had been reported previously. In interpretation of the roentgenograms, all patients with generalized

TABLE 2.—*Exposure, stage, and symptoms in 18 silicosis cases*

Case No.	Occupation	Dust exposure in years	Silicosis stage	Symptoms
795	Ladleman	20	I	None
32	Craneman	26	I	None
201	Molder	24	I	Slight dyspnea
184	Molder	25	I	None
542	Molder	32	I	None
260	Molder	40	I	None
707	Molder	40	I	None
816	Molder	33	I	Slight cough Slight dyspnea
252	Molder	31	I	Slight cough
835	Molder	20	I	None
629	Molder	31½	I	Slight cough
749	Molder	35½	II	None
401	Molder	27½	III	Slight cough Moderate dyspnea Frequent colds
580	Chipper	10	II	None
17	Chipper	28	I	None
802	Chipper	17½	I	None
399	Chipper	35	I	None
162	Chipper	33	I	None

increased pulmonary fibrosis and suggestive nodulation were considered to be stage-1 silicosis and were reported as such. After complete examination of each patient, no other diagnosis was plausible. Fifteen cases were found in stage 1, two in stage 2, and one in stage 3. In both cases of stage-2 silicosis, the disease unquestionably antedated employment in this Navy Yard. Both patients had worked many years in private industry, and at the present time one has but 2 years and the other 3½ years of service here. However inasmuch as routine pre-employment chest x-ray examinations were not done until this year, their condition was not discovered until this study was undertaken.

Characteristically the large percentage of these patients are symptom-free, and the few who complain of only slight cough are in each instance, coincidentally or not, excessive smokers (40 to 60 cigarettes per day). At the outset each patient was assured in various ways that the examination was being conducted primarily for his benefit and would result in no hardship to himself, economically or otherwise; which we believe made the histories reliable. A summary of these cases showing duration of dust exposure in years, stage of silicosis, and symptoms, is shown in table 2.

Two of these men are no longer working at hazardous occupations, having been placed on other jobs for nonmedical reasons before this survey was begun. The remainder are continuing at their regular employment. All cases have been reported in routine manner to the United States Employees' Compensation Commission for their disposition in the event of future disability.

It will be seen from table 3 that the average dust count has been reduced from 15 mppcf. in 1939 to 5.2 mppcf. in 1944, or a reduc-

TABLE 3.—*Dust exposures of various occupational groups (comparison of years 1939 and 1944)*

Activity	Number of men		Number of samples		Dust concentrations mppcf.*		Remarks
	1939	1944	1939	1944	1939	1944	
Molders, and molder helpers	187	287	20	17	11.9	4.4	No great variation among large or small molds.
Coremakers	10	.....	14	26	4.9	3.3	
Furnacemen, heaters and melters	19	20	2	7	11.8	5.1	
Chippers, welders and buffers	35	83	11	36	25.1	6.3	
Cranemen and cupola tenders	.....	37	.....	6	.....	3.0	
General helpers	32	21	22	17	11.8	4.4	
Common laborers	17	43	19	200	18.8	5.2	These groups are employed throughout the foundry and thus the count given is the average count for entire foundry.
Common laborers†	22	.....	15	.....	301	5.2	
All others	46	47	.....	.....	15.3	5.2	

*Million particles per cubic foot.

†301 mppcf. found in 1939 was for shake-out crew. These men are no longer exposed to this hazard.

tion of approximately 65 percent. Considering the marked increase in activity during this period, the figures are significant and testify to the adequacy of the corrective measures instituted. They show dust counts which are at the minimum hazard level. Consequently there should be little danger of the development of new or the further aggravation of old cases. Pre-employment chest x-ray examinations and periodic physical examinations and dust-counts will be continued in the manner described. Aluminum therapy has not been used here, but advances in this field are being followed closely.

Tuberculosis.—Thirteen cases of tuberculosis, an incidence of 1.5 percent, were discovered. All cases, whether active, arrested, or merely suspected, were referred to the chest clinic of the District of Columbia Health Department for study and disposition. One man with moderately advanced active tuberculosis was hospitalized shortly after the original examination.

SUMMARY

1. In May 1944, at the United States Naval Gun Factory of the Washington Navy Yard a survey on 842 employees of the steel and nonferrous foundries was made for the detection of silicosis and tuberculosis.

2. Eighteen cases of silicosis were found, fifteen of stage 1, two

of stage 2, and one of stage 3, an incidence of 2.12 percent. All have been reported to the United States Employees' Compensation Commission.

3. Thirteen cases of tuberculosis were discovered, an incidence of 1.54 percent. These cases were referred to the District of Columbia Health Department for disposition.

4. Within the past 3 years various protective measures have been instituted, the most important of which are enumerated. Their efficacy is attested by the fact that present dust counts average approximately 65 percent lower than previous figures. It is thought that although the silicosis hazard in the Navy Yard Foundry has not been eliminated, it has been appreciably decreased, and the likelihood of the development of new cases or further aggravation of existing cases in these foundries is minimal.

ACKNOWLEDGMENT.—The authors are particularly grateful to Mr. J. E. Crown, master mechanic of the foundries, whose interest and cooperation have contributed in great measure to the success of the study. We are also indebted to Capt. C. F. Behrens (MC) U.S.N., Chief of X-ray Service, National Naval Medical Center, Bethesda, Md., and to Medical Director H. E. Hilleboe, Chief of Tuberculosis Control Division, U. S. Public Health Service, who with their staffs, were of great assistance to us in the interpretation of many of the x-ray films.

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ACCIDENT PREVENTION ABOARD SHIP

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This study is a review of all accidents occurring aboard an aircraft carrier of the *Independence* class during its first year of commissioned service. While reviewing statistical data for our first Annual Sanitary Report, it became apparent that many accidents were often repeated, occurring in essentially the same circumstantial settings, in spite of warnings in the "Plan of the Day" and timely submission to division officers of injury reports with suggested preventive measures. In view of this general observation, it was decided to undertake an accident cause-analysis study in order to educe all essential elements. The tangible facts of this study were most revealing to us. We feel that similar analyses by other ships would be valuable from an accident-prevention point of view.

During the year we treated 63 major and 90 minor accident cases. All of these required admission to or treatment in the sickbay and resulted in a loss of man-days or a reduction in efficiency. Twenty-three of the most seriously injured were transferred to Naval hospitals or hospital ships (of the 23 cases transferred, it is believed that at least four or five will never be returned to full duty status). Table 1 reveals a break down of all injuries into nature, location, negligence factor and preventability, along with the number of man-days lost as the result of each type of injury.

From table 1, it is deduced that 80.4 percent of the accidents aboard this ship during the one year reported were not due to negligence or misconduct. Negligence did account for 11.7 percent of the total, however, and misconduct caused 7.8 percent of the 153 accidents considered. It is significant that *24.8 percent of all accidents—flying and nonflying combined—are considered preventable.*

It is of interest that only 9.8 percent of the total accidents were flying casualties and 4.5 percent of the accidents were casualties

TABLE 1.—*Negligence factor in accidents*

Injury	Negligence not apparent							Negligence			Miscon-duct		Prevent-able	
	Number	Non-flying	Days lost	Flying	Days lost	Flying in battle	Days lost	Non-flying	Days lost	Flying	Cases	Days lost	Cases	Days lost
Abrasions	6	5	12	....	....	....	....	1	4	....	....	....	1	4
Contusions	24	21	44	....	....	....	....	2	....	....	1	....	5	2
Lacerations	54	38	31	5	1	....	....	4	3	....	7	11	15	22
Sprain—ankle	3	3	6	....	....	....	....	....	....	....	....	....	....	....
wrist	1	1	....	....	....	....	....	....	....	....	....	....	....	....
knee	2	2	11	....	....	....	....	....	....	....	....	....	....	....
back	2	2	4	....	....	....	....	....	....	....	....	....	....	....
other	2	2	....	....	....	....	....	....	....	....	....	....	....	....
Fracture—finger	2	2	3	....	....	....	....	....	....	....	....	....	....	....
toe	4	4	10	....	....	....	....	....	....	....	....	....	....	....
wrist	3	2	2	....	....	....	....	1	3	....	....	....	2	3
ankle	1	....	....	....	....	....	....	1	....	....	....	....	1	....
nose	1	....	....	1	....	....	....	....	....	....	....	....	....	....
jaw	1	....	....	....	....	....	....	....	....	....	1	....	1	....
skull	2	2	31	....	....	....	....	....	....	....	....	....	....	....
other	2	1	15	....	....	....	....	....	....	....	1	6	1	6
Dislocation—arm	2	2	....	....	....	....	....	....	....	....	....	....	2	....
Intracranial injury	4	3	40	1	1	....	....	....	....	....	....	....	1	....
Internal injuries	1	....	....	....	....	....	....	....	....	....	1	55	1	55
Injuries, multiple, extreme	8	1	....	3	....	4	....	....	....	....	....	....	....	....
Submersion	5	....	....	3	....	....	....	1	....	....	1	2	2	2
Burns—1st degree	2	2	2	....	....	....	....	....	....	....	....	....	1	....
2d degree	9	4	24	1	6	....	....	4	21	....	....	....	4	24
3d degree	2	....	....	1	....	....	....	1	....	....	....	....	1	....
Foreign body	5	2	6	....	....	3	16	....	....	....	....	....	1	6
Eye injury	4	2	....	....	....	....	....	2	3	....	....	....	3	13
Ear injury	1	....	....	....	....	....	....	1	....	....	....	....	1	....
Total	153	101	241	15	8	7	16	18	34	0	12	74	43	137

to plane personnel in battle. No injuries to shipboard personnel have thus far been incurred in battle.

Sixty-three major injuries required admission to our sickbay. Three hundred sixty-three man-days were lost to the service by hospitalization aboard this ship, and the patients transferred lost an additional 795 man-days in hospitals up to 1 January 1944, at which time many of these were still on the sick list or had been evacuated to hospitals in the United States. Hence many

more sick days will pile up before the last man of the 23 returns to duty or is surveyed from the Naval service. Of the 363 man-days lost aboard this vessel, 136 were unquestionably due to preventable accidents, which represents 37.7 percent of the total man-days lost. From the above fact, it is apparent that fully *one third of our injury sick days were preventable.*

In a consideration of all accidents, regardless of the presence of negligence or misconduct, it will be noted that lacerations and contusions are the most frequent. Sprains, fractures, burns and foreign-body injuries are the next in frequency in our experience. Flying and battle casualties were small considering the extent of operations in the war zone, and no accidents due to negligence were incurred in flying during the entire year, a gratifying achievement aboard a carrier. Several flying accidents were considered preventable, however, just as in the case of nonflying activities.

The following sample accidents are quite typical of those classified as preventable, and some of those injured in these accidents are still on the sick list with continued accumulation of sick days.

ACCIDENT EXAMPLES

Example 1.—An aviation machinist's mate, third class, on plane maintenance duty was ordered to inflate a plane rear tire. He foolishly choose a bottle of high pressure air having no check valve, gage or caution sign included. The bottle had been used for tire inflation (erroneously) although its purpose was to clear hydraulic lines. The plane tire upon inflation exploded in the man's face. He sustained gross subconjunctival, uveal and retinal hemorrhages in both eyes with a marked reduction of vision months after healing.

Negligence on the part of the materiel force in not restricting and marking the compressed air bottle, and poor judgment and incomplete instruction on the man's part contributed to this entirely avoidable accident.

Example 2.—While underway, a casualty to the No. 1 plane elevator occurred, resulting in severe injuries to two officers and two enlisted men and the lesser injury of eight others. Two flight crews and several officers were standing on the elevator at the flight deck. The elevator, one of the cable type, was released, jammed in its descent and pitched a number of the passengers to the hangar deck below, a distance of about 25 feet.

One man sustained an extensive fracture of the base of the skull; another a compound fracture of the skull; a third received gross intracranial injuries; and a fourth suffered multiple fractures of the pelvic girdle.

More careful check and adjustment of the elevator locking machinery might have prevented the accident. New safety devices and routine inspection have prevented a recurrence of this casualty.

Example 3.—During good flying weather, a pilot attempted a carrier landing following three "waveoffs" because of faulty approaches. The fourth

attempt was considered good enough to bring him aboard. However the pilot hesitated at the crucial moment of landing instead of coming in, and then gave a burst to the throttle. The plane bounced, the hook failed to engage and the plane crashed into the catwalk against a gunmount. One wing was torn off and gasoline streaming out of the wing tank ignited almost at once. The pilot left the burning plane with clothing aflame, sustaining extensive second- and third-degree burns. The heat caused the wing machine guns to detonate, fortunately without injury to personnel.

The captain of the gun crew on the mount where the plane crashed had not sought shelter prior to the plane landing, as ordered. His negligence cost him his life, for gasoline spray set his clothing afire. He had also neglected to require another man in the same crew to take shelter and when burning gasoline caught the second man, the latter jumped overboard. Despite a persistent destroyer search, he was never picked up.

A seaman bystander, in a heroic but miscalculated attempt to rescue the pilot before organized rescue service could be effected, was enveloped in flame and later died. One other man lost his life while bravely attempting to extinguish the burning clothes of one of the victims.

Three of the four deaths were considered preventable, for had all spectators complied with the regulations regarding seeking shelter, and had no one save the fire-fighting crew approached the plane, the severe burns would never have occurred.

The faulty landing was deemed due to pilot error and pilot fatigue after long operational flying and no negligence on the part of flight personnel was in evidence.

It is realized that there is a certain dissimilarity in cause, nature

COMMENT

In civilian industry (*1*) injuries are most often caused by:

	Percent
Handling of tools and objects	37
Falls of workers	20
Mechanical apparatus	12
Falling objects	6
Stepping on or striking objects	5

In our series aboard this ship, we found the causes for accidents to be somewhat different (table 2).

	Percent
Falls of workers	24.2
Striking objects	20.9
Missiles, objects falling or adrift	19.6
Due to aircraft	15.6
Handling of tools and objects	9.8
Mechanical apparatus	3.9
Other	5.9

TABLE 2.—*Causes of accidents*

Injury	Handling of tools and objects	Falls	Mechanical apparatus	Missiles, objects falling or adrift	Striking objects	Due to aircraft	Other
Abrasions		1		2	3		
Contusions		10	1	7	6		
Lacerations	9	5	4	10	21	5	
Sprain—ankle		3					
wrist	1						
knee		2					
back		3					
other	1						
Fracture—toe	1			3			
finger	1					1	
wrist		2		1			
ankle		1					
nose						1	
jaw				1			
skull		2					
other		1		1			
Dislocation—arm		2					
Intracranial injury		2			1	1	
Internal injury		1					
Injuries, multiple, extreme						8	
Submersion		2				3	
Burns—1st degree					1		1
2d degree						3	6
3d degree						2	
Foreign body				5			
Eye injury	2		1				1
Ear injury							1
Total	15	37	6	30	32	24	9
Percentage	9.8	24.2	3.9	19.6	20.9	15.6	5.9

and effect between civilian industrial accidents and shipboard accidents. We live as well as work within the confines of a ship which is subject to a variety of unpredictable and at times violent motion. Our accident statistics indicate that 64 percent were directly or indirectly attributable to motion. Those accidents due to handling and operating machinery are not considered excessive (10 percent), and those due to aircraft seem remarkably low (15 percent). We believe that the incidence of accidents of all types can and will be reduced by pursuance of a vigorous program of

accident investigation with a view toward prevention.

It is generally conceded that accidents resulting in injury are caused by one or more factors. These may be grouped as: (1) Supervisory errors and (2) physical errors (*2*). Those most often encountered are:

Supervisory errors:

1. Faulty instruction.
2. Inability; experience; poor judgment.
3. Poor discipline; disobedience of the rules; interference by others; clowning and tinkering.
4. Inattention.
5. Unsafe practices; short-cuts; haste; chances.
6. Mentally inept; fatigue; excitability.
7. Physically unfit; fatigue; weak.

Physical errors:

1. Physical hazards—unguarded hatches; unmarked equipment.
2. Poor planning—improperly piled or stored "materiel"; congestion.
3. Improper or unfortunate conditions—poor light, etc.
4. Improper dress—no goggles; gloves; masks.

As a result of an admirable cooperation a great many dangers have been eliminated or reduced to unavoidable minimum. During all aircraft operations the firemain pressure is boosted to 100 pounds per square inch and port and starboard hose are led out on the flight deck. Avoidance of unnecessary personnel on the flight deck during air operations has been standardized.

Guards and snubbers have been installed throughout the ship over dangerous overhead projections. Obstructions in passageways and limits of pitfalls have been marked with luminous paint.

The inept have been transferred to simpler tasks. An accident prevention education program has been instituted circulating the circumstances surrounding accidents, together with suggestions for avoiding repetitions.

Despite all casualty prevention measures, however, avertible mishaps still occur.

CONCLUSIONS

Accidents caused by unsafe and careless action are not at all mysterious in background nor are they laborious in analysis, although a complete history and record are essential. The need for a

full statement of fact and an interview with all parties concerned are vital. Records are often all too cursory. In the event of negligence, or if a pension or compensation is sought, the medical officer must be complete in his records of the case. When a man says that he didn't hear the elevator horn or see a signal, he may in fact be found to have defective vision or hearing, and he should be given a thorough examination to ascertain such facts. Perhaps he *does* need glasses, or perhaps he *is* poorly adapted to his job.

Accident prevention depends upon several programs (*2*):

1. Executive recognition, interest, support, and participation.
2. Accident cause-analysis.
3. Selection and application of a remedy.
4. Education of personnel in hazards and their prevention.
5. Enforcement of corrective practice.

It has frequently been said that little can be done about accidents because they are the result of the "machine age" (*3*). The National Safety Council, however, has stated that only 17 percent of industrial type accidents are due solely to mechanical causes. Falls, unsafe acts, and a host of other misdirected actions seem to be the cause of the great majority of accidents, despite the increasing number of machines in use.

For every 1 person accidentally killed, about 50 are permanently disabled and approximately 200 are temporarily disabled and require medical care (*3*). Thus prevention of accidents becomes a major duty of everyone aboard ship and especially of the medical officer.

Accident prevention measures will never be popular with the ship's company, but *must* be enforced by every individual in the echelon of command.

There is definitely another cause for accidents, termed by some "accident proneness" (*4*). This appears to be a personality trait; certain individuals become involved in repeated accidents. "Dilbert" typifies the one who persistently, and apparently "accidentally," associates himself with disaster. Such an individual must be sought out and eliminated from vital activities for the safety of himself and others.

We believe that we can further reduce the accident rate aboard this vessel by aggressive application of the prevention plan we have formulated as a result of this study. That we learn more from our mistakes than from our successes is a medical truism which is especially applicable to accident prevention.

The following is proposed as a plan for accident prevention:

1. Establish an informal board for accident investigation, composed of a representative from each department.

2. The board should make an initial survey of all shipboard activities from an accident-prevention point of view and draw up regulations for shops and for hazardous activities or operations. The board, in its survey, should refer to all specific safety ordinances as prescribed in U. S. Navy Regulations and other pertinent publications.

3. The board should meet periodically for the purpose of studying recent accident reports, and should draw up new regulations or modify existing ones as indicated.

4. These regulations should be submitted to the executive officer for action.

It is believed that this informal board will result in more effective accident prevention because of its representative constitution, its "pooled" technical knowledge, its concrete recommendations, and its tendency toward making all departments accident conscious.

SUMMARY

1. A detailed analysis is presented of 63 major and 90 minor accident cases occurring during the first year of operation of an aircraft carrier of the *Independence* class (CVL).

2. Twenty-five percent of these accidents are considered preventable.

3. Thirty-eight percent of the total man-days lost were due to preventable accidents.

4. Falls, striking objects and articles adrift caused 64 percent of the accidents aboard ship and were directly or indirectly attributable to motion.

5. A discussion of accident causes and their prevention is presented.

6. A plan for an informal Board of Accident Investigation is proposed which will further reduce the incidence of preventable casualties.

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MICROBIOLOGIC CONTROL OF WATER SUPPLIES ON A LARGE NAVAL BASE

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Adequate supervision and treatment of public water supplies have become well-established public health practice paying splendid dividends in the reduction of enteric diseases, but periodic outbreaks of epidemic proportion resulting from laxity in supervision or failure to carry out satisfactorily some phase of the treatment process still occur. Unfortunately water quality is confusing because its microbiologic condition cannot be determined either by appearance, or by its immediate effects. Therefore a constant check on all phases of water sanitation is necessary because there is no specific measurable characteristic which has a constant relationship to its safety.

This report describes the means by which satisfactory microbiologic control of water has been achieved on a large Naval base and adjacent Naval activities utilizing the same source of supply.

Some of the problems encountered included contamination of mains by ships' salt-water pumps, broken lines, repairs, failure to chlorinate new construction before putting into service, and failure to operate chlorinators on a continuous basis and at a high enough level to maintain a residual at all times through the system. These conditions necessitated making bacteriologic examinations on a large scale and required repeated tests to the extent that existing laboratory facilities were overtaxed.

The value of the bacteriologic examination is predicated on its ability to show contamination and provide a check on effectiveness of treatment procedures. However it must also be borne in mind that a positive coli-aerogenes test is not a specific diagnostic instrument for detecting the presence of enteric pathogens. To subculture all suspected colonies and work out their characteristics is too laborious a task to undertake as a routine procedure on a large base. Search for specific organisms is difficult and not often successful. The time interval between infection and appearance of clinical symptoms of water-borne disease is so long that the infected water has usually gone, or the organisms have died out. On the other hand coli-aerogenes are very widespread

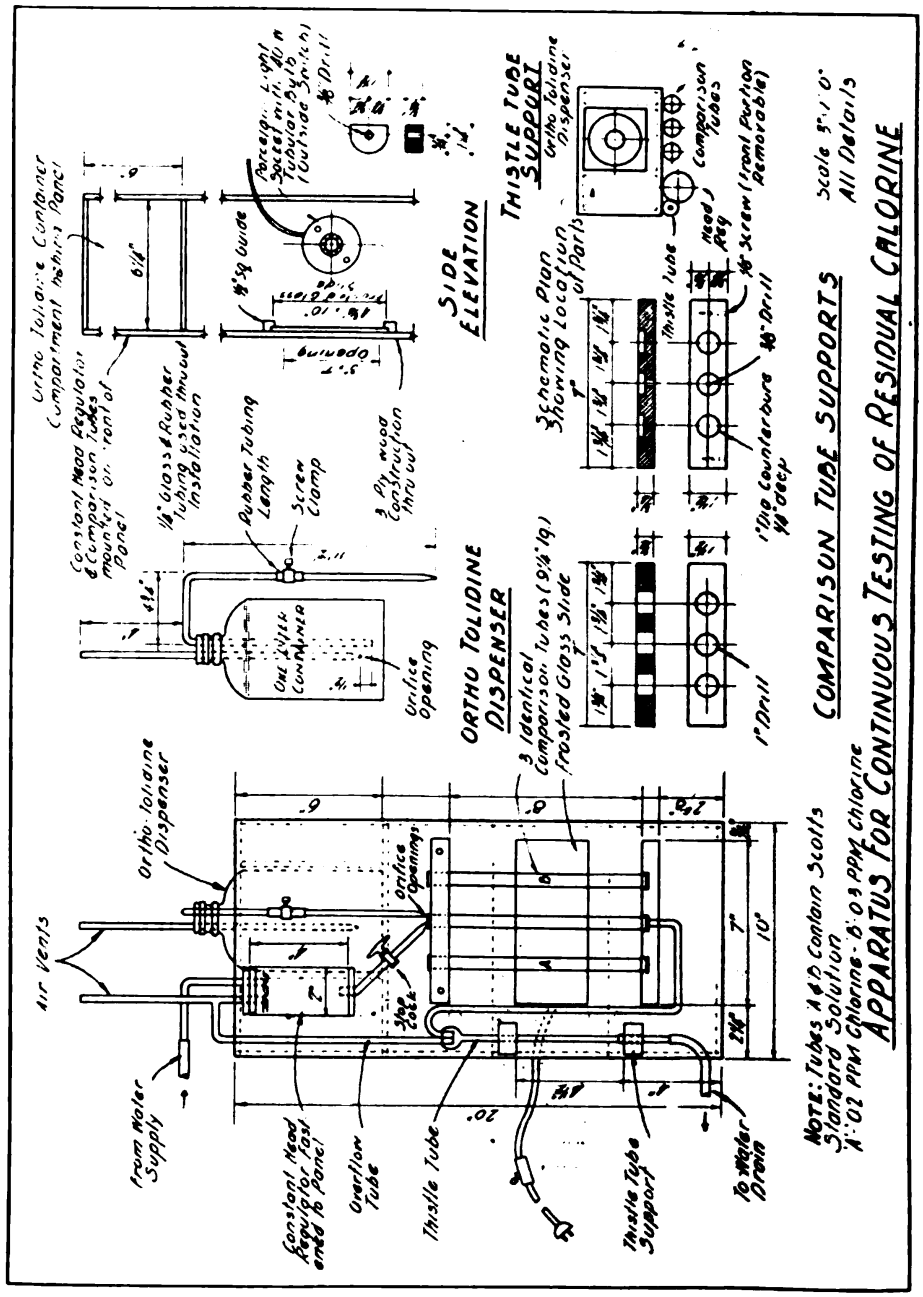


Figure 1.

in nature, and their occasional presence in selective water sampling is therefore to be expected. The number of organisms, and not simply their presence, is the important factor as an index of recent excremental contamination. Consequently a mere positive test need not give rise to undue alarm, especially when sources of supply, methods of treatment, storage, and distribution systems are properly safeguarded.

The method of treating water on this base is by chlorination. Although the amount of chlorine required for destruction of germ life is small, relatively large doses are required because its efficiency is affected by temperature, hydrogen-ion concentration, length of exposure, amount of organic matter in suspension, and resistance of various pathogens to chlorine under these varying conditions. Previously no attempt had been made to determine the extent of residual chlorine in the water following treatment. Therefore it was decided to inaugurate the orthotolidine test for residual chlorine, a colorimetric test which is easy to make and which requires no specialized training. The testing apparatus as used by local Army officials was not entirely satisfactory and had to be improved to meet specific needs (fig. 1).

Following installation of this equipment, subsequent examinations revealed that many areas had no residual. It was significant also that bacteriologic samples taken from these sections showed a high percentage with varying degrees of coli-aerogenes contamination. This undoubtedly was due to failure to increase concentration of chlorine at the point of treatment, to the long distances water had to travel from the sources of treatment to the points of consumption, and to other factors, previously enumerated, which affect bactericidal action of free chlorine. As an added measure of safety, the chlorine residual was built up to 0.2 parts per million throughout the entire distribution system. After this had been accomplished there was a drastic reduction in the number of positive B. coli tests. In some instances it was necessary to install subsidiary chlorination equipment in order to maintain a residual, because the distance was too great from the source of the treatment to the point of consumption, and to avoid excess chlorination at Naval activities immediately adjacent to treatment centers.

Location of residual-testing apparatus should be as far from the sources of chlorination as possible, and on a main trunk line. Prior to installation the distribution system should be checked in detail with the Public Works officer to determine at what point, or points, units should be placed to give complete coverage to the system. Wherever practical they should be placed in dispensaries

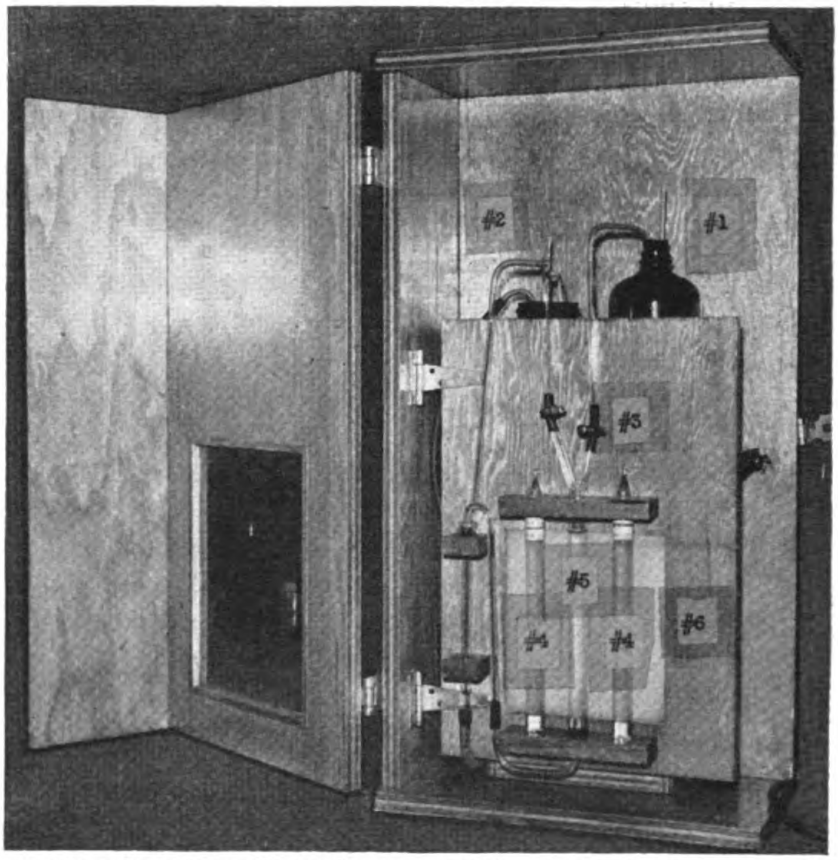
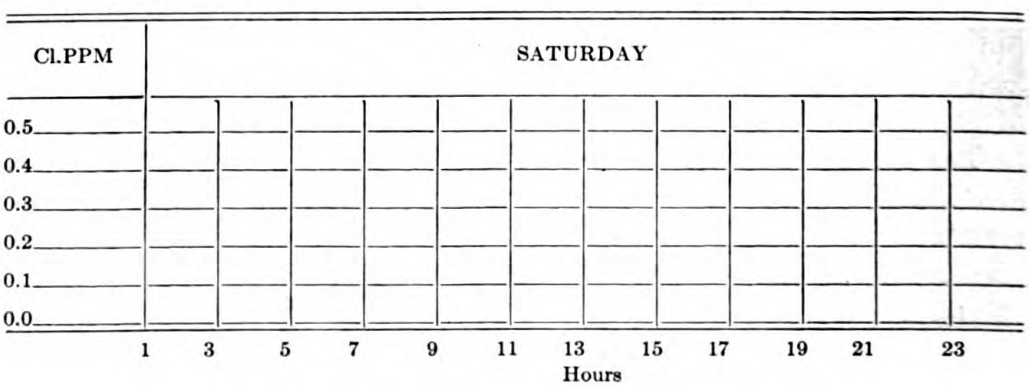


Figure 2. Interior view of continuous chlorine testing apparatus. 1. Orthotolidine bottle. 2. Pressure reducing bottle. 3. Drip regulators. 4. Chlorine standards. 5. Test chamber. 6. Light source.

or laboratories because the Medical Department assumes responsibility for their operation and supervision. Once installed, readings are made every 2 hours and recorded on a graph such as follows:



Sample of daily chlorine residual report form.

This procedure has proved to be of value in helping to regulate the concentration of chlorine by pointing out the periods throughout the day when residual is either low or too high. If no trace

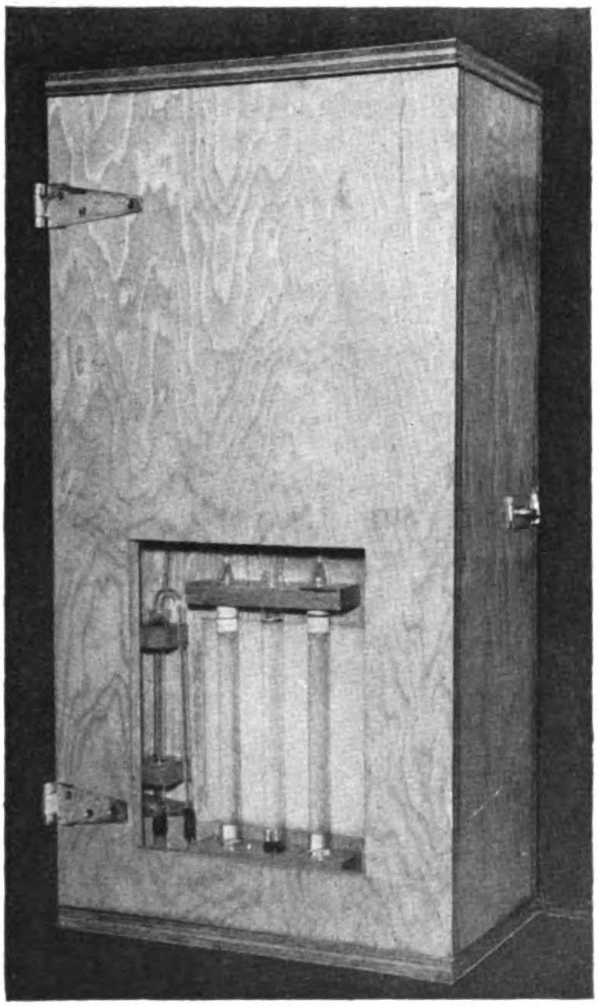


Figure 3. Testing apparatus set up for use.

of chlorine is present at the time of reading, another check is made at the end of 1 hour. If the water still remains chlorine-free, the responsible authorities are notified. In the event that there is no satisfactory explanation, bacteriologic examinations are made immediately.

Orthotolidine testing solution is prepared as follows:

1. Weigh out 0.5 gm. orthotolidine, transfer to a large mortar and add 3 cc. approximately 20-percent hydrochloric acid (as prepared in paragraph 3 below).

2. Grind powder into thin paste and add 250 cc. distilled water. (The orthotolidine goes into solution immediately.)

3. Transfer to suitable container and add 247 cc. 20-percent hydrochloric acid solution, which is prepared by adding 50 cc. concentrated acid to 200 cc. distilled water.

4. This is known as the stock solution and should be stored in amber bottles not exposed to light and not kept longer than 6 months.

5. To prepare final solution to be used in indicator, dilute 1 part of stock solution with 9 parts of distilled water.

The rate of drip of the testing solution into the water should be between 10 to 15 drops per minute. Water being tested should range from 175 to 200 drops per minute. Chlorine standards (comparator tubes), one of which contains 0.2 ppm chlorine and the other 0.3 ppm, should be rechecked every 2 to 3 months with a standard comparator indicator. Standards become faded in color upon aging as a result of prolonged exposure to heat and light. A reddish brown film will also form on the inside of the testing tube from the action of orthotolidine solution. This should be removed every 2 or 3 days by cleaning with a brush and soapy water.

This criterion, like any other test, has its limitations. It can be used with any degree of accuracy only when the water is clear. Where there is considerable turbidity, the chlorine unites with the organic matter in suspension, and fails to disinfect the water completely. The test in this instance will usually indicate presence of more chlorine than actually exists in a free state. Under such conditions, bacteriologic examinations will frequently show high B. coli-aerogenes counts. Even under these circumstances the test can be used as a supplement to bacteriologic analysis. Advantages derived from use of the test are as follows:

1. The test provides a check on the operation of chlorinators and acts as a regulator for application of chlorine by determining extent of residual in the mains.

2. It curtails large scale routine bacteriologic sampling, thereby releasing laboratory facilities and personnel for other essential activities.

3. The need for installation of additional chlorination equipment in order to maintain a residual in all branches of the system is proved.

4. It functions as an indicator of contamination by showing little or no residual, or an excessive demand for chlorine in an area for a prolonged period of time.

Best results can be obtained with this equipment by making one person responsible for its operation.

NOTES ON OUR RESERVE CONTRIBUTORS

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NAVY DEPARTMENT
WASHINGTON, D. C.

NAVMED 112

COVER PHOTOGRAPH

Quizzically surveying the dressing which has been applied to her wound in a Naval evacuation center on Leyte, a Filipino mother and her pensive child reveal in their faces the hardships to which they have been subjected under Japanese rule. In the left background, a soldier may be seen routing out snipers.

—Official U. S. Navy Photo.

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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Volume 20, 1924, Nos. 2, 5, and 6.
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PREFACE

The UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

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It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

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TABLE OF CONTENTS

CLINICAL NOTES

MEDICAL AND SURGICAL DEVICES

EDITORIALS

BOOK NOTICES

PREVENTIVE MEDICINE

U. S. NAVAL MEDICAL BULLETIN

VOL. 44 APRIL 1945 NO. 4

SPECIAL ARTICLES

BACTERIDS PROVOKED BY INTERNAL SULFONAMIDE ADMINISTRATION

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and
PAUL L. GORSUCH
Lieutenant, junior grade (MC) U.S.N.R.

In the skin diseases known to have their origin in allergy to bacteria and their products, the usual doses of sulfonamide drugs may produce a marked aggravation of the existing symptoms. The resulting manifestations are of sudden onset, severe in nature, and may lead to a period of hospitalization which would be unnecessary if these drugs were administered in small initial doses with gradual increase each day.

The similarity of the skin and constitutional symptoms of these aggravations to those found in bacterids and other skin conditions produced by allergy to bacterial products is striking, and suggests that the action of these drugs is that of a rapid liberation of bacterial toxins from the primary focus of infection. This results in an upset of the individual's normal immunologic balance to these substances.

In defining the nature of "id" reactions, Sulzberger (*1*) states that these are local tissue allergies to the disseminated products of bacteria which arise in a primary focus of infection. A demonstrable previous exposure of the individual to the microorganism in question must have existed. And the skin of these individuals must show a specific altered capacity to react to the extracts of these bacteria, either by increased sensitivity or entire absence of reaction (anergy).

"Ids" can be provoked, as a rule, within 48 hours by the injection of an excessive dose of the extracts of the particular bacteria to which the individual is susceptible. Andrews and Barnes (*2*) in describing a pustular bacterid draw attention to its symmetric distribution, its accompanying leukocytosis, and its disappearance following the removal of the primary focus of infection. According to the Suttons (*3*) the skin manifestations of bacterids and those caused by bacterial products may be in the nature of scarlatiniform, follicular, pityriasis rosea-like or urticarial eruptions. Erythema multiforme, erythema nodosum, eczematoid dermatitis, or vesiculopustular eruptions of the hands and the feet may also be produced.

Among the characteristics of the constitutional reactions and skin eruptions produced by drugs, as outlined by Coca and his coworkers (*4*) and Sulzberger and Wise (*5*), is their delayed appearance to between the sixth and thirteenth day when the drug is being administered for the first time. This is in contrast to their rapid appearance within 2 or 3 hours, or at the latest within 48 hours, in instances in which the individual has been previously exposed to the particular drug.

Most methods of testing for drug hypersensitivity are unsatisfactory, except possibly in cases of the eczematous type of reaction. This is because no specific reagins can be demonstrated in the blood and attempts at passive transfer consequently are unsuccessful. Among other characteristics of drug hypersensitivities are (1) a history of atopy and (2) failure to desensitize the patient by administration of gradually increasing doses of the offending drug.

Although there is much in the literature pertaining to the toxicity and skin manifestations produced by the sulfonamides (*6*) (*7*) (*8*) (*9*) (*10*) (*11*), there is no evidence to indicate that these reactions depart from the pattern of those described for other drugs. The consensus is that intolerance to sulfonamides is usually manifested by a low-grade fever, conjunctivitis, leukopenia, relative lymphocytosis, and by skin eruptions of a morbilliform, maculopapular, scarlatiniform, or petechial type. These dermatoses appear usually after from 35 to 66 gm. of the drug has been administered and between the fifth and fourteenth day of therapy.

The following case reports illustrate provocation of bacterids in patients who could not be considered allergic to sulfonamides, as they had no history of previous use or contact with these drugs.

CASE REPORTS

Case 1.—A 17-year-old seaman, second class, was admitted on 5 January 1944 with an acute vesicular and bullous eruption of the hands and feet

secondary to a nummular eczema of the leg. There was no previous personal or family history of allergy, and he denied the use of any form of sulfonamide medication.

One week after admission, when the eruptions on the hands and feet were apparently quiescent, he was started on sulfadiazine in an effort to clear up the nummular eczema. Six hours following an initial dose of 0.5 gm., there developed a classic picture of erythema scarlatinoides, with a temperature of 102° F., a white blood cell count of 24,000, 87 percent of which were polymorphonuclear leukocytes, and a severe aggravation of the existing eruption on the hands and feet.

Careful examination for foci of infection revealed only the presence of tonsil tabs. Two months later this patient developed an acute otitis media, in the treatment of which he received a total of 7 gm. of sulfadiazine before he again developed a similar scarlatiniform syndrome with an accompanying temperature of 100.4° Fahrenheit.

Case 2.—A 30-year-old gunner was admitted on 20 March 1944 with a diagnosis of infectious eczematoid dermatitis, the result of a chronic discharge from both ears, and an eczematous involvement of the auricles and adjacent portions of the face. There was also a symmetric vesicular eruption of the palms and of the plantar surfaces of both feet, together with a generalized macular eruption of the body. The aural discharge had been of many years' duration, but the generalized skin manifestations had appeared only within the past 24 hours and had followed the ingestion of 8 gm. of sulfadiazine the previous day. He had no personal or family history of allergies, and denied any prior use of the sulfonamide drugs either locally or by mouth. A leukocyte count was not obtained until the fifth day after onset of the reaction but at that time was 8,050 with 55 percent polymorphonuclear cells.

After the skin manifestations had disappeared, but before the patient was released, he was again placed on a regime of sulfadiazine therapy because of the discharge from the ears. The initial dose was 0.5 gm. during the first 24 hours. This was increased by 1 gm. per day until he was taking 3 gm. daily with no evidence of intolerance or recurrent bacterids.

Case 3.—A 21-year-old motor machinist's mate, second class, was admitted on 15 June 1944 with a diagnosis of a discoid type of lupus erythematosus of the face, this eruption being of 4 years' duration. There was no personal or family history of allergy and no previous local or general use of the sulfonamides.

In preparation for a tonsillectomy the patient was given 0.5 gm. of sulfadiazine as a single test dose. Within 24 hours symmetric, edematous, erythematous plaques appeared on the palms and the plantar surfaces of the feet and there was an increase in the redness and edema of the involved portions of the face. The temperature rose to 99.2° F., and the leukocyte count from 6,350 to 11,800 with 56 percent polymorphonuclear cells.

The patient's skin sensitivity to bacterial vaccines was found to be increased with catarrhalis mixture, and moderately reactive to staphylococcus, streptococcus and fungus mixtures. The use of sulfadiazine was continued in doses of only 1 gm. daily for the next 2 days, at the end of which time the eruption had subsided. The dosage was then gradually increased by 0.5 gm. daily until the patient was taking 4 gm. a day without further untoward reactions.

COMMENT

Shaffer and his associates (*12*) reported similar exacerbations of skin eruptions of an "id" character in patients who had previously received sulfonamides either orally or topically. He believes that the Herxheimer-like effect of these drugs may be produced by the liberation of bacterial toxins to which the patient is sensitive. In all four of their cases, however, previous exposure was admitted and the patients had positive passive transfer tests which indicated a mild sensitivity to the drugs. Livingood and Pillsbury (*13*) also mention these explosive "id" reactions in patients previously sensitized by local application of sulfonamides.

Unless there is an unknown relationship between the sulfonamides and other drugs derived from the coal tar products, there could scarcely have been any sulfonamide sensitivity in the patients whose cases are reported here because there was no history of any form of local use or ingestion of these drugs. In each case there was an increased leukocyte count in the blood, a rise in temperature, and the skin eruptions produced were of the type commonly associated with bacterids. In no instance was there any personal or family history of allergy.

It would seem likely, as Livingood and Pillsbury contend, that individuals presenting this syndrome can later take larger doses of the drug than those which originally produced the reaction, and that the local aggravations observed were of benefit in a more rapid healing of the primarily affected skin area. From observations during the past 8 months of 12 patients who had acute exacerbations of the type described by these authors, we do not agree that the observed increased tolerance to sulfonamides administered internally was in the nature of a hyposensitization to the drug. It is believed, rather, that it was a desensitization to the bacterial toxins gradually liberated by the action of small, increasing doses of the drug on the locally infected areas.

SUMMARY

Three cases are reported in which sulfonamide drugs administered for the first time provoked or aggravated bacterids of the skin with accompanying constitutional symptoms of sufficient severity to require the patients' hospitalization. It is suggested that, when these drugs are used for skin diseases known to be caused by bacterial allergies, they be administered in a manner similar to that used with bacterial vaccines, beginning with a small initial dose followed by increasingly larger doses until a satisfactory therapeutic level is reached.

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SODIUM BICARBONATE IN RODENT ULCER

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ABUSE OF SULFONAMIDES

IN THE TREATMENT OF ACUTE CATARRHAL FEVER

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There is an increasing tendency on the part of Naval medical officers, as well as physicians in general, to prescribe sulfonamides routinely in the treatment of the common cold on the grounds that it prevents complications, such as pneumonia, and that it shortens the clinical course of the cold. What is more to be condemned, laymen have added sulfonamides to their armamentarium of self-medication.

Such treatment is rarely administered in a dosage which experience has shown to be needed to control pneumococcal infection. It therefore not only fails at times to prevent pneumonia but also is responsible for sulfonamide-resistant strains of pneumococci that cannot be typed. Such treatment is rarely standardized by blood count or by blood level of the drug, so that serious toxic effects could be well under way before being recognized.

Above all, such promiscuous use of sulfonamides may lead to a considerable number of cases of sensitization, rendering future use of the drug dangerous at a time when its help is desperately needed, as for example in the treatment of a pneumonia, or dressing of a battle wound. The routine use of sulfonamides in the treatment of acute catarrhal fever is, therefore, strongly to be condemned. This thesis is not new. Many writers have called attention to the potential toxic and allergic effects of the therapeutic use of the sulfonamide drugs. However the warning is repeated because of a succession of experiences which support these observations.

Allergy to sulfonamides.—Twenty years ago the commonest drug sensitivities were those to aspirin, to quinine, and to phenolphthalein, in the order mentioned. Today allergy to the sulfonamides far exceeds in frequency any or all of these. This proves that the sulfonamides are excellent sensitizers. Fifteen percent of the population is allergic. This means that at some time in the lives of these people they exhibit an obvious manifestation of allergy, such as asthma, hayfever, allergic eczema, or urticaria. They are not merely sensitive, but *sensitizable to new antigens.*

It is therefore obvious that in the future an increasing number of sulfonamide drug sensitivities will develop and will constitute a growing hazard in the treatment of subsequent infections.

The story of sulfonamide allergy has been developing somewhat in this manner: Sensitivity was first observed chiefly in patients who had received sulfonamides over a considerable period of time in the treatment of a serious ailment, such as pneumonia or sepsis. Only an occasional patient showed evidence of trouble with the first or early doses of the drug.

At that time nearly all patients were getting sulfonamides for the first time in their lives; some of them became sensitized during the first week or 10 days after the beginning of the treatment, and because treatment was continued beyond that interval they developed the symptoms of their allergy during their first course of treatment with the drug. Only an occasional patient had been sensitized by previous treatment, or was primarily sensitive for no discoverable reason, and so developed symptoms at the beginning of treatment. More recently the incidence of patients reacting to the first dose is rising, especially in patients whose need for sulfonamide therapy recurs within a year or so of a previous course of treatment with the drug. Experience is accumulating to show that the sensitivity usually lasts for a year or longer.

It must be emphasized that the absence of allergic symptoms in the course of sulfonamide therapy does not mean that the patient is not being sensitized to the drug. It takes at least a week, and it may take 20 days, or longer, after administration of the first dose before a sensitivity has been established. Symptoms of sensitization therefore do not occur unless the treatment is continued long enough to extend into the period when sensitization exists. Otherwise the sensitivity is not discovered until a later infection again calls for the use of the drug.

The sensitivity may be to a radical that is common to all sulfonamides, or it may be to a radical peculiar to an individual member of the group. If the former condition obtains, it becomes dangerous to use any sulfonamide in treating such a patient. Fortunately the sensitivity is, as a rule, only to the sulfonamide to which the patient was exposed, so that he may be given another sulfonamide with safety. But here, too, there is a decided possibility of his becoming sensitized to the new drug.

The following case illustrates a number of these points.

Case 1.—A 52-year-old farmer, in December 1939, had a lobar pneumonia from which he made a complete recovery under treatment with sulfapyridine. On 28 January 1941 he was thought to be experiencing another attack of pneumonia and again sulfapyridine was administered. This promptly precipitated severe vomiting, a generalized punctate rash and a

leukopenia of 1,400, and the drug was stopped on 30 January. Two days later, fever returned and the evidences of pneumonia increased.

On 3 February the temperature rose to 105° F. Sulfathiazole therapy was begun that day and was followed by prompt improvement in the patient's condition. There were no ill effects in the week that followed. For a time the patient seemed to convalesce satisfactorily, but cough and expectoration continued and there were physical signs of a persisting lesion in the lower lobe of the right lung.

Upon admission of the patient to the hospital of the University of Pennsylvania on 14 March, bronchoscopic examination revealed a fungating lesion in the right main-stem bronchus that on microscopic section proved to be a bronchogenic carcinoma. On 24 March a right total pneumonectomy was successfully performed and on 7 May a seventh rib thoracoplasty.

Because of the threat of empyema, sulfathiazole was administered. This was followed promptly by vomiting, fever, and a beginning rash, so that the drug had to be stopped. Sulfadiazine was substituted and was well tolerated. The patient was discharged from the hospital on 24 May in good condition.

Here then, is a patient who, in three critical illnesses occurring within a period of 17 months, became sensitized successively to sulfapyridine and sulfathiazole. His sensitivity to sulfapyridine was still present 14 months after administration of the drug which produced it.

Lyons and Balberor[1] observed febrile reactions in 36 percent of patients upon readministration of sulfathiazole, while Dowling and Lepper[2] observed "drug fever" accompanying a second course of sulfathiazole in 16 percent, sulfadiazine in 7.4 percent, and sulfapyridine in 9 percent of cases. The latter authors advised that whenever a second course of a sulfonamide is needed a different form of the drug be used than the one originally given. They also noted that there was no relation between the length of the first course of the drug and the likelihood of "drug fever" developing during the administration of the second course. In other words, the dose of a sulfonamide given in the treatment of catarrhal fever is as likely to cause sensitization as is the maximum dose used in pneumonia.

Other effects.—Sulfonamide therapy in the treatment of the common cold involves, in addition to the danger of sensitization, three further threats to the patient with respect to pneumonia.

1. *It does not prevent pneumonia,* chiefly because the dosage used in such cases is inadequate to produce the concentration of the drug in the blood which experience has shown to be necessary to cure a pneumococcal infection.

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[1] LYONS, R. H., and BALBEROR, H.: Febrile reactions accompanying readministration of sulfathiazole. J.A.M.A. 118: 955-958, March 21, 1942.

[2] DOWLING, H. F., and LEPPER, M. H.: "Drug fever" accompanying second courses of sulfathiazole, sulfadiazine and sulfapyridine. Am. J. M. Sc. 207: 349-353, March 1944.

2. If the patient who has a cold and has also virulent pneumococci in his respiratory tract is given a dosage of a sulfonamide too small to cure the pneumococcal infection, there is the further danger that the *pneumococci may become resistant to sulfonamides*. Should a pneumonia develop within the next week or so, then the sulfonamides could no longer be used effectively in treating the disease.

3. The sulfonamide drugs alter the immunologic characteristics of pneumococci. Thus within a few hours of sulfonamide administration *it is impossible to determine the type of pneumococci.*

When sulfonamides are found to be ineffectual in pneumonia after from 36 to 72 hours, the next step is to test the sensitivity of the organisms to penicillin, and if they are found to be penicillin-resistant, or if no penicillin is available, resort is had to type-specific immune serum. But the latter procedure entails proper typing of the organism causing the infection, and experience has shown that such typing must be undertaken before sulfonamide treatment has begun. Obviously the patient who has had sulfonamides for his cold and subsequently develops pneumonia may thereby be robbed of his chance both for adequate drug therapy and for serum therapy. The following is a case in point.

Case 2.—A 19-year-old hospital apprentice, first class, was admitted to this Naval hospital on 9 March 1944 with a diagnosis of acute catarrhal fever. First symptoms of a cold had begun 3 days before, and on the day prior to admission his throat became sore. The patient's temperature was 102° F., pulse rate 100, and respirations 24 per minute. The lungs were normal. Because of the sore throat he was given 2 gm. of sulfadiazine immediately and 1 gm. every 4 hours thereafter. The following day the leukocytes numbered 16,300 per cu. mm. with 83 percent neutrophils. A chest x-ray showed no lung involvement.

Three days later the patient was much improved, the temperature was 99° F., pulse rate 80, and respirations 24 per minute. On the succeeding 3 days, however, his condition gradually became worse, with progressively more fever and cough, and râles at the bases of both lungs, more pronounced on the right side.

On 13 March he received an additional 2½ gm. of sulfadiazine by mouth. Two days later the temperature reached 102° F., and by nightfall the respirations were 44 per minute. Yet on that day the first blood-level determination, after 6 days of sulfonamide administration, showed a concentration of only 3.1 milligrams per 100 cubic centimeters. A chest x-ray on this day showed involvement of the entire right lung.

The patient was transferred to the pneumonia ward and placed in an oxygen tent. On the following day his condition was obviously grave. The leukocyte count was 14,300 per cu. mm. with 93 percent neutrophils. The sulfonamide concentration in the blood had risen only to 7 milligrams.

At this point the alternative of specific serum therapy was considered. Unfortunately three successive attempts to identify the type of organism failed, both directly in the sputum and in cultures.

In the course of the next 15 days the patient was given 25,000 units intramuscularly at 3- or 4-hour intervals for a total dosage of 2,495,000 units. On 20 March the first signs of improvement were evident. Thereafter his condition became slowly better, and on 12 April the lungs were clear. Further convalescence was uneventful.

This patient did not have pneumonia on admission, either clinically or by x-ray evidence. Sulfadiazine did not prevent pneumonia in this case, even though it was given in a dosage higher than is commonly used in such cases, but nevertheless inadequate as shown by an inadequate blood-level concentration on the seventh day of such continuous treatment. The sulfadiazine therapy did, however, result in rendering the pneumococcus resistant to the drug when the dosage was eventually increased, and made it impossible to type the organism, thereby preventing the use of specific serum.

Self-medication with sulfonamides by laymen for the common cold is to be expected if the use of sulfonamides is made routine by physicians in treating that ailment. It is known that laymen have been purchasing sulfanilamide without a physician's prescription from unscrupulous druggists for self-treatment of gonorrhea. Self-medication is already being practiced by small numbers of service personnel in units where medical officers had first introduced them to such medication. Lay personnel, usually officers, in order "to lick this cold without turning in," have sometimes been able to obtain sulfonamides from the corpsmen in the sickbay or dispensary. It is certain that few physicians would advise that laymen be led to believe that they can use with safety a drug potentially so dangerous. Moreover the layman puts his faith in the drug alone and omits the general measures.

Another consideration that should make undesirable the *routine* use of sulfonamides in treating lesser infections is its *interference with the establishment and maintenance of active immunity to commonly occurring, practically unavoidable, pathogenic agents.*

There are two phases to this: (1) The general aspect of the patient's immunologic experience over years, and (2) that which has to do with the current infection. It is pointed out that persons in an urban community and in a temperate climate are repeatedly and unavoidably exposed to respiratory infections with various pathogenic agents, some of relatively minor significance and others in minimal doses, even though potentially serious, such as staphylococci, N. catarrhalis, streptococci, pneumococci, and others.

Most such exposures to various pathogens occur while the individual has a common cold. In the majority of instances such repeated minimal exposures tend to produce an increasing, relatively active immunity that accrues to the patient's permanent

advantage; witness the lessening seriousness of rheumatic fever with advancing age in regions where that disease is endemic. Since avoidance of such infections is practically impossible, and since as yet no systematic prophylactic immunizations to most of them are available, one could argue, with some justification, that the *routine* use of sulfonamides in common colds would interefere with the natural development of such protective immunities. However it is impossible at present to evaluate the importance of this general immunologic consideration.

The immunologic phase of the current infection of a patient being treated with a sulfonamide is very important. A patient with pneumonia who gets well without treatment does so by reason of a high degree of immunity which he has produced against that particular pneumococcus; an immunity, moreover, that he has produced in a relatively short time and that is his greatest protection against relapse during convalescence. The pneumonic patient who gets well under medication with sulfonamides has his fight against the pneumococcus made easier by the drug which holds the invader in check (bacteriostasis), but the immunity which he produces is slower in developing and lesser in degree than the immunity of the patient not so treated.

The convalescence from pneumonia in the sulfonamide-treated patient is, therefore, on the average slower, and the danger of relapse is greater than in the patient not so treated. The same effects can occur in patients with common colds who are treated with sulfonamides. Although it is difficult to ascertain variations in the length of convalescence from a disease usually of such short duration, there is a tendency toward relapse in the course of days or a couple of weeks, with manifestations of pyogenic infections in the respiratory tract.

Certainly, therefore, no investigation of the efficacy of the *routine* use of sulfonamides in treating the common cold is complete unless it includes follow-up study of the patients as well as of controls for a period of a month from the onset of the infection.

Such an investigation was undertaken by Short and his coworkers,[3] who concluded that: "The saving of time in sick days and the almost certain prevention of more severe pulmonary complications in a certain percentage of catarrhal fever cases make the sulfonamides the measure of choice for routine therapy." The evidence on which this conclusion is based is as follows: Of 827 patients, a control group (228 patients) was managed only by

[3] SHORT, J. J.; TOOMEY, L. O.; SCHOENHEIT, E. W.; SMITH, F. R., JR.; and SLAGLE, G. W.: Comparison of four routine procedures in the treatment of acute catarrhal fever. U. S. Nav. M. Bull. 42: 848-851, April 1944.

general measures, such as bed rest, nursing care, abundant fluids during febrile periods, sedatives when indicated, codeine when necessary for severe cough only, and laxatives if and when indicated. In a second group (194 patients), in addition to these general measures, every 4 hours two capsules, each containing aspirin grains 3, phenacetin grains 2, and caffeine citrate grain 1, were given, in addition to elixir of terpin hydrate and codeine as needed for cough.

A third group (309 patients), in addition to the general measures, received sulfadiazine grains 30 on admission and grains 15 every 4 hours until the temperature had been normal for 48 hours.

A fourth group (96 patients), in addition to the general measures, was given a capsule after each of the three meals and two capsules at bedtime, each capsule containing codeine sulfate ½ grain and ephedrine sulfate ⅜ grain.

The average hospitalization periods for these four groups were respectively 6.7, 6.2, 5.6, and 7.3 days. Three patients (1 percent) of those given sulfadiazine developed skin reactions that receded on withdrawal of the drug. No data were given as to the extremes and the pattern of scatter of the hospitalization periods in the various groups, there was no statement as to blood-level determinations of the drug, the leukocyte counts or hemoglobin estimations in the patients given sulfadiazine, and there was no follow-up.

As to the "saving of time in sick days," in the absence of data as to the duration of individual cases it is impossible to prove from the published figures the advantage of sulfadiazine treatment over phenacetin compound and codeine treatment. The authors do not state that they made such an analysis. It seems highly probable that this advantage is not statistically significant. Had the patient cited here (case 2) been included in their sulfadiazine-treated series, the figures would have been radically changed, for at the end of 102 days he is still on the sick list.

The authors find the same advantage of 0.6 day in favor of no medication at all as opposed to treatment with codeine and ephedrine, the treatment which made the patients more comfortable than did any of the other methods. Surely on such trifling evidence in favor of "no medication," they would scarcely conclude that, were there only the alternatives of "no treatment" and codeine and ephedrine, "no treatment" should be preferred.

The "almost certain prevention of more severe pulmonary complications," is another assumption not warranted by the evidence. It is true that none of their 309 patients treated with sulfadiazine developed such complications, but neither did any of their 518 patients not so treated.

SUMMARY

It is not logical to advance, in support of the routine use of sulfonamides in treating colds in order to prevent pneumonia, the use of such drugs in units of service personnel, among whom streptococcal or meningococcal infections, or rheumatic fever have appeared, to prevent the spread of such infections. The two situations are far from analogous. In the latter, there is a strong probability that many would develop a serious illness that to some would prove fatal. The obvious risk of serious illness or death far outweighs the potential danger of the prophylactic sulfonamide administration. Moreover such drug use has been shown to be highly effective in preventing infections with the streptococcus, meningococcus, and the pathogen of rheumatic fever, and effective in a dosage far smaller than that suggested for use in colds.

But the serious complications of the common cold are infrequent. The dangers to health and life involved are trifling. To cure a pneumococcal infection already existing in the patient with a cold calls for a dosage so large as to be potentially more dangerous than the risk of pneumonia, were it to be applied to all patients with colds.

Finally, it is emphasized that it is the *routine* use of sulfonamides in treating colds that is here condemned, not its judicious use in *selected* cases. Selection is essentially diagnosis. Catarrhal fever does not include tonsillitis, streptococcal sore throat, and other respiratory infections, primarily bacterial, or secondarily so in complicating a virus ("cold") infection. Merely looking into the patient's throat will not settle this point.

In selected cases, such as those, for example, in which many streptococci are demonstrated on throat smear, sulfonamide therapy is indicated. But the smear might show Klebs-Löffler bacilli, and thus prove the "catarrhal fever" to be diphtheria. Perhaps the most serious charge that can be brought against the routine treatment of so-called colds with sulfonamides is that it leads to that cardinal sin of medical practice, treatment without diagnosis.

CONCLUSIONS

The *routine* use of sulfonamides in the treatment of catarrhal fever (the common cold) is to be condemned because:

1. It involves the risk of inducing sensitivity to a drug that may be more needed in a later serious infection.

2. It does not necessarily prevent pneumonia, since the dosage employed is usually inadequate.

3. This inadequate dosage can be responsible for a drug-fast strain of pneumococcus.

4. It renders pneumococci untypable and so precludes the use of specific serum therapy in patients with drug-fast pneumococci and in the absence of penicillin.

5. It encourages laymen to self-medication with a dangerous drug.

6. It interferes with the development and maintenance of a desirable active immunity to a number of common pathogenic organisms, and so may result in an increased incidence of pyogenic complications in the respiratory tract in the period immediately following the cold.

7. It leads to failure to select by proper study those cases in which sulfonamide therapy is indicated; in short, treatment without diagnosis.

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SULFATHIAZOLE PASTE IN VINCENT'S INFECTION

At the first sitting very little instrumentation is done. The necrotic gingival crests and papillae can be carefully removed with a pledget of cotton rolled about a toothpick dipped in 3-percent solution of hydrogen peroxide. A warm spray of the solution removes the necrotic tissue and debris in the interproximal spaces. A thick aqueous paste of sulfathiazole and sodium perborate, equal parts, is prepared. Its consistency should approximate that used in a surgical pack following gingivectomy in periodontal treatment. This paste is applied with a tongue depressor, bucally and lingually in the upper arch, and left in place for from 5 to 8 minutes. This procedure is repeated in the lower arch, followed by a thorough rinsing of the mouth with warm 3-percent hydrogen peroxide diluted to one-half its volume.

Brushing the teeth at home is advised against until the inflammatory process subsides. A mouthwash of hydrogen peroxide, 3 percent, diluted to one-half volume is prescribed, to be used at least four or five times each day. The patient returns to the dental office every 24 hours for the first 4 days for treatment. This is later increased to one visit every 48 hours.

When the infection is under control the usual prophylactic treatment is instituted, such as scaling and curettage, balancing the occlusion, removal of gingival flaps surgically or the removal of partially erupted or malposed third molars. The patient is familiarized with maintaining an optimum tissue resistance by good oral hygiene. If the tissue destruction has been extensive, frequent checkups should be advised.—ZODDA, F. J., Lieutenant (DC) U.S.N.R.

SALIVARY SULFONAMIDE LEVELS AFTER CHEWING PARAFFIN AND CHICLE VEHICLES

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Reports have appeared in the literature (*1*) (*2*) regarding the use of the sulfonamides in chewing vehicles for the treatment of "sore throat." Tonsillitis and pharyngitis are real problems in the Navy, accounting for 26 percent of all admissions to some sick-bays (*3*). On request two manufacturers submitted for testing the following experimental preparations of the sulfonamides in chewable form: (1) Sulfadiazine, 325 mg., plus aspirin, 190 mg., in paraffin (commercial preparation); and (2) sulfathiazole, 250 mg., in chewing gum (commercial preparation). Since sulfathiazole is much more soluble than sulfadiazine, it was necessary to test both drugs in the same vehicle. Each was therefore incorporated in paraffin-wafers. Attempts in the laboratory to mix sulfadiazine in chicle were unsuccessful.

The formulas for the paraffin wafers prepared in this laboratory were as follows:

	Gm. or cc.	
Sulfadiazine or sulfathiazole	0	250
Aspirin	0	300
Paraffin	1	5

The calculated amount of paraffin for 48 wafers was melted over a gas flame. The aspirin was intimately mixed with the sulfadiazine, stirred into the paraffin until the mixture was almost congealed, and this was poured into a flat-bottomed pan. Squares of appropriate size were scratched on the surface of the paraffin, and after cutting, the wafers were weighed to assure uniformity. Underweight wafers were discarded and overweight wafers were brought to proper weight (2.05 gm.).

All chewing vehicles were tested in an identical manner; the subject was instructed to chew at his normal chewing rate. The subject was advised to let the paraffin wafers lie in his mouth for from 2 to 3 minutes before chewing in order to prevent initial fragmentation. Saliva samples were collected during the following

TABLE 1.—*Sulfathiazole concentration (mg. percent) in saliva after chewing medicated chicle (commercial preparation)*

Subjects	Sulfathiazole in sediment, minutes						Sulfathiazole dissolved, minutes					
	5	10	15	30	60	90	5	10	15	30	60	90
WB.....	Trace	Trace	Trace	Trace	Trace	Trace	26	19	22	23	43	35
HLH.....	3	Trace	Trace	5	140	152	35	24	37	35	38	29
MAE.....	Trace	Trace	Trace	Trace	Trace	.....	17	8	10	17	30	.....
HLH.....	Trace	3	Trace	3	3	24	15	20	23	36	32	47
HLH.....	3	2	2	3	4	95	44	20	23	37	52	50
CCP.....	Trace	Trace	Trace	8	16	Trace	44	51	65	79	112	30
HW.....	5	Trace	5	12	41	94	36	226	221	27	32	30
CCP.....	4	3	2	4	6	4	43	23	25	32	36	28
GW.....	2	Trace	Trace	Trace	6	23	35	18	20	24	20	28
Average.....	2	2	2	4	24	49	33	45	50	33	44	31

TABLE 2.—*Sulfadiazine concentration (mg. percent) in saliva after chewing medicated paraffin (commercial preparation)*

Subjects	Sulfadiazine in sediment, minutes						Sulfadiazine dissolved, minutes					
	5	10	15	30	60	90	5	10	15	30	60	90
HLH.....	3	26	52	84	49	19	3	3	3	22	31	22
EMD.....	6	20	42	107	57	30	Trace	Trace	Trace	7	42	70
EMD.....	5	7	25	125	118	74	Trace	Trace	Trace	8	13	17
HLH.....	9	51	103	105	51	6	Trace	Trace	Trace	28	23	17
EMD.....	7	8	10	67	64	53	Trace	Trace	Trace	8	19	51
HLH.....	7	34	53	41	7	Trace	6	10	18	33	24	16
TB.....	Trace	18	19	19	Trace	Trace	13	30	102	60	58	19
HLH.....	23	14	24	58	25	20	20	6	12	3	37	30
HLW.....	10	26	61	19	42	39	4	2	3	Trace	2	18
Average.....	8	22	43	69	36	27	6	6	16	19	28	29

time intervals: 0 to 5, 5 to 10, 10 to 15, 25 to 30, 55 to 60, and 85 to 90 minutes. At least nine subjects were used for each of the four wafers tested. The blood level of two subjects was determined after 6 hours of chewing, during which time a new wafer was used every 90 minutes.

Saliva samples were measured, and a 5-cc. aliquot of each was centrifuged in a conical centrifuge tube with a narrow base. The supernatant layer was diluted and analyzed for sulfonamides by the Bratton and Marshall (4) method. The sediment was dissolved by agitation in 5 cc. of N/10 NaOH and then assayed for sulfonamide content. (Centrifuging was found to give more con-

TABLE 3.—*Sulfadiazine concentration (mg. percent) in saliva after chewing medicated paraffin (NMRI)*

Subjects	Sulfadiazine in sediment, minutes						Sulfadiazine dissolved, minutes					
	5	10	15	30	60	90	5	10	15	30	60	90
HLH	Trace	Trace	5	13	38	36	4	4	4	6	18	25
MEH	3	2	2	8	10	10	6	4	4	7	22	29
CCP	1	Trace	3	13	28	54	4	7	10	9	33	37
HLH	1	Trace	1	3	34	33	3	5	7	8	27	13
HLH	Trace	Trace	2	13	24	37	2	5	5	5	10	16
CCP	1	1	2	29	45	78	2	6	8	7	33	42
HLH	Trace	Trace	2	16	69	76	3	5	5	5	11	30
JMT	2	2	8	36	26	19	12	10	8	8	37	34
HLH	2	4	16	27	88	63	3	4	3	3	8	36
Average	1	1	5	18	40	45	4	5	6	7	22	29

TABLE 4.—*Sulfathiazole concentration (mg. percent) in saliva after chewing medicated paraffin (NMRI)*

Subjects	Sulfathiazole in sediment, minutes						Sulfathiazole dissolved, minutes					
	5	10	15	30	60	90	5	10	15	30	60	90
CCP	58	73	60	49	6	3	68	61	49	42	27	19
HLH	46	115	119	66	9	3	50	46	40	30	25	13
HS	58	65	57	31	26	Trace	30	24	33	31	8	6
HLH	47	87	60	36	6	2	38	39	31	22	11	5
MEH	50	66	70	35	5	5	33	41	33	47	20	32
HLH	59	95	84	64	6	2	32	44	42	38	21	11
HLH	73	74	59	44	25	Trace	52	46	37	29	18	8
HLH	21	46	63	48	12	2	30	32	31	28	22	8
MEH	43	49	47	40	16	6	47	39	41	33	32	23
Average	50	74	69	57	12	3	42	41	38	33	20	14

sistent results than filtration.) For convenience the sulfonamide content of the dissolved sediment was expressed as milligrams percent but this can be converted to milligrams of sulfonamide in 5 cc. of saliva by dividing by twenty.

RESULTS

Under the conditions of these experiments, where a definite attempt was made to differentiate between the sulfonamide dissolved and that suspended in the saliva, it was found that the chicle type of chewing wafer tended to fragment after from 60 to 90 minutes, whereas the paraffin wafers tended to fragment in the

first 15 minutes. Sulfathiazole gave the highest consistent salivary levels of dissolved sulfonamide. Maximum values developed early (within 10 minutes) and were maintained for 90 minutes (tables 1 to 4). The average for 9 subjects chewing sulfathiazole in paraffin reached a peak of 37 mg. percent at 10 minutes, compared with the peak for sulfathiazole in chicle of 44 mg. percent at the 60-minute period. In contrast, sulfadiazine (in paraffin) consistently gave very low salivary levels for the first 30 minutes. Both the commercial preparation and the sulfadiazine wafer made in this laboratory yielded the same average peak value of 29 mg. percent, which was reached only after 90 minutes of chewing. The more soluble sulfonamides (sulfanilamide, sulfacetimide) could not be used because of a bitter taste which could not be disguised with sugar or with peppermint. The addition of aspirin to the mix resulted in a more homogeneous wafer.

Blood levels were determined in eight subjects at the end of 6 hours of continuous chewing without expectoration. These varied from a trace to 1.25 mg. percent. No significant difference between the blood levels of subjects chewing sulfadiazine and those chewing sulfathiazole was noted.

COMMENT

The best therapy for severe tonsillitis is bed rest and the oral administration of sulfonamides or other effective therapeutic agents. However, under the exigencies of war, ideal therapeusis can seldom be attained. The incidence of "sore throat" has been sufficient in many training camps to warrant trial of daily doses of from 0.5 to 1 gm. of sulfadiazine for all trainees. This prophylactic dose, while effective in preventing the spread of streptococcal infection, has been accompanied by an incidence of about 0.5 percent of toxic reactions. If local treatment of sore throat by means of high salivary levels proves effective, the usual incidence of reactions (5 percent with full therapeutic doses) (*5*) (*6*) should be lessened because blood levels are consistently low with the sulfathiazole-paraffin wafers. Salivary sulfonamide levels after therapeutic oral doses are known (*7*) to be slightly lower than the corresponding plasma levels; however the reverse distribution obtained with chewing vehicles may provide a more effective mode of local application.

The effect of salivary sulfonamide levels on tonsillar infection must be dependent on two factors; the susceptibility of the infecting organism and the penetration of the tonsillar crypts and mucous membrane by the sulfonamide. At present, data are not available on the latter variable, hence only the relative bacterio-

static potency of the available sulfonamides can be a guide. Inasmuch as sulfathiazole has been shown to produce the most consistently high salivary level with both vehicles and because its actual bacteriostatic potency is twice that of other sulfonamides, it is at present the drug of choice for trial by this method in tonsillitis and pharyngitis. Many types of stomatitis which might not respond to a low blood sulfonamide level will probably respond to the high salivary levels which can be attained with chewing-wafer medication.

SUMMARY

Sulfathiazole, whether chewed in chicle or paraffin, promptly attains a high salivary level which is maintained for 90 minutes. Sulfadiazine does not attain a high salivary level until the vehicle has been chewed for 90 minutes. A paraffin vehicle tends to fragment in the first 15 minutes of chewing, whereas a chicle vehicle tends to fragment in the 60- to 90-minute period.

ACKNOWLEDGMENTS.—Grateful acknowledgment is made to E. R. Squibb & Sons, and to the White Laboratories, Inc., for some of the samples tested; and to Captain A. R. Behnke (MC) U.S.N. and Ensign E. M. K. Darby, H(W) U.S.N.R. for helpful advice and suggestions.

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SULFADIAZINE AS A PROPHYLACTIC AGENT AGAINST MENINGITIS

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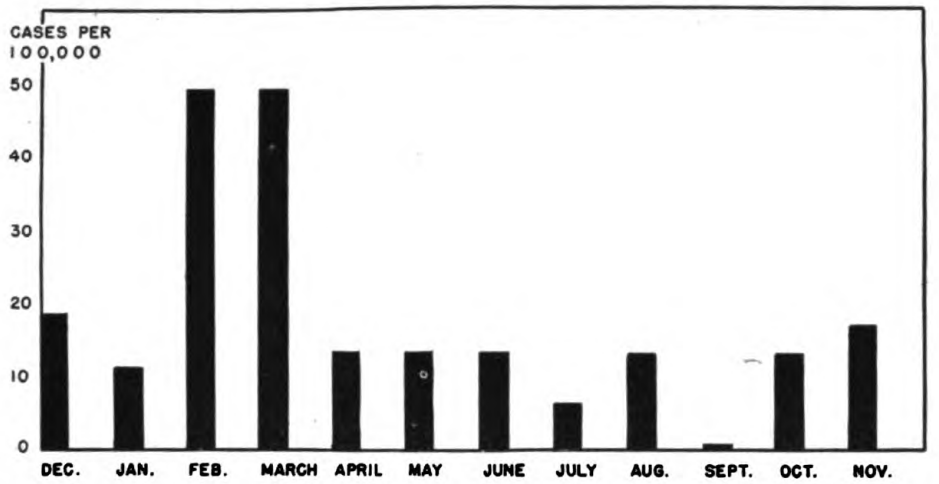
In the epidemiology of meningococcic meningitis it is usually impossible to link one active case to another. Often an epidemic of meningitis is started by the occurrence of a single case. This case is followed by other cases scattered as to time and location throughout the military organization or civilian community. The control problem in epidemic meningitis resolves itself into the control or elimination of carriers.

The carrier rate in meningitis, unlike that of most diseases which at times assume epidemic proportions, shows an increase prior to the onset of the epidemic. The increase in the carrier rate, as determined by the nasopharyngeal cultures of a representative sample of the population, presages the danger of an epidemic or a definite increase in the case incidence of the disease.

In the military services the attack rate for this disease is much greater in recruits than in men who have been in the military organization for some time. The attack rate in recruits has been found to rise steadily and to reach a peak after from 6 to 8 weeks of service; following this period a gradual decrease in case incidence occurs. The attack rate usually follows the trend for respiratory diseases, increasing with the increase in respiratory diseases and decreasing when this rate decreases.

Control measures have always been directed at carriers. Measures previously advocated have included prevention of overcrowding, protection from fatigue and exposure, and the prompt isolation of all active cases of meningitis and cases of common respiratory diseases. Carriers, when detected, have been isolated until they showed two successive negative nasopharyngeal cultures. Other methods used to render carriers innocuous included topical applications to the nose and throat, gargles, and nasal sprays.

In 1941 (*1*) it was found that meningococci disappear promptly from the nasopharynx of patients undergoing treatment with certain sulfonamides. This seemed to be the answer to the problem of eliminating the carrier state. The effectiveness of the drugs in maintaining a negative nasopharyngeal culture remained to be



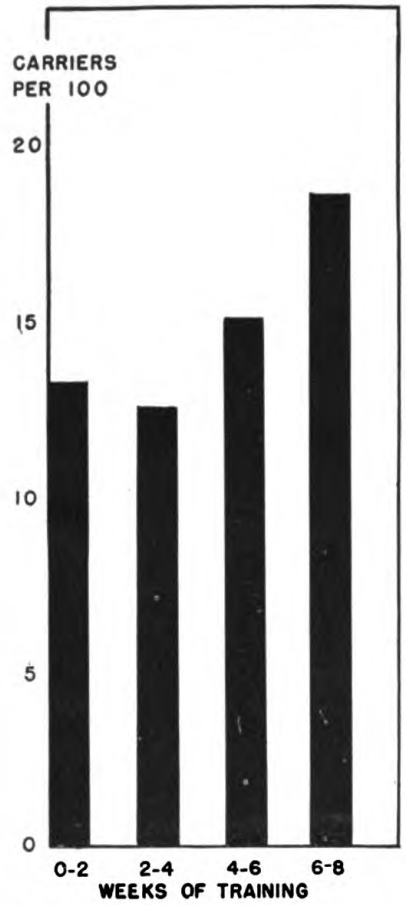
1. Attack rate per 100,000 per month during the period from 1 December 1942 to 30 November 1943.

proved, as also the toxicity of the various sulfonamides, the necessary dosage, and the length of time in administration of the drugs.

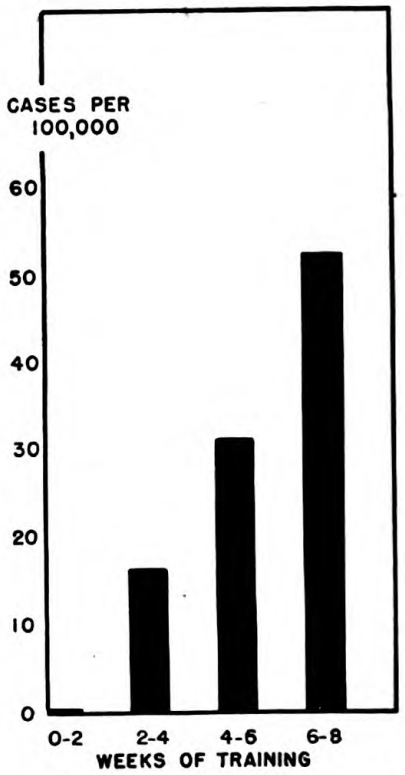
Routine statistical work at this Marine barracks revealed that the one serious contagious disease was meningococcic meningitis, with February and March being the peak months.

On 1 December 1943 a random sample of recruits was taken to determine carrier rates on admission to recruit training. Nasopharyngeal cultures from every third recruit, on the second day of his training, were taken on sterile bent wire applicators and immediately placed in warm tryptase phosphate broth. The cultures were grown on fresh chocolate agar plates to which 0.5-mg. percent para-aminobenzoic acid was added. These plates were incubated for 24 hours at 37°C. under approximately from 10- to 15-percent carbon dioxide in candle jars. The plates were then examined and typical colonies were tested with 1-percent para-aminodimethylaniline monohydrochloride. Those typical colonies which gave a positive oxidase test were confirmed by inoculation into differential sugar media. Facilities for typing the organisms were not available.

Culture findings from 500 men indicated that 13.4 percent of them were carriers of meningococci. The survey was continued to determine the change in carrier rates which occurred as length of service progressed. Groups of 500 men picked at random were studied at 2-week intervals during their training period. A steady rise in carrier rate, directly proportional to the length of service, continued up to 8 weeks, at which time it was impossible to observe the men further because of completion of their training period. The case incidence followed the same curves as that for carrier rates. It is believed, however, that if these men could have



2. Carrier rates in relation to duration of service.

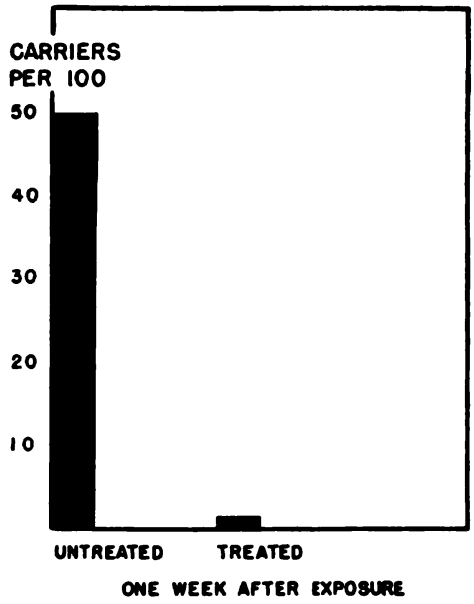


3. Attack rates in relation to duration of service.

been observed over a longer period of time, a gradual decrease would have been noted in carrier rate. This is inferred from the low carrier rate among seasoned troops.

Dunham (*2*) states that a carrier rate of over 5 percent in a training camp deserves special control measures. Platoons which had been aboard for from 2 to 4 weeks showed a carrier rate of 12.5 percent, those with from 4 to 6 weeks' service had a rate of 15.2 percent, and those with from 6 to 8 weeks' service showed a rate of 18.7 percent. Several platoons at the 8-week period showed rates as high as 26 percent. Cultures were taken on each of the 500 men comprising these groups.

Platoons in which cases of meningitis had occurred were placed in group quarantine, that is, allowed to continue their training but isolated and not permitted to attend public gatherings, movies, etc. Cultures were taken from these platoons after a week of group quarantine. The carrier rate in four platoons showed 50.7 percent positive findings, and second cases of meningitis occurred in two platoons. This figure bears out previous work done under identical



4. Carrier rates after exposure and the effect of prophylactic sulfadiazine.

conditions at another training station (*3*) in which the contact carrier rate was found to be 36.7 percent, while the noncontact group showed a carrier rate of 4 percent.

Group quarantine of exposed platoons was continued and prophylactic treatment with sulfadiazine instituted. One gram of sulfadiazine was given three times a day for 3 days. Cultures from 23 platoons (1700 men) at the end of 1 week, 4 days following the completion of their prophylaxis, revealed the carrier rate to be reduced from 50.7 percent to 0.45 percent. There were no second cases of the disease reported.

From the figures derived from these contact platoons it is concluded that (1) the carrier rate had been high when the initial case occurred, or (2) the high carrier rate and the second cases occurred as a result of the group quarantine, and (3) that sulfadiazine in the dosage employed was effective in reducing the carrier rate and in preventing second cases in the same platoon.

From the Public Health Reports (*4*) it was considered that an epidemic might be imminent. In the 19 March 1943 issue it was stated that the incidence of meningitis during the last months of 1942 and the early months of 1943 had approached the epidemic proportions of 1929. The case incidence for December 1943 in the nation was much above that for December 1942. This fact, together with the increased attack rate at this post (six cases in December 1943 compared with two cases for December 1942), the high carrier rate, the high attack rate in this area, and the increased incidence in States from which this post draws recruits, suggested the use of prophylactic sulfadiazine in new recruits.

Each recruit was given 1 gm. of sulfadiazine three times daily for the first 2 days of his training. The drug was issued to the drill instructor at the time the platoon went through the Hygienic Unit, and he was made responsible for giving the medication. The recruits followed the usual routine of training and no reactions to the drug were observed. Men who had arrived prior to 10 January, and permanent personnel were not given prophylaxis.

Platoons were again cultured at 2-week intervals in their training, and records were kept on the incidence of meningitis in these platoons. Two hundred fifty men were used in these samples. At the end of 2 weeks one man was found to be a carrier. No carriers were found at 4 and 6 weeks; two were found at 8 weeks.

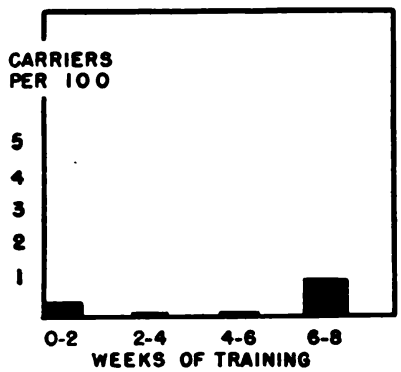
TABLE 1.—*Carrier rates in treated and untreated*

Group	Weeks of training when cultured	No. of men cultured	No. of carriers	Percentage of carriers
Untreated	0–2	500	67	13.4
Treated	0–2	250	1	0.4
Untreated	2–4	500	62	12.5
Treated	2–4	250	0	0.0
Untreated	4–6	500	76	15.2
Treated	4–6	250	0	0.0
Untreated	6–8	500	93	98.7
Treated	6–8	250	2	0.8

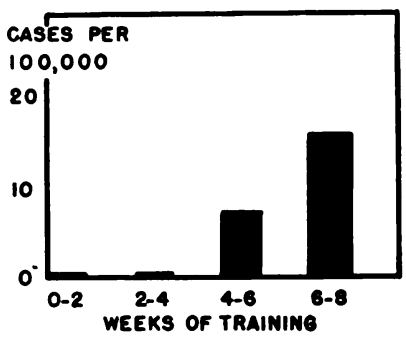
Table 1 indicates the comparison between carrier rates in men who received prophylactic sulfadiazine as compared with men in the same period of training who did not receive any prophylaxis. In all instances the carrier rate in the treated group was less than 1 percent whereas the untreated group showed a steady rise to 18.7 percent at 8 weeks, and in all instances was well above the normal rate of 5 percent (*2*).

Figures 4 and 5 indicate the relation between carrier rate and case incidence. Practically the same ratio exists between carrier rate and case incidence in both the treated and untreated groups, that is, case incidence rises and falls with rise and fall in carrier rate. From this fact it is concluded that reducing the carrier rate will result in a reduction in the case incidence.

It is thought that the program of prophylaxis was an effective control measure. In February 1943 there were 2,959 reported



5. Carrier rates in relation to duration of service after prophylaxis.



6. Attack rates in relation to duration of service after prophylaxis.

cases of meningococcal meningitis in the nation and in February 1944 there were 4,488 cases, an increase of 1,529 cases. In February 1943 there were 9 cases reported on this post; in February 1944 there were 2 cases. In the first two weeks of March 1943 there were 3,515 cases in national figures, while in this same period in 1944 there were 5,073 cases, or an increase of 1,558 cases. During the first two weeks of March 1944 there were 3 cases of meningitis reported on this post in comparison with 5 cases for the same period in 1943. In the estimated 13,000 men given prophylactic sulfadiazine there were 2 cases of meningococcemia and 1 case of meningitis. All of these were mild cases and all occurred more than 6 weeks after the administration of sulfadiazine.

In the 18 cases occurring during the peak months of February and March 1943 there were two deaths. In the eight cases during the same months in 1944 there were no deaths. The lower case incidence of 1944 is partly responsible for this, but improvements in therapy and possibly a milder type of infection as previously suggested must be considered. Of the 18 cases reported during February and March 1943 only one was diagnosed as meningococcemia, considered by most authorities as an early phase of the disease. This case of meningococcemia, however, was of the fulminating type and the patient died. In 1944, in the same period, there were two cases of meningococcemia; both of these were of the subacute type and both patients had received prophylactic sulfadiazine. These facts would seem to suggest a modification of the disease due to chemoprophylaxis.

Comparing the number of cases at this post during the peak months of 1943 and the national attack rate for 1943, with the national attack rate for 1944, it is estimated that during February and March of 1944 there should have been between 25 and 30 cases of meningitis on this post. There were actually eight cases and five of these had not received prophylaxis. Weather conditions this year were as bad if not worse than last year, the training schedule was not altered, the physical condition of the recruits was no better and the daily average strength was approximately the same. The only factor which was changed was that the recruits arriving after 10 January were given sulfadiazine as a prophylactic. It is thought that if all the recruits on the base had received prophylaxis the attack rate would have been lowered even more.

In a similar study in an Army training camp (*5*), the camp was divided into two groups. One group (9,500 men) was given prophylactic sulfadiazine and the other group (7,000 men) was used as a control. In a period of 8 weeks, 2 cases of meningitis

occurred in the treated group, whereas 17 cases occurred in the control group. In a second study, 8,000 men received treatment and 9,300 men were used as the control group. There were 23 cases of meningitis among the control group and no cases in the treated group during an 8-week period.

The possibility of sensitization was considered. Consensus on the subject is that the danger of sensitizing the individual is slight; however the bacteria seem to be sensitized by contact with the drug and seem to set up a defense mechanism which renders them more resistant at a later date.

The smallest effective dosage of the drug to be used in prophylaxis must also be determined. The present study was limited to one dosage; however other studies have been made varying the routine. Phair et al. (*6*) showed that 1 gm. daily for 3 days, or 1 gm. three times daily for 1 day, was as effective as 1 gm. three times daily for 2 days, but a single 1-gm. dose was not effective in reducing the carrier rate or case incidence.

CONCLUSIONS

1. Meningitis in its epidemic form is a problem of carriers.
2. Sulfadiazine in 1-gm. doses three times daily for 2 days has reduced the carrier rate in recruits.
3. It appears that the attack rate is lowered by this program in direct proportion to the carrier rate.

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SKIN REACTIONS TO DIROFILARIA IMMITIS EXTRACT

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Observations by Taliaferro and Hoffman (*1*) and by Fairley (*2*) raised the hope that skin tests with extract of the dog heart worm, Dirofilaria immitis, might be of assistance in the diagnosis of filariasis. Since circulating microfilariae are frequently, indeed usually, absent in clinical syndromes attributable to wuchereria (*3*), a diagnostic aid of this sort, if reliable, would be of considerable value. Subsequent experience with the test has been somewhat discordant (*4*) (*5*) (*6*). However it would seem that there are marked group and individual differences in reactivity to dirofilaria preparations, reactivity being slight or absent in groups with little opportunity for exposure to filariae or other helminths.

The clinical utility of such a test could be established only by the most thorough study. Basic considerations forbid its uncritical acceptance as a diagnostic measure. Variation in susceptibility to a biologic product might be due to varying distribution of a neutralizing antitoxin, to varying allergic sensitization and desensitization, or to differences in intrinsic vulnerability without specific immunologic basis. Thus individuals differ markedly in vulnerability to nonantigenic agents such as histamine, ultraviolet light, or the application of a tourniquet. It is quite conceivable that biologic extracts, even chemically pure "antigens," may contain a primary irritant radicle, vulnerability to which may vary as much as vulnerability to ultraviolet light in the absence of specific immunologic differences. It is important to remember that irritant property may be produced or enhanced by careless or drastic treatment. Thus Cooke (*7*) has found that autoclaved horse serum will produce a reaction in many subjects who fail to react to the unheated serum.

If we conclude that reactivity to dirofilaria extract is largely conditioned by allergic sensitization, we have scant data on the taxonomic specificity of that sensitization. The original work of Taliaferro and Hoffman and of Fairley was inspired by the hope that D. immitis might contain antigen common to the filarial

group. Granting that some basis has been established for this belief, we might then expect to find some overlapping with other helminth groups as well. The whole subject of the specificity of helminth skin reactions is in a state of some confusion. Finally it is clear that subclinical wuchereriasis is frequent (*3*), and the great volume of work on human skin tests of all sorts has failed to show that any specific skin test is able to discriminate between clinical and subclinical infection. Indeed in helminth and other infections, it seems that massive infection may be associated with nonreactivity (*8*) (*9*).

In general, workers with D. immitis extract have been aware of these difficulties. Since some controls may show an appreciable degree of reactivity, in order to make a distinction between positive and negative reactions as to which has the most chance of being useful, one may follow Taliaferro and Hoffman in emphasizing pseudopods, Fairley in attributing significance to large reactions only, or the most recent workers in the use of minute doses (*6*). With any method it seems that group differences are striking.

The writer recently had an unusual opportunity to study reactivity to D. immitis preparations. Stationed in an area hyperendemic to filariasis, he was able to test newly arrived troops, men with several months' residence and vague or uncertain symptoms, and patients with clinical "mumu" (early filariasis). Brief reference has already been made to the results of this work (*10*) (*11*). The original intention was to postpone further discussion of the skin test data until some experimental work could be completed. However, at present there is no likelihood that this work can be resumed, and it seems well to present the experience to date. The skin tests were of considerable importance in the study of the etiology and pathogenesis of mumu. Their epidemiologic connotations received considerable support from studies on mosquitoes (*12*). Finally although limitations to the diagnostic value of the test had been stressed in previous papers, it seemed that further emphasis on this point might be desirable.

METHODS AND MATERIAL

Preliminary tests were made with an extract of a 1:1,000 suspension of dried D. immitis in saline, the dose being 0.25 cubic centimeter. This was the dosage recommended by Fairley. Ten mumu patients showed extremely striking, immediate and 24-hour reactions, while reactions in five controls were negative. The writer, who did not develop clinical mumu until five months later, though he had been in the area for seven months with massive

mosquito exposure, had a strongly positive reaction. Attention was focused upon the 24-hour reaction because of its striking resemblance to clinical mumu of the arm. The reactions in this group of patients were so severe and uncomfortable that it was decided to decrease the amount of fluid injected and the dose of extracted material in further work.

Most of this work was done at a mobile hospital on a South Pacific island, and hence the laboratory equipment was not as extensive as one would find on the mainland. Local dogs were killed with chloroform. After elevation of the chest plate the pulmonary conus and right ventricle were opened in situ. After any worms were removed from the pulmonary artery, the heart was excised. Although the left side was always opened, worms were never found there. In general, the prevalence of D. immitis among local dogs was astonishing. We failed to find worms in approximately one dog out of four, worm-free dogs usually being those with large thymuses, namely, the young. About one dog in four had so many worms that it seemed they must constitute a severe obstacle to the circulation. One dog crawled up to a battalion aid station and died, and autopsy showed no explanation other than a tremendous mass of worms in the pulmonary artery and right ventricle. It seemed that such masses might help to account for the striking lethargy characteristic of local dogs. A single worm may be as much as 6 inches long and 1/16 inch wide.

The worms were removed, freed of clots, washed in running water overnight, then in repeated changes of distilled water. The worm mass was then treated with two changes of acetone. More drastic defatting, namely, extraction with ether and alcohol, was found undesirable, as it appeared to denature the residue. After treatment with acetone the worms were thoroughly dried in the incubator, then kept in the refrigerator till needed. For preparation of extract, a suitable quantity of worms was weighed and pulverized in a mortar. The powder was again quickly treated with acetone and allowed to dry. Saline was then added in the proportion of 200 parts of saline to 1 part of worm. The suspension was allowed to stand for one-half hour. It was then filtered through a filter which used pads made for a water purifier in a Seitz-type frame made out of pipe fittings. This improvised filter was eminently satisfactory, sterilizing the filtrate without appreciable loss of active material. After return to the United States, a regular Seitz was found to be much less satisfactory.

It was found that if the technic given was rigidly adhered to, extract of uniform potency could be regularly prepared. More thorough comminution, such as that produced by using sand in the grinding process, resulted in a more irritating extract, and

other workers have reported a greater yield of active material with repeated freezing and thawing (*6*). The important thing is for each worker to use a consistent technic, and to determine by tests on a considerable series of controls what actually is the base-line irritant property of his preparation.

Three-tenths percent phenol proved a satisfactory preservative. The extract could be kept in the refrigerator for several weeks at least, without loss of potency. For skin testing, 1:50 and 1:5 solutions were used, as well as full-strength solution for all who did not react too strongly to the dilutions. The dose was 0.025 cubic centimeter. The edema was measured at 30 minutes and at 24 hours. Erythema without edema was disregarded. Thus at 30 minutes the wheal only was measured. Various controls were used—phenolized saline, extract of powdered dog heart muscle, and extract of Ascaris lumbricoides (1:200 in saline solution).

Stools were examined for ova and parasites by the salt-flotation technic.

A few individuals had more than one test. However in view of the possibility of sensitization by the first test, the results of the second have not been included in the basic data.

After return to the United States a preliminary experiment was begun on guinea-pig sensitization. Dried worm powder was suspended in saline or paraffin oil, and injected into the skin. The dose varied from 0.025 mg. to 2.5 mg. of worm powder, and all animals in the group had at least three injections at intervals of a week or more. This group and a group of normal controls were then tested with 0.2 cc. of undiluted extract intradermally.

RESULTS

In order to simplify the presentation, the chronologic order will be disregarded and the guinea-pig data given first. The results of the test with 0.2 cc. of extract are shown in table 1. It seems clear that though the extract is not entirely devoid of irritant activity in the controls, the sensitized animals are much more reactive.

In table 2 are given the results on a group of control subjects, who had been but 10 days in the area. As a result of much similar experience, a positive reaction was defined as a 30-minute wheal measuring 15 mm. or more (positive immediate reaction) followed by a 24-hour area of definite edema measuring at least 30 mm. with the full-strength solution, or at least 20 mm. with the diluted solutions. In most instances the reactions in the control group were too small to warrant measurement.

From the figures in table 2 it is evident that positive 24-hour reactions were less frequent than positive immediate reactions,

TABLE 1.—*Guinea-pig reactions to 0.2 cc. of dirofilaria extract; size of wheal in millimeters*

Control guinea pigs		1 hr.	4 hr.	8 hr.	24 hr.	48 hr.	72 hr.	96 hr.
Tests given 23 Aug.	11							
	12	15x12x1						
	13							
	14	20x15x0.5	15x15x0.5		8x8x0.5	4x4x0.5		
	15							
	16				15x15x1	8x8x0.5	6x6x0.5 necrosis 4x4	
Tests given 25 Aug.	17							
	18							
	19					5x5x0.5	doubtful	
	20							
Sensitized guinea pigs								
Tests given 23 Aug.	1	25x25x2	35x35x2	35x30x2	30x30x1 necrosis 4x4	15x15x1 necrosis 4x4	8x8x0.5	5x5x0.5
	2	25x25x3	30x25x3	30x30x1	15x15x1	16x14x0.5	doubtful	5x5x0.5
	3	25x20x2	30x25x2	33x33x2	30x30x0.5	10x10x0.5	8x8x0.5	5x5x0.5
	4	25x25x2	30x30x2	40x36x3	40x30x1 necrosis 3x2	15x15x0.5 necrosis 5x5	7x7x0.5 necrosis 4x4	10x10x1 necrosis 8x8
	5	30x20x2	30x28x3	35x30x2	25x25x2 necrosis 4x4	15x15x0.5 ill defined necrosis 6x6	6x6x0.5 necrosis 3x3	8x8x0.5 necrosis 6x6
	6	25x20x1	30x20x1	25x20x1 ill defined	20x20x0.5 necrosis 3x3	15x15x0.5 necrosis 5x5		5x5x0.5 necrosis 3x3
	7	25x25x2	35x25x2	25x20x1 ill defined	doubtful	6x6x0.5		4x4x0.5
	8	25x20x1	30x25x2	30x25x2	25x20x0.5 ill defined	11x11x0.5 ill defined		
	9	30x25x3	35x35x3	35x28x2	20x18x1 necrosis 4x4	12x9x0.5 necrosis 4x4	8x8x0.5 necrosis	8x8x1 necrosis 4x4
	10	30x30x2	30x25x2	30x30x1	25x25x0.5	15x15x0.5 necrosis 6x6	10x10x1	4x4x0.5

Guinea pigs 1 to 8 were given the first injection of D. immitis saline suspension on 9 July. Guinea pigs 9 and 10 were started on D. immitis in oil on 23 July. All 10 animals had had at least three injections. Dosage varied from 0.025 mg. to 2.5 mg. of worm powder. The animals receiving small doses seemed as well sensitized as those receiving large doses.

and that reactivity to dirofilaria was usually associated with a more marked reactivity to ascaris. Control tests with saline and with dog heart extract were done on other groups, and were negative with but one or two exceptions.

Reference has already been made to a group tested with extract from material which had undergone drastic defatting with ether and alcohol. Of 30 men with 3 weeks' residence in the area, in a poorly screened camp next to a native village, 12 gave positive immediate reactions to this extract. Only 4 of these gave positive 24-hour reactions. The 8 others were retested with a new lot of extract prepared in the orthodox manner. This time only 3 gave positive immediate reactions. All subjects, both patient and con-

TABLE 2.—*Results in 33 controls with 10 days' residence in Samoa. Test dose 0.025 cubic centimeter*

Subject	Control (ascaris)		Dirofilaria immitis					
			1:50		1:5		Full strength	
	30 min.	24 hr.	30 min.	24 hr.	30 min.	24 hr.	30 min.	24 hr
1	13x12x2							
2	12x10x2							
3								
4	15x12x2	32x22x2						
5								
6	12x12x2							
7	12x8x1							
8								
9								
10	24x24x3		9x9x1		15x14x2		17x14x2	
11								
12								
13	11x9x1				12x2x2		17x16x2	
14								
15								
16	24x18x2		12x10x1		26x22x2		23x22x2	
17								
18	11x9x1							
19								
20		20x19x0.5						18x16x0.5
21	11x10x1							16x16x0.5
22								
23								
24	20x16x2	170x110x4	12x10x1		16x14x2		20x16x2	65x50x1
25	12x10x1							
26								
27								
28	16x15x2	85x60x4	12x11x1		17x15x2		26x20x2	
29								
30	14x13x2							
31								
32	18x14x2				17x12x2		17x15x2	
33		16x16x1				18x16x1		28x26x2

trol, who were tested with the extract from material which had been treated with alcohol and ether, have been excluded from the data to be presented.

In all, 128 controls were tested, the group just mentioned being excluded. Of these 128, 6 gave positive reactions as defined above. It is of interest that one of these had a health-record entry of hookworm disease the previous year. Twelve subjects gave positive immediate and negative delayed reactions, and 4 gave negative immediate and doubtful delayed reactions (edema between 20 and 30 mm. in diameter with the full-strength solution).

The behavior of the mumu patients was startlingly different. Figures on a group of patients tested with the test and control extracts used on the controls of table 2 are given in table 3.

Since the maximum dose used in humans was only one-eighth of that used in guinea pigs, human skin is clearly more reactive than guinea-pig skin. In both controls and patients there is definite correlation between reactivity to ascaris and reactivity to dirofilaria. However in the controls the ascaris appeared stronger, and in the patients the dirofilaria. The tendency to weak or nega-

TABLE 3.—*Tests on "mumu" patients.*
Same test and control extracts as used on controls of Table 2.
Test dose 0.025 cubic centimeter

Patient	Control (ascaris)		Dirofilaria immitis						Comment
			1:50		1:5		Full strength		
	30 min.	24 hr.	30 min.	24 hr.	30 min.	24 hr.	30 min.	24 hr.	
34	17x15x2	85x60x2	18x16x2	.....	25x16x3	55x40x2	20x15x3 with long additional pseudopod	110x70x5	Stool exam. neg.
35	17x14x2	55x50x1	12x12x2	25x20x1	15x10x2	60x55x2	18x10x2	105x80x4	Stool exam. neg.
36	10x10x1	.....	.....	.....	16x12x2	22x18x1	26x14x3	75x40x2	Stool exam. neg.
37	.....	30x20x2	7x7x1	15x15x0.5	12x12x2	45x25x2	16x14x2	60x45x3	Very acute case.
38	14x12x2	.....	.....	.....	12x12x2	22x18x1	15x15x2	32x30x2	
39	.....	.....	.....	.....	.....	.....	.....	.....	Very severe and acute case.
40	15x12x2	.....	12x10x2	.....	15x12x3	50x45x1	17x12x3	95x50x3	
41	15x15x2	35x22x2	12x10x1	25x15x2	17x15x2	30x25x1	16x14x2	35x22x1	Stool exam. neg.
42	9x9x1	.....	9x9x1	.....	15x12x2	50x45x2	15x12x2	70x45x3	Stool exam. neg.
43	21x16x1	70x60x2	15x12x2	.....	18x14x2 additional pseudopod	70x60x2	20x15x3	85x60x3	Stool exam. neg.
44	.....	14x12x2	.....	.....	.....	14x14x1	.....	14x12x2	
45	10x8x1	.....	10x9x1	.....	17x14x2	.....	15x14x2	.....	Very acute case.
46	10x10x2	.....	.....	.....	14x12x2	.....	17x15x2	50x30x2	
47	11x11x1	.....	9x9x1	.....	18x14x2	55x40x1	20x16x2	80x40x2	
48	12x10x1	.....	.....	.....	.....	.....	16x15x2	60x40x2	Acute arm.
49	15x12x2	45x30x2	.....	15x15x1	15x12x2	55x50x2	15x12x2	70x60x3	
50	9x9x1	.....	.....	.....	15x12x2	35x30x2	15x12x2	50x40x2	
51	12x10x2	60x50x2	12x8x2	35x30x2	20x15x3	130x65x4	18x16x2	170x100x8	
52	.....	.....	.....	.....	.....	23x22x2	.....	30x20x2	
53	15x12x2	110x28x8	16x12x2	.....	18x15x2	Confluent	25x18x3	170x100x8	
54	10x10x1	20x20x2	.....	.....	16x15x2	55x50x2	17x14x2	95x60x3	
55	10x8x2	.....	11x11x2	.....	20x18x3	55x50x2	24x16x3	95x60x3	
56	.....	.....	.....	.....	.....	.....	.....	.....	
57	.....	40x30x2	.....	22x20x0.5	.....	22x20x1	.....	50x35x2	

tive skin tests in particularly severe cases of mumu was consistently observed. The writer was able to produce a certain amount of desensitization in himself by repeated doses of extract. In a few instances the desensitization in mumu patients was sharply localized to the affected arm.

Taliaferro and Hoffman stressed pseudopods as a feature of the positive reaction. In this present work it was noted that reactions which reached a size to be classed as positive practically always showed a marked irregularity of outline at some stage of their development. Pseudopods were often striking. However this irregularity had often disappeared at 30 minutes when the wheal reached its maximum size, and it seemed that careful measurement was a better means of determining the status of a reaction than the recording of pseudopods. It was of interest that the wheal was sometimes larger and the pseudopods more pronounced with the 1:5 dilution than with the full-strength solution. The latter always yielded the larger 24-hour reaction.

Control tests with dog heart extract gave but one positive 24-hour reaction in tests on 40 patients and 30 controls. Immediate reactions large enough to be measured were not infrequent but only three measured 15 mm. or more.

In all, 202 mumu patients were tested, of whom 168 gave positive tests (positive immediate and delayed reaction). Figures on those tested by the three-dilution technic are given in table 4.

TABLE 4.—*Results in mumu patients treated by the three-dilution technic*

1:50				1:5				Full strength			
30 min.		24 hr.		30 min.		24 hr.		30 min.		24 hr.	
+	—	+	—	+	—	+	—	+	—	+	—
47	145	43	149	140	47	140	47	147	30	164	3

One patient (No. 45 in table 3) had a positive 30-minute and a negative 24-hour reaction to full-strength extract. One of the 10 patients of the preliminary group, tested with 0.25 cc. of a 1:1,000 extract, had a similar reaction. Of the 15 patients in table 4 who were not tested with the full-strength solution, 2 gave 30-minute positive and 24-hour negative reactions to the dilute solutions, the reactions in the other 13 being consistently positive.

Stool examinations were recorded in 57 patients with mumu who were skin tested. Intestinal parasites were found in but 8, ascaris in but two. In general our experience at this hospital showed a low incidence of intestinal parasitism in the area.

Individuals with several months' residence in the area, but without findings sufficient to justify a diagnosis of mumu, showed almost as high an incidence of positive reactions as did the mumu group. Thus of 23 men tested in February and March 1943, only 6 failed to show positive reactions. It is important to note that many of these men later developed clear-cut mumu. The fate of others is uncertain. Tests on 29 members of the hospital staff without evidence of lymphangitis, but with 8 months or more in the area, showed 6 with positive reactions, 5 with doubtful reactions, and 18 with negative reactions. Some of those with positive reactions later developed clinical mumu. It was also of interest that retests on 3 men who developed mumu and whose previous tests had been negative, showed 2 complete positives, and 1 immediate negative but 24-hour positive reaction.

No attempt was made at purification of the extract. Extracts contained considerable trichloracetic-precipitable material. This material, after repeated treatment with ether, could not be redissolved in saline solution.

A topic of some importance is the relation of sensitivity to filaremia. It is difficult to think that an individual whose blood teems with microfilariae can be particularly sensitive to filarial protein. Likewise it is not easy to see how the apparent inverse relationship between filaremia and clinical manifestations (*3*) can be explained except by differences in sensitization. It was, therefore, of some interest to note that a native woman, in good health but with blood full of microfilariae, gave strong immediate and very weak 24-hour reactions. Two other natives without filaremia or clinical symptoms gave such strong 24-hour reactions, with chills and ascending lymphangitis, that the writer was afraid to continue studies on natives. With suitable dilutions, however, such studies could be pursued and it is to be hoped that they will be.

COMMENT

These data are in agreement with those of others in indicating that while Dirofilaria immitis extracts are not devoid of primary irritant property, reactivity to such extracts is largely conditioned by allergic sensitization. The fact that reactions quite comparable to natural mumu can be elicited with dirofilaria extracts supports the belief that wuchereriae are themselves capable of producing inflammatory reactions, and that at least some of the clinical pictures of "filariasis" are correctly so designated and are not due primarily to bacterial infection.

The test in our hands was by no means specific for the filarial group. However in view of the low incidence of intestinal helminthiasis among troops in the area, and the high incidence of filariae among mosquitoes and natives, it seemed probable that the reactions elicited in the group of patients with mumu and in other long-time residents represented, for the most part, sensitization by, as well as sensitization to, filarial substance. The skin test results accord well with epidemiologic data, mosquito studies, the characteristic histologic picture, the absence of demonstrable bacterial infection in mumu, and the finding of filariae in excised tissues (*10*) (*11*) (*13*).

The entire body of evidence supports the belief that the highly characteristic clinical entity of mumu is, as Buxton and Hopkins (*14*) suspected, of filarial origin. While the evidence is not altogether as direct as one might wish, it is difficult to think of a rival hypothesis. The evidence seems at least as clear as that linking filariasis with any other pathologic process, and doubt as to the filarial etiology of mumu would seem to involve doubt of the pathogenicity of filariae.

It is the writer's conviction that this test as done by him, while

helpful in the general study of the etiology of mumu, is not particularly helpful in the diagnosis of individual cases. With the cross-reactivity with other helminths, the occurrence of sensitization in pre- or subclinical infection, and of desensitization in particularly severe cases (and some others), ambiguities of interpretation appear greater with the skin test than with the clinical picture. It is conceivable that the great majority of men who develop positive skin tests would develop clinical mumu on longer residence in the area, but data on this point are fragmentary.

It is important to realize that variations in the technic of preparation of the extract may greatly affect its activity, and that a good series of controls is essential. It seems that other workers are developing much better methods of doing the test (*6*), and it is not at all unlikely that with such methods the test may have greater diagnostic significance than was suggested by our work in Samoa. However it is thought that the work there was sufficiently comprehensive to justify presentation, and that workers with little experience with the skin test should be warned of its ambiguities.

CONCLUSIONS

In our hands the skin test with Dirofilaria immitis extract provided important data on the pathogenesis of mumu (early filariasis) and the epidemiology of filariasis. The test did not appear to be strictly specific for the filarial group, cross-reactivity with ascaris being unmistakable, and it was positive in pre- and subclinical filariasis as well as in frank mumu. It was negative in some of the more acute and severe cases of mumu. Thus even though the test was positive in but 5 percent of newly arrived controls and in 83 percent of mumu patients, its value as a diagnostic aid in individual cases was decidedly limited. In our experience, ambiguity of interpretation was less marked with the clinical picture than with the skin test.

The writer wishes to acknowledge the splendid cooperation from patients, newly arrived controls, and other subjects who gladly submitted to a test which was often uncomfortable and promised them no personal benefit. Their interest in "pure science" was surprising and gratifying. The writer is likewise indebted to the commanding and medical officers who had charge of these men, and in particular to Major General Henry L. Larsen, U.S.M.C., and to Commander Gordon M. Bruce (MC) U.S.N.R. It is also a duty and a pleasure to acknowledge indebtedness to technical assistants, both at this hospital and at San Diego. Particular thanks are due to Chief Pharmacist's Mate J. B. Knight and to Pharmacist's Mate, second class, R. W. Tibbs, as well as to Machinist's Mate, first class, D. F. Bright, who made the filter. It is fair to say that any merit which this contribution may possess is due to the writer's active and passive collaborators, while its deficiencies must be ascribed to those of the writer or to limitations imposed by field conditions.

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CORRECTION

In the December 1944 BULLETIN, in the article on Cold Hemagglutination Test in Diagnosis of Primary Atypical Pneumonia by Commander Arthur A. Humphrey, an error appears on p. 1118. No. 2 under the paragraph headed *Method*, reads "Four to six cc. of the citrated blood," whereas the original copy read "Four to six cc. of the *remaining* blood."

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DRAFTS CAUSE COLDS

In a study of colds among 5,500 employees of Johnson and Johnson in New Brunswick and Chicago from July 1942 to February 1944, it was found that every sudden drop in temperature was followed in a day or two by a rise in the number of colds.

Shipping departments, which are usually drafty places, had uniformly a high general incidence of colds and a high incidence of time-losing colds. There were fewer colds in air-conditioned plants.

Sex, age and the working posture were also found to have a bearing on the number and severity of colds. There were many more time-losing colds among women throughout the year.

The largest number of colds occurred in the 20 to 29-year age group and the lowest in the age group above 50 years. The percentage of time-losing colds, however, increased with age.

There were consistently more colds among office employees than among factory employees. Posture also had a marked influence on the severity of colds. The smallest percentage of time-losing colds was found among those who walk about at their jobs and the highest among those who mostly sit at their jobs.

Smoking apparently had little effect on colds. Almost half, 45 percent, of those with colds did not smoke at all. The influence of vitamins on incidence and severity of colds was "unquestionable." Early treatment seems to be of greatest value.—Drafts Do Cause Colds. Science News Letter 46: 262, October 21, 1944.

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THERAPEUTIC PROPERTIES OF CAJANDOL

A new compound, called cajandol, is now being offered to the medical profession to aid in the treatment of irritative and inflammatory conditions of the lower genito-urinary tract. It has been used in many clinical cases and has proved to be a soothing analgesic and a mild antiseptic. It is not considered as a cure-all but a useful adjunct along with other well established therapeutic procedures for the relief of the distressing symptoms of urethritis in the male and female, general cystitis, interstitial cystitis, prostatitis and some cases of tumor of the bladder. After instrumentation of the urethra and bladder, it tends to make the patient more comfortable. No reactions or aggravation of symptoms in any patient have been noted from its use. It is economical. —BURKLAND, C. E.: Cajandol. Am. J. Surg. 66: 86–87, October 1944.

FILARIASIS

A STUDY OF 737 PATIENTS SO DIAGNOSED

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The material for this paper has been obtained from the health records and examinations of 737 patients admitted to a Naval mobile hospital in New Caledonia between July 1943 and March 1944. A diagnosis of filariasis or lymphadenitis (presumably of filarial origin) had been made in each case. Two large groups are represented: (1) A Seabee battalion which had over 10 months of duty in Samoa and the Wallis Islands, where filariasis is endemic; and (2) part of a Marine regiment which had some of its overseas training period in American and British Samoa. The temporary nature of their quarters and the conditions under which they lived in close proximity to the natives have been described by Burhans et al. (*1*). The first group had not seen combat but had done considerable physical work. The second group was used extensively in the Bougainville campaign. In addition to these two main groups there were a few patients from other units, who had seen service on islands in the endemic regions. Included among these were five hospital corpsmen attached to the staff of this hospital, who had been transferred here for duty after 9 months with outfits in the field.

All of the patients were white. None had knowingly come in contact with filariasis before the current tour of foreign duty. The average age of the Marines was 22 years; of the Seabees, 30 years. The exposure of the Marines varied from 3 to 17 months with an average of 9 months. They had been away from the endemic area for from 3 to 5 months. The Seabees had had from 5 to 10 months of exposure, with a mean of 9, and had come directly from the operational area to New Caledonia.

The symptoms have shown a great variance. The most frequent complaints of the Marine group are "groin pain," pain in the medial aspect of the thighs, and excessive fatigue. Some noticed that the straps of their packs hurt their shoulders. Many have been given "light duty" even in the field. In quite a number, "combat" and "operational fatigue" symptoms predominate. In contrast to the "groin pain" of the Marines, the prominent com-

TABLE 1.—*Correlation of filarial complaints leading to admission with the physical findings on previous examination and upon examination at this hospital*

Subjective symptoms on admission		Positive findings on previous physical examination	Positive findings on present admission	Regional lymph nodes only
Location	Number			
Arms:				
Right only	73	76	40	67
Left only	48	47	18	42
Both	81	8	1	107
Legs:				
Right only	27	7	1	51
Left only	26	1	0	29
Both	145	10	4	190
Scrotal contents:				
Right only	19	47	29	5
Left only	31	87	60	2
Both	33	68	38	12
Unspecified	7	1	0	.....
Arm only	151	6	*	.....
Arm and scrotal contents	37	22	*	.....
Leg and scrotal contents	47	1	*	.....
Lymphadenitis only	8	193	505	.....
Pectoral enlargement	4	5	8	.....
Lymphangitis, acute	.....	2	9	.....
Inadequate data	.....	153	24	.....

* These figures have been combined above under their appropriate headings. If tabulated separately the various combinations made the table too bulky. In many incidences the figures were too small to be significant.

plaint of the Seabees is aching and pain in the arms, often described as a sensation of heaviness. Abnormal fatigue, irritability, nervousness, and loss of libido are frequent. All of the Seabees have been evacuated under the diagnosis of lymphadenitis, presumably of filarial origin, much as were those cases discussed by Burhans. It was very noticeable that there was a tendency for the patients who were grouped together to standardize on similar symptoms.

In 227 instances (31.4 percent) there had been, according to the patients' statements, a previous mild attack of filariasis which had not been reported or entered upon the health record. Quite a number, especially the officers, elected not to report their symptoms in order to participate in combat activities. For the remaining 510 (68.8 percent), the attack leading to admission was the first.

Burhans and his coworkers made the observation that a large part of their group of patients first noticed their symptoms between the months of September and December. Among those of this series, 37 percent began in the months of July to September and a like percentage between October and December. Sixteen percent began between January and April, and 10 percent between May and September.

Because of the difference in the findings at this hospital from those reported upon these same patients elsewhere, a compilation was made and incorporated into table 1. This table gives a correlation between: (1) The symptoms leading to the current admission, classified according to region; (2) the physical examination at some point near the original evacuation station; and (3) the findings here. In the first column of the examination at this hospital are included patients in whom positive physical findings were obtained, while in the second are those in whom an enlargement of regional or satellite glands was found in the absence of observable filarial findings.

It is to be seen that the arms are the most frequent site of symptoms, and that in them more concomitant physical findings are observed. Three-fourths of the Seabees had arm symptoms alone or in conjunction with other complaints elsewhere. The right arm was involved more often than the left. The legs showed filarial findings far less frequently (less than 10 percent). However even these cases presented some degree of enlargement of the femoral-inguinal chain of lymph nodes.

That there are more findings of abnormalities of the scrotal contents than there were subjective symptoms is explained by the fact that it was the practice to examine periodically for evidence of filariasis those troops who had had duty in the endemic areas. In interpreting abnormalities of the scrotal contents additional difficulties arise. It was noticed that there was in many instances a divergence of opinion among the several examiners as to the amount of cord enlargement, and if present its significance. The intensity of the tenderness of the cords proves to be a very unreliable subjective symptom. Upon examination here, abnormalities of the cords and epididymides were found in 127 patients (16.5 percent) whose complaints originated in those structures. But on the other hand an almost equal number (123) had enlargements of one or both cords without complaints relative to the scrotal contents. It was observed that the left spermatic cord was involved three times as frequently as the right. Hydrocele was so seldom seen among this group of patients that it was included among cord enlargements. Acute lymphangitis of the scrotum and elephantiasis were not encountered. These findings are in harmony with the observations of Dickson and his associates (*2*) whose patients were studied while still on Samoa.

The observable filarial findings were smaller in number and less acute than have been previously noted. Very few patients had the acute symptoms of filariasis during their stay. Febrile periods were not noted. The typical centrifugal lymphangitis was found

only nine times, all in the arms. The macular erythematous rash associated with filariasis was observed three times. In most instances only a firm swelling, usually on the medial side of the forearms and the volar surfaces, was present. On but one patient was it possible to palpate a cord-like fullness in the thigh which could be considered a total blockage of the lymph channels. The diminution of the positive findings is attributed to the beneficial effects of rest, which resulted in the subsidence of the temporary edema of the parts involved.

As a result of the exigencies of the service, health records are often too brief and so may not contain findings to substantiate the diagnosis, or data essential to a study. The absence of detailed descriptions of glandular enlargements and scrotal abnormalities was especially disappointing, as it was felt that abnormalities of both might well have existed for some time and be wholly unrelated to filariasis.

The patients' statements, more often than not, are very unreliable. The relationship of filariasis as an etiologic factor in the production of varicocele, and vice versa, is not fully determined. In most instances where there was no proof of the latter's previous existence, its presence was recorded as a positive finding. It is recognized that this procedure is open to criticism and is condoned only because of desire to give the patient all benefits of the doubt.

After the Bougainville campaign there was a noticeable increase in the number of patients received with the diagnosis of filariasis. It is believed that the hardships brought out hitherto latent symptoms. It is felt, however, that combat fatigue had some bearing in making more manifest the symptoms of a psychosomatic nature. The fact that evacuation to the United States had been possible for other shipmates tended to cause a hopeful mimicry. However the fact that a further infestation while in the Solomon Islands may have occurred must not be overlooked. That this incidence is of minimal importance, however, is shown by the fact that only three substantiated cases occurred in personnel whose only combat service had been on Guadalcanal.

In many instances the examiners were at a loss to determine the exact source of the complaints as no observable signs were present. Making a diagnosis was especially difficult for those medical officers who examined the patients only in the quiescent stage. As there are factors in filariasis, as seen in American troops, that have not been conclusively explained, it was found serviceable in making a diagnosis and disposition to use the terms "tenable" and "untenable." It was not considered advisable to strike out the diagnosis even in the face of negative findings.

The group of patients upon evacuation from this hospital showed a diagnosis of filariasis made as follows:

	Percent
Tenable upon past history only	26
Tenable upon past history and physical examination elsewhere but not here	33
Tenable upon physical examination here	25
Untenable throughout	16

Much attention is being focused upon lymphadenopathy as cardinal evidence of filariasis. It was found in all the cases in this series in which the diagnosis was tenable, but the converse is not true. Lymphadenitis in personnel who have had duty in the tropics is so universal that not to find it in some degree is exceptional. It accompanies malaria. The fungus infections and pyodermas all produce it. Of the 590 patients on whom the data regarding fungus infection of the feet were available, 272 (46 percent) had at the time, or had had recently, some degree of skin infection which definitely had bearing upon the enlargement of the lymph nodes. In filariasis these can be palpated in all sorts of odd places, especially in the intercostal region, the popliteal spaces, and in the back. They are by no means always symmetric; in fact, the asymmetry of the lymph node enlargement can serve as a differential factor. It has been suggested that acute and chronic gastrointestinal symptoms can be produced by involvement of the retroperitoneal chain. The satellite gland of filariasis is smaller and firmer than that resulting from a pyogenic lymphangitis of similar degree. It does not enlarge as regularly with an extension of the lymphangitis. An enlarged epitrochlear gland was found in 38 percent of the patients of this series. Filariasis must then, like syphilis and malaria, be classified as a disease in which epitrochlear glands are frequently palpable.

TABLE 2.—*Lymph node enlargement*

Location of enlargement	Number
General glandular enlargement	96
Cervical	242
Axillary	511
Epitrochlear	283
Inguinal	645
Femoral	532
Other	23

DISPOSITION

No attempt was made to treat the patients here other than with methods of a general nature. During 1943 a determined effort was made to separate those patients who had filariasis from those who

had symptoms simulating the disease ("pseudofilariasis"). The former were evacuated to the United States, the latter returned to duty. Smears for microfilariae were done for a time, but after a large series had shown consistently negative results they were discontinued. Patients were put upon a hard work detail to observe the results of muscular activity in producing swellings of the extremities and the scrotal contents. These occurred surprisingly seldom, but work definitely increased those which were there. After 24 January 1944, however, exercise tests no longer were done routinely. From that date evacuation to the United States of all patients upon whom a diagnosis of filariasis had been made at any time was carried out. Materials for skin and complement fixation tests were not available at this station.

SUMMARY

It is believed that the symptoms and signs ascribed to filariasis in American troops in this area by some medical examiners are greatly overemphasized, and that there are not as many individual cases in the active stage as the "F" cards would indicate. As pointed out by Rome and Fogel (*3*), there is a marked difference in the psychosomatic response. This variance in degree has made a careful differentiation between the actual disease and "pseudofilariasis" difficult. Because of the indefinite period of activity of the causative parasite, it is recognized that there may yet be latent cases which will become active at some future date (*4*). There is no way to predict, at this time, individual relapses and progressions. It is noticeable, however, that in many patients there is a diminution of complaints, once their evacuation disposition has been established, out of proportion to a change in the physical findings.

In the absence of the detection of the causative parasite, upon which the specificity of the disease depends (*5*) or the absence of satisfactory laboratory tests to indicate its presence, the diagnosis must rest upon clinical findings. It is believed that with the following findings the diagnosis of filariasis is tenable:

1. A centrifugal or retrograde lymphangitis, with or without an erythematous rash.
2. A tender satellite gland which is smaller and firmer than that accompanying a pyogenic infection.
3. A temporary firm edema, increased by exercise and diminished by rest.
4. Fullness of the forearm, most pronounced in the volar aspect, with the superficial veins less visible.
5. A palpable cord-like fullness along a lymph channel.

6. Fullness and tenderness of the spermatic cord and epididymis.

7. Regional lymphadenopathy, often asymmetrical; aberrant lymph nodes.

8. The history of duty in Samoa or similar endemic areas.

Frequently found secondary symptoms are:

1. Irritability.
2. Excessive fatigue.
3. Muscle pains and soreness which are increased by exercise.
4. Loss of libido.

Filariasis, as seen in an evacuation hospital some distance from the combat zone, is of a much milder form than that which has been reported among service personnel in the endemic areas. The problem of differentiating the disease from "pseudofilariasis" is complicated by factors which have not been produced by the disease itself. This study of a disease which requires a long period of follow-up cannot be complete, coming as it does from one Naval hospital where the disease was seen for the most part in the quiescent stage, but it is hoped that it will add to the solution of a problem as yet not satisfactorily solved.

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TRAUMATIC URÆMIA

Of eight cases of uremia following war wounds six were fatal. The kidneys and other organs of four of the fatal cases have been examined and bear a close resemblance to those described previously in crush syndrome. It is suggested that the renal changes may be due to anoxia, secondary to hypotension or vascular spasm or both.—DARMADY, E. M., et al.: Traumatic uraemia; reports on eight cases. Lancet 2: 809-812, December 23, 1944.

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BLOOD VISCOSITY AND HEART MURMURS

Using a modified Wiggers circulation machine it was shown that with a hemoglobin level of 140 percent and erythrocyte count of 6.9 million, no murmur could be detected, either in the records or by auscultation. At 120-percent hemoglobin, a very faint murmur was detected by the increased amplitude of the vibration. The murmur grew progressively louder as the blood was diluted, until at a hemoglobin level of 10 percent it was louder than normal heart sounds over the pulmonic area. Below a hemoglobin level of 70 percent no change in the intensity of the murmur could be found.

The results show that lowering of viscosity is in itself enough to produce a definite murmur where none was heard before. This may indicate the origin of the hemic murmur. With high blood viscosities, the absence of a murmur does not rule out gross structural cardiac abnormalities.—GARB, S.: Relationship of blood viscosity to intensity of heart murmurs. Am. Heart J. 28: 568-573, November 1944.

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LYMPHOCYTES SPECKLED IN SCRUB TYPHUS

There are peculiar granules in the protoplasm of lymphocytes. They can be stained only with azure in dry smears and therefore have been named azurophilic granules. Unlike the specific granules of the granular leukocytes, they are not constant and are supposed to be the visible symptom of a peculiar secretory function or of another metabolic process, or a temporary cell constituent reflecting a stage in the activity of the cell.

A count was made of these speckled lymphocytes in some 400 smears in an attempt to discover under what conditions their numbers varied and whether any such variations had any significance.

No very great change from the normal figures was encountered in septic conditions, malaria, dengue or pulmonary tuberculosis. A change occurred in amebiasis and in scrub typhus. The exact change in the body which leads to an increase in the number of speckled lymphocytes is quite unknown, but it seems most unlikely that such a change occurs in only those conditions where it has been investigated. It is suggested that it would be a useful line of research to determine in what other conditions the change occurs, and if possible the change in the internal organs responsible.—WEDD, S.: Lymphocytes speckled and plain: Unrecorded blood change in scrub typhus. J. Roy. Nav. M. Serv. 30: 137-144, July 1944.

INTESTINAL PARASITES AMONG MELANESIANS

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Single specimens of feces from each of 125 Melanesians who live adjacent to this encampment were studied in order to ascertain what sanitary precautions should be taken. One hundred natives were from an island in the central part of the island group and twenty-five were from an island in the northern part of the same group. The specimens were observed macroscopically and any doubtful portions were examined microscopically. A normal saline preparation of the specimen was examined for motile amebas and flagellates. A portion of feces about 1 inch in size was treated by the zinc sulfate concentration flotation method and the preparation examined for protozoan cysts, helminth eggs and larvae. Iron-hematoxylin smears were made on all specimens.

Analysis of the results showed conclusively that natives in the area of the survey were highly infected with intestinal helminths. Nearly all of them had hookworm ova in their feces and nearly half harbored Trichuris trichiura ova. Ascaris lumbricoides and Strongyloides stercoralis were frequently present. Among the nonpathogenic parasites, Endamoeba coli was most common. Various types of other parasites both pathogenic and nonpathogenic were found in a small percentage of these people. Endamoeba histolytica and various tapeworms were relatively uncommon. Table 1 is a compilation of the findings.

The high incidence of hookworm infection indicates the need of a course of therapy for the native population. Careful instruction and supervision of natives in regard to sanitation should be instituted. Moreover it should be recalled that the natives segregated on this island as a work battalion have come from other islands in the group, and consequently sanitary measures also should be applied to the home islands. Troops in the vicinity of native camps or villages should be prohibited from going barefoot. Trading with the natives for souvenirs is a common practice, and articles thus obtained should be sterilized in the autoclave or by other suitable methods of sterilization.

TABLE 1.—*Tabulation of findings*

Parasite	100 men from central island	25 men from northern island	Cumulative percentage
Hookworm	96	25	97
Trichuris trichiura	43	9	40.8
Ascaris lumbricoides	24	6	24
Endamoeba coli	23	4	21.6
Strongyloides stercoralis	17	4	16.8
Endolimax nana	12	3	12
Iodamoeba buetschlii	10	2	9.6
Oxyuris vermicularis	10	2	9.6
Giardia lamblia	6	1	5.6
Endamoeba histolytica	5	2	5.6
Dipylidium caninum	4	1	4
Balantidium coli	4	0	3.2
Fasciolopsis buski	2	0	1.6
Dientamoeba fragilis	2	2	3.2
Chilomastix mesnili	1	1	1.6
Hymenolepis nana	4	0	3.2
Hymenolepis diminuta	1	0	0.8
Taenia	3	0	2.4
Embadomonas intestinalis	2	0	1.6
Trichomonas hominis	4	0	3.2

A few facts in regard to the habits of the natives shed some light on the incidence of intestinal parasites. The incidence of tapeworms is low because very little meat is eaten, but the practice of constantly going barefooted exposes these people to infections with hookworm and strongyloides.

A comparison of the results of the various methods of study showed the high efficiency of the zinc sulfate concentration flotation method for the demonstration of protozoan cysts, helminth eggs and larvae. Saline smears failed to demonstrate 44 percent of hookwork infections, 40 percent of ascaris, and 55 percent of Trichuris trichiura infections; all smears, however, were valuable in demonstrating motile amebas and intestinal flagellates. Iron-hematoxylin preparations demonstrated various types that had been missed by other methods.

SUMMARY

1. A survey of intestinal parasites among 125 Melanesians showed hookworm infection to be highly prevalent. There was a high incidence of Trichuris trichiura and a moderately high incidence of Ascaris lumbricoides and Strongyloides stercoralis.

2. The zinc sulfate concentration flotation method is highly efficient for demonstrating protozoan cysts, helminth eggs and larvae.

3. Sanitary measures should be improved in native villages and camps and the entire population should be treated for hookworm infection.

LARGE SCALE ISOLATION AND IDENTIFICATION OF SHIGELLA ORGANISMS IN THE FIELD

EPIDEMIOLOGICAL UNIT NO. 40[1]

In the field there are many occasions when sanitary conditions cannot be ideal. Large numbers of men may be exposed to dysentery and, if an epidemic is to be averted, drastic sanitary measures and epidemiologic procedures are necessary. This is especially true in a combat organization in which training schedules and over-all planning cannot be interrupted.

During such an emergency one of the more important epidemiologic procedures is the isolation and treatment of carriers. To do this thoroughly it may be necessary to make thousands of stool cultures in a short period of time. This epidemiological unit was confronted with such a problem and in a 2-month period completed 5,250 stool cultures. To accomplish this with limited personnel and field equipment, it was necessary to omit certain established steps in favor of more rapid, but efficient and sound bacteriologic methods.

When this work was first begun it immediately became apparent that the collection of fecal specimens in suitable containers was not only impractical but impossible if large numbers of cultures were to be done daily. Therefore the rectal swab technic as described by Hardy[2] was adopted.

Soft rubber tubing with an outside diameter of 0.8 cm. and an inside diameter of 0.5 cm. is cut into lengths of approximately 12 cm. and each piece is beveled at one end. Cotton is wrapped tightly around wooden applicator sticks to make a swab that will easily slide through the rubber tubing. Care must be taken that the cotton is firmly attached; moistening the tip of the applicator with water at the time the cotton is wound will insure this. The swabs are inserted into the tubing so that the cotton tip appears just below the bevel. These are wrapped in newspaper (50 units to a pack) and sterilized in an autoclave.

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[1] Personnel of this unit include the following: Lieutenant Ralph W. Getty (MC) U.S.N.R.; Chief Pharmacist's Mates Frank Clifton and Raymond Haringa U.S.N.R.; and Pharmacist's Mates, first class, J. Max Rukes and Stanley Rosch U.S.N.R.

[2] HARDY, A. V.; WATT, J.; and DECAPITO, T. M.: Studies of acute diarrheal diseases; new procedures in bacteriological diagnosis. Pub. Health Rep. 57: 521-524, April 10, 1942.

For use, the external surface of the beveled end is lubricated with a sterile water-soluble lubricant and, with the patient in a suitable standing position, the unit is inserted into the rectum about 2 inches beyond the sphincter. The swab is pushed beyond the rubber sheath, or the sheath can be slightly withdrawn and the specimen collected by a sweeping rotary motion of the swab applicator. After moving the swab so that it is again within the tubing, the unit is withdrawn.

One Petri dish containing the appropriate selective medium is immediately inoculated by rotating the swab as it is being drawn across the surface. No secondary streaking from a primary inoculum is necessary as the material is usually scant, and appropriate selective media require heavy seeding. Almost invariably well-isolated colonies are obtained, and the time and material saved by eliminating secondary streaking more than justifies an occasional repeat culture made necessary by an overgrown plate. The applicator swab is discarded and the rubber tubing is saved, as it can be cleaned and resterilized for future use.

The medium of choice is S-S (salmonella-shigella) agar, but sodium desoxycholate-citrate is nearly as good. These media do not require autoclaving and both are highly selective, yielding well-isolated colonies when heavily inoculated. Petri dishes should be clean before pouring the medium, but it is not necessary that they be sterilized if they are to be used within 24 hours after pouring. A dry-surface medium aids in obtaining isolated colonies. This is assured by properly cooling the medium before pouring and by tilting the cover of the Petri dish while the medium is solidifying. If flies are abundant, the plates with tilted covers should be protected with netting. In addition to contamination, flies will deposit eggs on the medium, and the larvae which develop overnight will foul its surface.

Plates are incubated for 24 hours at 37° Centigrade. A field-type kerosene incubator is preferred as electricity is frequently unavailable. In the absence of kerosene, or if the incubator is damaged, a small alcohol lamp placed inside the incubator will give sufficient heat. In the absence of an incubator and in a tropical area, incubator temperature may be obtained in a tent with sides and door flap closed.

At the end of 24 hours the plates are examined for typical colonies. Often in clinical cases of dysentery an almost pure culture of shigella is obtained, and usually the pathogen, if present, represents the predominant growth. Any colorless, transparent or translucent colony, however, is regarded with suspicion. A plate with such colonies often has a distinctive, semen-like odor.

A representative number of suspected colonies are selected and

transferred to Russell's double sugar agar and to tubes containing mannitol. No precaution to insure purity of growth is taken except that well-isolated colonies are chosen and that the needle tip touches only the edge of the suspected colony. Gram stains are not made, as a gram-positive organism will yield no appreciable growth in 24 hours, and a Gram stain will not differentiate between a lactose and a nonlactose fermenting gram-negative bacillus.

Liquid carbohydrate broths are impractical in the field; therefore Russell's double sugar agar and saccharose-mannitol agar are preferred. It is good practice, when possible, to prepare in advance of going into the field all media that require sterilization. Solid media will not spill in transit and, sealed with paraffin, will remain sterile and moist for months.

After 24 hours' incubation, Russell's slants and mannitol tubes are examined. Infrequently cultures show bizarre reactions or gross contamination; these are set aside for restreaking and further study. All cultures with an alkaline slant and acid butt, with or without gas, are screened by rapid slide agglutination.

A pooled shigella immune serum, containing anti-dysenteriae, anti-paradysenteriae (V, W, X, Y, Z), anti-Newcastle and anti-sonnei sera, all of a titer of 1:1,280, is diluted 1 part to 50 and distributed in droplets on a glass or plastic pane. A Petri dish cover will do, but a piece of nonbreakable, colorless, transparent plastic pane, approximately 8 by 12 inches is more convenient. A droplet of normal saline solution is placed beside each droplet of diluted serum. Growth from a Russell's slant is transferred by loop to the serum and saline in an amount yielding the opacity of milk, smoothly emulsified. Suspensions are agitated by gentle shaking for about 5 minutes and then examined for agglutination against a black background with a strong light from the underside.

Cultures which show no agglutination are eliminated immediately except in instances where some cultural feature suggests further study. Infrequently freshly isolated shigellas are inagglutinable and can be made to agglutinate by serial transplanting. This is well warranted if the culture is nonmotile. Motility can be checked in a variety of ways. One simple method is by examining the water of condensation under the microscope. Also a bit of agar with adherent growth may be scooped from the surface of the slant, compressed beneath a coverslip, and examined microscopically.

In instances of cultures which show agglutination, the corresponding saline suspensions are examined to make sure that the agglutination is not spontaneous. On the basis of the reaction

with mannitol and Russell's slant, cultures which show true agglutination with pooled antisera are tested with an appropriate range of specific antisera. This is diluted 1 part to 50 in the manner previously described and identification is based on the results observed.

DISADVANTAGES AND ADVANTAGES

It is not claimed that the above routine is without flaw and it is emphasized that it has been adopted only for emergency situations. Some of its recognized limitations are:

1. Usual bacteriologic procedures are based upon cultural diagnoses with specific agglutinations as confirmatory evidence. In the method described here this procedure is reversed and complete reliance is placed on the diagnostic antiserum employed. It is important, therefore, to have available a complete set of antisera of known value. (When most of this work was done no antiserum was available for the Sachs' group or for the strains ambigua, ceylonensis, madampensis, and Boyd types. If these organisms were isolated, they were not identified.)

2. The use of serum of high concentration (1:50) can give a misleading result because of common antigens existing between this shigella group and other groups of enteric pathogens. However in many instances agglutinations are checked by means of a serum diluted to its titer.

3. Subcultures are held routinely only for 24 hours. Thus the possibility arises of missing, on a cultural basis, the late lactose fermenters of the shigella group, but these would be noted serologically.

4. Other groups of organisms, such as salmonella (in particular) as well as paracolon, proteus and pseudomonas are completely disregarded. Thus additional and valuable epidemiologic data may be lost.

5. As no stock culture is prepared, and in effect the Russell's slant serves in this capacity, extreme care must be taken in selecting suspected colonies. This can be offset somewhat by selecting more than one colony if possible, and using a corresponding number of Russell's slants.

6. The use of but one plate of selective medium for the primary inoculum is open to criticism. However experience has shown that one plate will give well-isolated colonies in nearly every instance.

Advantages of the routine described may be listed as:

1. Over 5,000 cultures of specimens were made on food handlers in a 2-month period and a threatened epidemic was prevented. Later as a preventive measure 1,530 cultures were made on specimens obtained from food handlers in a 12-day period. In the

9-month period that this technic has been employed, 8,200 cultures have been made.

2. In this method necessary laboratory personnel and equipment can be transported to any location where cases of dysentery are occurring, and with relative ease and speed specimens from all members of the affected organization can be cultured in order to detect carriers. This can be illustrated best by the following incident:

A U. S. Navy troop transport being used for amphibious training operations was discovered to have clinical cases of bacillary dysentery among members of its crew. This was not discovered until 358 members of a military organization had been aboard for several days and a few clinical cases had developed among them. With a 5-hour notice, this epidemiological unit transported itself and equipment to the ship and in 2½ hours obtained and plated a stool specimen on each of the 531 members of the crew. A complete roster of the ship's personnel was used to be certain that every officer and enlisted man had been included.

Two days later the 15 carriers detected had been reported. It is presumed that these men were isolated and treated, as 1 month later no further cases of diarrhea or dysentery had occurred. The day after these cultures were taken, specimens from the 358 men who had immediately been removed from the ship were cultured, and 13 of these proved positive for the same organism as that obtained from the ship's crew.

In a survey of food handlers employed in a galley serving an organization which was having a large number of clinical cases of dysentery, 252 men were examined and 40 were found positive for the same organism. Upon their removal outbreaks of infection ceased immediately. A detailed study later sustained the accuracy of identifications arrived at by the routine described. Identifications were confirmed by two other laboratory activities.

CONCLUSIONS

The routine described here for the large-scale isolation and identification of shigella organisms has been used with good results in controlling and preventing epidemics caused by this group of organisms. It has been used during actual combat and found satisfactory even during frequent changes of location, lack of a suitable shelter for bacteriologic work and an inadequate supply of such basic materials as facilities (including water) for washing glassware. With necessary materials such as glassware and media, and in the absence of circumstances requiring hasty diagnoses, there is no reason why a similar routine could not be employed in the identification of other groups of enteric pathogens.

POSITIVE DICK-TEST REACTORS

RELATION OF INCIDENCE TO HABITAT

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It has been generally accepted that people who live in the country are more susceptible to scarlet fever than are those of the city. This fact is based on the existence of much higher incidence rates of Dick-positive reactors among country people as compared with city dwellers. In 1926 Dyer et al. (*1*) tested a large group of rural and urban children and found positive skin reactors in 73.6 percent of the former and in only 8.1 percent of the latter. Debré and Lamy (*2*), a year later, tested a group who ranged between 17 and 19 years of age. Those in this group who came from the outlying country districts were found to be 87.5 percent Dick-test positive, while in those from urban homes, schools, and hospitals the percentages positive were 35.7, 29.2, and 18.4 respectively. At the same time Toomey, Braun, and Halperin (*3*) reported a study of 100 rural and 100 urban individuals. They observed that the incidence of positive reactors from the city was 14 percent as compared with 54 percent among the country dwellers. As recently as 1940, Dunham (*4*) reported that "In general, troops recruited from rural communities have a higher susceptibility to scarlet fever than those drawn from urban cities."

If it is true that because of their lack of contact either with a case of scarlet fever or with a carrier of a scarlatinogenic streptococcal strain, individuals from the country are Dick-positive, then the incidence of Dick-positive reactors should be higher among our recruits from rural areas. Conversely the recruits from the cities should show a lower incidence because of their more intimate contact with either a patient or a carrier. The more intimate contacts of the urban dweller would lead to the development of some type of neutralizing agent or immune body, with resultant lowering of the number of positive Dick-test reactors.

Because large numbers of recruits from rural and urban areas alike were being received, the opportunity of investigating the

validity of these facts in the face of present-day conditions was afforded.

The Dick test was performed on 26 companies of recruits. Of these, 20 companies were white and 6 companies were composed of colored recruits. A total of 3,168 men were tested within 3 days of their arrival on the station. The usual technic was employed in making the test, namely, the injection of 0.1 cc. of streptococcus toxin intracutaneously. The reaction was read in from 18 to 24 hours. The toxin used was a standard commercial product prepared in the following manner:

Types I, II, III, and IV streptococci strains are transplanted every 8 hours in a proteose peptone broth (0.02 percent dextrose) for three successive transplants. The third subculture of each strain is pooled and planted (1 percent seed) into this toxin broth plus 0.1 percent dextrose. All planted bottles are incubated for 12 hours at 37° C. Then 0.02 percent dextrose is added hourly (30 percent solution) for 20 hours—totaling 0.5 percent dextrose. The pH is kept at 7 to 7.2 with additions of 20 percent NaOH. When the pH remains constant (40 to 48 hours) the bottles are smeared and plated and 0.5 percent phenol is added. The bottles are stored overnight at 5° C. The contents of the pure bottles are pooled and filtered through soft filter paper. The toxin is then filtered through "N" Berkefeld candles and allowed to stand in the dark at room temperature for 2 to 3 weeks. Final filtration is through "W" Berkefeld candles, followed by aging for 2 months at 5° C.

At the time the skin test was interpreted each recruit was interviewed personally. In order to place each man in his proper category of habitat, certain criteria had to be met. The town from which the recruit came was considered a country region if the population was under 10,000. This figure was arbitrarily chosen because it offered about the best boundary between congested and noncongested living conditions. If this sized town, or one smaller, was located close to or readily accessible to a large city by modern transportation it was ruled out as a country district.

The family history and background of each recruit was investigated, especially as to familial incidence of scarlet fever. If a case had developed in the family, the severity and degree of contact was ascertained. The type of school attended by the recruit and the average census of the classrooms were probed in order to determine the degree of contact during the ages of greater susceptibility. If necessary inquiry also was made of each recruit as to the size and location of the church attended and frequency of attendance.

Of the 3,168 men tested, 795 (25 percent) were found to exhibit positive reactions to the streptococcus toxin used. This incidence is essentially the same as that revealed by Jundell (*5*) in his study of Army and Navy recruits in 1925. In the former group, 30.2

percent were skin-test positive, while in the latter, 20.2 percent were Dick-positive. The age group studied by him was from 20 to 25 years. The recruits in the present survey ranged from 18 to 26 years. Many studies have been made on this subject and the findings show a range of incidence rates of from 20 to 60 percent in this age group (*2*) (*6*) (*7*) (*8*) (*9*).

The incidence of all positive reactors from the country as compared with those from the city was found to be essentially the same. Of the 1,811 urban dwellers, 491 (27.1 percent) were Dick-positive and of the 1,357 rural dwellers, 304 (22.4 percent) were Dick-positive. Thus it was apparent that no significant statistical difference existed. Similarly when the colored positive urban recruits were compared with the colored positive rural recruits, no significant difference was evident.

TABLE 1.—*Total results*

	Total recruits			Urban				Rural			
	Tested	Positive		Tested		Positive		Tested		Positive	
		No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
White...	2,454	676	27.5	1,334	54.4	407	30.5	1,120	45.6	269	24.0
Colored.	714	119	16.6	477	66.8	84	17.6	237	33.2	35	14.7
Total.	3,168	795	25.0	1,811	57.3	491	27.1	1,351	42.7	304	22.4

Of the 2,454 white recruits tested it was found that 1,334 were city dwellers and 1,120 were rural dwellers. The number of Dick-positive reactors was found to be 30.5 percent (407) of the urban dwellers and 24.0 percent (269) of the rural dwellers. This finding of a larger percent of Dick-positive reactors among urban dwellers than among rural dwellers is statistically significant. There also was found a statistically significant difference of positive reactors between the white and colored recruits. The former showed 27.5 percent to be positive and the latter 16.6 percent positive. Similar findings were noted in the urban and rural groups (table 1).

Tables 2, 3, and 4 show the Dick-test positive reactors according to States in addition to their urban or rural origin.

The results presented seem to vary from the long-standing opinion that Dick-positive reactors are more common in the country than in the city. A quarter of a century ago rural people had a tendency to a more restricted mode of living and less occasion arose to subject themselves or their neighbors to outside contacts with cases of scarlet fever or with carriers of scarlatinogenic strains of streptococci. This sort of isolation did not afford these people the opportunity to develop any immunity

TABLE 2.—*White recruits according to States*

State	Tested			Dick positive		
	Total	Urban	Rural	Total	Urban	Rural
Alabama	9	4	5	2	2	0
Colorado	1	1	0	0	0	0
Connecticut	2	1	1	1	0	1
Delaware	33	29	4	13	12	1
District of Columbia	17	17	0	3	3	0
Florida	315	189	126	86	54	32
Georgia	114	60	54	22	15	7
Illinois	7	5	2	2	1	1
Kansas	2	1	1	1	0	1
Kentucky	2	1	1	1	1	0
Louisiana	2	1	1	0	0	0
Maine	1	1	0	1	1	0
Maryland	14	9	5	3	1	2
Massachusetts	2	2	0	0	0	0
Michigan	4	4	0	1	1	0
Minnesota	1	1	0	1	1	0
Mississippi	2	0	2	0	0	0
New Jersey	345	247	98	155	100	55
New York	13	9	4	7	4	3
North Carolina	776	323	453	175	81	94
Ohio	5	4	1	2	2	0
Oregon	1	1	0	0	0	0
Pennsylvania	419	285	134	145	104	41
South Carolina	222	94	128	30	12	18
Tennessee	112	36	76	15	10	5
Virginia	29	7	22	7	1	6
West Virginia	3	2	1	2	1	1
Wisconsin	1	0	1	1	0	1
Total	2,454	1,334	1,120	676	407	269

TABLE 3.—*Colored recruits according to States*

State	Tested			Dick positive		
	Total	Urban	Rural	Total	Urban	Rural
Alabama	19	6	13	0	0	0
Arkansas	24	8	16	4	2	2
California	26	26	0	5	5	0
Colorado	1	1	0	0	0	0
Connecticut	9	9	0	3	3	0
Delaware	31	12	19	9	3	6
District of Columbia	23	22	1	4	4	0
Florida	23	15	8	4	3	1
Georgia	59	37	22	11	5	6
Illinois	44	37	7	10	9	1
Indiana	7	7	0	2	2	0
Kansas	1	1	0	1	1	0
Kentucky	1	0	1	0	0	0
Louisiana	22	11	11	3	1	2
Maryland	13	11	2	3	3	0
Massachusetts	2	1	1	0	0	0
Michigan	20	20	0	1	1	0
Mississippi	5	2	3	0	0	0
Missouri	8	5	3	2	0	2
Nebraska	4	4	0	1	1	0
Nevada	1	1	0	1	1	0
New Jersey	15	10	5	4	3	1
New York	37	36	1	8	7	1
North Carolina	42	18	24	4	1	3
Ohio	9	9	0	2	2	0
Oklahoma	11	0	11	3	0	3
Pennsylvania	57	54	3	11	11	0
Rhode Island	1	1	0	0	0	0
South Carolina	57	31	26	3	2	1
Tennessee	25	22	3	5	4	1
Texas	49	26	23	3	1	2
Virginia	66	33	33	10	8	2
West Virginia	2	1	1	2	1	1
Total	714	477	237	119	84	35

TABLE 4.—*Total white and colored recruits according to States*

State	Tested			Dick positive		
	Total	Urban	Rural	Total	Urban	Rural
Alabama	28	10	18	2	2	0
Arkansas	24	8	16	4	2	2
California	26	26	0	5	5	0
Colorado	2	2	0	0	0	0
Connecticut	11	10	1	4	3	1
Delaware	64	41	23	22	15	7
District of Columbia	40	39	1	7	7	0
Florida	338	204	134	90	57	33
Georgia	173	97	76	33	20	13
Illinois	51	42	9	12	10	2
Indiana	7	7	0	2	2	0
Kansas	3	2	1	2	1	1
Kentucky	3	1	2	1	1	0
Louisiana	24	12	12	3	1	2
Maine	1	1	0	1	1	0
Maryland	27	20	7	6	4	2
Massachusetts	4	3	1	0	0	0
Michigan	24	24	0	2	2	0
Minnesota	1	1	0	1	1	0
Mississippi	7	2	5	0	0	0
Missouri	8	5	3	2	0	2
Nebraska	4	4	0	1	1	0
Nevada	1	1	0	1	1	0
New Jersey	360	257	103	159	103	56
New York	50	45	5	15	11	4
North Carolina	818	341	477	179	82	97
Ohio	14	13	1	4	4	0
Oklahoma	11	0	11	3	0	3
Oregon	1	1	0	0	0	0
Pennsylvania	476	339	137	156	115	41
Rhode Island	1	1	0	0	0	0
South Carolina	279	125	154	33	14	19
Tennessee	137	58	79	20	14	6
Texas	49	26	23	3	1	2
Virginia	95	40	55	17	9	8
West Virginia	5	3	2	4	2	2
Wisconsin	1	0	1	1	0	1
Total	3,168	1,811	1,357	795	491	304

against these organisms. On the other hand the city recruit who had had more intimate and prolonged contact with either case or carrier, because of his congested type of living, showed a lower incidence of positive reactivity to the Dick test.

With the change in modern trends of transportation and the rapidity of communications between urban and rural areas, the relative isolation of the rural dwellers vanished and the degree of his contact with streptococcal carriers or cases approached that of the urban dwellers. The result was that he then became either a case or carrier in turn and was able to develop immunizing or neutralizing agents to the same degree that his urban brother did. Thus from the point of view of susceptibility to scarlet fever he was no longer any more vulnerable. When the rural recruit was brought into the massed pool of service men during the present war his neutralizing agents and antibodies were as highly developed, he showed no higher rate of positive reactions to the Dick test, and presumably his susceptibility to scarlatinogenic streptococci was no greater than that of an urban recruit.

Whites are more often positive to the Dick test than are the colored. It was also noted that a higher incidence of positive Dick tests existed in the urban centers than in the rural areas. This difference, at first glance, did not appear significant, until calibrated statistically. It then became apparent that our opinion of the Dick-positive incidence might have to be altered. Also in certain regions it was not only the same for the city and country but even higher in the urban communities than in the rural areas.

SUMMARY

A large number of recruits were Dick tested to determine whether or not there was any difference between the country and city incidence rates of Dick-positive reactors.

The data obtained would seem to indicate that there was no significant difference in incidence. If there was any trend at all, it seemed to favor an increased Dick-positive incidence among the recruits coming from urban areas.

The present-day mode of living and the disappearance of country isolation may have influenced this change in the incidence of Dick-positive reactors among country recruits.

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DRUNKENNESS

A REVIEW

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In the course of his service as an officer of the Navy, and particularly as a medical officer, the physician has considerable responsibility to carry in the matter of drunkenness. Except in rare instances the medical officer has not had the experience in the interpretation of regulations which is given to an officer of the line. The reserve officer's correspondence course may not have been completed. If completed, the officer may have forgotten the points which are important to discipline and good order in the Navy. Upon reporting for active duty in time of war the urgency of his purely medical responsibilities may distract him from the importance of his other duties as a Naval officer.

Knowing the pitfalls awaiting a witness appearing before an able defense attorney in civilian life, the careful physician hesitates to diagnose drunkenness, and will attempt to qualify his statements. He knows the many "ifs," "ands," and "buts," and the doubts which can be raised by an unscrupulous lawyer, whose task it is not to see that justice is done, but rather that justice not be done to his client. On Naval duty the physician is again confronted with the problem. Fortunately Naval courts emphasize justice and do not permit many loopholes to the counsel for the accused. As an officer in the Navy the doctor sooner or later finds himself in one of the following situations: He may be a witness; he may be a member of the court; or he may act as an attorney for the accused.

Unless he is familiar with legal as well as medical aspects of drunkenness, he learns by experience. But this is not without confusion in his own mind, and confusion or delay in court procedures. Advice has been set down for his enlightenment, but this he sometimes does not see even after he has made his first attempts to clarify the subject in his own mind. To assist medical reserve officers it is well to bring to light a few decisions and some advice found in Naval legal files.

Under Naval law the terms "drunkenness," "intoxication," and "under the influence of intoxicating liquor" are synonymous. Attempt to distinguish these is an error frequently made by medical officers and there are many references to this truth (*1*). Evidence

to support the charge of drunkenness must show sensible impairment of faculties. The odor of alcohol on the breath is not essential, provided there is other evidence (*2*). The alcoholic breath does not show impairment of faculties, nor does any impairment necessarily result from the act of drinking intoxicating liquor (*3*). These may support a charge of an offense against the article for the government of the Navy concerning the possession and use of intoxicating liquor (*4*). On the charge of drunkenness it does not matter whether the accused has imbibed freely or sparingly (*5*), and the degree of drunkenness, of intoxication, or of influence of the liquor is of no consideration; the accused is either drunk or he is sober (*6*).

An important exception to this occurs when criminal offenses are charged. A grossly intoxicated person may not be able to distinguish right from wrong, or to appreciate the nature and consequences of his acts; he may be in no condition to entertain a specific intent to commit an offense against the law. In the case of murder, evidence of an advanced state of intoxication may be a mitigating factor; in the case of larceny it may result in acquittal.

Apparently drunkenness of itself is not an offense unless the faculties are impaired to a degree that will incapacitate for the proper performance of any duty which a person of the rank or rate of the accused could be properly called upon to perform (*7*). Unfitness for duty can only be decided by court. No witness, not even a medical officer, can decide fitness for duty (*8*). In M.M.D. par. 742 (a), the medical officer is told to make a sufficiently comprehensive examination to determine among other things, fitness for duty. He should not express a bald conclusion on that subject, but should so testify as to show to what extent intoxication has impeded the man's ability to perform the skilled acts peculiar to his duty. The medical officer will save himself much embarrassment and will prove himself a better officer and a better witness if at the time of his examination he makes a written record of the details of his examination and keeps this record on file for later reference.

A court-martial order commented in 1927 (*9*):

> One difficulty which appears to trouble the service at large is: What evidence is sufficient to establish a case? For instance (in the case of drunkenness), the following are a few of the means that may be used to establish facts from which drunkenness may be shown:
>
> (a) Testimony of a medical officer who had made an examination of the accused at the time in question. Where possible it is deemed advisable to have a doctor make an examination of the accused as soon as possible after the condition of the accused is noted. The testimony of a medical officer is desirable, although it is not necessary in order to establish drunkenness.
>
> (b) "Incapacity for the proper performance of duty," is not a question

that must be proved by direct testimony of a medical officer or other person in authority, but it is a fact that the court itself may find to be proved by taking into account all the testimony as to the condition of the accused at the time in question. In other words if evidence is offered to satisfactorily prove that the accused is under the influence of intoxicating liquor, the court then is justified in arriving at a finding on its own initiative that the accused is incapacitated for the proper performance of duty.

(c) A finding of "under the influence of intoxicating liquor" may also be arrived at by testimony of a competent witness as to the condition of the accused at the time, such as the odor of intoxicating liquor on his breath, that the accused was unsteady in his gait, that he was incoherent in his speech, that his eyes were red and swollen and his sight impaired, that he was either wholly or partially oblivious of conditions about him, or other conduct or symptoms indicating intoxication.

There are many references to support the statement that a medical officer is not essential to support the charge of drunkenness. These (especially *10*) show that opinions which are practically instantaneous conclusions based on the daily observation and experience of a witness are admissible. The opinion of any intelligent witness may be accepted as testimony to the sobriety of the accused, and such opinions should be admitted by a court to prove the degree of intoxication though the accused may already have pleaded guilty to the charge of drunkenness. As stated in the exception as noted above, this is necessary to rebut the possible defense of the accused that he was unconscious and unaccountable for his acts (*11*).

As in civilian life, before answering hypothetical questions on the stand the medical officer must be qualified before the court as an expert witness (*12*).

It should be well known that medical illness directly resulting from and immediately following intemperate use of alcoholic liquor is subject to checkage of pay provided the illness causes loss of more than one day at any one time (*13*). In order to decide this there should be sufficient evidence as described above to prove intoxication (*14*). Similarly in case of fatal injury, to prove misconduct there must be evidence of the intoxication being the proximate cause of the injury (*15*). If the use of drugs, alcoholic liquors, or other misconduct prior to entry into the service results in an entry to the sick list for a disease or injury, it is held to be "not in the line of duty, but not due to his own misconduct" (*16*).

Misconduct as determined in the health record is an administrative matter to be determined by Navy Department regulations. It is independent of court-martial findings. The charge of misconduct has been permitted to stand on the health record in the case of an officer admitted for "delirium, alcoholic," and later acquitted on court-martial proceedings consequent to that admission (*17*).

Since mental or physical illness has frequently been offered as an excuse for drunkenness, the courts have decided a policy to be followed. Intoxication cannot be charged against an individual if it is due to the improper use of opiates or drugs (*18*). The offense charged should be the intemperate use of drugs. Nervousness is not an excuse for drinking. Intoxication occurring among those individuals diagnosed as "psychopathic state, inadequate personality" is regarded as misconduct (*19*). The failure of an individual to seek medical care when in a weakened physical condition cannot be accepted as an excuse (*20*). It is understood that an officer will have sufficient fortitude to withstand adversity and therefore cannot be excused if he allows himself to become intoxicated after a hardship (*21*).

Drunkenness which is the direct cause of an officer's admission to a hospital while he is on leave status is misconduct and as such is an offense (*22*). When the same occurs in an enlisted man he is said to be absent from his regular duties during his hospital stay and therefore subject to pay checkage (*23*).

This brief review is submitted not as a comprehensive study, but merely to direct attention again to an interesting and important aspect of Navy life.

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2. Court-Martial Order No. 6-1932, pages 6-7.
3. Court-Martial Order No. 1-1922, pages 14-16; No. 1-1923, page 8; No. 11-1925, page 5; No. 3-1930, page 11; No. 11-1930, pages 7-9; No. 7-1932, pages 7, 8, 15.
4. U. S. Navy Regulations, Article 13.
5. Court-Martial Order No. 1-1922, page 14.
6. Court-Martial Order No. 17-1917, page 4.
7. Naval Courts and Boards, Section 55.
8. Court-Martial Order No. 1-1929, pages 30-31.
9. Court-Martial Order No. 7-1927, pages 5-8.
10. Naval Courts and Boards, Section 227, and others.
11. Court-Martial Order No. 3-1929, pages 23-24.
12. Naval Courts and Boards, Section 229; Court-Martial Order No. 5-1927, pages 7-8.
13. General Order No. 20, paragraph 3.
14. Court-Martial Order No. 10-1936, page 6.
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16. Court-Martial Order No. 12-1922, page 11.
17. Court-Martial Order No. 1-1929, page 36.
18. Court-Martial Order No. 11-1929, page 8.
19. Court-Martial Order No. 4-1924, pages 3-8; No. 10-1932, page 11.
20. Court-Martial Order No. 91-1918, page 2.
21. Court-Martial Order No. 113-1918, page 2.
22. Court-Martial Order No. 10-1930, page 21.
23. Court-Martial Order No. 3-1933, page 8.

CHEMICAL DIAGNOSIS OF DRUNKENNESS

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Since the pioneer work of Bogen (*1*) (*2*) (*3*) on the relationship between the alcoholic concentration of body fluids and intoxication, there has been extensive investigation of the subject by a number of scientists. Bogen in a series of 300 patients found the incidence of intoxication with an estimated alcoholic concentration below 1 mg. per cubic centimeter to be zero percent; between 1 mg. and 2 mg. per cubic centimeter 50 percent; 3 mg. per cubic centimeter 75 percent; and 4 mg. per cubic centimeter and above almost 100 percent.

Johnson (*4*) reported 200 cases of acute alcoholism in Naval personnel. He considered all men with 3 mg. per cubic centimeter and above intoxicated, while 50 percent of those with 1 mg. & 2 mg. per cubic centimeter were so adjudged. More recently Jetter (*5*) investigated the blood alcohol concentration and presence or absence of intoxication in a series of 1,150 subjects.

A study has been made at this activity of a series of 500 subjects examined clinically and chemically for intoxication. The data so obtained are compared with those of Jetter in the table below.

It will be noted from the table that there is fair agreement between the two series, although Jetter found more individuals intoxicated at concentrations of 1 mg., 1.5 mg., and 2 mg. per cubic centimeter. There are two possible explanations for this difference in the findings. Either Jetter's clinical criteria of drunkenness were not as strict, or the class of individuals with which he dealt was less resistant to alcohol.

At this dispensary, individuals declared intoxicated were those considered unfit for duty by the examining medical officer. Jetter's

Comparison of chemical and clinical observations in two studies of acute alcoholic intoxication

Alcohol (mg./cc. whole blood)		0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
Percentage of men intoxicated	Jetter	10.5	18.5	47.0	83.6	90.0	95.1	96.0	93.3	100
	Newman-Ashenburg	10.3	7.9	22.1	34.9	80.5	100	95.0	100	100

criteria indicate a degree of intoxication more than adequate to render a man unfit for duty. Thus it is unlikely that a difference in criteria alone can account for the divergence in results.

The subjects examined at this Naval activity were for the most part young, vigorous males. On the other hand Jetter's material, taken from admissions to a public hospital, undoubtedly included both females and males of quite a different physical and social status. It seems probable, therefore, that the difference in results was due to a difference in material examined rather than in criteria of drunkenness employed.

The obvious conclusion to be drawn from the data presented is that there is a very definite relationship between blood alcohol concentration and clinical drunkenness. Thus blood alcohol determination is a useful adjunct in the diagnosis of intoxication. It is equally shown, however, that this relationship, although statistically valid, is subject to the individual variation characteristic of all biologic phenomena. In both series about 10 percent of individuals with blood alcohol concentrations of 0.5 mg. per cubic centimeter were clinically drunk, and yet at a concentration of 2.5 mg. per cubic centimeter, or five times the blood level of the first group considered, a small but significant percentage of them were sober.

This is merely experimental proof of the widely accepted opinion (*6*) that tolerance to alcohol varies widely among different individuals, and should be constantly kept in mind when applying laboratory findings to the diagnosis of intoxication. The determination of blood alcohol concentration may supply valuable information regarding the amount of alcohol which circulates in the individual's blood. It remains for the medical officer, utilizing this and all other available data, to determine whether or not the individual is drunk.

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CERTAIN PSYCHIATRIC REACTIONS IN OPERATORS OF ANTISUBMARINE SOUND GEAR

REPORT OF TWO CASES

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It has been recognized in industry that certain types of monotonous, repetitious work, requiring constant attention but infrequent intellectual effort, may give rise to nervous tension, anxiety, and early fatigue, which in turn may eventually lead to inattention and inefficiency. To combat this tendency it has been found helpful to limit the hours spent at such occupations and to intersperse the periods of work with brief rest periods.

In the modern, highly mechanized Navy, many men are occupied with highly specialized, technical duties, which require much concentration and unvarying attention to detail, but which are essentially monotonous and fatiguing. A task of this nature is that of the operator of the antisubmarine sound gear, who may work in a small space barely large enough to accommodate man and equipment. The man must sit facing a dial, around the periphery of which travels a small point of light, a sharp, high-pitched sound being given out by the machine at the completion of each revolution of the light.

The operator's duty is to watch the traveling dot of light, listen to the rhythmic sound, and govern manually the direction of the searching beam projected by the machine. When contact is made with a solid body in the water, an echoing note may be audible, but for much the greater part of the time there is no such contact and there is only the monotonous circling of the tiny light with its accompanying irritating pinging sound.

Although various types of such equipment may differ in details, the rhythmic repetition of auditory and visual stimuli is found in nearly all types. The fatiguing nature of this work is further increased by the stress of war, when the anxiety and increased emotional and physical strain attendant upon operation in dangerous waters are added factors, yet it is of the utmost importance to the security of the ship that the sound man be constantly alert and free from any distractions.

Cases are cited here of the development of psychotic reactions in two sound operators attached to a small vessel which had been

operating in a combat area for about 4 months. These men stood 4-hour watches, followed by 8 hours off watch, but rest periods were often disrupted by general quarters, drills, and so forth. That they were under considerable emotional strain associated with their occupation was recognized by their shipmates, who often jokingly referred to sound gear operators as becoming "ping happy." There was noted an underlying element of anxiety, and several men training for this work aboard ship expressed concern over the fatigue and "nervousness" resulting from a 4-hour watch.

It is not contended that the men whose cases are reported here became ill directly as the result of their duties as sound men; however the circumstances are believed to be of interest. Both cases occurred within a month of each other on the same ship. On this ship sound watches were thereafter reduced from 4 to 2 hours, and when possible the 2-hour periods were occasionally interrupted by 5-minute rest intervals. This policy necessitated the training of more men to operate the machine. During certain emergencies the best trained men were called to watch for indefinite periods of time, a situation which seems unavoidable in war.

CASE REPORTS

Case 1.—The first man to develop a mental illness was a seaman, first class, acting as a sound operator. He was 21 years of age, and had been in the service slightly over 2 years at the time of the onset of his illness. Quiet and rather reserved, his Navy adjustment had apparently been good. The first symptoms of his illness were manifested rather suddenly, and consisted of auditory hallucinations, ideas of reference and unworthiness, and marked religious preoccupations.

He was transferred to a hospital ship and then to shore facilities, where he became mute, catatonic, manneristic, fearful, and believed that he was being persecuted. There was little improvement after several months' hospitalization, the patient requiring tube feeding, and becoming a rather typical case of catatonic schizophrenia.

This man's social history was of interest. He came from a broken home, being cared for in an orphanage from the age of 4 to 11 years, when he was adopted. His mother had died while a patient in a mental hospital. The patient before his enlistment was described as being seclusive, egocentric, a poor student, and a "problem child." Despite this history, however, he was well liked aboard ship and his work was considered to be satisfactory.

Case 2.—Approximately 1 month later another case occurred. This patient was a sonarman, third class, 24 years of age, with about 2½ years of satisfactory service in the regular Navy. He was a rather aggressive, extroverted individual who was well liked by his associates. While at sea he became restless, overactive, and very talkative. These symptoms were intensified until he displayed grandiosity, flight of ideas, auditory and visual hallucinations, very defective judgment, and required restraint. After admission to a shore facility he displayed great emotional instability, confusion, paranoid trends, ideas of reference, and anxiety. He improved gradually under subconvulsive insulin therapy.

Although he was discharged from the hospital after several months, within a year's time a recurrence of his symptoms required his admission to another mental institution. The diagnosis of schizophrenia was made because of his bizarre mental content and inappropriateness of affect, the final opinion being that he had undergone a catatonic excitement. A review of the social history revealed no significant abnormalities, except that he had joined the Navy after scholastic failure in his second college year.

These two men showed somewhat different clinical reactions, but in each case confusion, anxiety, marked emotional instability, hallucinations, ideas of reference, and paranoid tendencies were noted. These clinical pictures are common and are not necessarily to be explained by the work done by these men. The question raised is whether their duties as sound operators acted as precipitating agents of their illnesses. The answer cannot be given now, but it should be of interest to record any similar cases occurring in like situations.

SUMMARY

1. It is suggested that the monotonous, repetitious work performed by antisubmarine sound gear operators (as well as certain other technicians) may give rise to a type of "occupational fatigue," which in some instances may lead to more severe psychiatric reactions.

2. Two case histories of sound operators who developed acute schizophrenic episodes while at sea are reported. These men, as well as other operators, complained of the nervous fatigue and tension attendant upon their 4-hour watches.

3. It is suggested that the situation might be relieved somewhat by more frequent rotation of the watch, with additional brief rest periods. The use of a sound of lower pitch and less irritating intensity might also be of value.

4. In selecting men for these duties, stable, less emotional, well adjusted types probably should be favored.

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HEN EGGS AND SALMONELLA INFECTION

There have been at the most only one or two food-poisoning outbreaks which might be ascribed to the use of infected hen eggs (excluding dried eggs). While infections with salmonella strains in hens have been fairly numerous—and expensive to breeder and owner—almost always the source of infection has been Salmonella pullorum or S. gallinarum, strains not pathogenic to man. Recent work shows, however, that more toxic strains may be present.—Editorial: Eggs and salmonella infections. Brit. M. J. 2: 760-761, December 9, 1944.

CORNEAL ANESTHESIA IN HYSTERIA

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The corneal reflex has been defined as a wink response elicited by touching the cornea, usually with a piece of cotton. Corneal anesthesia, then, is the failure of the reflex closure of the palpebral fissure normally functioning on such a stimulus. Since there may be recognition of the stimulus by the subject even though no response is elicited, in this study the failure to lacrimate and to close the palpebral fissure was used as the criterion for delineating the normal from the abnormal response.

The question of whether the cornea has touch fibers seems to have been settled in the affirmative of recent years. Wechsler contended that the cornea had only pain fibers. Gifford states that "from 60 to 80 nerves enter the cornea from the ciliary nerves at the limbus," not specifying what sort of impulses are carried. Marshall[1] held that the cornea had a dual supply, the upper half being supplied by the ophthalmic and the lower half by the maxillary. Rowbotham[2] states that the Sjöqvist operation, which severs the descending fibers of the trigeminal tract in the medulla oblongata at the level of the first vagal root, renders the cornea insensible. He says that there is reception of light touch as well as pain, but that touch is ordinarily in abeyance because it is overwhelmed by pain sensations.

The sensory pathways are in the ophthalmic division of the fifth nerve, the motor pathway in the seventh. Peripheral trigeminal innervation is ipsilateral, and cortical or thalamic innervation is contralateral. Fibers from the ophthalmic division descend lowest in the trigeminal root (sensory) almost down to the second cervical segment of the cord. As the corneal reflex is a consensual one, touching one side of the cornea causes bilateral winking. Because the seventh nerve furnishes the efferent side of the arc and the trigeminal the afferent, if the trigeminal nerve is involved, there is neither direct nor consensual winking, whereas if the seventh

[1] MARSHALL, E. N.: The sensory functions of the trigeminal and facial nerves with special reference to deep sensibility of the face and the innervation and sensibility of the cornea. M. D. Thesis, University of Manchester, 1931.

[2] ROWBOTHAM, G. F.: Observations on effects of trigeminal denervation. Brain 62: 364-380, December 1939.

nerve is affected, there is no ipsilateral winking but rather there is normal consensual response of the opposite eyelids.

From an understanding of this anatomy we can utilize this reflex for the localization of supra- and infra-tentorial lesions. posterior fossa neoplasms, and low central lesions. However in addition to these organic lesions in which the corneal reflex is unilateral, we also find the absence of reflex (anesthesia) to be bilateral in a large number of cases diagnosed as psychoneurosis, hysteria.

Since the reflexes are simple to elicit and are limited only by the number of subjects and the supply of cotton, a series was run on men being examined at an induction station to ascertain the relationship between corneal anesthesia and hysteria. In this series the men were divided into five groups consisting of (1) 200 literate inductees; (2) 100 illiterate inductees; (3) 100 Army personnel being reclassified; (4) 200 inductees rejected at previous examinations for neuropsychiatric reasons; and (5) 50 men, not included in group 4, on whom a specific diagnosis of hysteria was made.

In group 1, there were 5 men with bilateral corneal anesthesia or hypesthesia. In all cases this finding coincided with frank conversion symptoms. An example may be cited as follows.

Case report.—The inductee, a high school graduate, aged 19, had a marked right torticollis. Approximately 2 years ago a severe right torticollis had come on suddenly without apparent cause. Six months after onset, as there was no remission of symptoms, section of the right sternocleidomastoid muscle was performed. The torticollis had not been relieved by this operative procedure and at the time of examination the chin was pulled almost down to the right clavicle. There was no evidence of any organic or neurologic basis for this condition.

Because of the time element, the psychiatric interview was brief, and the psychogenesis of the condition was not learned. However there had been enuresis until the age of 12, and an overprotective environmental situation was revealed. Corneal anesthesia was bilateral. The visual fields were normal on gross testing. No specific visual field examination was performed.

In group 2, there were four cases of corneal anesthesia, again coinciding with conversion symptoms. However in this group there was one man with a hysteric aphonia (laryngeal examination did not disclose any abnormalities) and one with marked loss of visual acuity, and bizarre eccentricities of the visual fields. In both these men bilateral corneal reflexes were present. There was also one case of deafness which was contradicted by audiograms and was subsequently proved to be an instance of malingering.

In group 3, consisting of men already in the Army, one case of complete bilateral corneal anesthesia was discovered in a man applying for paratroop duty. Neurologic and psychiatric examinations did not reveal any abnormality.

There was in this group also one case of unilateral corneal anesthesia with no other neurologic findings. However a history of an old facial paralysis was elicited. The paralysis had completely disappeared except for this corneal manifestation.

In group 4, of 200 men previously rejected as psychoneurotic, approximately half were found to be fit for service after a review of their cases. Of the entire group, 8 had bilateral corneal anesthesia and all 8 had concomitant symptoms. None in this group had either corneal anesthesia or hysterical manifestations alone; both were invariably present.

In group 5, consisting of men whose conditions had been specifically diagnosed as hysteria and who were not included in group 4, all had various conversion symptoms, but 7 did not have corneal anesthesia.

SUMMARY

Among 600 men examined routinely there were 19 in whom the diagnosis psychoneurosis, hysteria, was made. There seemed to be no material difference between literates and illiterates. Seventeen of these 19 had bilateral corneal anesthesia. There was also one unexplained case of corneal anesthesia in a man otherwise apparently normal, and one case of unilateral corneal anesthesia attributable to an old facial paralysis. Among 50 men whose conditions had previously been diagnosed as hysteria, and who had confirming symptoms, 47 had bilateral corneal anesthesia.

It may be concluded, therefore, that bilateral corneal anesthesia must be considered an important and virtually pathognomonic sign of psychoneurosis, hysteria. No conclusions as to the cause of this sign have been drawn, but it has been suggested that the element of unwitting hypnosis exerted by the examiner must be considered.

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ROUTINE ROENTGENOGRAMS IN TUBERCULOSIS DETECTION

An analysis of 39 cases revealed that only through compulsory x-ray examination did the patients learn that they had active pulmonary tuberculosis. Contact was given as a source of probable infection in only 4 of the 39, 8 had minimal lesions, 14 were moderately advanced and 17 were in the far advanced stage of the disease. Twenty of the 39 definitely denied having symptoms of active pulmonary tuberculosis or of a persistent respiratory infection prior to their x-ray examination.—REST, A.: Role of roentgenograms in tuberculosis finding. Rocky Mountain M. J. 41: 906-910, December 1944.

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STREPTOMYCIN AND STREPTOTHRICIN

The search for a chemotherapeutic agent effective in the treatment of gram-negative bacterial infections recently led to the isolation of streptothricin. This agent was shown to be active in vitro and in vivo against a variety of gram-negative bacteria, as also in vitro against the tubercle bacillus.

Recently, a second substance was isolated in crude form from a microorganism called Actinomycetes griseus, which was named streptomycin. Like streptothricin, this substance was found to be active against gram-negative bacteria in vitro and in vivo.

Streptomycin seems to possess some advantages over streptothricin particularly from the point of view of toxicity and its greater action against certain gram-negative and gram-positive bacteria in vivo. Although certain batches of streptomycin appear to have the same order of toxicity as streptothricin, the findings suggest that under proper conditions a relatively nontoxic preparation can be obtained. Streptothricin seems to be much more effective in vitro against pathogenic fungi than streptomycin.—ROBINSON, H. J.; SMITH, D. G.; and GRAESSLE, O. E.: Chemotherapeutic properties of streptomycin. Proc. Soc. Exper. Biol. & Med. 57: 226-231, November 1944.

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BITE PATTERNS OF SNAKES

The literature on snake poisoning is misleading in stating that a pit viper in biting makes only one or two large punctures, in contrast to the several rows of small ones made by a harmless snake. It is demonstrated that pit vipers of the United States bite as effectively as most innocuous snakes; in no sense do they merely stab. The bite pattern of the pit viper, though not simple, can be recognized. Moreover a careful study of the bite may reveal the approximate location of the pocket of venom, the size of the snake and even its generic identity.

Physicians who report cases of poisoning should include diagrams of all marks made by teeth and fangs and thus help in the accumulation of data on bite patterns. Directions for the treatment of snake bite should explain the true difference between the patterns of harmless and venomous snakes and explain how interference by clothing will invariably modify both.—POPE, C. H., and PERKINS, R. M.: Differences in patterns of bites of venomous and of harmless snakes. Arch. Surg. 49: 331-336, November 1944.

EXPERIENCES WITH GROUP PSYCHOTHERAPY

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Men with the combat fatigue syndrome present a therapeutic challenge which is especially pressing when there are large numbers. The following description is based on experiences at a training station dispensary and at a Naval hospital. Most of the cases seen could be grouped into two categories, depending upon the dominant clinical picture. One group, numerically the larger, was characterized by anxiety symptoms in varying intensities. The other presented hostility and resentment as the dominant affect.

Naturally there were individuals with both anxiety and hostility traits. They were treated in the group in which they seemed to improve most, usually the anxiety group. The division into groups is important because the type of group therapy varies with the dominant clinical picture. The number of groups worked with was not large, but the distinction between "anxiety groups" and "hostility groups" and the types of therapy that were successful in each seemed sufficiently important to warrant description.

Both the arbitrary grouping and the methods of group psychotherapy were the result of trial and error. The groups, it was learned, must be small, no larger than six men. It is desirable to have the group meet in the psychiatrist's office. These meetings should take place at least three times a week and oftener if the pressure of work permits. Meetings should last about 45 minutes and not more than an hour. On the average, group treatments were extended over a period of from 4 to 6 weeks.

The group with anxiety manifestations as the predominating feature profited markedly by the didactic type of group therapy, with the psychiatrist acting as lecturer. The topics discussed were those relating to the particular symptoms of this group, how they probably originated, the effect of emotions on body physiology, what psychologic illness is, how their symptoms might be alleviated, the fear of death and mutilation that all have, the necessity and meaning of discipline, loss of freedom, and related subjects. The object was to give plausible, simple explanations not burdened with technical phraseology, along with considerable reassurance, sympathy, and an attitude of confidence that recovery would eventually result. Discussion was encouraged after the didactic presen-

tation and often brought up subjects which served as topics for another meeting.

The group with hostility and resentment dominating did not profit by didactic meetings. With them cathartic treatment, that is, complete ventilation of their hostilities, was best. The psychiatrist acted as a guide and funneled the hostility so that the meetings did not degenerate into a vituperative "gabfest." For example, a number of meetings might be devoted to hostility to "gold braid." This was usually constructively formulated as a counter aggression against a "father" figure who did not protect them or who was identified with a tyrannical father. The psychiatrist would attempt to guide the ventilation by pertinent questions or brief formulations so that in the end the catharsis served at least to obtain for the patient a constructive formulation in relation to the objects of his hostile expressions. Resentment has been difficult to treat, and this may be explained in part by what seems to be its psychopathology, which is discussed later.

Groups with anxiety–hostility profited by a combination of cathartic and didactic measures. And often those with marked hostility displayed considerable anxiety when the hostility subsided, necessitating didactic measures. Obviously the groups overlap and the technic of therapy must be flexible. On the whole the men treated gained in stability, assurance, security, and obtained moderate insight and at the same time a goodly amount of mental hygiene.

One of the most important findings in this study is that group therapy can only be an adjuvant to individual, personal psychotherapy. The success of any group therapy depends upon the relationship built up between the psychiatrist and the individual patient. The former must afford the patient security, reassurance, an acceptance of his illness and a willingness to be helped. In addition the patient must be encouraged to talk out his combat experiences during the personal interviews.

Individual therapy need not be a prolonged analysis and synthesis except in very rare cases. The stress and pressure of work make this impossible. But the problems of the patient can be handled as they arise, and when attitudes need further reorientation not achieved in a group, this too can be handled individually. Therapy can be enhanced by such simple acts as watching a group play cards or do finger painting. The mere interest shown helps the patient-psychiatrist relationship.

Inherent in the grouping are two questions. Why do some develop anxiety as the dominant affect and others hostility? Why does one therapeutic measure have more effect than another, de-

pending upon the dominant affect? Naturally these questions do not arise if one does not make the group distinctions.

In general it appeared that those who had a strong element of hostility in their personality picture had a lifelong pattern of counteraggression in which they were the object of what they considered an aggression. In most the aggression actually was a feeling of injury and abandonment and was usually fixed upon the officers (the officers representing authority and protective figures). Combat experiences with the resultant threat to personality integrity were common to all, but those who developed symptoms focused their counteraggression upon some external object or figure. Such individuals paid little heed to anxiety symptoms but were so bent on expressing their aggressions (hostility) that didactic presentations merely annoyed them, and abrupt pointing up of their hostility produced marked resentment. It seemed that psychologically they were attuned for catharsis.

The individual with anxiety and anxiety symptoms predominating in the clinical picture was far more interested in his symptoms and usually displayed exaggerated body concern. These subjects welcomed reassurance, security, and didactic procedures and gained comfort from the fact that they were not the only ones with these symptoms. Those developing anxiety symptoms as the result of the extreme peril to the personality were not those usually reacting with counteraggression, but rather those who reacted by means of withdrawal or self-directed aggression, of which exaggerated body concern and hypochondriasis may be considered a feature.

Anxiety appeared to be mainly the result of the extreme peril to the personality—more a fear reaction than the anxiety commonly known as anxiety neurosis and attributed to suppression of hostile impulses (or other explanations depending upon bent of thought).

Resentment was difficult to treat and was a frequent outlet of hostile expression, as were contempt and envy. Resentment is present in all of us to some degree, but in the hostility group it reached pathologic proportions and appeared to be a paranoid-like projection to the outside world of hostile and aggressive feelings. The development of such resentment is not attributable solely to combat conditions, but can be regarded as a personality pattern reaction of long standing, brought to pathologic intensity by the impact on that personality of the special conditions of combat.

In summary, with individual psychotherapy brief and basic, group therapy is successful. And in group therapy the method used depends upon the group. Those with anxiety dominant, profit most with a didactic approach; those with hostility dominant, profit with a cathartic type of treatment.

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PENICILLIN PASTILLES IN ORAL INFECTIONS

Penicillin included in a pastille under suitable conditions of manufacture is liberated in the mouth in an active form. The pastilles were made of gelatin and cut to a standard size, ⅜ inch square and ⅛ inch thick, to permit retention in the buccal sulcus. The penicillin strength varied from 1,000 to 100 units. The concentration in the mouth can be maintained, and the pastille can be kept for a period of at least 3 months without appreciable deterioration or loss of efficiency of the penicillin. It is simple to use and is well tolerated even by children.

Acute ulcerative gingivostomatitis (Vincent's type) can be treated more simply and more quickly with the use of penicillin pastilles than by any other method. Patients with acute hemolytic streptococcal tonsillitis, including scarlet fever, seemed to respond clinically to treatment with pastilles. The effect on the throat flora appeared to be rapid. The treatment of throat carriers of hemolytic streptococci proved disappointing, as was anticipated. Nevertheless it is of interest that they became negative while undergoing treatment. It appeared that surgical conditions of the mouth and throat could be kept free from pathogenic organisms during administration of the pastilles, with marked symptomatic relief. On bacteriologic grounds faucial diphtheria should be an indication for treatment with penicillin pastilles.—MACGREGOR, A. B., and LONG, D. A. Use of penicillin pastilles in oral infections; preliminary report. Brit. M. J. 2: 686-689, November 25, 1944.

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VITAMIN-C DEFICIENCY IN CHILDREN

Vitamin-C saturation tests performed on 848 children showed defective vitamin-C nutrition in a high percentage of the children. Despite the rare finding of frank scurvy, the children, most of whom came from slum districts, showed subnormal vitamin-C saturation when compared with children living in good conditions. The deficiency was especially noticeable in the year 1941-1942 when dietary sources of vitamin C were at their lowest. The low vitamin-C saturation found in children admitted to the hospital was partly due to the fact that many of them were suffering or recovering from various acute infections, such as pneumonia, gastro-enteritis, or febrile illness. It is suggested that children living in bad social conditions or those having infections should receive ample supplies of vitamin C.—WALLACE, D. H., and ADLER-TANZ, P.: Study of vitamin C saturation in hospital children. Glasgow M. J. 24: 55-64, September 1944.

TREATMENT OF ATELECTASIS

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Postoperative pulmonary complications frequently follow surgical procedures. Many of these are comparatively minor, manifested by excessive bronchial secretion and cough which causes the patient much distress from pain in the incision following forceful coughing. Frequently, however, patchy atelectasis or lobar atelectasis will occur, which if allowed to persist is always complicated by some degree of superimposed pneumonitis.

Incidence.—King (*1*) analyzed all postoperative pulmonary complications seen at the Massachusetts General Hospital during a 2-year period. He found that less than 10 percent were on a true infectious basis or bronchopneumonia. The other 90 percent represented varying degrees of bronchial obstruction on a mechanical basis, associated with some degree of pneumonitis. He found that 13 percent of all laparotomies and herniorrhaphies were followed by some form of postoperative pulmonary complication as compared with 1 percent for all other operations. Thyroid patients were particularly prone to develop pulmonary complications with an incidence of 7.4 percent. Of all laparotomies studied, gastric operations on males were the poorest risk, from 40 to 60 percent developing some form of pulmonary complication; any sepsis increased noticeably the incidence.

Cause.—Many theories have been advanced regarding the causes of postoperative atelectasis. In former years all pulmonary complications were classed as "ether pneumonia" on the theory that irritation from ether vapor somehow predisposed to the development of chest complications. This has been disproved by noting that as high an incidence of pulmonary complications follows spinal or local anesthesia as that following general ether anesthesia (*1*).

The commonly accepted theory now is that atelectasis, or pulmonary collapse, is a result of the postoperative depression of all the body functions. Bronchial secretions which the patient would normally cough up during the day, are not expelled because of the pain in the operative site from forceful coughing. To this general postoperative depression is added the elevation of the diaphragm incident to any laparotomy with interference in respiration, the restriction of tight abdominal binders, and the depressant effect of

morphine. These factors combine in the series of events which lead to the formation of an inspissated mucous plug, which partially or completely blocks off one of the larger bronchi, with absorption of the air distal to the bronchial plug.

Prevention.—The avoidance of surgery in the presence of an upper respiratory infection is a well-known surgical law. Patients with a chronic bronchitis are particularly prone to develop excessive bronchial secretion postoperatively, which frequently leads to atelectasis. If there is any evidence of increased bronchial secretion during the early postoperative period, the patient should be encouraged to cough, the nurse applying pressure support over the patient's incision to lessen the pain associated with coughing. Abdominal binders should be applied loosely so that they will not hinder respiration, morphine given in as small amounts as possible, and the patient's position changed frequently. Carbon dioxide inhalations have proved valueless in the prevention of chest complications (*1*).

Diagnosis.—Atelectasis usually occurs from the second to the fifth postoperative day and is associated with a sharp rise in temperature, pulse, and respiration. Depending on the amount of lung tissue involved, the patient may appear cyanotic. The leukocyte count will be elevated, usually around 20,000, with an increase in the segmented cells.

Examination reveals the patient, with an anxious facial expression, lying quietly in bed. He may complain of chest pain. If the atelectasis is unilateral there will be evidence of diminished thoracic excursion on the affected side, dullness to flatness on percussion, diminished to absent breath sounds, diminished vocal and tactile fremitus, and perhaps scattered râles.

X-ray film of the chest will demonstrate positive findings depending on the area and amount of lung tissue involved. It should be remembered that a mucous plug may completely occlude a bronchus so that no respiratory exchange is taking place, yet the lung in the x-ray will appear aerated. This is because it takes several hours for the air beyond the plugged bronchus to be absorbed completely. The x-ray film may not, therefore, give a true picture of the amount of lung tissue involved.

Usually there will be evidence of one or more positive x-ray findings, including increased density in the parenchyma, narrowing of rib interspaces, mediastinal shift, or elevation of the diaphragm. It should be remembered that it may be impossible to differentiate by x-ray a patchy atelectasis in both lungs from a bronchopneumonia; each appears as scattered areas of increased density.

Treatment.—Postoperative atelectasis treatment should be primarily through tracheal catheter suction or bronchoscopy. The majority of cases can be handled by catheter suction alone. The technic of this is not difficult and is within the scope of every surgeon and anesthetist. The posterior pharynx and epiglottis are anesthetized by spray with either 10-percent cocaine or 2-percent pontocaine solution. No attempt is made to anesthetize the trachea, as it is desirable to retain a strong cough reflex to aid in expelling the mucous plug. A No. 20 to 24 urethral catheter is passed through the nose and into the posterior pharynx. The larynx is then exposed by direct laryngoscopy with a laryngoscope, the catheter in the posterior pharynx seized with a right-angle forceps and the catheter passed directly into the trachea. The catheter is connected immediately to strong suction.

On insertion of the catheter into the trachea the patient coughs violently, raising thick, tenacious mucus into the trachea. The mucus is removed by suction through the catheter. The mucous plug causing the atelectasis is usually expelled by the violent cough reflex, and the collapsed lung reaerated with dramatic clinical improvement in the patient.

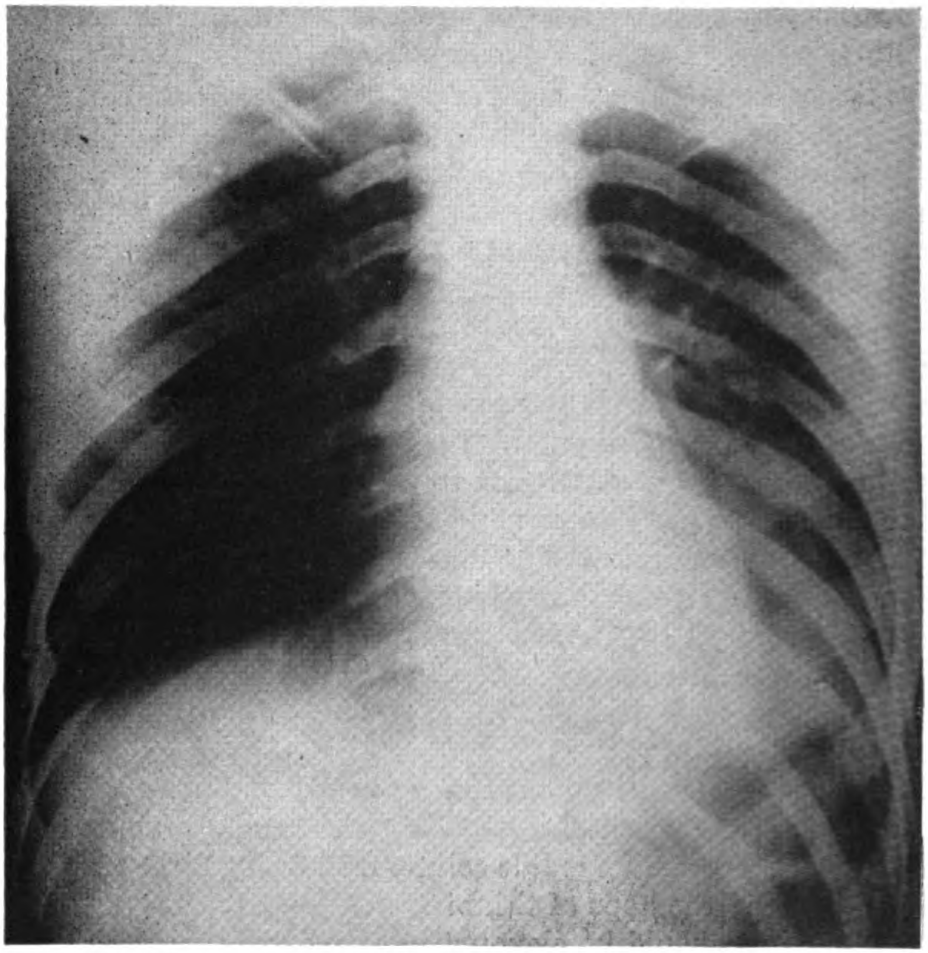
In addition to catheter suction or bronchoscopy, sulfonamides are usually given with the hope of preventing a superimposed pneumonitis. Potassium iodide solution, 10 drops three times daily, may be given in the hope of thinning the bronchial secretions. The foot of the bed should be elevated to assist in bronchial drainage, morphine is given in as small amounts as possible, deep breathing and frequent coughing are encouraged, and the patient is instructed to lie either on his back or on the unaffected side. Holinger, Basch and Poncher (*3*) have shown that carbon dioxide inhalations tend to liquefy bronchial secretion and may be used once or twice daily.

CASE REPORTS

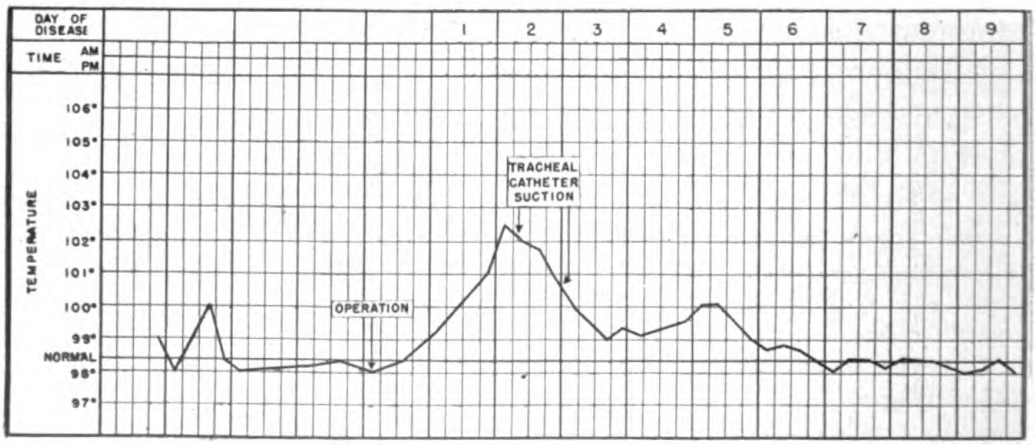
Case 1.—A 20-year-old white male entered the hospital 13 May 1944 complaining of frequent attacks of dull abdominal pain in the right lower quadrant. On 17 May 1944 a chronically inflamed appendix was removed under spinal anesthetic, using 15 mg. of pontocaine-dextrose.

On the second postoperative day the patient had a sudden onset of chest pain, dyspnea, and moderate cyanosis. There was an associated sudden elevation of temperature to 102.8° F. Examination at that time revealed dullness to percussion over the entire left chest posteriorly, with diminished to absent breath sounds. A film of the chest made with a portable x-ray demonstrated collapse of the left lower lobe.

Tracheobronchial aspiration with a No. 20 urethral catheter was carried out with dramatic clinical improvement. The cyanosis was immediately relieved, with complete disappearance of the chest pain.

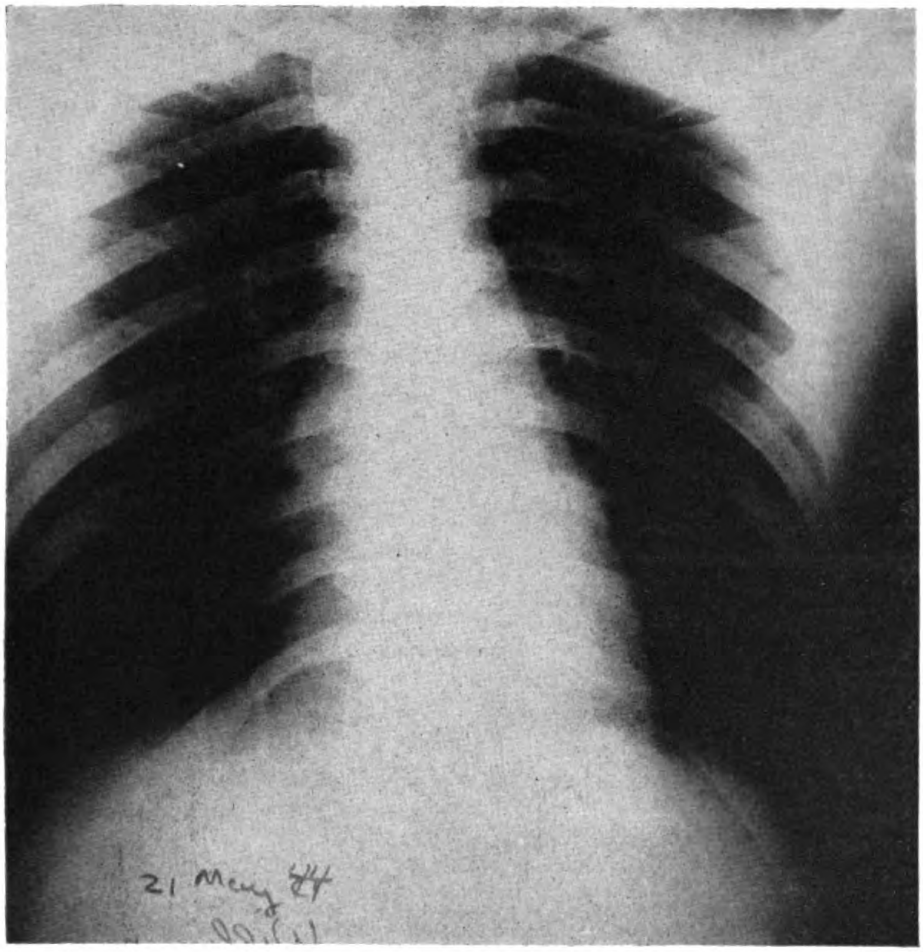


1. Case 1. Bedside film on second postoperative day, prior to tracheal aspiration.



2. Case 1. Clinical chart.

By the third postoperative day the patient exhibited noticeable clinical improvement, but examination revealed breath sounds moderately diminished over the left chest. Tracheal suction was repeated. The patient made an uneventful recovery, with normal temperature on the fifth postoperative day.



3. Case 1. Bedside film on fourth postoperative day, after tracheal aspiration.

Case 2.—A 19-year-old white male entered the hospital on 29 May 1944 complaining of pain in the right inguinal region. Examination revealed a right complete indirect inguinal hernia, and on 1 June 1944 a right inguinal herniorrhaphy was done, using 15 mg. pontocaine-dextrose spinal anesthetic.

On the second postoperative day there was a sudden elevation of temperature to 101.8° F. The patient appeared in moderate respiratory distress, although there was no evidence of cyanosis. Examination revealed decreased breath sounds, dullness to percussion, and decreased vocal fremitus over the entire left chest. On percussion the left border of cardiac dullness was at the anterior axillary line.

A film of the chest made with a portable machine demonstrated an atelectasis of the left lower lobe with mediastinal shift to the left. The patient's trachea was aspirated with a No. 20 urethral catheter. There was marked clinical improvement, and chest x-ray taken immediately after tracheal suction showed the atelectasis completely cleared and the mediastinum in the midline. The patient continued to improve and made an otherwise uneventful convalescence.

SUMMARY

Atelectasis is a postoperative complication comprising more than

90 percent of all pulmonary complications following surgery. It is particularly prevalent following laparotomies, herniorrhaphies, thyroidectomies, and any sepsis. It usually occurs on the second to the fifth postoperative day and presents classical physical signs and usually definite x-ray changes. It can be completely cured and a postoperative pneumonia and a stormy convalescence avoided by catheter tracheal suction alone in the majority of cases.

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EPIDEMIOLOGY OF SCRUB TYPHUS

The lessons to be learned from outbreaks of scrub typhus in Australian troops are that: Endemicity of scrub typhus is restricted to small foci of high infection widely separated from each other even in apparently similar terrain. These foci show an association with jungle-fringed streams. Infection of man takes place only at atmospheric temperatures over 65° F., and the usual incubation period is about 12 days.

There is no indication of the animal reservoir beyond the fact that it is probably an animal of semiaquatic and jungle habit. It is highly improbable that the wide diversity of rodents suspected by Heaslip serves as a reservoir for the infection of man, but there is no evidence to incriminate any one particular species of mite as the specific vector. It does, however, appear that the mites causing scrub itch are not concerned.

The epidemiology of scrub typhus is consistent with its transmission by larval ixodid ticks and the desirability of inquiry in this field is indicated.—COOK, C. E.: Observations on epidemiology of scrub typhus. M. J. Australia 2: 539-543, November 18, 1944.

TREATMENT OF EMPYEMA

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Modern chemotherapy and the use of penicillin have reduced the incidence and mortality of empyema following acute upper respiratory infections. During the last war, an empyema commission[1] was created to deal with the problem of empyema due to Streptococcus pyogenes. The present article, however, deals with a small number of cases of empyema, transferred for convalescent care to the U. S. Naval Convalescent Hospital, Asheville, N. C. The experience in management of these cases is reviewed here in the light of the lessons learned from the last war.

Before 15 March 1918, most empyema patients in Army hospitals were treated by rib resection and drainage, immediately following the discovery of fluid in the chest. The mortality among these cases averaged 30.2 percent. After 15 April 1918, in accordance with the recommendations of the commission, such an operation was delayed until the clinical condition of the patient began to improve and the character of the chest fluid became definitely purulent. The mortality rate dropped immediately to 4.3 percent.

The high mortality rate associated with early operation, especially of empyema caused by hemolytic streptococcus infection, was attributed to:

1. The occurrence of pleuritis either at the onset of the pulmonary infection or during the course of an extensive bronchopneumonia when the majority of patients were dyspneic and cyanotic. In addition the effusion was usually large and the adhesions between the lung and parietal wall were not sufficient during the first few days of the disease to prevent collapse of the lung when the pleural cavity was opened.

2. The fever being usually at its maximum when the exudate was formed. Patients were sometimes delirious and refused to take fluids. When the effusions were drained during this intensive toxemia, the delirium was often more violent and all nourishment and fluids were refused for the following two or three days. Thus no immediate benefit was derived from the operation.[2]

[1] The Medical Department of the United States Army in the World War. Vol. XI, part 2. Government Printing Office, Washington, D. C., 1924. pp. 33-392.
[2] Ibid.: pp. 261-284.

The advantages gained by deferring free operative drainage were:

1. The danger of creating an open pneumothorax during the pneumonic stage was avoided.

2. By the time the pneumonia had subsided and the pleural exudate had become frankly purulent, a more or less diffuse cellulitis of the pleura had become converted into an abscess shut off by adhesions, and the inflammatory thickening of the mediastinum made the mediastinum less mobile.

3. The reduction of toxemia and dyspnea associated with recovery from the pneumonic stage of the disease, made it more possible for the patient to withstand the danger of an open pneumothorax.

To tide the patient over the acute pneumonic stage, either repeated aspiration of fluid with a needle, or continuous closed drainage with a catheter and with instillations of Dakin's solution was done.[3]

When infection of the pleural cavity complicates an acute upper respiratory infection these days, the course pursued by that infection can often be altered by the sulfonamide drugs or penicillin therapy. The clinical condition of the patient can be made to improve in shorter time. The pleural infection may be aborted, the character of the fluid formed may never become frankly purulent, and the pleural cavity may more easily be rendered bacteriologically sterile.

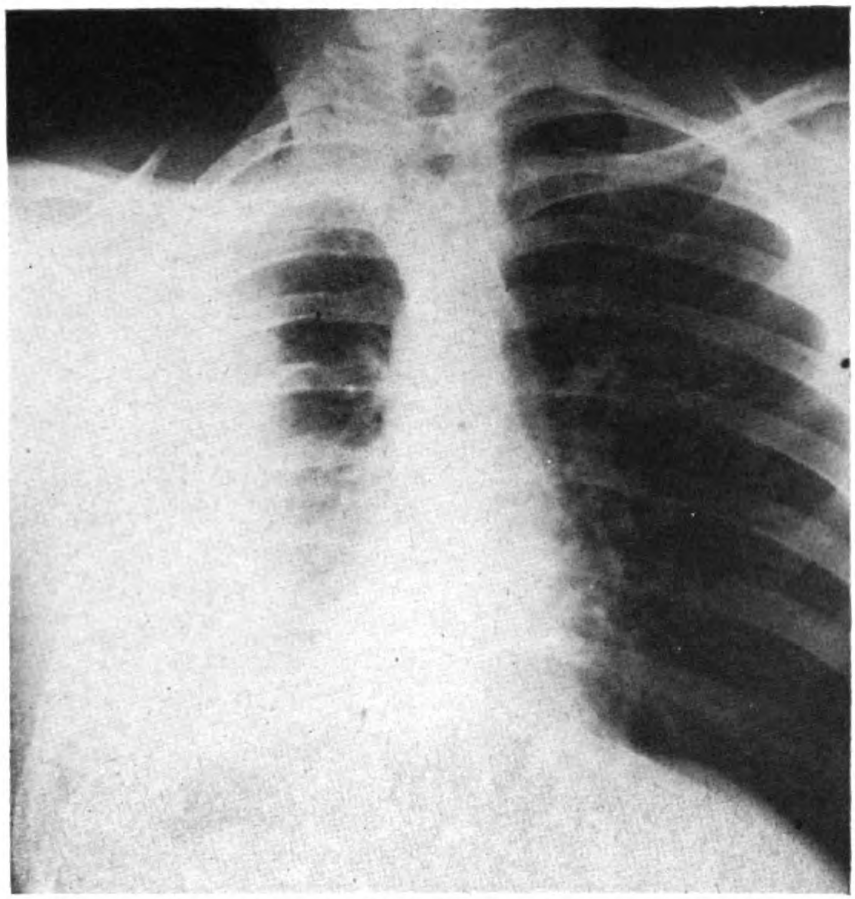
However judging from results among the cases transferred to this hospital, which were not treated by adequate surgical drainage, too much reliance is being placed on the ability of these drugs to cure empyema. According to Graham, the treatment in any case of empyema should be aimed at the saving of life, the prevention of chronicity, and the restoration to conditions that are as nearly normal as possible. These last two aims are not being attained in some cases because of inadequate surgical drainage.

The following case histories illustrate different aspects of the therapeutic problems of empyema.

CASE REPORTS

Case 1.—A 19-year-old male developed pain in the left side of his chest followed by fever. X-ray film of chest on 6 December 1943 revealed an extensive pleural effusion. Sulfadiazine was administered. Thoracentesis yielded 500 cc. of turbid yellow fluid 3 days later, and 10 days after this operation 790 cc. of similar fluid was obtained. The temperature became normal soon after and only from 20 to 50 cc. of thicker yellow fluid could be removed by three subsequent taps at 10-day intervals, although roentgen studies suggested

[3] The Medical Department of the United States Army in the World War. Vol. XI, part 2. Government Printing Office, Washington, D. C., 1924. pp. 285-319.



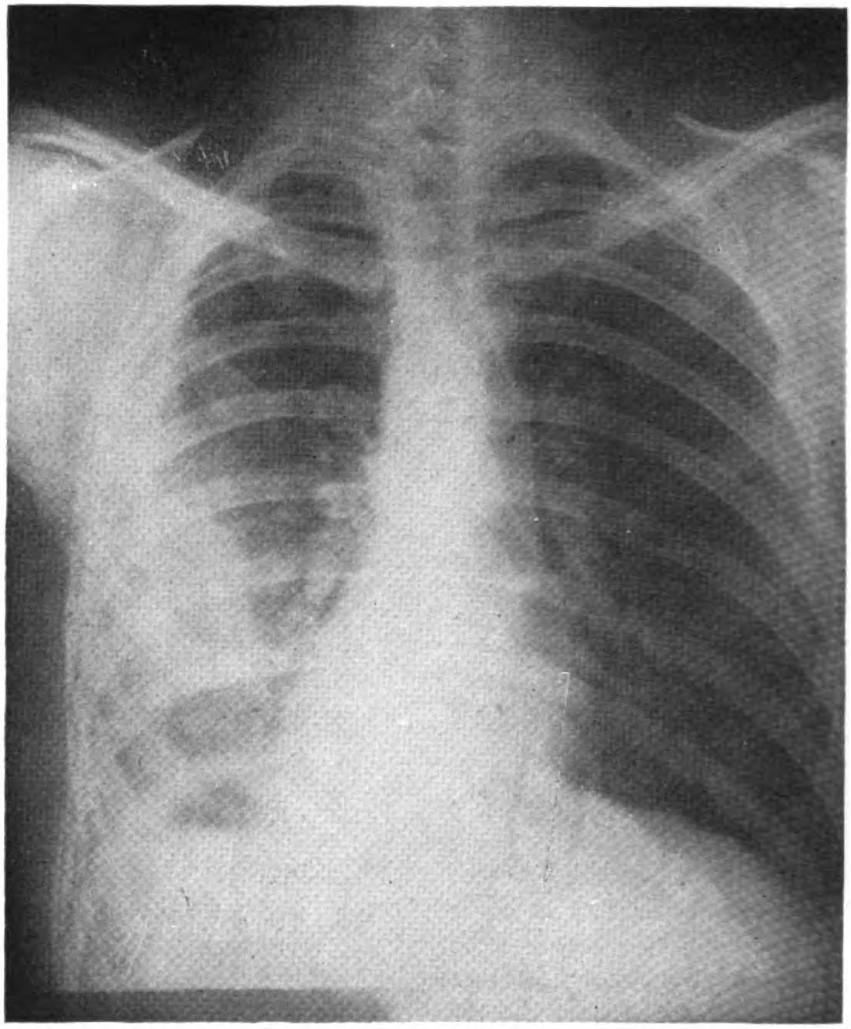
1. Case 1. X-ray film of chest showing large encapsulated empyema. Note shifting of heart and mediastinal shadows to the right (postero-anterior view).

the presence of larger quantities. The fluid was free of bacteria on direct smear and culture.

The patient was transferred to this hospital on 3 February 1944 for convalescent care. He complained of dyspnea on exertion, was afebrile, and x-ray film of chest (fig. 1) on admission revealed a large encapsulated empyema shifting the heart and mediastinum to the right. Blood sedimentation rate was normal.

Thoracentesis on 16 February 1944 yielded only 5 cc. of thick yellow fluid. This fluid was sterile and contained innumerable polymorphonuclear cells. Thoracentesis was again attempted 5 days later at different sites but no fluid was obtained. During his convalescence his general condition improved greatly and he gained 20 pounds in weight. The empyema was reabsorbed spontaneously, but at the time of the patient's discharge from the hospital on 21 July 1944 chronic pleuritis and secondary pulmonary fibrosis were demonstrable by roentgen-ray.

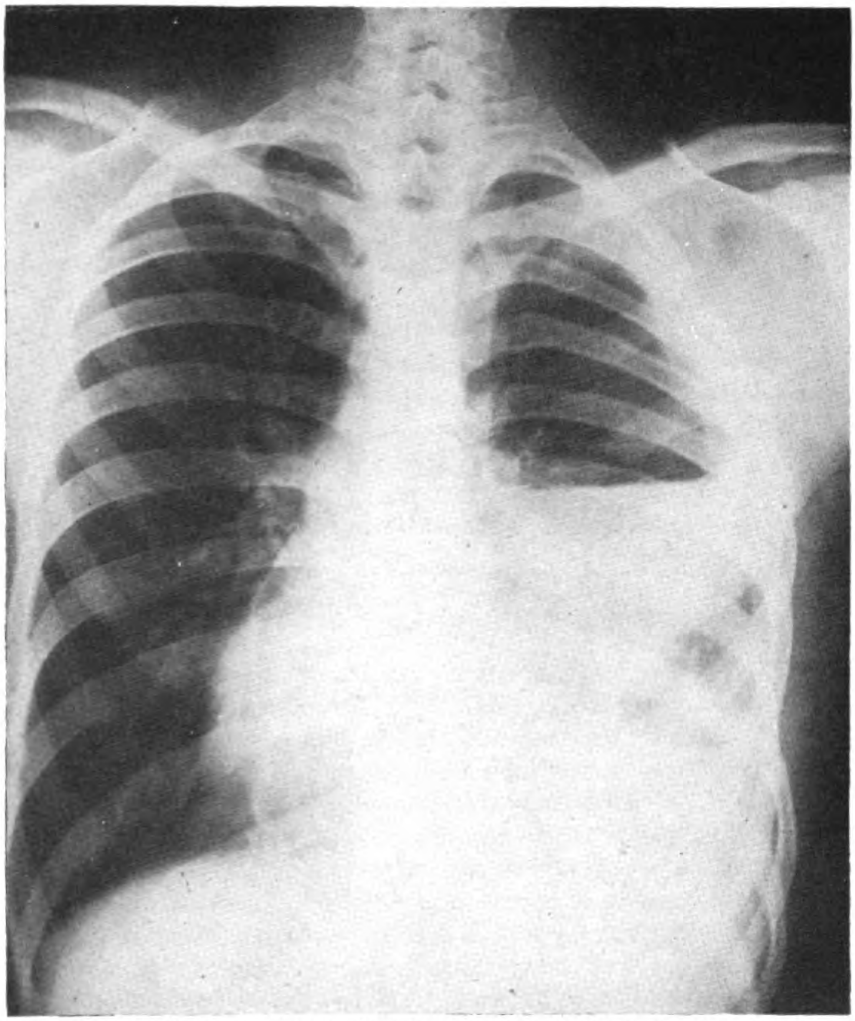
This case demonstrated the remarkable degree of resolution an empyema can undergo without the aid of surgical drainage. It was not possible to empty the pleural cavity by needle aspiration. This was also the experience in the last war. At operation, large masses of fibrin and necrotic tissue would be forced into the surgical open-



2. Case 2. X-ray film of chest showing encapsulated pleural effusion extending from apex to base of lung field (postero-anterior view).

ing by the patient's coughing and straining. These masses of fibrin were sometimes as large as the palm of the hand and if retained they delayed healing. In addition, the value of early bacteriologic study is emphasized. Of 138 cases of chronic empyema at Fort Sheridan during the last war, 10 percent were tuberculous. Although the case previously discussed is not considered of tuberculous origin, open surgical drainage of simple tuberculous empyema should ordinarily be avoided. The question raised by this case is whether adequate surgical drainage might have shortened the convalescence.

Case 2.—A 19-year-old male developed pain in the left side of his chest followed by fever. X-ray film of chest revealed a pneumonic infiltration near the left hilus and blood culture revealed pneumococci, untyped. Diagnostic thoracentesis yielded 20 cc. of turbid, yellow, thin fluid, containing type-9



3. Case 3. X-ray film of chest showing encapsulated effusion with pneumothorax in posterior portion of right side of chest (postero-anterior view).

pneumococcus. Sulfadiazine therapy was discontinued and penicillin was substituted 5 days after the patient's admission to the hospital. Following the withdrawal of 600 cc. of fluid, penicillin was introduced intrapleurally. Forty-one chest aspirations of fluid followed by instillation of penicillin were done in as many days. The fluid became thick pus. After 17 instillations bacteria were no longer demonstrable and the temperature returned to normal. The patient was transferred to this hospital for convalescent care on 18 March 1944. He complained of dyspnea on exertion and x-ray film of chest (fig. 2) revealed an encapsulated pleural effusion on the left side, extending from apex to base. Blood sedimentation rate was normal. During convalescence the patient regained his normal weight and became asymptomatic. Roentgen-ray film of chest on 28 July 1944, prior to his return to active duty, revealed residual thickening of the pleura of the left chest.

This case also demonstrates satisfactory recovery from empyema, without surgical drainage. The question, however, is whether surgical drainage might not have hastened recovery, especially when combined with the use of penicillin.

Case 3.—A 20-year-old male developed pain in the right side of his chest associated with fever. Roentgen-ray film of chest revealed a massive right pleural effusion. Thoracentesis yielded 750 cc. of straw-colored fluid, containing hemolytic streptococcus on culture. The chest fluid became thickened on subsequent aspirations and finally frankly purulent. Sulfadiazine therapy was discontinued and penicillin therapy, intramuscularly and intrapleurally, was instituted 3 weeks after admission to the hospital. The chest fluid became sterile 2 days after the change in therapy and his temperature dropped to normal. Fluid was aspirated and penicillin instilled intrapleurally on 4 subsequent occasions.

The patient was transferred to this hospital for convalescent care on 8 June 1944. He complained of weakness and dyspnea and was 20 pounds below his average weight. X-ray film of chest on admission (fig. 3) revealed an encapsulated effusion with pneumothorax in the posterior portion of the right side of his chest. Convalescence has not been complete, but his general condition has improved. Film of chest on 22 August 1944 revealed marked clearing of the pleural pathosis, with moderate residual pleural thickening.

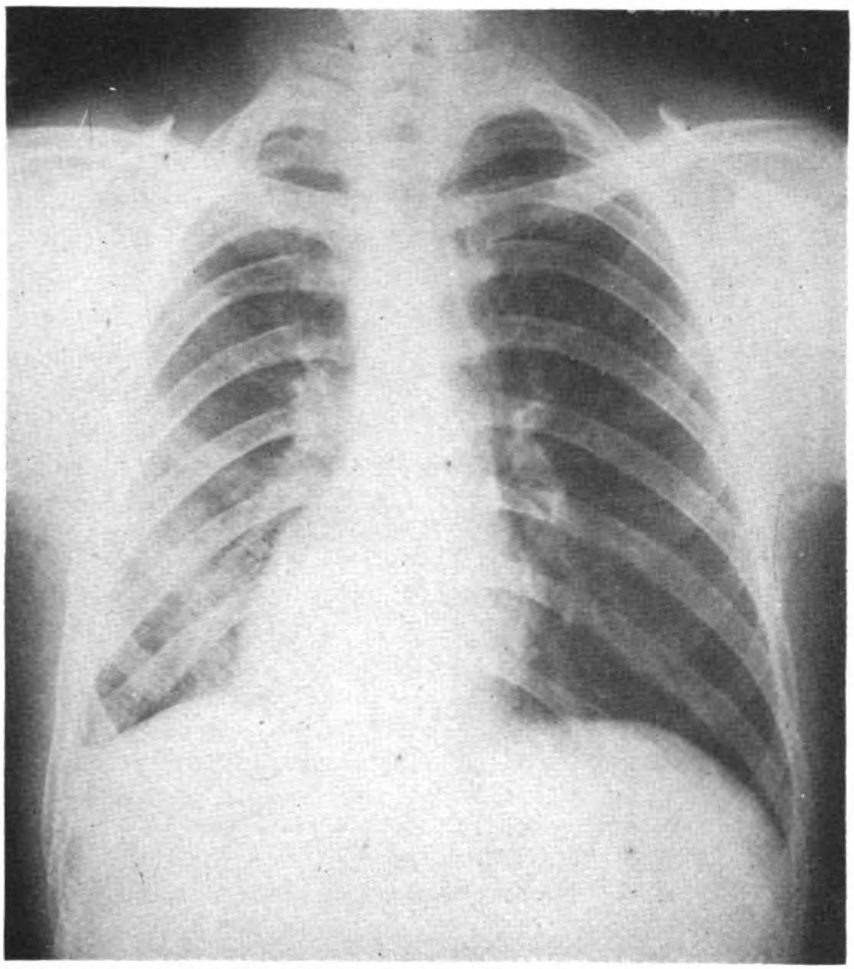
This case differs from case 2 in that hemolytic streptococcus instead of pneumococcus was cultured from the chest fluid.

Case 4.—This 18-year-old male was admitted to a surgical ward with a diagnosis of acute appendicitis. Hemolytic streptococcus was cultured from the chest fluid but treatment was dictated by the surgical aspect of the case. It illustrates the course pursued by many such cases treated in the last war without full use of the advantages of penicillin therapy.

This patient developed pain in the left side of his chest followed by fever. Physical examination revealed a spastic abdomen and he was admitted to the hospital with a diagnosis of acute appendicitis. Roentgen-ray examination of the chest revealed clouding at the left base. The patient did not respond to sulfadiazine therapy, and x-ray examination 6 days after admission showed a large left pleural effusion. Thoracentesis yielded yellow, cloudy fluid, containing hemolytic streptococcus on culture. Though the patient's general condition was considered definitely improved, the following week the temperature fluctuated daily, reaching 103° Fahrenheit.

Resection of the left ninth rib in the postero-axillary line was done one week later under local anesthesia supplemented by gas and oxygen. The left chest cavity was partly filled with purulent material of almost caseous thickness. A large rubber tube was inserted into the empyema cavity and the wound closed. A Wangensteen apparatus was connected to the rubber tube. In the late afternoon of the day of the operation the patient went into shock with a pulse of 140 and the usual cold, clammy skin. Plasma, dextrose in saline and sulfathiazole were administered intravenously. The patient improved the next day. Though his temperature was falling to normal, his condition was considered critical and penicillin was given intramuscularly, intrapleurally and into the chest wound. The temperature reading returned to normal. Nineteen days after instituting the penicillin therapy the chest wound was healed. Subsequent x-ray films of the chest revealed a residual pyopneumothorax which appeared to increase temporarily but soon began to reabsorb.

The patient was transferred to this hospital for convalescent care on 27 May 1944. He complained of slight dyspnea on exertion. Roentgen-ray examination of the chest on admission revealed an encapsulated effusion over the



4. Case 4. X-ray film of chest showing minimal pleural changes of the left side of the chest and obliteration of the costophrenic angle (postero-anterior view).

axillary portion of the left lung. The sedimentation rate was normal. Chest films on 2 August 1944 (fig. 4) revealed minimal residual pleuritis of the left side of the chest with obliteration of the costophrenic sinus.

The clinical course pursued by this patient was characteristic of that shown by the average case of streptococcic empyema during the last war. Sulfadiazine therapy did not dramatically affect the course of the disease, though it may have helped to localize the infection to the involved areas. The general condition of the patient improved as a result of symptomatic therapy, combined with aspiration of chest fluid to relieve respiratory embarrassment.

During the last war it was found advisable to wait for this general change in the patient's condition before surgical drainage was instituted. The character of the fluid found at operation in this case was described as thick purulent material of almost caseous consistency. This was in accordance with experience in the

last war, which convinced some surgeons of the futility of attempting to drain such material by needle aspiration.

The alarming character of the symptoms in this patient, which developed 7 hours postoperatively, was suggestive of the development of a large pneumothorax with mediastinal shift. The failure to use penicillin preoperatively was ill advised. The rapid clinical response following its use and the speed with which the empyema cavity decreased in size was impressive. The tendency for fluid to re-form, however, following closure of the chest wall is noted.

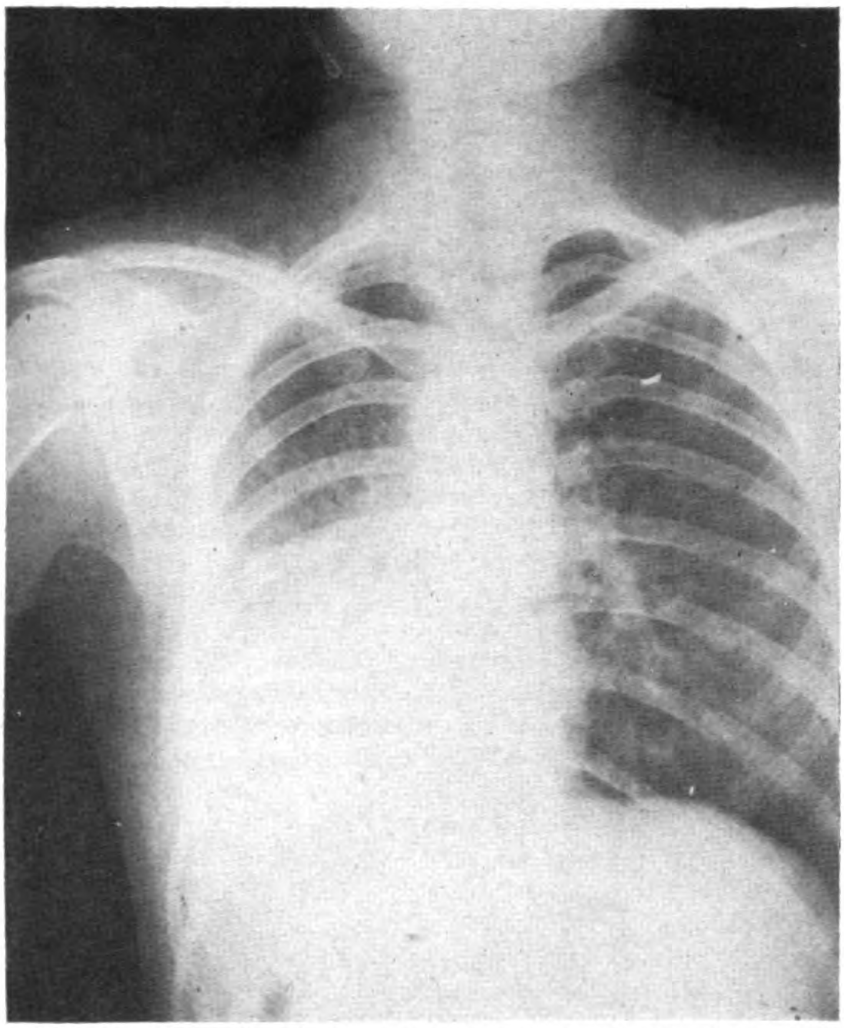
Case 5.—A 33-year-old female developed pain in the left side of her chest, associated with fever. Roentgen-ray examination of the chest revealed a left pleural effusion, and thoracentesis yielded thin purulent fluid containing hemolytic streptococcus. Sulfadiazine therapy was ineffectual. A catheter was introduced into the left pleural cavity and penicillin was administered intramuscularly and intrapleurally for 1 week. The temperature dropped to normal, the chest fluid became negative on culture and the catheter was removed. Following the removal of the catheter the fluid reappeared. It was found sterile.

Convalescence was complicated by a tendency for the temperature to fluctuate around 99° Fahrenheit. The patient gradually improved without specific therapy and was transferred to this hospital for convalescent care on 20 March 1944. X-ray films of the chest on admission (fig. 5) revealed an encapsulated effusion and thickened pleura at the base of the left lung. During convalescence the general condition improved and her weight returned to normal. Roentgen-ray examination of the chest on 8 July 1944 indicated only partial resorption of the pathosis at the left base. She was discharged to duty shortly afterward.

The final result in this case was not as satisfactory as in the previous patient who was treated with more adequate surgical drainage over a longer period of time. In the experience of the last war, purulent pleural pockets were found in from 4 to 5 percent of the patients during the third to the sixth month of convalescence. A persistent temperature, tachycardia, and failure to gain weight were associated with such an occurrence. This patient was clinically well at the time of discharge to limited duty.

During the last war there was much discussion of the relative merits of early needle aspiration followed later by open operation, and of continuous closed catheter drainage combined with the instillation of Dakin's solution. At the time Graham insisted that although the mortality rate associated with both procedures was not appreciably different, every case should be regarded as one in which an operation for the creation of free drainage would sooner or later be necessitated. Chronic empyema because of inadequate drainage was the most feared complication of the too conservative treatment.

Furthermore the use of Dakin's solution in empyema was then a



5. Case 5. X-ray film of chest showing encapsulated effusion and pleural thickening at left base (postero-anterior view).

highly regarded procedure. The main value of Dakin's solution was attributed to its ability to dissolve necrotic tissue and fibrin, as well as to its direct antiseptic action. The relative ease with which penicillin sterilizes these infected cavities is remarkable. The question arises whether Dakin's solution could be advantageously used, once the cavity has been sterilized.

CONCLUSIONS

All the patients with empyema admitted to this convalescent hospital have recovered sufficiently to return to active duty. Some of them have had at the time of admission small residual pleural effusions which underwent spontaneous and practically complete resorption in a relatively short period. Others, like those which have been discussed in this paper, have not cleared completely

during a hospitalization of from 6 to 8 months. In patients with large empyema, especially when positive bacteriologic findings are demonstrable during the acute stages and the fluid tends to become frankly purulent, some kind of adequate surgical drainage, combined with the use of penicillin, should shorten convalescence.

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WAR AND MENTAL HEALTH

Summing up the effect of war on mental health, no evidence was found that the war has brought about any increase in serious cases of mental breakdown. Though admissions to mental hospitals do not by themselves give a complete picture of the incidence of psychosis and neuropsychosis, they indicate the general trend. Even in the "blitz" areas there are relatively few cases in which the mental breakdown can be attributed with certainty to the effects of war and more particularly of air raids. Where breakdown appears to have been caused or accelerated by air raids it is generally found that the patients' past histories suggest that they might have developed mental trouble in any event, though possibly at a later date. Looking at the situation as a whole, it may fairly be claimed that the war has demonstrated the mental stability of the nation.—Editorial Annotation: War and mental health. Brit. M. J. 2: 762, December 9, 1944.

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VASOCONSTRICTORS IN THE COMMON COLD

The usual pH of the nasal secretion varies from 5.5 to 6.5, and this is presumably the optimum value, but it alters on very slight provocation. Cold induces alkalinity, and heat acidity. In acute rhinitis the reaction becomes increasingly alkaline. Rest and sleep, on the other hand, produce a shift towards acidity, and this immediately suggests one form of treatment for the common cold.

The remedies intended for intranasal application are nearly all vasoconstricting or astringent, and the patient is impressed by the sensation of clearness and coolness they suddenly, and as it were magically, produce in his nose. The reactionary congestion which comes later is ascribed to the cold, the obvious treatment for which is more drug. This cycle of congestion and decongestion often results in subacute and even chronic rhinitis. In the severe case the nasal mucosa is thickened and sodden, and the patient has the local symptoms of a perpetual cold.—Editorial Annotation: Vasoconstrictors in common cold. Lancet 2: 791-792, December 16, 1944.

SCALENUS ANTICUS SYNDROME

WITH REFERENCE TO INJURIES OF THE THORACIC DUCT

REPORT OF A CASE

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In the treatment of wounds at the base of the neck, and in elective surgery of this region, it is possible to injure the thoracic duct. Though these injuries are relatively infrequent, they are known to occur in procedures involving block dissections of the neck for tuberculous glands, in the radical extirpation of malignant lesions, and in scaleniotomy for alleviation of the neurovascular symptoms attributable to scalenus anticus compression.

Chyle is necessary for normal nutrition, containing as it does the constituents of modified blood plasma with emulsified fats and minerals. Loss of this metabolic product through persistent, unchecked lymph fistulae is productive of rapid dehydration and starvation, leading to extreme tissue desiccation, inanition, and death. Estimated losses of chyle from a chylous fistula vary from 50 to 100 cc. hourly, a considerable fluid loss over a 24-hour period. The added depletion of minerals and fats necessary for nutrition leads to rapid asthenia and collapse, the symptoms resembling those of a severe hypoglycemic reaction.

Normally chyle is propelled from one part of the body to another by the differential pressures existing at both ends of the lymphatic system aided by (1) respiration, (2) cardiac systole, and (3) the intrinsic contractile force of the relatively large amount of smooth muscle contained within the walls of the thoracic duct. The progress of flow is estimated at 4 mm. per second and is slower than the rate of flow of venous blood.

The scalenus anticus syndrome.—The scalenus anticus syndrome is a symptom complex of combined vascular and neurologic signs involving the shoulder, arm, and hand. In 1907 Murphy called attention to a disturbance referred to as brachial neuritis. Prior to exhaustive studies eliminating arthritis of the shoulder and diseases of the tendons and bursae about the shoulder, clinicians were forced to conclude that the patient suffered from a neuritis of unknown etiology. It is also a clinical fact that traumatic and infectious lesions of the shoulder girdle will produce symptoms not

unlike those due to cervical rib, and may be ascribed to muscular spasm incident to arthritis.

The pathologic physiology ascribed to cervical rib and its treatment by scaleniotomy were brought out by Adson and Coffey[1] in 1927. Cervical rib at the Mayo Clinic was diagnosed 303 times out of 540,413 admissions (an incidence of 0.056 percent) of which 84 were males and 218 females.[2] Indications for surgery to alleviate the symptoms of the scalenus anticus syndrome have been extended since the condition has had accurate anatomic diagnosis.

Surgery of cervical rib.—Resection of a cervical rib can be a formidable procedure to the occasional operator and is infrequently done, because section of the scalenus anticus muscle accomplishes the same result and is simpler. The technic of scaleniotomy is clearly and comprehensively described in any up-to-date surgical text. According to Adson:

> Comparing the simplified technic of the anterior approach and the division of the scalenus anticus muscle with the lateral approach and the retraction of the brachial plexus necessary to expose and resect the cervical rib, one appreciates very readily the difference between the two methods, to say nothing of the relative effectiveness of the two procedures. The former can be carried out with ease, whereas the latter requires considerable dissection and retraction of the brachial plexus.

Surgeons are generally in agreement that surgery is indicated in those cases causing disability of moderate or severe degree. When there is bilateral involvement, only one side at a time should be resected because of the inevitable temporary phrenic paralysis that ensues from traction upon the phrenic nerve at the time of operation. Most gratifying results from operation are achieved with the true anatomic type of cervical rib, with persistent symptoms associated with hypertrophies and contractures of the muscle. Symptoms of the simple muscular hypertrophies which occur in athletes and which produce compression of vessels and nerve roots, are alleviated by conservative therapy.

CASE REPORTS

Case 1.—A woman, 21 years old, complained of an inability to lie comfortably in bed during postoperative convalescence from appendectomy. She complained of lancinating pains unless she was propped up with two pillows beneath the shoulders. On the fifth postoperative day of an eventful convalescence, there were symptoms of numbness, tingling, and coldness of both hands, and profound cyanosis of the fingertips, with aching extending down the back of the arms into the fourth and fifth fingers, corresponding to the peri-

[1] ADSON, A. W., and COFFEY, J. R.: Cervical rib; method of anterior approach for relief of symptoms by division of scalenus anticus. Ann. Surg. 85: 839-857, June 1927.

[2] CHRISTOPHER, F.: A Textbook of Surgery. 2d edition. W. B. Saunders Company, Philadelphia, 1940. pp. 390-392.

pheral distribution of the ulnar nerve. The pulses were barely palpable at both wrists when the patient was lying prone.

X-ray of the cervical spine revealed bilateral complete cervical ribs. Since clinical symptoms were most pronounced and disabling on the left side, left scaleniotomy was performed.

Using a local anesthetic, scaleniotomy was executed by the anterior approach described by Adson. The anterior scalenus muscle was resected in close proximity to its insertion, releasing the subclavian artery and the posterior cord of the brachial plexus. No operative difficulties were encountered, and convalescence was followed by a total absence of symptoms.

Ten months later this patient gave birth to a 9-pound infant, and during the second stage of labor, right-sided symptoms developed. Operation was later successfully accomplished.

Case 2.—A 57-year-old man complained of symptoms resembling those of a pseudo-angina. His past medical history revealed a search for possible foci of infection, which included a tonsillectomy and extraction of all his teeth. Vitamin therapy, limitation of his smoking habits, xanthine diuretics, and rest were also tried without success.

Physical examination revealed the patient to be hyperkinetic. His temperature was 98.8° F., and pulse rate 86. There was an accentuated rhythm over the aortic and pulmonary areas and a moderate systolic hypertension. Exercise resulted in a rise of 18 millimeters of mercury in the diastolic blood pressure. Electrocardiographic studies and complete blood examination did not show any abnormalities. The blood nonprotein nitrogen and blood urea were without normal limits. There was a significant diminution in volume and stroke of the radial pulse bilaterally, slightly more pronounced on the right side.

Pain was accentuated when the patient was lying in such position that his shoulders drooped. There were lancinating pains about the shoulders, referred principally to the scapulae, which lasted into the night. There were no atrophies of the intrinsic muscles of the hand and no trophic disturbances of the fingers.

Scaleniotomy, performed on the left side through the Adson anterior approach, was followed by almost immediate and complete amelioration of symptoms. Incomplete bilateral cervical ribs were found at operation. The patient returned one year later for a right scaleniotomy which was done without complications. The patient is now completely freed from the brachial neuritis and has no anginal symptoms.

Case 3.—A young man, 19 years of age, was admitted to the hospital with complaints of severe burning pain and aching in his left hand and arm. The pain was intensified when he was driving a truck or sitting relaxed in a chair reading a book. His work required considerable manual labor, loading carts with ammunition. Pain in the left arm and hand gradually became disabling, necessitating the patient's absence from work several times weekly. His medical past and family histories were irrelevant.

Physical examination revealed the patient to be a well-developed, well-nourished male. The left hand was cyanotic in a dependent position, and the left radial pulse volume was much diminished. There was no motor loss but a distinct dissociation of pain along the course of the ulnar nerve, with obliteration of the radial pulse. Urine and blood analyses were within normal limits. X-rays showed a prominent left transverse process of the seventh vertebra.

At operation accidental transection of the thoracic duct was discovered in the course of dissection. The patient at first experienced a slight reaction to the procaine anesthetic, becoming restless and apprehensive despite adequate preoperative sedation. The sudden appearance of a moderate amount of chyle in the wound provided a grave complication.

A silk suture was placed around the transected end of the duct proximally and distally and the wound was lightly packed with gauze. Twelve hours later chyle saturated the dressings. A second ligation was done and the wound frosted with sulfanilamide. Drainage, however, persisted. Under the circumstances surgical intervention a third time was not deemed advisable. Fluids were administered in the amount estimated to replace the chyle lost, but appetite disappeared rapidly, tissue turgor diminished, and the chylous drainage persisted despite pressure and packing. As the dehydration and emaciation progressed, the respirations became more labored and rapid, which increased the output of chyle.

Episodic and cyclic weakness not unlike semicoma set in on the eighth day and persisted until death. Cyanosis and air hunger became more profound, and the patient expired on the twelfth postoperative day. Permission for necropsy was not obtained.

COMMENT

When transection of the thoracic duct occurs, two methods of treatment may be pursued: (1) Ligation of the severed ends of the duct proximally and distally in the hope that collateral circulation will be established; and (2) lateral anastomosis of the duct to the subclavian vein. This is a difficult technical procedure.

Injury to the thoracic duct can cause pathologic disturbances leading to rapid fatality from tissue dehydration, starvation, inanition and death. Restoration of proteins in the form of blood and plasma without fat and minerals, in the presence of uncontrolled fistula, is insufficient to avert a fatal outcome. The conceded mortality is from 15 to 20 percent. The margin of safety with depletion of fat and minerals is far less than that with protein starvation alone, and adequate replacement of the lost chyle by the parenteral route should be attempted.

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PIN TRANSFIXION OF FRACTURES

Ambulation and early mobilization of joints should not be the motivating factors for the use of external mechanical pin fixation. It should be restricted to certain problem fractures and to persistently displaced compound fractures, in which, by visual manipulation, the reduction can be facilitated and maintained until a properly fitting encasement can be expected to maintain the realinement of the fragments.—SIRIS, I. E.: External pin transfixion of fractures; analysis of 80 cases. Ann. Surg. 120: 911-941, December 1944.

MISTAKES IN WAR SURGERY

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Too few surgical errors are discussed in the literature. More case reports in which diagnosis and treatment were faulty, would probably save as many lives as the too frequent, glowing reports of cases handled correctly. Errors emphasized by pertinent case reports enable one to avoid pitfalls.

The following cases are presented not in the spirit of casting aspersion upon the responsible surgeon but rather to learn from retrospect a possibly better surgical management, under combat conditions, of a severely wounded patient.

The wounded are grouped into those with abdominal and those with extremity injuries.

ABDOMINAL WOUNDS

Treatment of penetrating wounds of the abdomen presents a grave problem, particularly in a forward combat area. A few salient points however should be emphasized. The importance of early operation is well recognized and operation is expedited by rapid administration (1,000 cc. in 10 minutes) of blood and plasma, as a shock control measure. The slow administration of intravenous fluids when their remedial effect is urgently needed is an anachronistic carry-over from the days when a severe reaction could be expected with most intravenous medication. It is believed here that citrated blood, quantity for quantity, is two to three times as effective as plasma in the treatment of primary and secondary shock. This is based on clinical observation unaided and unconfirmed by laboratory procedures. The only reason to operate on a patient in shock is to control hemorrhage.

Holes in the small intestine should be closed transversely with avoidance of resection if possible, but if the closure of a defect in the small intestine narrows it unduly, the insertion of a small rubber tube into the lumen will keep this open until edema subsides. As many as two tubes have been used successfully in closure of extensive small intestinal wounds. This tube is later passed by the patient through the rectum. When a V-shaped defect is present in the small intestine and it is feared that closure will result in undue narrowing of the lumen, the wedge may be widened by excising the sides of the V so as to increase the acute

angle. Closure then results in a lumen which is larger than it was before the wound was incurred. When resection is necessary, cutting the bowel obliquely will avoid undue narrowing of the gut when an end-to-end anastamosis is to be used.

All wounds of the colon should be exteriorized and a double-barreled colostomy done with the afferent and efferent loops sutured together after the method of Mikulicz. Wounds of the colon should not be sutured and returned to the abdomen, although this can at times be successfully done, particularly if Wangensteen continuous suction is used and if a Miller-Abbott tube can be introduced into the lower ileum. A free or attached omental graft should be applied over the suture line of any large bowel wound which is closed and returned to the abdomen; the same procedure should be done moreover over any other doubtful suture line. A wound of the rectum should be treated by debridement, drainage, suture of the bowel when possible, and a double-barreled sigmoidostomy.

When a retroperitoneal hematoma involving the mesocolon is present, a leaf of the mesentery should be incised and the posterior surface of the colon inspected. If a wound of the colon is present, the colon should be exteriorized, and drainage of the retroperitoneal tissues instituted, preferably through the flank. If no wound is present the mesentery should be closed without drainage.

The postoperative care of the patient is as important as the actual operation and his safety is furthered by tube decompression of the gastro-intestinal tract. The Miller-Abbott tube is essential in many cases, but continuous Wangensteen duodenal drainage using a duodenal tube size 18 F. inserted through the nose is very satisfactory in most cases if started immediately after operation. The rectal tube should be used, occasionally with Wangensteen suction, but it will not replace colostomy. Occasional irrigation of the rectal tube with hydrogen peroxide prevents its obstruction with fecal particles. Parenteral administration of adequate fluids and sulfadiazine is important, but 5-percent dextrose-saline solution should be alternated with 5-percent dextrose in distilled water in order to avoid edema due to chloride retention, and a urinary output of 1500 cc. should be maintained. A red blood cell count of above 4,500,000 should be attained as soon after operation as possible, but the administration of 500-cc. transfusions of citrated blood, and frequent small (100- to 200-cc.) blood transfusions and 2 or 3 units (500 to 700 cc.) of plasma each day should be given throughout the immediate postoperative period. The benefits of removal to a rear area are overrated and

should not outweigh the well-known dangers of moving a recently operated patient. Late evacuation (after 7 days) is important.

CASE REPORTS

Case 1.—A 20-year-old Marine, was shot as he was crawling into a foxhole. The bullet (Jap 25 mm.) entered the left buttock in the gluteal fold 6 inches from the midline and emerged in the right posterior axillary line about 1 inch below the costal margin. The medical officer who admitted the patient failed to note the buttock wound, as the patient was covered with blood and mud in this region. The patient was admitted to the ward and the attention of the medical officer was promptly called to the buttock wound by an alert corpsman. Feces and blood were exuding from the wound. Rectal examination revealed a tear of the posterior rectal wall 1 inch long, 2 inches above the anus. Laparotomy under ether anesthesia, approximately 8 hours after he was wounded, revealed that the bullet had not entered the peritoneal cavity, but there was approximately 40 cc. of a thin serosanguineous fluid in the peritoneal cavity with a large hematoma of the sigmoid mesocolon. The lateral layer of the peritoneum covering the sigmoid mesocolon was incised and the posterior wall of the colon inspected, but no perforation was found. Two soft rubber drains were inserted into the buttock wound down to the rectal tear.

The patient's postoperative course was stormy and complicated by bronchopneumonia accompanied by much coughing; rectal hemorrhage was alarming the first day. On the fifth postoperative day the abdominal wound disrupted. Examination disclosed that neither the operative wound nor the peritoneal cavity was infected. The wound was closed with through-and-through braided silk sutures under intravenous sodium pentothal. Four blood transfusions and adequate parenteral fluids were given. Both bullet wounds drained profusely. Occasional sloughs of necrotic tissue emerged from the buttock wound but there was no evidence of peritonitis at any time. The patient died of retroperitoneal sepsis on the tenth day after the first operation. A long unavoidable trip by boat on the ninth postoperative day contributed to, but was not the primary cause of this man's death.

According to Gordon-Taylor, 20 percent of the wounds of entrance in penetrating wounds of the abdominal cavity are in the buttocks; therefore this region should have been carefully inspected. The buttock wound may be very small and appear innocuous. Careful questioning of this patient would have been helpful. Excision of the wounds of entrance and exit to remove dead tissue and provide free drainage, and suture of the rectal wound were indicated, and it is believed in retrospect that a double-barreled Mikulicz sigmoid colostomy should have been done, and that this omission was the main error in this case.

Case 2.—The patient, a young Marine, was admitted soon after having been shot in the right loin. The wound of entrance was 1 inch above the crest of the ilium in the posterior axillary line and there was no wound of exit. The wound was dressed and the patient sent to the ward. One-half hour later a medical officer, redressing the wound, noted drainage of a dark bloody fluid with a fecal odor.

At operation, 5 hours after the wound was incurred, and with ether as the anesthetic, it was found that the bullet had not entered the peritoneal cavity. The lateral attachment of the cecum was incised and the laceration in its posterior wall, one-half inch long, was repaired using two layers of sutures. Sulfanilamide crystals were placed in the loin wound. A Penrose drain was placed from a point 1 inch from the suture line along the bullet track to the wound of entrance, and the suture line was placed retroperitoneally by suturing the cecum back into place. Sulfanilamide crystals were placed in the peritoneal cavity, which was closed without drainage.

The postoperative course was characterized by the usual signs of sepsis. The patient was placed on the Ochsner regimen and was given frequent blood transfusions, but he died on the ninth postoperative day of retroperitoneal sepsis.

At autopsy the hole in the cecum was found open. From the clinical course the sutures must have held about 5 days. There was no peritonitis but the retroperitoneal tissues were involved in an inflammatory process, with the production of an extensive brown slough. The spinal process of the fifth lumbar vertebra was fractured by the bullet which had lodged in this region.

This patient would probably have had a better chance for recovery if the cecum had been mobilized medially so that the cecal wound could have been exteriorized. Closure of the defect lateral to the cecum could have been effected by suturing a portion of the omentum into it as a free or attached graft. In the event that the cecal wound could not be exteriorized, a cecostomy by relieving local tension would have expedited healing.

Two months after this man's death, it was learned that one of the blood donors used had suffered an attack of malaria the day after the transfusion, a not uncommon occurrence. Although malaria played little or no part in the patient's death, it is highly advisable that a malarial smear be done every day on every sick surgical patient in malarial regions and on those who have been in a malarial region during the preceding two years. The blood for this smear should be taken at the peak of the fever, but the smear is often positive in an afebrile patient.

When few or no laboratory facilities are available, a sick surgical patient under these conditions should receive from 10 to 15 grains of quinine dihydrochloride intravenously every day, and this should be supplemented and eventually replaced by quinine and atabrine by mouth as soon as it is clinically possible. If intravenous quinine is not available the following mixture may be used by rectum:

	Gm. or cc.
Quinine dihydrochloride	1
Starch	90
Water q.s. ad	120

The administration of anything by rectum should be avoided in a patient with an actual or possible peritonitis.

Case 3.—The patient was a young Marine who was shot approximately 7 inches below the inguinal ligament in the center of the anterior surface of the right thigh. The bullet traveled upward and to the left. Examination revealed that the abdominal wall was rigid and tender; for this reason an exploratory operation was believed indicated. This was done 8 hours after the injury had been incurred. A left rectus incision was made under a spinal anesthetic. Two holes, 1 inch long and ¼ inch wide, were found in the descending colon approximately 12 and 15 inches respectively below the splenic flexure. Unfortunately the sigmoid colon was filled with solid feces and several large fecal masses were lying free in the peritoneal cavity. The feces were removed and the holes in the colon closed with a double row of continuous catgut sutures. Sulfanilamide crystals were placed in the peritoneal cavity, and two rubber drains were inserted in the pelvis. The radial pulse became imperceptible during the operation. Four units of plasma (1,000 cc.) were given intravenously, and at the conclusion of the operation the radial pulse was 120 and of fair quality; the general condition was good. Postoperative treatment was routine, the only possible criticism being that gastric suction was not continuous and the Miller-Abbott tube probably was not passed beyond the stomach. The patient followed a febrile course and died of peripheral circulatory collapse due to sepsis about 7 days postoperatively.

At autopsy the gastro-intestinal tract was distended by gas and fluid, and a generalized peritonitis was present. Examination of the two suture lines revealed that the lower one in the colon leaked gas upon pressure.

Spinal anesthesia in a penetrating wound of the abdomen is to be condemned on two counts: (1) It is not advisable to give a spinal anesthetic when a patient is in shock or potentially so, and almost all penetrating wounds of the abdomen encountered in war surgery fall into these two groups. Spinal anesthesia is contraindicated because it dilates the small peripheral blood vessels in a patient with a diminished blood volume, who needs all available blood to nourish the more central vital structures, and this small blood vessel dilatation also produces a harmful stasis anoxia. It has been said that spinal anesthesia is the ideal form of euthanasia in war surgery. (2) A spinal anesthetic causes the intestinal tract to contract, tending to express the contents of the intestines into the peritoneal cavity.

In this case the perforations of the colon were closed and the colon returned to the abdomen, but a much safer procedure would have been to exteriorize the two wounds of the colon and to sew the afferent and efferent loops of the colon together after the method of Mikulicz. The lateral leaf of the descending mesocolon can be incised to facilitate its anteromedial mobilization. It is believed by some that a Miller-Abbott tube introduced into the terminal ileum is as efficient as a colostomy in decompressing the colon, but this may be incorrect, and because of the occasional failure of the Miller-Abbott tube to pass through the pylorus and the frequent lack of time to devote to this procedure, the colostomy is probably more satisfactory for field use.

The failure to keep this man's intestinal tract at rest was caused by clamping off the suction at times, and by permitting the Miller-Abbott tube to become obstructed. No well-executed attempt was made to pass the tube through the pylorus, although it was assumed that it was in the small intestine.

Case 4.—A young Marine who had been bayoneted several times was brought to the hospital. When he was seen in the operating room, it was noted that there was a bayonet wound in the right anterior axillary line about 4 inches above the costal margin. A thigh wound which was present was not examined by the surgeon and it was assumed that the wound in the anterior axillary line had penetrated the abdomen. Moderate tenderness and rigidity were present; this was most noticeable in the right lower quadrant. The abdomen was opened 5 hours later, using an upper right paramedian incision. There was 75 cc. of blood in the peritoneal cavity, which seemed to be mostly in the right lower abdomen. No wound of the parietal peritoneum or liver could be palpated, but it was wrongly assumed that the blood in the peritoneal cavity was due to an undetected wound of the liver. Further exploration of the abdomen was not done; sulfanilamide powder was placed in the peritoneal cavity and it was closed without drainage.

The patient's postoperative course was unsatisfactory and he died 3 days after the operation with the symptoms of circulatory collapse. At autopsy it was noted that the bayonet had passed upward from the right thigh beneath the inguinal ligament, through the right rectus muscle, and injured the sigmoid colon. This wound was 1 inch in length. Solid feces were in the colon near the wound cavity. The wound in the anterior axillary line did not enter the peritoneal or thoracic cavity. Both lungs were collapsed in the posterior part of the thoracic cage, but no obstruction to the bronchi or trachea was noted. The pulmonary collapse seemed to be the immediate cause of death, although the wound of the colon undoubtedly would have caused a fatal peritonitis.

Careful questioning of the man as to his position at the time of injury and that of his assailant would probably have yielded valuable information. All wounds should be inspected by the operator before abdominal exploration. As in Case 3, in which the wound of entrance was in the anterior right thigh, the intestinal wound in this patient was in the descending colon.

Case 5.—This patient was a young Marine who had been wounded by a mortar shell fragment, with a wound of entrance approximately 1 inch in diameter, 1 inch below and 1 inch to the left of the xiphoid process. The patient complained bitterly of pain. His abdomen was rigid but his general condition was good. A spinal anesthetic, procaine hydrochloride (150 mg.), was administered, but as the patient still complained loudly a 2.5-percent solution of pentothal sodium was given intravenously with a rapid disappearance of abdominal rigidity. On palpation a foreign body was felt 1 inch lateral to the outer margin of the right rectus muscle and approximately 6 inches below the costal margin. The wound track between the wound of entrance and the foreign body, was opened and it was found that the shell fragment had passed through the right rectus muscle severing it completely, exposing but not perforating the posterior rectus sheath. The shell fragment

measured ½ by ½ by ¼ inch. Sulfanilamide powder was placed in the wound which was left open, and the patient made an uneventful recovery.

When there is a wound of the anterior abdominal wall and doubt exists whether the peritoneal cavity has been entered, the wound should be opened and explored under local or ether anesthetic, usually the former. Probing is usually unreliable and inadequate. The fact that the use of procaine locally inhibits the local action of the sulfonamides should be ignored. If the peritoneum has been entered, the peritoneal defect should be closed if it is larger than the width of an ordinary pencil, the wound treated with sulfanilamide crystals and left open. Excision of the wound, especially when the causative missile is a bomb or shell fragment, is advised.

Following this procedure will avoid many unnecessary explorations of the abdomen, but if doubt exists the abdomen should be opened. This should be explored through a separate incision, using another set of instruments. In cases where the possible penetration is through the posterior peritoneal wall, an exploration through the anterior abdominal wall is usually the only safe way to rule out penetration.

This patient, who was thought to be suffering from a penetrating wound of the abdomen, was given two anesthetics which are both contraindicated in gunshot wounds of the abdomen. Intravenous pentothal anesthesia seems to increase shock, possibly because it is frequently accompanied by anoxia.

WOUNDS OF THE LOWER EXTREMITY

Case 6.—This patient was a young Marine whose left lower thigh had been shattered by shell fragments. On arrival at the hospital, approximately 6 hours after the injury, he was in profound shock and looked moribund. The left lower thigh was severed almost to the bone, which was fractured, and for a distance of 10 inches the thigh muscles were laid open in a longitudinal direction. A tourniquet had been placed tightly about the junction of the upper and middle third of the thigh, but there was slight bleeding from the wound although no dorsalis pedis or posterior tibial pulsation could be palpated even when the tourniquet was removed. The tourniquet was replaced, 500 cc. of blood and 4 units of plasma (1,000 cc.) were given. In order to maintain the patient's blood pressure at a little over 80 systolic it was necessary to administer plasma continuously. It was decided to delay amputation until the condition of the patient improved. Sulfanilamide, 4 gm., was given intravenously, and pieces of dried palm leaves, stones and small sticks were removed from the wound with forceps. The administration of plasma was intermittently continued for 8 hours, but at the end of that time the patient's blood pressure was 70, and he still presented the clinical picture of shock.

A transfusion of 1,000 cc. of citrated blood and 3,000 units of antigas-gangrene serum were administered (10 hours after admission and 16 hours after

injury). The patient's condition slowly improved and sulfanilamide 4 gm. was given intravenously. Eighteen hours after admission, the pulse became rapid, the temperature elevated, and an odor of gas infection was noted. Two hours later a guillotine amputation at the upper third of the thigh was performed under ether anesthesia. Amputation was done above the tourniquet, and when the adductor muscles were severed they presented the brick-red color of gas infection and slight crepitus was noted.

The general condition of the patient postoperatively was good. He was given transfusions, placed on large doses of sulfanilamide, and 30,000 units of antigas-gangrene serum every 6 hours. He seemed to be recovering, but approximately 20 hours after the operation he died.

Case 7.—A young Marine was shot in the right popliteal space and came to the hospital bleeding profusely from this wound, despite a rubber tourniquet which had been placed around the middle third of the thigh. There was a pool of blood one inch deep on the stretcher and blood had seeped through and was dripping from the canvas. The patient was in shock. A tight rubber tourniquet was reapplied and plasma administered.

At operation, the popliteal artery was found to be severed and about 3 inches of it badly lacerated; the severed ends were ligated. The patient's blood pressure at the end of operation was 86/60; plasma was continued until the systolic pressure reached 100, after which the patient was sent to the ward. Further transfusion was not done, principally because it was believed this could be safely deferred until morning. Approximately 5 hours after the operation he died in shock. An autopsy was not done.

An effective tourniquet should have been applied immediately. Palpation along the course of the femoral artery distal to the tourniquet will demonstrate whether arterial flow has been stopped. Suturing of the main knots of the tourniquet with strong suture material, insures against slipping and this should be done when bleeding from a large artery is suspected, especially in a person covered with oil.

Case 8.—This patient was a young Marine who was shot through the lower part of the right buttock, receiving a compound fracture near the greater trochanter of the femur. A buttock wound was present, extending transversely through the buttock to approximately 2 inches from the midline. The patient was in shock, but there was no bleeding. The wound was dressed, a Thomas splint applied, and 3 units of plasma (750 cc.) and 500 cc. of citrated blood were given. The patient's pulse became palpable and he began to bleed profusely from the wound. The dressing was removed and the wound tightly packed with gauze, but blood began to soak through this dressing 5 minutes later. The patient was taken to the operating room, a pack was inserted and the margins of the wound sutured tightly together over the pack. A few minutes later he died. No autopsy was done.

There may have been no way to save this patient, but the trauma of packing his wounds lessened his chance of survival, and it did not stop the bleeding. As the vessels involved were probably the inferior and superior gluteal, these structures should have been exposed and clamped or occluded by manual pressure against the pelvis. This would probably have controlled hemor-

rhage. If hemorrhage was still alarming, after the general condition improved, ligation of the internal iliac artery should have been attempted through an abdominal approach under ether or local anesthetic. As soon as the internal iliac was clamped, 500 to 1,000 cc. of blood should have been given, and the clamp could have been left on the artery and removed after 3 to 4 days, particularly if ligation presented technical difficulty or unduly prolonged the operation. Whether this patient could have withstood ligation of the internal iliac is debatable.

SUMMARY

Case reports of penetrating wounds of the abdomen and wounds of the lower extremities are presented with attention directed to their therapeutic management under combat conditions. Mistakes in treatment are pointed out and suggestions for possible improvement in the therapy of each case discussed.

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INCIDENCE OF CONGENITALLY ABSENT KNEE JERK

Examination of 5,000 healthy young men between the ages of 17 and 26 ordered to an armed forces induction center for preinduction physical examination revealed that only in 6 (0.12 percent) was it found impossible to elicit a knee jerk reflex. Several generally accepted technics for the elicitation of this reflex were employed as well as the repeated use of Jendrassik reenforcement maneuvers. Seventy-eight of the 5,000 (1.56 percent) required repeated reenforcement. Justman's procedure was used to facilitate the reflex when it was found to be extraordinarily sluggish. None of the 5,000 men tested presented any demonstrable neurogenic, myogenic, or skeletal abnormality. The serologic test and pupil reflex of the 6 men whose knee jerks could not be obtained were normal. Repeated attempts by various examiners excluded possible technical error, transient tension, or inhibition on the part of the subject.

In three of the six persons in whom no knee jerk could be demonstrated, other absent deep tendon reflexes were noticed. In one man the ankle jerks were also unobtainable; in another no deep tendon reflex whatsoever was discernible; in a third, absent knee jerks and ankle jerks were associated with extremely active biceps and triceps reflexes.

No anatomic, pathologic, psychologic, or physiologic explanation in any of the six exceptions was discovered despite the most thorough and conscientious attempts to ascertain an explanation for what is regarded as a congenital anomaly.—GERSTLE, M. L., JR., Commander (MC) U.S.N.R.

APPENDICITIS IN NAVAL PERSONNEL

OBSERVATIONS ON 109 CASES

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The incidence of appendicitis assumes greater significance in the armed forces than in civilian practice. At a Naval dispensary in a noncombatant area over a period of 18 months there were 4,852 admissions, 2 percent of which were for appendicitis, and appendectomy constituted 14.8 percent of the major surgical procedures.

Appendicitis is the most common abdominal condition requiring surgery, but because it may simulate many other diseases, its diagnosis necessitates an "appendicitis alertness" on the part of the medical officer in all cases of abdominal pain among the young males who form the bulk of Naval patients. In shore establishments where the personnel is within immediate reach of a medical officer at all times, conditions should be ideal for early diagnosis. This has been true in my experience and in that of Irwin and Coates (*1*).

In this series the average duration of symptoms in acute, nonruptured cases was 21.9 hours. This contrasts sharply with the civilian experience of Skinner and Duncan (*2*) whose nonruptured cases averaged 52 hours.

TABLE 1.—*Duration of symptoms*

Duration in hours	Cases
0–6	16
7–12*	26
13–24**	38
25–36	4
37–48	6
Over 48	19
Total	109

* Forty percent reported within the first 12 hours.
** Seventy-three percent reported within the first 24 hours.

The availability of medical facilities leads to earlier observation and should result in a lower mortality. This is verified by the fact that the over-all mortality rate of appendectomy among Naval personnel in 1940 was 0.042 percent (*3*) as compared with the University of Minnesota Hospitals' mortality of 1.75 percent (*4*).

The purpose of this presentation is to analyze 109 appendectomies which were performed under spinal anesthesia through a McBurney incision by various operators without fatality (table 2). The findings, not being remarkable, need no explanation. There are, however, certain things which should be noted:

There were eight ruptured appendixes, five of which were drained, and the patients hospitalized for an average of 23.6 days. Three patients whose appendixes were not drained had an average convalescence of 12.7 days. All these cases were comparable in severity, and drainage was done at the choice of the operating surgeon.

A high percentage (24.8) of cases were classified as gangrenous. Gangrene in the majority of instances implies delay in operation; analysis justifies this assumption. The elapsed time before operation was 35.5 hours, almost 14 hours longer than in acute and suppurative cases.

TABLE 2.—*Case analysis*

Appendix	Normal[1]	Suppurative	Gangrenous	Acute inflammatory changes[2]	Total
Total cases	28	41	27	13	109
Average hospital days	9.0	10.4	13.3	10.6	10.7
Found complications[3]	0.0	4.9	40.7	23	10.5
Duration of symptoms—hours	86.4	15.5	35.5	14.1	38.5
Average W.B.C.	9.0	13.9	14.3	13.8	12.9
Average polymorphonuclears	63	72	75	69.7	70
Average temperature (F.)	98.8	99	99.4	99	99
Duration of operation—minutes	45.3	56	66.5	48.0	55

[1] Includes all cases which did not show evidence of acute inflammation. Many of these contained fecaliths, kinks, occluding adhesive bands and constrictions considered factors in appendiceal pain.
[2] Cases in which no mention was made of suppuration or gangrene.
[3] Includes all skin infections, hematomas, stitch abscesses or any factor interfering with primary healing.

Where information was available, reasons for delay in operation among the gangrenous cases can be grouped as follows:

1. Aboard ship or at outlying station—four cases.
2. Rapid onset of gangrene (patients operated upon in less than 12 hours)—seven cases.
3. Observation by medical personnel—six cases.
4. Patients' failure to report—six cases.

The first two of these classifications cannot be rectified but the incidence in the others, constituting 52 percent, seems excessive.

It is concluded that medical personnel should be as "appendicitis alert" as they are "chancre conscious"; that corpsmen should be forbidden to prescribe for any patient with abdominal pain

when medical officers are available; and that the crew should be given advice about "stomach aches" along with the venereal disease lectures.

From table 3 it is interesting to note the greater percentage of wound complications and the increase in average operating time when the more highly technical operative procedures were employed. Appendectomy, like any other surgical procedure, is technically simple but can be extremely difficult, even when performed by a capable surgeon with a trained assistant. That anyone should undertake this operation without adequate experience and under adverse conditions is startling (*5*) (*6*). It should be kept in mind that the appendix is retrocecal in approximately 69 percent of cases, and that, when inflamed, often may be almost inaccessible.

TABLE 3.—*Methods of handling the stump*

Procedure	Ligation and inversion	Ligation without inversion	Inversion without ligation
Total cases	65	25	19
Healed primary intention	54	24	17
Wound complications[1]	11	1	2
Percentage wound complications	16.9	4	10.5
Percentage gangrenous appendixes	23	24	15.8
Average time consumed—minutes	56	35	44

[1] Includes all skin infections, hematomas, stitch abscesses or any factor interfering with primary healing.

Should chemotherapy prove successful it may be an answer to "sea operations," but where proper facilities exist, the only treatment will continue to be intelligent, conscientious study of all abdominal pain, and early operation. All efforts should be directed to reducing further the time between onset of symptoms and operation. A short time-interval means fewer gangrenous appendixes with resultant complications and prolonged convalescence.

CONCLUSIONS

1. Appendicitis ranks high among the infirmities of Naval personnel.

2. Although Naval mortality is 75 percent less than the average civilian mortality for this disease, it can be reduced further.

3. Efforts should be directed toward earlier observation and toward educational measures.

4. Appendectomy should be undertaken only under favorable conditions. Chemotherapy may prove to be preferable to unskilled operation.

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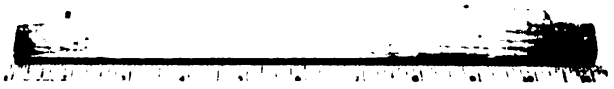
FOREIGN BODY IN RECTUM

Objects inserted intentionally into the rectum are legion; bottles, corncobs, silverware, potatoes and an extraordinary variety of other things have been reported. The circumstances associated with the finding of a piece of wood in the rectum of a Marine private, first class are unique.



Photograph of foreign body.

He was admitted to this activity with the history of having been attacked and a piece of wood shoved up his rectum. He had since experienced indefinite pains in the abdomen and difficulty in voiding, was able to urinate while in a sitting position but not while standing, and had bleeding rectally when attempting a bowel movement. Previous proctoscopic examination disclosed nothing abnormal, a barium enema disclosed a straight and perpendicular rectal shadow, and digital examination revealed an easily palpable end of a stick 1½ inches inside the rectum. Muscle rigidity made attempts at removal under local anesthesia painful. A spinal anesthetic was employed, and with an Ochsner forceps, a stick of wood 10 inches in length and ¾ by 1¼ inches thick was removed. One edge of the stick was irregular, sharp, and jagged.

The patient's postoperative course was uneventful. He was able to void within 24 hours and had a normal bowel movement 48 hours after removal of the foreign body.—PORTER, J. E., Captain (MC) U.S.N.

CONCUSSION FRACTURES AND DISLOCATIONS ABOARD SMALL CRAFT

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With the advent and increasing use of light craft such as LCT, DE, YMS, and AM, the severe explosive effects of mines and torpedoes produced a shattering type of fracture, primarily in the ankle and knee area. The causative force was the sudden violent lurch of the deck either laterally or upward, or a combination of these stresses.

In a total of 57 fractures involving the lower extremity, only 8 were caused by missiles; the remainder were the result of sudden movement of the deck. The body in all these cases constitutes a force downward, varying with the weight of the individual. This force is maintained in position by the deck; an equal and opposite force. If the movement of a directly upward force is sudden and violent enough, as in the explosion of a mine or torpedo, it produces a compression fracture of the os calcis, or comminution of both tibial condyles, or dislocation of the knee, usually the tibia going anterior to the plane of articulation with the femur. If, however, the deck force should be lateral, or lateral and upward, the type of fracture noted is either a tear of the tibio-fibular ligament, fracture of the fibula and lateral displacement of the astragalus, or if the ligamentous structures remain intact the severe shattering fracture occurs in the lower tibia and fibula, one to two inches above the articulating plane of the ankle. When the force is not expressed here, the knee becomes the next fulcrum point rather than the shaft of the tibia. With the leg moving into sudden abduction and the force of gravity still maintaining the body in a downward direction, the result varies from tears of the capsule, to tearing of the tibial collateral ligament with fracture of the tibial spine, or comminuted fracture of the lateral condyle.

In the entire series the most striking feature was the involvement about the knee, although shattering of the ankle and displacement of the foot was consistently more severe than seen in civil life. Of a total of 22 knees involved, 7 had various types of soft tissue injury, and 7 suffered dislocation. A striking point was that three of these dislocations required amputation, one immediately, the remaining two in from 7 to 10 days later.

In injuries about the knee one must always consider the vascular injury as the primary factor. The popliteal artery may be injured by direct pressure, as in fracture of one or both condyles with rotation of a fragment into the popliteal space, or by contusion of the arterial wall at the time of the injury, or by sudden stretching of the vessel, as in dislocation of the tibia anteriorly on the femur. All three of these causes can result in arteriospasm.

The vascular damage presents an emergency that requires immediate reduction of the fracture or dislocation with maintenance of a 30°-flexion of the leg. Where it is possible a Thomas splint with Pearson attachment should be used without a pad in the popliteal space. This type of immobilization is primarily to allow constant check on the circulation. When there is any sign of vascular embarrassment, paravertebral lumbar block should be done and repeated as needed. If it is possible, ice should be applied to the extremity from the thigh down, in order to reduce the demand of the tissue during its period of reduced oxygen supply. This failing, then one must resort to removal of that section of the artery in spasm, the accompanying vein being ligated at the same time.

When using plaster, one should be certain to maintain the knee in moderate flexion after the reduction, to split the plaster down to the skin, to keep a constant check on the circulation as noted in the toes and dorsum of foot, and to mark the plaster clearly so that as the patient moves along into other hands any problem present will be brought to attention immediately.

This type of injury will be coming to the fore in ever increasing numbers. In this small group seen 3 weeks after the initial injury, of four amputations three resulted from posterior dislocation with vascular injury; the fourth was loss of the leg secondary to traumatic amputation by a shell.

In the one case where a fragment of the tibial condyle fracture was displaced into the popliteal space, gangrene of the toes and of the dorsum of the foot developed. The remaining four dislocations, which were devoid of vascular involvement, presented three peroneal nerve pareses. There was no notation of nerve involvement in those cases requiring amputation.

In fractures involving the ankle, immediate reduction is necessary. When seen late, as was the case at this station, none of the deformities could be corrected by closed methods. Most required open reconstructive surgery.

In brief the fractures seen in the lower extremity in Naval personnel aboard light craft, are similar to those seen after falls from a height, except that here the driving force is from the deck, with the body remaining inert in the first stage. The knee is most

frequently involved, followed closely by the lower tibia and astragalus, and lastly by the os calcis. The femur tends to remain free of involvement. The primary complication is vascular and nerve injury about the knee.

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ATYPICAL FILARIASIS

Filariasis of the spermatic cord has been mistaken for hernia. In one case, operation revealed a mass of inflammatory tissue in the right inguinal canal and no hernial sac. Biopsy of this tissue proved it to be of a chronic granulomatous nature, suggestive of filariasis. Two weeks after operation the right spermatic cord and epididymis became swollen and a week later the left spermatic cord was similarly involved and seemed typically filarial.

Pain in the lower abdomen can be confusing and usually precedes any demonstrable lesion. In one case, 3 days following the removal of a normal appendix for what had seemed to be atypical appendicitis, the right spermatic cord and epididymis were acutely swollen and epitrochlear adenopathy was observed. No cause other than filariasis could be found.—KING, B. G.: Early filariasis diagnosis and clinical findings; report of 268 cases in American troops. Am. J. Trop. Med. 24: 285–298, September 1944.

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EXOTIC DISEASES IN UNITED STATES

It is well to remember that there actually are relatively few diseases that are limited purely to the tropics. Certain peculiarities of these regions often confine some diseases to the warm areas of the globe, but they occur in temperate climates. Yellow fever has occurred as far north as Boston. Cholera has been reported in many places in the United States. Leprosy is an endemic disease in southern United States. A small focus of filariasis existed for many years around Charleston, South Carolina. Malaria and dengue are not uncommon in southern United States. Malaria has occurred in many parts of northern United States and small foci still exist in certain areas. Plague is permanently established in the wild rodents of the Western States, including six areas in Colorado. Endemic typhus is relatively common in southern United States.—FLORIO, L.: Introduction of exotic diseases into United States. Rocky Mountain M. J. 41: 643-647, September 1944.

MEDICAL PROBLEMS IN A CONSTRUCTION BATTALION

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A discussion of the more common conditions accounting for morbidity and lost work days as seen in a construction battalion in the Central Pacific area presents some interesting observations. This battalion has been out of continental United States only a short time and its activities have been limited strictly to construction as contrasted with those units which have faced active combat conditions or those put under strain by assignment to an area subjected to enemy bombing attacks.

The basic principle followed in handling the sick personnel has been not to transfer a patient to a Naval hospital as long as the condition appeared compatible with duty, however limited, and did not show changes of a progressive or irreversible nature. This information is important in considering the morbidity, inasmuch as the age and physical limitations of the average Seabee are considerably greater than those of the personnel of other Naval units.

HERPES-LIKE LESIONS OF THE LIPS.

Certain conditions that arose had been entirely unforeseen and no provision had been made for handling. Outstanding among these was the effect of solar radiation on the lips. The lesion is apparently a true burn as opposed to the herpes so frequently seen at coastal resorts in the States. The lips become greatly swollen, and the surface completely denuded of epithelium, producing an extremely painful weeping and encrusted lesion. Persons with thin skin, in whom small capillaries are visible and who are subject to sunburn of the nose, are more likely to be affected. No preventive measure has been found and every treatment so far devised has been without effect. In general, measures that splint the movement of the lips, such as application of compound tincture of benzoin, or that cover or soften them seem to give the best results. The condition is persistent and has a tendency to run its course until natural protective mechanisms come into play. In many cases it is difficult for the patient to eat, and in not a few instances it was necessary to place the person on night duty before securing relief.

URINARY CALCULI.

Calculi of the urinary tract have also been observed in a greater number of instances than could normally be expected in a group of this size. The condition is not confined to men in the older age group, some cases having been seen in the younger and more vigorous, healthy individuals. This has presented less of a treatment problem than might be expected of a condition known to have inherent sinister implications.

Contrary to the cases reported in the literature, these calculi were apparently not uric acid stones, as they occurred in the majority of instances in highly alkaline urine. Frank hematuria was seen in all, and the stone was recovered in all but one patient by the simple expedient of having all urine passed through a piece of gauze.

All patients were promptly relieved of symptoms and were willing and eager to get back to work within 24 hours following passage of the stone. Forcing fluids and relief of pain by morphine when indicated, constituted the only treatment.

The frequency of this condition was attributed to urinary concentration inevitably arising in men who are working hard under a tropical sun, with limited fresh water intake. The possibility of vitamin deficiency was entertained but could not be demonstrated. X-ray facilities were not available.

FATIGUE SYNDROME.

There are certain features about a fatigue syndrome which was encountered that lend emphasis to its importance and interest. This condition was seen in both the young and rugged as well as in persons of middle age. In most instances it appeared where no suspicion of malingering could be entertained, men who were among the best workers in their company and experienced in their line. The signal feature exhibited by all was tachycardia. The rate was usually about 110 when in the sitting position. Cardiac consciousness and severe fatigability, even after the most simple forms of work, were generally experienced. In every instance it was necessary to relieve these patients of all duty for a period of time. This was rendered easier by the fact that the battalion's initial mission was about completed when the first cases appeared, and that the battalion was moving to an island where demands were at a minimum and where men were expected to have a period of rest before their next assignment.

A certain psychic pattern was common to all these patients and some psychotherapy as well as rest was indicated. In the more phlegmatic persons no difficulty was experienced in making a

return to normal activity but in every instance at least one week was required. In some an anxiety state arose accompanied by and gradually moving into a state almost indistinguishable from the classic picture of neurocirculatory asthenia.

Certain of these patients have presented a real problem in management and several weeks have elapsed without any signal improvement in their condition or alteration in the rapid pulse rate.

In one instance the condition arose simultaneously in identical twins who are emotionally bound to each other. Here the tendency to compare notes and indulge in mutual introspection has resulted in a greater than usual anxiety state with a certain loss of faith in the medical attention they have been receiving, a situation decidedly prejudicial to their recovery.

Correction of vitamin, calcium and salt deficiency, as well as sedation, were included in the therapy of all these patients, but rest and simple reassurance seemed to aid most in their improvement.

PSEUDO-ULCER SYNDROME.

A peptic ulcer-like pattern of symptoms constituted the most vexing problem, particularly as applied to therapy. With the limited laboratory facilities available it has not been possible to make a thorough study of these patients. Pain before or after eating, with or without relief by soda, with apparent intolerance to food, seemed to color the histories in all these cases. Daily appearance of these men in the sick-call frequently was a trial to the patience and ingenuity of the medical staff.

In all cases stool examination was done for occult blood, with negative results. In one patient whose symptoms were more severe, an upper abdominal barium study was done on a hospital ship. The results were entirely negative. Gastric analysis yielded low free and total hydrochloric acid values. Blood counts on all patients were noninformative.

No scales were available to observe the weight of these persons. However no significant weight loss was found despite the apparent inability to eat the food presented to them in the general mess. A ration of evaporated milk served every two hours, with a gradual transition to Jello, custards, cereals, and puréed vegetables helped in the control of these patients. The armamentarium for treatment of disorders of this nature is distinctly limited in an otherwise well-supplied medical store of a construction battalion.

It is apparent that this condition will inevitably arise and no method of pre-induction examination will adequately screen out

such cases. That this represents, in most cases, a subconscious protest and failure of adjustment can hardly be doubted. It is believed that most of these men can be retained and that little is to be gained by cluttering up the wards of the otherwise heavily burdened Naval hospitals with persons whose adjustments to life will never be entirely adequate.

FUNGUS INFECTIONS.

The prevalence of fungus infections of the skin, particularly of the external ear canal and of the feet, should make everyone conscious of this problem. The multitude of remedies attest the lack of superiority of any one. One-percent thymol solution in cresatin, alternated with sulfathiazole powder in glycerin, as wicks or instilled with a plug of cotton has been found sufficient to keep the majority of infected ears under control. Secondary infection of the external ear canal has at times occurred as a distressing complication. No significant contribution can be added to the problem of fungus infection of the feet. The basic principles of treatment of infection were applied.

INSOMNIA.

That insomnia should be a significant complaint among a large group of hard working young men seems somewhat unusual and merits some comment. A certain amount of this undoubtedly has been caused by overindulgence in coffee. Here again an insufficient supply of mild sedatives renders this a problem to corpsmen and medical officers. No cases of long duration have been encountered.

COMMENT

A fact not anticipated and viewed with understandable pleasure is the over-all improvement in the general health and vigor of most of the men after residence in this area for a period of time. It can be little doubted that this is due to regular hours of work and sleep, as well as to the enforced absence from the flesh-pots of the coastal cities of the States with the contingent deprivation of alcohol.

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EMETINE IN AMEBIC DYSENTERY

The common practice of periodic courses of emetine injections is injurious and should be discouraged as liable to produce emetine-resistant strains of Endamoeba histolytica. The combined treatment with emetine bismuth iodide and chiniofon now offers the best hope of a permanent cure, but details of administration must be observed.—MANSON-BAHR, P.: Amoebic dysentery; facts and fallacies in radical treatment. Lancet 2: 718-720, December 2, 1944.

A STATISTICAL REPORT OF MALARIA DURING ONE YEAR ON ISLAND "X"

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It was decided at the time this group of men, a special construction battalion, U. S. Navy, landed on Island "X" that a careful record of the data pertaining to malaria should be kept. The results of this study are presented here. It must be remembered that these problems and statistics relate to only one battalion. Because of differences in the species of mosquito vector and its habits as well as variances in the climate and topography in various areas, it should not be assumed that the conditions encountered by this activity will be similar to those met by another group in another locality.

The island on which the present study was made has a rainy season from December through May and a comparatively dry season from June through November. Malaria control for the entire island had been begun by the Malaria Control Unit, U. S. Army, three or four months before arrival of this unit. The malaria vectors present on the island were the Anopheles punctulatas farauti and the Anopheles punctulatus moluccensis. The pest mosquitoes, aëdes and culex, were plentiful.

This island has been one of the most heavily infested malaria areas in the world. The battalion landed after only slight previous contact with malaria and remained on the island for a period of 1 year. These factors formed ideal conditions under which malaria in a group of men could be studied.

The battalion was divided into two echelons. Each echelon after leaving the United States arrived at a tropical island and remained there for 6 weeks before proceeding to Island "X." The former island was moderately infested with malaria. The first echelon remained aboard the ship during the stay at this point and few daytime shore leaves were granted. There were no cases of malaria in this group before arrival at Island "X."

The second echelon, while at the first island, sent a working party of 150 men ashore for 2 weeks. Many other men went ashore to work daily, and there were frequent liberties. There were 13 cases of malaria in this group before arrival at Island "X."

The first case of malaria appeared in the first echelon 14 days after landing on Island "X." The first echelon received no atabrine therapy until arrival at the final destination. The men in the second echelon began taking atabrine 1 week after arrival at the first island, which was 5 weeks before arrival at the final destination.

The camp site on Island "X" was designated by military necessity, with no consideration given to malaria prevention. The camp was located at the seashore in a palm grove adjacent to a river. The elevation was approximately one foot to four feet above sea level. The drainage was exceedingly poor and mud plentiful. The working period was divided into day and night shifts. There were frequent air raids so that the men spent many hours in foxholes where the mosquitoes were numerous. Regulations demanded sleeping under mosquito nets, and wearing long trousers and shirts with long sleeves during the hours from 1800 to 0700.

During the early months insect repellents were not available. In camp areas necessary spraying with Diesel oil No. 2 was started at once and such drainage as possible was done when manpower was available. For the first 6 months the tents rested on the ground, with no flooring, but later were placed on wooden elevated platforms.

There was a total of 396 malaria cases in this battalion. Of these 264 were primary and 132 secondary cases. In addition 76 patients from casual units were treated; however these are not included in this study. The incidence of primary and secondary cases by the month is presented in table 1. It will be noted that in the second month after arrival, the incidence of primary cases was high. Following the third month the primary cases decreased while the secondary cases increased. During February there were no primary cases.

It is evident that something occurred to cause the decline in cases during the later months. During the first half year, because of frequent air raids, the men were often exposed to mosquitoes at night, frequently without sufficient time allowed before entering the foxholes to clothe themselves properly for mosquito protection. The first months were very rainy. During midsummer an adequate amount of mosquito repellent was obtained to supply each man's needs, and the Battalion Malaria Control Unit was constantly at work. At first there were myriads of mosquitoes, but during the later months they were few and at times rare.

TABLE 1.—*Incidence of malaria by months*

1943	Primary	Secondary	Total	Average strength
March	0	0	0	1,033
April	27	0	27	1,025
May	111	5	116	1,019
June	40	20	60	981
July	15	11	26	968
August	17	9	26	947
September	11	14	25	928
October	10	18	28	909
November	16	10	26	897
December	4	10	14	860
1944				
January	8	22	30	843
February	0	7	7	826
March	5	6	11	822
Total	264	132	396	919

Casual cases treated—76
Total cases treated—472

It is impossible, as long as a man remains in a malarial area, to determine if later attacks caused by the same species of the genus plasmodium are exacerbations of latent malaria or if there has been a reinfection. The later attacks caused by a different species are clearly reinfections. There are many words to describe these later attacks, such as refractory, recurrent, relapsing or secondary, all of which connote an exacerbation of a pre-existing malaria or a reinfection. Since many of these attacks were reinfections, the term secondary attacks seems most appropriate. In this report all attacks after the initial or primary one will be referred to as secondary attacks inasmuch as the cases studied here were those of men in a malarious area during the entire time.

The antimalarial measures used were chemoprophylaxis with atabrine, and vigorous mosquito control and protective measures. It is believed from our experience that mosquito control is the more important of the two.

The incidence of malaria in rate per thousand per annum by months, is obtained by the transposition of the figures given in table 1, with corrections for variations in the days of the months and in the personnel strength, by the following formula:

$$\frac{\text{Cases}}{\text{Strength}} \times 1{,}000 \times \frac{\text{Days of year}}{\text{Days of month}}$$

The result of this transposition is presented in table 2 and the accompanying graph. This gives a more accurate statement of the mathematical facts concerning the incidence of malaria. It will be noted that these figures tend to correspond to those in table 1.

For comparison the total incidence for the entire island, including all units reporting to the Malaria Control Unit, U. S. Army, is also given in table 2 and the accompanying graph. The malaria

TABLE 2.—*Cases per thousand per annum*

1943	Primary	Secondary	Total	Rate for all activities on the island[1]
April	321	.....	321	1,052
May	1,282	58	1,340	900
June	496	248	744	636
July	182	134	316	608
August	211	112	323	263
September	144	184	328	287
October	129	233	362	230
November	217	136	353	206
December	55	137	192	150
1944				
January	122	334	456	200
February	.....	107	107	126
March	72	86	158	124
Cases per 1,000 for the year	287	144	431	398

[1] The figures in the last column are those of the Malaria Control Unit, U. S. Army.

incidence for all units corresponds somewhat to the incidence encountered in the group under study. The Malaria Control Unit was very active in the surrounding areas during the entire year.

Due to the fact that the first echelon did not receive atabrine prior to arrival and had little liberty at the first island, and that the second echelon had working parties living ashore and others working ashore from the ship, had fairly frequent shore leaves, and received atabrine for 5 weeks before arriving at their destination, it seems worth while to present the statistics relating to the malaria incidence in each group. Table 3 gives these data on each group for the first 3 months.

TABLE 3.—*Malaria during the first 3 months in the first and second echelons*

First echelon

Days		Primary attack	Secondary attack
21 March through 20 April		13	0
21 April through 20 May		39	1
21 May through 20 June		19	7
Total	79	71	8

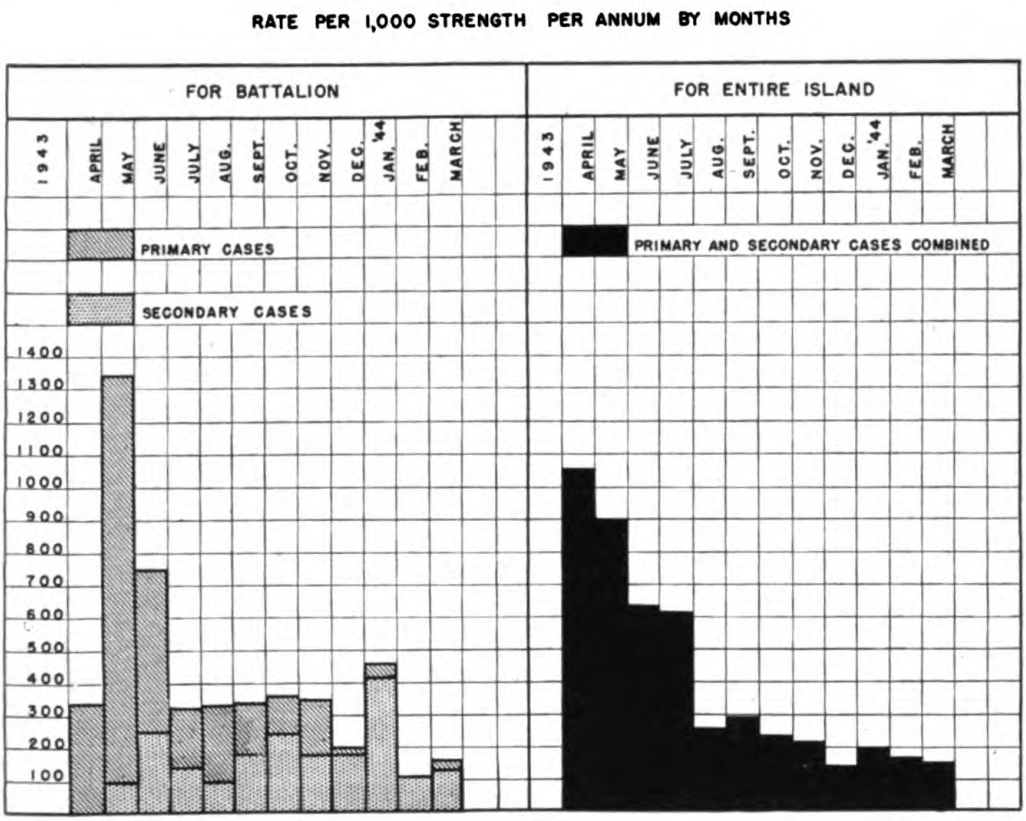
Strength, March 31—489

Second echelon

2 May through 1 June		67	2
2 June through 1 July		22	11
2 July through 1 August		9	11
Total	122	98	24

Average strength, April—508

The first group had a total of 79 cases, the second group a total of 122 cases. The second echelon was quartered in an area closer to the river than the first. The first group had 13 cases of malaria



during the month following debarkation, while the second group had 67 cases in the corresponding month. In the first echelon there was a time-interval of 13 days before the appearance of the first case. In the second echelon there had been some malaria cases before arrival and were some at the time of arrival at Island "X." The fact that the second echelon was exposed to malaria before arrival would seem the logical explanation of the higher incidence of the disease in this group. It should be borne in mind that this group also had received atabrine for 5 weeks before arrival. The atabrine did not prevent but probably did check the malaria.

The conditions necessary to observe closely the clinical course of malaria are fulfilled in this study. The men lived and worked as a group. They were encouraged to report at sick call at the earliest appearance of symptoms, and cases could be detected early, treatment begun, and the men returned to duty with a relatively short period of disability.

The majority of men reported within the first to third day after the appearance of symptoms. Of these, 84 had fever for only 1 day, 96 for 2 days and 68 for 3 days. Following the fever, 54 men were kept in the sickbay for 2 days, 102 for 3 days and 109 for 4 days. All patients were given 7 days' treatment in their quarters after discharge. During this period they were confined to

TABLE 4.—*Symptoms in 370 patients*

1.	Fever	357
2.	Malaise, fatigue, debility, generalized aching of muscles and joints, various joint pains	256
3.	Chills	242
4.	Headache	240
5.	Bachache	78
6.	Nausea and vomiting	47
7.	Rhinitis, cough, sore throat	31
8.	Dizziness	17
9.	Diarrhea	17
10.	Profuse sweating	10
11.	Abdominal pain or distress	10
12.	Chest pain (2 very severe)	7
13.	Insomnia	5
14.	Nervousness	3
15.	Mental depression	2
16.	Irrationality	2
17.	Cardiac pain	1
18.	Difficult breathing	1
19.	No symptoms	6

their quarters for the first day and allowed about camp as their strength returned. They were carried on the sick list during the 7 days.

There were very few men who were not able to return to a full work schedule following this treatment. In the majority of instances an interval of from 10 to 12 days elapsed between initial treatment and final return to work. It was found that this was sufficient for almost complete recovery of strength. In special cases, it was recommended that the patient be placed on "light duty" for as long a time as necessary, and in some cases an extension of "no duty" was recommended. Under the emergency conditions prevailing, it was vitally important that each man be kept at work as many hours as possible.

Table 4 lists the symptoms encountered in the order of their frequency. The most common symptoms were fever, malaise, and generalized or localized muscle and bone or joint pains. Next in order were chills, headache and backache. It is of interest that six patients were entirely without symptoms and were carrying on their full duties, and only during the examination of routine smears was the presence of malaria detected.

There was no difference in the clinical course or symptomatology in benign tertian and malignant tertian cases. This was probably due in part to the immediate or early treatment given which did not allow the individual types of malaria to follow the orthodox course. The physical findings as a rule were negligible. The spleen was palpable in only a few instances.

Treatment consisted of the administration of (1) quinine hydrochloride, grains 15 three times a day until the patient was free

from fever (this dosage was reduced later in the year to grains 10 three times a day); and (2) atabrine, either one (grains 1½) or two (grains 3) tablets three times a day. Later in the year this was changed to two tablets (grains 3) three times a day for 5 days. A blood smear was made on the fifth day. If it was positive, treatment with atabrine was continued until the smear became negative. All patients were then given atabrine, one tablet (grains 1½) twice daily until they returned to work.

When a patient was unable to ingest quinine or atabrine, quinine dihydrochloride was given intramuscularly, or grains 7½ in 500 cc. of saline and dextrose solution was administered by the intravenous route. Atabrine dihydrochloride grains 3 was given intramuscularly. One or both were given at 6-hour intervals until the patient could take oral medication.

Nausea and vomiting frequently accompanied oral administration of the drugs, but in very few instances was it necessary to resort to intramuscular or intravenous administration of quinine or atabrine. Severe nausea was usually prevented by giving morphine tartrate grain ¼ for one or two doses 1 hour prior to the medication.

Occasionally there were complaints that the drugs caused severe dizziness, nausea, vomiting, or abdominal pain. In these instances quinine was discontinued and atabrine was given alone. Rarely did atabrine have to be discontinued in favor of quinine. The patient's general condition was watched and adequate intake of liquids was stressed.

In cases of severe debility or secondary anemia, iron sulfate grains 5 three times a day and multiple vitamins, two capsules twice daily as needed, were prescribed. Response to these medications was usually rapid. When an illness was at first believed to be of intestinal or respiratory origin, and later proved to be malaria, sulfathiazole was given early. There was usually no improvement in these cases until malaria therapy was begun. On the other hand those patients on whom negative smears were obtained but in whom there was strong clinical evidence of malaria were given treatment upon admission. Many man days were saved in this manner.

SECONDARY MALARIA

Malaria tends to be a chronic disease and the initial or primary attack is frequently followed by secondary attacks. Table 5 presents the incidence of secondary cases by months.

With the passing of time the number of secondary attacks in individuals increased to as many as six (a total of seven attacks)

TABLE 5.—*Secondary attacks of malaria by months*

	1943 Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1944 Jan.	Feb.	Mar.	Total
Primary	27	111	40	15	17	11	10	16	4	8	0	5	264
Secondary:													
1st	.....	5	15	9	5	11	9	6	5	12	2	1	80
2d	.....	.....	5	2	3	2	7	2	1	6	2	2	32
3d	.....	.....	.....	.....	1	.....	2	2	.....	.....	2	.....	7
4th	.....	.....	.....	.....	.....	1	.....	.....	3	2	.....	1	7
5th	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	1	2
6th	.....	.....	.....	.....	.....	.....	.....	.....	1	2	.....	1	4
Total of secondary	.....	5	20	11	9	14	18	10	10	22	7	6	132
Total	27	116	60	26	26	25	28	26	14	30	7	11	396

in this group. It should be borne in mind that these secondary attacks were of two origins; those caused by an exacerbation of the dormant original infection, and those caused by an entirely new infection. It was impossible to distinguish between the two types. The incidence of secondary attacks presented no marked variation during the year, being at no time less than 5 or more than 22 in 1 month.

TABLE 6.—*Secondary malaria as to types*

Number having secondary malaria	Benign tertian	Malignant tertian	Clinical	Species undetermined	Mixed	Records not available
68	81 61%	24 18%	13 10%	4 3%	1 0.7%	9 7%

Total secondary cases—132

Table 6 compares the attacks of secondary malaria as to types.

TABLE 7.—*Types of malaria in relation to attacks*

Number of patients	Original attack	Secondary attacks					
		1st	2d	3d	4th	5th	6th
5	Clinical	Benign	.....	.....	.....	.....	.....
7	Benign	Clinical	.....	.....	.....	.....	.....
2	Malignant	Benign	.....	.....	.....	.....	.....
1	Benign	P. S. U.	.....	.....	.....	.....	.....
4	Benign	Malignant	.....	.....	.....	.....	.....
1	P. S. U.	Malignant	.....	.....	.....	.....	.....
1	Benign	Malignant	Benign	.....	.....	.....	.....
2	P. S. U.	Benign	Benign	.....	.....	.....	.....
1	Clinical	Benign	Benign	.....	.....	.....	.....
2	Benign	Malignant	Malignant	.....	.....	.....	.....
1	Malignant	Malignant	Benign	.....	.....	.....	.....
1	P. S. U.	Benign	Malignant	.....	.....	.....	.....
1	Malignant	Benign	Benign	.....	.....	.....	.....
1	P. S. U.	Clinical	Benign	.....	.....	.....	.....
1	Benign	Benign	Malignant	Benign	.....	.....	.....
2	Benign	Benign	Benign	Malignant	.....	.....	.....
1	Benign	Malignant	Mixed	Benign	.....	.....	.....
1	P. S. U.	P. S. U.	Clinical	Benign	.....	.....	.....
1	Benign	Benign	Benign	Malignant	Malignant	.....	.....
1	Benign	Benign	Benign	Benign	Malignant	.....	.....
1	Benign	Benign	Benign	Benign	Benign	P. S. U.	Benign

P. S. U. = Plasmodium species undetermined.

There were 68 individuals with secondary attacks and a total of 132 cases. Benign tertian recurred about three times as often as malignant tertian malaria.

Thirty-eight patients had attacks of more than one kind of malaria as shown in table 7.

With this wide variety of possible combinations, it is obvious that many secondary attacks must be due to reinfection. It is probable that the higher incidence of recurrent attacks of benign tertian is related to the more frequent occurrence of primary benign tertian cases, in addition to the fact that this variety tends to recur most frequently.

It was found that the men having repeated attacks of benign tertian malaria were more debilitated by the disease than were those having the malignant tertian variety.

LABORATORY DATA

Table 8 includes laboratory results on patients not included in this study but treated by this medical department, and therefore will not correspond to any other figures as presented. Some of the laboratory work during the first few weeks was done by a neighboring unit and this data is not included.

TABLE 8.—*Laboratory data*

1943	Number smears examined	Positive smears	Plasmodium				
			Vivax	Falciparum	Malariae	Mixed	Undetermined
April	163	32	3	12	0	1	16
May	279	57	13	30	0	2	12
June	427	84	28	34	0	4	18
July	346	42	21	17	0	1	3
August	269	29	12	9	0	1	7
September	197	19	16	2	0	0	1
October	202	28	16	7	0	2	3
November	138	19	13	5	0	1	0
December	150	25	18	4	1	0	2
1944							
January	168	28	24	3	0	0	1
February	206	12	12	0	0	0	0
March	123	9	9	0	0	0	0
Totals	2,668	384	185	123	1	12	63

Smear examination was made whenever malaria was suspected. The method of staining was Giemsa's thick smear technic. In many instances it was necessary to take four or five smears before the presence of the parasite could be detected. The ratio of positive smears to the total number examined is significant in that many men who had some of the symptoms of malaria had negative smears and were usually considered not to have malaria.

During the period 16 November to 6 December 1943, thick blood

smears of the entire personnel were sent to and examined by the Malaria Control Unit, U. S. Army, which reported as follows:

1. A total of 890 smears were examined, among which 6 (0.7 percent) were found to be positive for malaria.

2. Due to the very light infections, it was possible to identify the parasite with certainty in only one case. In this instance it was Plasmodium vivax, and it is probable that all the other infections were the same. Parasite densities ranged from 1 to 10 fields to 1 to 50 fields (thick smear), with most falling into the last category.

3. It is of interest that the six men with positive smears had never had symptoms of malaria, although the organization had been on this island since March, and its case rate during November was 353 per annum, the primary rate alone being two hundred seventeen.

TYPES OF MALARIA

Clinical malaria.—In this report clinical malaria includes that group of cases in which the symptoms were characteristically those of malaria with no evidence of other disease, the blood smears being repeatedly negative, and the responses to malaria therapy prompt. Malaria parasites were frequently present in small numbers and it was quite easy at times to overlook them. It was believed that in fairness to the patient and to the service these men should not be denied treatment. They were given a complete course of therapy and their condition was classified as "clinical malaria."

TABLE 9.—*Asthenia, postmalarial*

Cases	Number patients	Number evacuated
One attack P. vivax	2	
Two attacks P. vivax	5	
Three attacks P. vivax	2	
Six attacks P. vivax	1	
P. falciparum alone	0	
One attack P. vivax and two attacks P. falciparum	2	
One attack P. vivax and one clinical	2	
Four attacks P. vivax and one attack P. falciparum	1	
Five attacks P. vivax and one attack P. falciparum	1	
Six attacks P. vivax and one attack P. falciparum	1	
Two attacks P. vivax and one attack P. falciparum, one attack P. S. U.	1	
Total	18	

Asthenia, postmalarial.—Most patients were sufficiently recovered within a short time to return to work. However eighteen men (table 9) were so weakened by the attacks that either they could not return to work, or having returned to work were so weak and run down that they could not continue at their jobs.

These cases were classified as "asthenia, postmalarial," and 16 patients were evacuated. All 18 patients had had benign tertian malaria and five had had both the benign and malignant types. The average time between the initial attack and the date of evacuation was 6½ months, the longest interval being 10 months.

Of 264 individuals with malaria, only 18 (6.8 percent) were evacuated before the period of one year. This includes the 16 just mentioned, one with cerebral malaria and one with mental symptoms that were pre-existent but aggravated by malaria. The remaining patients were able to return to full duty. This indicates that malaria is not a disease which should necessitate evacuation from a noncombat forward area unless there is definite indication of injury to the individual.

TABLE 10.—*Operational fatigue and malaria*

Total cases of operational fatigue	196
Operational fatigue with types of malaria:	
One attack P. vivax	34
One attack P. falciparum	4
Two attacks P. vivax	7
Three attacks P. vivax	2
Two attacks P. falciparum	2
Two or more attacks P. vivax and P. falciparum	10
Total operational fatigue patients evacuated	161
Operational fatigue patients evacuated after 12 months	134
Operational fatigue patients with malaria	59
Percentage of entire battalion that had malaria	25%
Percentage of operational fatigue patients with malaria	30%

Operational fatigue and malaria.—During the year on the island there were 196 cases of operational fatigue, among these being 59 patients with malaria. One hundred sixty-one patients with operational fatigue were evacuated, including 134 transferred at the end of the 12-month period. Twenty-five percent of the entire battalion had malaria, and 30 percent of the patients with operational fatigue had malaria. There may have been a relationship between malaria and operational fatigue, but the statistics are insufficient. Some of the cases of operational fatigue however, appeared to have been initiated or aggravated by malaria.

Patients without fever.—Fifteen malaria patients had no fever at any time while under observation. Their infection was of the following types: Species undetermined 6; Plasmodium vivax 3; Plasmodium falciparum 2; and clinical malaria 4.

SPECIFIC THERAPY

Plasmochin.—Plasmochin was not used routinely. When prescribed because of asthenia or repeated attacks of malaria it was

of no value either in alleviating the symptoms or in preventing the recurrence of malaria. It was used in seven patients with the following results:

Case 1.....3 attacks P. vivax—evacuated.
Case 2.....7 attacks, mostly P. vivax—evacuated.
Case 3.....3 attacks P. vivax—evacuated.
Case 4.....4 attacks P. vivax—evacuated.
Case 5.....2 attacks P. vivax—returned to work well.
Case 6.....4 attacks P. vivax—evacuated.
Case 7.....4 attacks P. vivax—2 P. falciparum—evacuated.

Five of these men had attacks of malaria shortly after plasmochin was given. It was concluded that it was of little benefit in these cases, although it may have helped make these men noncarriers.

Atabrine.—There were only 17 men who were unable to take the suppressive treatment of atabrine (grain ¾ daily and grains 1½ on Sunday). In January 1944 this dosage was increased to grains 1½ six times a week. Those unable to take atabrine were given quinine grains 5 daily as a prophylactic dose. Atabrine was issued by a corpsman to each man at breakfast time and there was no check on its being ingested.

When the atabrine regimen was first started, many experienced slight or moderate abdominal discomfort or cramps. A few had diarrhea and some were nauseated. It was found that if atabrine was continued, the objectionable reactions would disappear within a few days.

MALARIA AND JAUNDICE

There were 12 cases of jaundice and of these, 3 patients had recently had malaria. In these 3 cases the average time elapsing between the malaria and the onset of jaundice was 15 days. The small number of jaundice cases observed would not warrant conclusions. Clinically the jaundice in all 12 cases was identical and seemed to be catarrhal or infectious in character. It is believed that atabrine and malaria played no part in the jaundice.

MALARIA CONTROL

The camp was classified as semipermanent. When the battalion landed there was no choice of camp site because of military necessity. There was little time and equipment available for malaria control work during the first months. In retrospect this was a grave mistake.

Mosquito control was carefully attended to, the area being sprayed with Diesel oil No. 2 at 5- to 7-day intervals or as needed. A weekly detailed inspection was made, with a thorough search for

unoiled pools of water, for bottles and cans which might hold water, and for mosquito larvae. The adjacent areas also were inspected by the Battalion Malaria Control Unit in cooperation with the Malaria Control Unit of the Army. Ditch cleaning and ditching in so far as possible were done by these men. Insecticides were used in all inclosures whenever practical.

All men were supplied with bed netting for sleeping. They were made to wear their sleeves and trousers rolled down from sunset to sunup. After some months mosquito repellent was freely obtainable, and during the later months the camp area was made out of bounds to natives. There were frequent lectures on malaria.

One year later, at about the same time of year that the battalion under study had landed, a similar battalion occupied the same camp site. Three months after landing not a single case of malaria had occurred. This strongly suggests that some of the primary cases of malaria which were diagnosed in the first battalion during the last few months on the island might have been earlier infections which had remained dormant until then. It proves also that the antimosquito measures used during the year were extremely successful.

COMMENT

There were no deaths in the malaria patients seen here. There was no relationship between the number of attacks of secondary malaria and the severity of the various attacks.

Many of the patients had respiratory or intestinal symptoms which obscured the malaria. These symptoms may have been a part of the disease, or they may have been coincidental. Anemia as a rule was moderate and responded quickly to iron and vitamin therapy.

It is believed that the high incidence of malaria in this group during the first three months could have been appreciably reduced if more rigid enforcement of the malaria preventive measures had been carried out.

CONCLUSIONS

1. Malaria control measures were successful with this group of men, as evidenced by the marked decrease in primary cases during the later months.

2. Mosquito control is more important than chemoprophylaxis with atabrine in the prevention of malaria; however both methods should be used.

3. Upon landing in a known malarious area, it is very important that mosquito control by the known successful methods be begun at once, and that discipline in this matter be rigidly enforced.

4. Atabrine does not prevent malaria.

5. In most cases of malaria 10 or 12 days is adequate time for treatment, recovery and return to duty.

6. In this group benign tertian malaria occurred three times as often and was more disabling than malignant tertian malaria.

7. In a noncombat forward area malaria alone is not sufficient cause for evacuation.

8. Malaria patients showing signs of severe asthenia or who have incapacitating complications should be evacuated.

9. Plasmochin was of little or no value in the few cases treated.

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GRAMICIDIN S

A new strain of aerobic sporulating bacteria has been isolated which produces a new and hitherto unknown crystalline polypeptide with the melting point 268-270° C. This substance has been named Soviet gramicidin or gramicidin S. It kills not only gram-positive but also gram-negative bacteria suspended in nutritive broth. Its toxicity is no greater than that of tyrothricin, and it is harmless when applied locally or in cavities in concentrations of 400-800 μg. per cc. of solution. Gramicidin S is stable and its antibacterial activity is not destroyed by autoclaving. It has been shown to protect against anaerobic infection in animals.—GAUSE, G. F., and BRAZHNIKOVA, M. G.: Gramicidin S; origin and mode of action. Lancet 2: 715-716, December 2, 1944.

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SYSTEMIC EFFECTS OF ANORECTAL DISEASE

Through the vegetative and cerebrospinal nervous systems the anus and rectum are in communication with every organ of the body, and it is through reflexes involving the vegetative nervous system that most of the obscure symptoms are produced.

Long-continued observation of the systemic effects of anorectal disease has shown that the chief complaints include such symptoms as abdominal pain with irritability of the colon; gastric hyperacidity; pain along the course of the sciatic nerve; arthritis; urinary symptoms for which no adequate cause could be found during the urologist's investigations; menstrual disorders; sacral or lumbosacral backache; and general nervous irritability or disorganization formerly attributed to neurosis.—THIELE, G. H.: Systemic effects of anorectal disease. Kansas City M. J. 20: 19-21, November-December 1944.

GINGIVITIS AMONG SUBMARINE PERSONNEL

A COMPARATIVE STUDY

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An established procedure aboard this submarine tender is to give each member of a submarine crew returning from patrol a complete physical and dental examination. In the first groups so examined the number of cases of bleeding gums, gingivitis, and Vincent's infection exceeded expectations. The incidence of these conditions among the submarine crews was therefore compared with that of the crew living aboard the tender, and possible etiologic factors were investigated.

During a 7-month period from 18 November 1943 to 21 June 1944 the crews of 17 submarines returning from war patrols were examined and classified according to their gingival health. On 1 and 2 May 1944 this was also done as a control on a random group of the crew living aboard the tender. An investigation was conducted on each submarine as to the adequacy of the diet of the crew and other health factors.

Gingival conditions were arbitrarily classified into four groups as follows:

Class I. Gums that do not bleed and that have the appearance of normal healthy gingival tissue.

Class II. Gums that bleed occasionally upon tooth brushing but have the appearance of normal gingival tissue.

Class III. Gums that bleed frequently upon tooth brushing or when otherwise slightly irritated and that objectively are moderately spongy, bleeding easily upon slight traumatization.

Class IV. Vincent's infection or ulcerative gingivitis.

In addition each man was examined for other evidences of vitamin deficiency. The characteristic signs and symptoms found in the various avitaminoses, as avitaminosis A, thiamine deficiency, riboflavin deficiency, pellagra, sprue, scurvy, and late rickets or osteomalacia, were all checked. In general no systemic manifestations of nutritional deficiency were detected.

Common signs and symptoms found in the majority of members of the various submarine crews were pallor from lack of sun-

shine, very slight weight loss,[1] occasional anorexia, and constipation. There were a few cases of follicular conjunctivitis and mild nervous tension and hyperirritability. These symptoms promptly disappeared during interpatrol rest periods, when sunshine, recreation and athletic facilities were available.

As no systemic symptoms or signs of avitaminosis were found in either the submarine groups or the crew of the tender, a classification of their gingival health was made in order to discover possible incipient evidences of vitamin deficiency. Scurvy among personnel of present-day vessels operating under the stress of wartime conditions is not an impossibility.

Nelson (*1*) found, in examination of the entire crew of a surface vessel, 64 cases of bleeding gums, an incidence of approximately 14 percent of the ship's complement. Typical clinical evidence of low-grade scurvy was disclosed on oral examination although no systemic symptoms of scurvy were found. In five of his cases, microscopic examination showed organisms in sufficient numbers to make an indisputable diagnosis of acute Vincent's infection. Under routine treatment consisting of 150 milligrams of vitamin C administered daily for a period of 2 weeks, the oral tissues in all cases returned to normal, bleeding stopped and the color of the gums became a healthy pink. Subsequent inspections of the menus showed a lack of vitamin C in the diet.

Other instances of gingivitis and stomatitis associated with vitamin deficiency have been reported. Stuhl (*2*) states that of 74 British soldiers with gingivitis, vitamin C saturation tests showed 46 to be definitely deficient in the vitamin, 22 were on the borderline of avitaminosis, and only 6 showed optimal vitamin C nutrition. Many also showed general symptoms of irritability, lethargy and lack of endurance. Vitamin C therapy resulted in prompt alleviation of symptoms, both gingival and general.

Sydenstricker (*3*) reported in 1943 that despite serious shortages in certain foods, the general health of the British people was good after three and a half years of rationing. Only occasional cases of avitaminosis A, pellagra, or riboflavin deficiency were seen in a group selected because inadequate nutrition was suspected. He states that gingivitis was common and was frequently associated with dental caries, but its relationship to nutrition was not established.

[1] Comparative weights of 159 men stationed on 3 submarines taken immediately after each of 2 successive war patrols showed an average weight loss of only 0.22 pounds per man. Submarine E showed an average weight loss of 5 pounds per man for 66 men. Submarine G showed an average weight gain of 5.7 pounds per man for 52 men; and submarine K showed an average weight loss of 0.073 pounds per man for 41 men.

Clarke and Prescott (*4*) found that mental and physical factors leading to a loss of appetite or impaired digestion precipitated symptoms of a vitamin B complex deficiency. Murphey (*5*) contends that ulcerative stomatitis rarely develops in persons in good health. He states that carious teeth, calculus, and poor oral hygiene, together with dietary deficiencies are causative factors.

The use of vitamin preparations as adjuvant therapy in cases of gingivitis and Vincent's infection is common practice today. Eskow and Berman (*6*), among others, use as adjuncts to local therapy of Vincent's stomatitis thiamine hydrochloride, 15 mg., and vitamin C, 50 mg., daily. Brooks and Wilson (*7*) prescribe nicotinic or cevitamic acid for patients hospitalized with severe cases of Vincent's infection as an adjunct to local measures but they state that they are not prepared to make any statement regarding either drug's contribution to cure.

In our opinion the value of vitamin therapy as part of the treatment for gingivitis or Vincent's infection is questionable unless there is a proved vitamin deficiency.

The results of the examinations in the present series are shown in tables 1 and 2.

The class IV cases of Vincent's infection and ulcerative gingivitis were diagnosed entirely by the clinical findings; smears were not taken. Brooks and Wilson (*7*) state that ". . . while it has been stated that the fusiform bacillus and the spirochete of Vincent are the active organisms, it is now known that others are involved, and the organisms are active only in a medium of filth. Hence we have not found it necessary or practical to take smears for diagnosis or determination of the cure; for smears from mouths free of the infection also would show positive cultures." They state further that "The incubation period has not been established, probably because of the presence of the supposedly causative organisms in practically all mouths—a filthy mouth is just a natural incubator."

Ludwick (*8*) agrees that "The presence of Vincent's organisms in a smear taken for microscopic study is not proof that the patient is afflicted with the disease. This cannot be overemphasized, for it is highly probable that these organisms are present in all adult mouths . . ." The presence of Vincent's organisms in the mouth may be likened to that of meningococci or diphtheria bacilli in the throats and nasal secretions of normal healthy carriers. The organisms are harmless until the local or general immunity of the carrier or his contact is lowered, when the organisms will produce the specific disease in their host.

TABLE 1.—*Initial examinations of submarine crews*

Submarine	Number of men examined	Class I		Class II		Class III		Class IV		Remarks
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	
A	60	37	62	17	28	6	10	0	.....	Poor oral hygiene
B	65	49	75	15	23	1	2	0	.....	.....
C	69	58	84	10	15	1	1	0	.....	.....
D	72	52	72	15	21	1	1	4	6	.....
E	77	64	83	9	12	4	5	0	.....	.....
F	76	69	91	7	9	0	.....	0	.....	Very good oral hygiene
G	78	63	81	15	19	0	.....	0	.....	.....
H	70	56	80	14	20	0	.....	0	.....	.....
I	81	73	90	8	10	0	.....	0	.....	Very good oral hygiene
J	79	70	89	8	10	1	1	0	.....	Very good oral hygiene
K	76	65	85	9	12	0	.....	2	3	.....
L	70	57	81	13	19	0	.....	0	.....	.....
M	67	46	69	14	21	7	10	0	.....	Poor oral hygiene
N	74	54	73	10	13.5	0	.....	10	13.5	Poor oral hygiene
O	76	66	87	9	12	0	.....	1	1	.....
P	76	63	83	9	12	4	5	0	.....	.....
Q	77	67	87	7	9	3	4	0	.....	.....
Total	1,243	1,009	81.2	189	15.2	28	2.2	17	1.4	.....

TABLE 2.—*Examination of submarine tender crew*

Number of men examined	Class I		Class II		Class III		Class IV	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
411	367	89.3	39	9.5	5	1.2	0	.....

The submarine crews grouped in classes II and III exceeded those of the crew of the tender by a ratio of approximately 5 to 3 (tables 1 and 2). Of the submarine crew 1.4 percent had clinical Vincent's gingivitis; no cases were found in the crew of the tender. It was noted that in those groups in which there was poor dental hygiene, as manifested by food particles in crevices, abundant calculus, and caries, there was also the lowest percentage of class I gums. Submarine N, for example, had a large percentage of class IV cases. Practically all of the crew of this vessel had filthy mouth conditions. The majority of officers of all submarines had class I gum conditions.

A careful inquiry was made into the quality and adequacy of the menu, from information not only furnished by the ship's cooks but also obtained from the individual crew members. Almost every submarine leaving on war patrol from this tender carried with it fresh and frozen provisions to the limits of their refrigerating spaces. With an average patrol run of 49.1 days for the particular submarines included in this report, the fresh provisions usually lasted throughout the first half of the run but were invariably depleted near the end of the patrol period. Frozen meats and canned fruits, fruit juices and vegetables were usually on hand in surplus amounts. Dehydrated vegetables and fruits are not popular and were not consumed in great amounts.

Milk, made from whole milk powder, was served daily, and ice cream was served twice weekly. Fresh eggs were served at breakfast at least three times weekly and were abundant enough to last throughout the patrol. Butter was usually plentiful. Fresh bread was served daily. Dry cereals were limited in amount, but usually were available for three-fourths of the run.

Because of frequent periods of standing watch, the usual custom of submarine personnel is to have two full meals a day with snacks of soup and sandwiches from the "open icebox." In addition most submarine pharmacist's mates take with them multiple vitamin capsules, each containing 2,500 U.S.P. units of vitamin A, 200 U.S.P. units of vitamin D, 1 mg. thiamine hydrochloride, 1.5 mg. riboflavin, 37.5 mg. ascorbic acid and 10 mg. nicotinamide, which is given to the men, one capsule every other day, starting 2 weeks after the beginning of the patrol.

The diet of these submarine personnel was thus not only adequate in all essential foods but of higher quality than that obtained in most Navy surface vessels and at advance bases.

The response of the gum conditions to local therapy was dramatically prompt in most instances. The filling of cavities, removal of calculus, and scaling and polishing of the teeth usually cleared up all cases of gingivitis in a few days' time. The cases of Vincent's infection were all cleared up within from 3 to 5 days. The only treatment was gross scaling, removal of necrotic tissue, frequent mouthwashes of 1:1,000 solution of bichloride of mercury in hydrogen peroxide, and, finally, deep scaling of the calculus and a prophylactic treatment. The bichloride-hydrogen peroxide mouthwashes seemed to be more efficient than the usual mouthwashes and applications. No adjuvant vitamin therapy was given. These results are in contradistinction to those of Nelson whose gingivitis patients all re-

sponded to vitamin C therapy alone.

The obvious conclusion in this series is that the gingivitis in these instances was not due to the lowering of general and local immunity to the organisms by avitaminosis, but due solely to the lowering of local immunity by local trauma or irritation and poor oral hygiene.

The principal factor responsible for the poor oral hygiene found in many of these submarine personnel is their failure to use toothbrushes properly and often enough. A contributing factor is the interruption of the customary daily routine caused by frequent and irregular watch standing, and the lack of water. Excessive smoking may be a contributing factor.

SUMMARY

1. Bleeding gums among submarine personnel returning from war patrols were more common than among personnel of a tender in the ratio of 5 to three.

2. Vincent's gingivitis was present in 1.4 percent of all submarine personnel examined. No cases were found among personnel of the tender.

3. The frequent finding of gingivitis in early avitaminoses is recognized.

4. Submarine personnel showed no clinical evidences of avitaminosis and their diet was found to be adequate in all respects.

5. Prompt response to local treatment without adjuvant vitamin therapy proved these cases to be caused by local factors alone, which in turn were brought on by neglect of oral hygiene.

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LUBRICATION AND STERILIZATION OF DENTAL HANDPIECE

REPORT OF A STUDY

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The acute shortage of dental instruments and equipment necessitates much more than ordinary care for their preservation. No instruments present greater problems than those having moving parts which are subjected to corrosive and abrasive agents, are difficult to clean and lubricate, and yet demand precision and accuracy for their intended use. The dental handpiece, composed of a shaft, sheath, and numerous small intermeshing gears which must be lubricated and yet be kept sterile, is always most difficult to maintain, particularly so in military units. Field units and many temporary installations lack facilities and equipment to give this instrument adequate care. Because of the difficulty it presents for cleansing and lubrication, it is usually neglected; consequently its period of usefulness is greatly shortened and its efficiency impaired.

Appleton in 1924 studied the problem. He used boiling mineral oil to accomplish the two purposes of lubrication and cleansing and presented a simple technic to overcome cross-infection which can, in general, be applied to most modern operative practices; however the problem of lubrication with the Appleton method, as with many others, is not entirely satisfactory. The present study showed the inadequacy of the lubrication factor in these technics. Other methods that have been advanced range from the use of chemicals, gases, moist heat, and dry heat, to actual flaming of the handpiece. Some features in each method are desirable, but each also has undesirable features.

In military service the handpiece must often be used by more than one operator, and its frequent use makes a rapid method of sterilization necessary. Accordingly an attempt was undertaken to find a simple preparation that would quickly condition the handpiece before each operation.

Effective lubricants adhere to metallic surfaces. Such oil films

collect abrasive materials, as pumice stone, powdered enamel, steel filings, and debris and retain them in the bearings and gears of handpieces. Abrasive and corrosive materials cannot be removed by adding excesses of lubricant, nor can adequate lubricating properties be expected by the use of excesses of cleansing agents. Thus it is reasonable to assume that a satisfactory cleansing agent cannot be incorporated in a lubricating agent. Contaminated lubricant must be removed with a suitable oil solvent, which must be clean in order to prevent corrosive action by moisture and chemical agents, and to reduce friction and heat.

It was thought that a highly volatile solvent might be used as a cleansing agent in a balanced formula with an effective lubricating agent. Rapid evaporation of the solvent might be expected to leave a sufficient amount of lubricant for necessary protection. Sterilization was to be effected by the addition of satisfactory germicidal agents to the solution. The use of a series of preparations described in the accompanying table showed the futility of such an effort, and a search was undertaken for another and more satisfactory method of handpiece conditioning.

The practical lubricant for universal use must be a simple preparation. The ingredients must be easily obtained at any military installation, and they must be effective following rapid and simple application. The ideal product should be an effective lubricant; it should have both cleansing and sterilizing action, a pleasant odor and taste, and be noncaustic and noncorrosive; it should have stability, and it must not interfere with the operation of the instrument by leaving a film on the operator's hands.

Obviously it is difficult if not impossible to incorporate all these desirable factors in a single preparation. Ingredients for a series of experiments were selected by availability and known physical properties. The results of nine experiments, conducted by different operators and based on their opinions, mechanical measurements, and bacterial tests are reported in detail as follows. A new Chayes contra-angle handpiece was the instrument used in each instance.

EXPERIMENTS

Experiment No. 1.—Two test tubes were used, one containing carbon tetrachloride and the other a mixture of 30 cc. of castor oil and 5 cc. of oil of wintergreen. A contra-angle handpiece was immersed in the carbon tetrachloride for from 20 to 30 seconds with the engine in motion. The handpiece was removed, dried

vith sterile gauze, immersed in the castor oil solution and run for between 20 and 30 seconds. The cleansing action was reported good, there was no apparent wear or corrosive action, and the lubrication was fair. Bacterial culture showed prolific growth which indicated insufficient germicidal value. The outside of the handpiece was difficult to clean and remained slippery and insecure in the operator's hand. The product should be considered not practical.

Experiment No. 2.—Two test tubes were used, one containing alcohol and 3-percent formalin and the other a light mineral oil.

The contra-angle handpiece was immersed in the alcohol solution for 2 minutes with the engine in motion. The handpiece was removed, dried with sterile gauze, and run in the oil for one minute. The cleansing action was reported good and there was no apparent wear or corrosive action. The lubrication was ineffective, since the handpiece generated excessive heat and after several minutes' continuous running the instrument would freeze. The lubricant was apparently too light and would not be retained in the moving parts of the handpiece. Bacteriologic examination showed the product ineffective as a bactericide. This product should be considered not practical.

Experiment No. 3.—The contra-angle handpiece with the engine in motion, was immersed in a test tube full of boiling white petrolatum for 1 minute. The handpiece was removed and while hot it was wiped free from excessive grease with a sterile napkin. The cleansing action was fair, there was no apparent wear or corrosive action, and the lubrication was good. Upon culture the growth of numerous organisms indicated that the handpiece should be immersed for a longer period of time in the hot petrolatum. Immersion for 10 minutes was found necessary to secure a negative culture. This method should be considered fairly practical.

Experiment No. 4.—The contra-angle handpiece was immersed in a test tube containing kerosense 30 cc. and oil of wintergreen 5 cc. and run for 2 minutes, removed and wiped free of excessive oil with sterile gauze. The cleansing action was reported good and there was no apparent wear or corrosive action. Excessive heat was generated after a short period, indicating insufficient lubrication. The odor and taste of the product was objectionable and the excess solution soiled the operator's hands and the patient's lips. Culture showed the product to be fairly germicidal. This product should not be considered practical.

Experiment No. 5.—A test tube containing 70-percent alcohol and another containing 30 cc. of castor oil and 5 cc. of oil of

Test of preparations combining solvent with lubricating agent.

Preparation	Days	Bacterial cultures				Active properties				Technic—Handpiece immersed in solution	Remarks	Conclusions
		Reaction	Types of organisms	Time		Cleansing	Corrosion	Wear	Lubrication			
				Immersion (secs.)	Incubation (hrs.)							
Solution No. 1 (2 test tubes) 1. Carbon tetrachloride 2. Castor oil 30 cc.; oil wintergreen 5 cc.	7	Pos.	Predom. staph.	(Each sol.) 30	96	Good	None	None	Fair	Thirty seconds—engine in motion (each solution)	Prolific bacterial growth indicates insufficient germicidal value. Undesirable oily film on handpieces difficult to remove	Unpractical.
	15	do	do	do	do	do	do	do	do			
Solution No. 2 (2 test tubes) 1. Formalin 3% and alcohol 2. Light mineral oil	7	Pos.	Predom. staph.	120	96	Good	None	None	Fair	Two minutes—engine in motion (each solution)	Lubricant ineffective. No germicidal property	Unpractical.
	15	do	do	(Each sol.) 60	do	do	Slight	Slight	Poor			
Solution No. 3 (1 test tube) White petrolatum (boiling)	7	Pos.	Predom. staph.	60	96	Good	None	None	Good	One minute—engine in motion	Lubrication good. Bacterial test satisfactory	Most satisfactory of those tested.
	10	Neg.		120	do	do	do	do	do			
	15	Pos.	Predom. staph.	do	do	Fair	do	do	do			
Solution No. 4 (1 test tube) Kerosene 30 cc.; oil wintergreen 5 cc.	7	Pos.	Predom. staph.	120	96	Fair	None	None	Ineffective	Two minutes—engine in motion	Lubrication insufficient. Odor, taste objectionable. Oil comes off instrument. Bacterial test satisfactory	Unpractical.
	15	do	do	do	do	do	do	do	do			
Solution No. 5 (2 test tubes) 1. Alcohol 70% 2. Castor oil 30 cc.; oil wintergreen 5 cc.	7	Pos.	Predom. staph.	(Each sol.) 30	96	Good	None	1/2000 in.	Good	Thirty seconds—engine in motion (each solution)	Lubrication effective. Bacterial tests satisfactory. Slight wear probably due to pumice stone	Fairly practical.
	15	Pos.	do	do	do	do	do	Slight	do			

Solution No. 6 (2 test tubes) 1. Alcohol 95% (flame) 2. Light mineral oil	7	Pos.	Predom. staph.	60	96	Fair	None	Slight	Inef-fective	One minute—engine in motion (each solution)	Lubrication insufficient. Undesirable film on handpiece, difficult to remove. Bacterial test from gears unsatisfactory. From outer sheath, negative	Fairly practical.
	15	do	do	120	do	do	do	do	do			
Solution No. 7 (1 test tube) Carbon tetrachloride 120 cc.; mineral oil 25 cc.	7	Pos.	Predom. staph.	(Each sol.) 30	96	Fair	None	Slight	Inef-fective	Thirty seconds—engine in motion	Lubrication insufficient; heat generated. Bacterial tests satisfactory. Oil comes off instrument	Unpractical.
	15	do		120	do	do	do	do	do			
Solution No. 8 Johnson's hot oil sterilizer	7	Pos.	Predom. staph.	600	96	Fair	None	Slight	Good	Ten minutes	Lubrication good. Bacterial tests satisfactory. Time requirement unsatisfactory	Unpractical for Naval use.
	15	do	do	do	do	do	do	do	do			
Solution No. 9 Commercial	3	Neg.		60	96	Fair	None		Fair	One minute—engine in motion	Lubrication insufficient. Cleansing action poor. Corrosive action. Bacterial tests unsatisfactory. Excessive wear. Unstable solution	Unpractical.
	7	Pos.	Predom. staph.	do	do	Poor	Slight	Gear worm ex.	Insufficient			
	10	do	do	do	do	Bad	Excessive	1/1000 in. (top bearing)	do			
Solution No. 10 (Formula No. 8) Commercial	7	Neg.		60	96	Fair	None	Slight	Inef-fective	One minute—engine in motion	Lubrication insufficient. Cleansing action poor. Slight corrosive action. Bacterial tests satisfactory	Fairly practical.
	15	do		do	do	Poor	Slight	do	do			
	30	do		do	do	Bad	do	do	do			
Solution No. 11 Cresol 3 cc.; lubricating oil 200 cc.; xylol 200 cc.; methyl salicylate 2 cc.	7	Pos.	Predom. staph.	60	48	Fair	None	None	Fair	One minute—engine in motion	Lubrication good. Cleansing action good. No apparent corrosive action. Bacterial test satisfactory	Fairly practical.

wintergreen were used in this experiment. The contra-angle handpiece was immersed while in motion in each solution for 30 seconds and dried. The cleansing action was reported to be good and there was no apparent corrosive action. Minimum heat was developed and the operator was enthusiastic over the results. Wear of 1/2,000 inch was detected. Culture showed this solution to be an effective germicide. This method should be considered fairly practical.

Experiment No. 6.—Two test tubes were used, one containing 95-percent alcohol and the other a light mineral oil. The handpiece was dipped into the alcohol and flamed with a lighted match. It was cooled and run for 1 minute in the light mineral oil, removed and dried with sterile gauze. There was apparently no corrosive action. The handpiece was difficult to clean and wear of the bearings was evident, which indicated insufficient lubrication. Tests of material taken from around the gears showed heavy bacterial growth, although results of tests on material taken from the outer sheath were satisfactory. The operator did not consider this method practical.

Experiment No. 7.—One test tube containing 120 cc. of carbon tetrachloride and 25 cc. of mineral oil was used. The handpiece while in motion was immersed in the solution for approximately 1 minute and wiped dry with sterile gauze. Excessive dirty oil accumulated on the outside of the handpiece. No corrosive action was detected, but wear was suspected and the excessive heat generated after use indicated insufficient lubrication. Culture showed satisfactory results. This preparation was not considered practical by the operator.

Experiment No. 8.—A Johnson patented electric sterilizer was used in this experiment. When the oil had reached a temperature of 150° C., the handpiece was immersed for 10 minutes and cooled in alcohol. The handpiece was kept reasonably clean, showed no corrosive action or noticeable wear. The lubrication was good and culture for bacteria satisfactory. When time is short (because each unit has only one contra-angle handpiece), the time necessary to heat to sterilizing temperature and to cool to usable temperature is too great for this method to be practical.

Experiment No. 9.—A commercial product was used and directions inclosed with this product were followed carefully. Experiments were terminated after 10 days because of the excessive bacterial growth this product permitted on the handpiece. The appearance of the cultures suggested that the product might furnish bacterial nutriment instead of having the desired bactericidal effect. Cultures taken from the handpiece after 3 days' use of the

product showed satisfactory results; cultures taken after 7 days showed definite increase in bacterial growth, and after 10 days the growth was excessive.

The handpiece was dismantled and examined for cleanliness, corrosive action, and wear. Abrasive deposits were detected around the bearings and gears in sufficient quantity to be harmful to the mechanical operation of the instrument. Definite evidence of corrosive action showed in the presence of rust on gears and shafts. The top bearing on the handpiece showed wear of 1/1,000 inch. The front gear was badly worn. During the test period heat was generated upon prolonged use at high speed, indicating insufficient lubricating properties. The results of our experiments do not support the claims of the manufacturer. The product was not considered effective as a germicide, cleansing agent, or lubricant.

Experiment No. 11.—After 8 months of use this solution composed of cresol 3 cc., methyl salicylate 2 cc., lubricating oil 200 cc., and xylol 200 cc., has been determined the most practical cold handpiece conditioner. The bacterial tests demonstrate some contamination but the instrument has been kept in excellent mechanical condition.

COMMENT

It is suggested that those handpieces which can readily be taken apart should be dismantled each evening and cleaned with a small, hard brush and carbon tetrachloride, xylol, or other oil solvent. After drying, sterile white petrolatum should be applied to gears and bearings and the handpiece assembled. Sterilization should be accomplished by the alcohol and flame (Harvey) method, or by judicious use of dry heat after each use. Those handpieces not easily taken apart can probably be given best care by the use of boiling oil or petrolatum (method No. 3 or No. 8).

It is concluded that:

1. Heat is the most effective sterilizing agent.
2. Chemical sterilization, using the phenol coefficient as a standard, requires too much time for complete sterilization.
3. Thin oils are not retained in the moving parts of the handpiece long enough to insure complete lubrication.
4. Materials of the viscosity of white petrolatum are apparently the best lubricants.

A DENTAL PROGRAM IN THE SOUTH PACIFIC AREA

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Although a Navy dental officer works under certain handicaps in the South Pacific area, it is possible to set up a satisfactory dental program.

Certain pieces of equipment are lacking from field chest No. 35, and it is a good idea for a dental officer leaving the States for the first time to be stationed with a Naval or Marine shore unit, to provide himself with (1) a small electric motor, 110 v., A.C., suit-table to supply power to the unit; (2) a rheostat for the motor, which may be built into a foot control; (3) an electric single-burner hotplate to use for sterilizing; (4) an electric fan; (5) a cowhorn forceps; and (6) one pint of merthiolate, if desired.

If it is possible to obtain more than one small electric motor, it is well to have a spare. This electric motor can be provided with blades and serve as a fan.

As soon as the unit has made camp, preparatory to remaining for a while, the dental unit may be set up. Emergencies must be taken care of and certain equipment will probably have to be broken out for this purpose. However the basic requirements of a good field office are as follows.

It should have a wooden floor, about 18 inches off the ground, a good roof for protection from rain, and if possible should be well screened. A tent with a wooden floor is a good substitute for a more permanent frame building. A porch of some type should be constructed, and a foot-scraper placed in front of it to aid in keeping the floor of the office clean. A foot-scraper can be made of a piece of large mesh screening over wooden supports, or from a box-like form with numerous cleats across the top.

Electric wiring can be installed to supply power for the unit and for lighting, and usually enough water may be piped in from the main line. At this activity a sheet-metal worker constructed a cuspidor, draining to the outside and away from the building. A sink is also very useful.

After the small porch had been built on the front of this tent office, a rule was made that all patients remove their shoes before entering. This may appear to be a silly ruling, unless one has experienced tropical mud. The mud on the floor dries to dust which blows over the sterile instruments.

After the office has been set up, a check of the records will often reveal that considerable time has elapsed since the men have had dental examinations. A roster of the unit can be secured from the personnel officer, and with the approval of the commanding officer, a schedule for examinations set up.

At this activity dental sick call was held daily from 0730 to 0830. During this time emergencies can be handled and appointments made for operative work.

Appointment slips may be mimeographed. A sample appointment is:

Name of unit

.....has a dental appointment for.....
at .....

NOTE: BE SURE TEETH ARE BRUSHED IMMEDIATELY BEFORE KEEPING APPOINTMENT.

.....
Dental Officer, Lt. (jg), (DC) USNR

Until the examinations were completed here, the mornings from 0830 to 1130 were allotted to examinations, and 30-minute afternoon appointments were made from 1300 to 1630. With a properly screened and lighted office, it was possible to book some evening appointments.

A yeoman from the unit assisted with health records. Forty patients per hour were examined at 0830, 0930, and 1030. The order in which they reported for examination was unimportant. In this way routine work was interfered with very slightly.

Many of the H-4 records were found to be inaccurate, having been made out rapidly with a certain percentage of errors at the various indoctrination centers and bootcamps, and in addition many men had had subsequent dental work done which had not been recorded. Since the dental record is important as a means of identification, these records were corrected during the examination period.

The procedure was as follows. As the group lined up outside for dental examination, the yeoman asked their names, checked them off on the roster, and as the man took his shoes off preparatory to entering the office, the yeoman found his health record, giving it to the patient. Inside, the corpsman, seated at the desk, took the health record from the entering man, and directed him to the chair.

The mouth examination was made in two stages. At the first examination missing teeth and permanent restorations were checked. Then teeth to be extracted and caries present were recorded, and irregularities in occlusion were noted under "Remarks."

Note was also made of any removable prostheses or appliances.

As the patient left the office he was given a mimeographed sheet of instructions on proper toothbrushing, including rinsing the mouth, and the value of periodic examinations.

In extraction cases the patient was given a mimeographed sheet of instructions for postoperative care as follows:

DENTAL DEPARTMENT
Name of unit

POSTOPERATIVE CARE

Directions to patient: READ CAREFULLY.

1. Continue to bite on the gauze pack provided for you at least ½ hour.
2. Keep all fluids and suction away from the extraction area. Try to eat on the other side of your mouth.
3. If necessary, when the anesthesia has worn off, you may take two of the tablets with which you have been provided. This may be followed in from 1 to 2 hours with a second dose if necessary.
4. Keep the remaining teeth brushed and the mouth as clean as possible, being careful of the extraction area for a few days.
5. Beginning the second day, and continuing for 7 to 8 days, obtain some salt from the galley, using about a teaspoonful to a cup of warm (if possible) water, and rinse the mouth after each meal and before retiring. Avoid the extraction area the first few days.
6. If bleeding should recur after the gauze has been removed, bite on a clean handkerchief for another half hour, or obtain fresh gauze from the Dental Clinic. In cases of severe bleeding contact the dental officer at once.
7. Report to Dental Sick Call on the second and fifth mornings.

Not all these patients require postoperative checkups on the second and fifth mornings, but it takes very little time to see them during the morning sick call period, and thus be assured that good healing is taking place.

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DRIED EGGS AND EGG POWDERS IN SALMONELLA INFECTION

Examination of 380 lots of Canadian egg powder for salmonella showed organisms in 28 samples. Nine different types were isolated. Except type Salmonella pullorum, all strains were potentially pathogenic to man. In the samples for which numerical estimations were made the actual number of salmonella organisms present was low, mostly less than from 1 to 10 per gram, but one sample contained 54 per gram. The presence was not related to general contamination as judged by coliform estimations. No information was available as to how these salmonella strains gained access to the egg powder.—Editorial: Eggs and salmonella infections. Brit. M. J. 2: 760-761, December 9, 1944.

CLINICAL NOTES

ODONTOMA ASSOCIATED WITH IMPACTED CUSPID AND RETAINED DECIDUOUS CUSPID

REPORT OF A CASE

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Lieutenant Commander (DC) U.S.N.
and
JAMES F. MATLOCK
Lieutenant, junior grade (DC) U.S.N.R.

The case presented here parallels one recently reported by Forsyth.[1] It is presented only as an additional record of a relatively unusual dental anomaly.

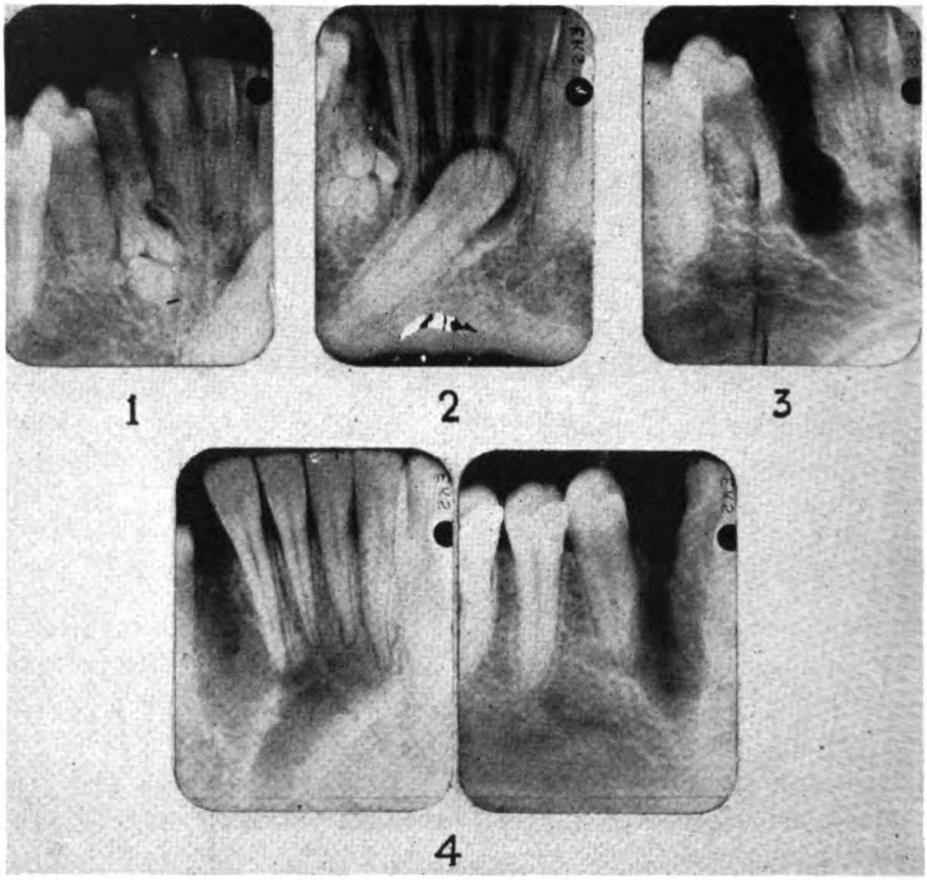
Odontomas occur most frequently in the lower jaw at the sites of unerupted teeth. To identify the type of odontoma removed, reference is made to Brophy's classification[2] in which a mixed odontoma is defined as one containing two or more of the following tissues—enamel, dentin, or cementum. This type of odontoma was found in the following case in conjunction with a retained mandibular right deciduous cuspid and an impacted mandibular right permanent cuspid.

Case report.—A male, aged 18 years, was seen on 11 July 1944 for routine recruit dental service. The gingival tissues presented a normal healthy appearance. There was occlusal caries in a mandibular right molar, and a retained deciduous mandibular right cuspid was present. The mandibular right permanent cuspid was missing, and upon palpation the crown of this tooth was located in the floor of the vestibule, labial to the roots of the mandibular incisors. Neither the odontoma which was subsequently revealed by roentgenographic examination, nor the impacted tooth had given rise to any symptoms and the patient was unaware of their presence.

Roentgenographic examination revealed the odontoma at the apex of the deciduous cuspid, and the permanent cuspid in an oblique position, its incisal edge approximately 3 mm. above the apices of the incisor teeth and its root tip approximately 3 mm. above the inferior border of the mandible. A large radiolucent area surrounded the crown of the impacted cuspid; the odontoma presented a typical gnarled appearance.

[1] FORSYTH, B. D.: Compound composite odontoma associated with impacted mandibular right lateral incisor. J. Am. Dent. A. 31: 1040-1042, August 1, 1944.

[2] MEAD, S. V.: Oral Surgery. 2d edition. The C. V. Mosby Company, St. Louis, 1940, p. 1,112.

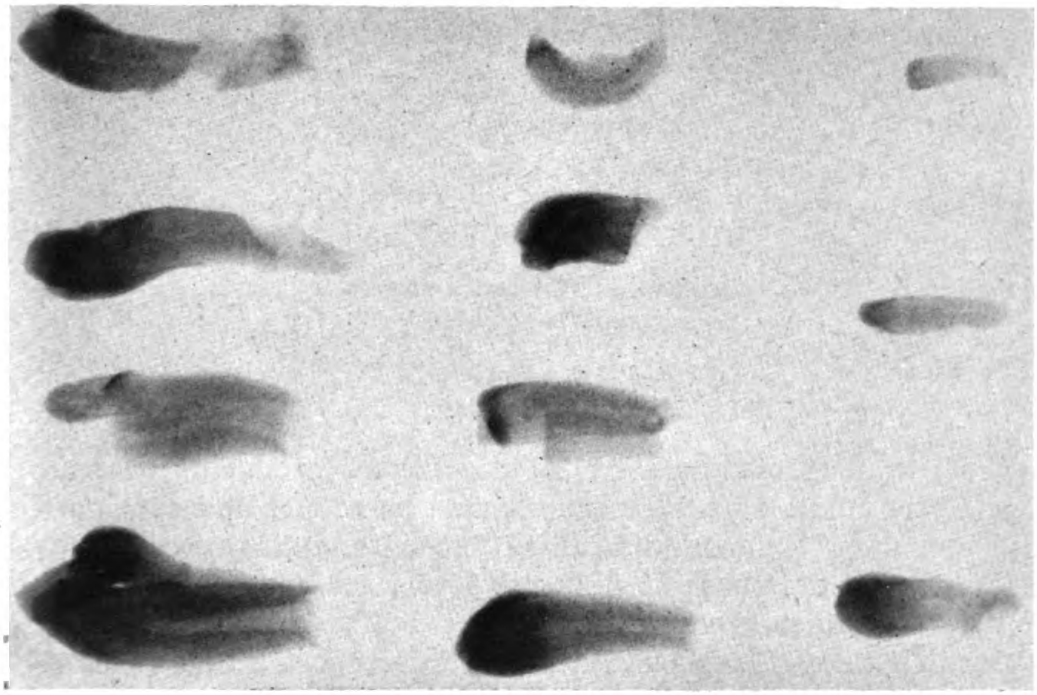


1. Showing relation of retained deciduous mandibular right cuspid to odontoma. **2.** Showing positional relationship of impacted mandibular permanent right cuspid to odontoma. Radiolucent area (tooth follicle) surrounds coronal portion of cuspid. **3.** Showing x-ray taken immediately after removal of odontoma and retained deciduous cuspid. **4.** Two views taken of area 24 days after removal of impacted cuspid, deciduous cuspid, and odontoma.

One and one-half grains of phenobarbital was administered to the patient 30 minutes before operation. Local anesthesia was obtained by a right mandibular injection of 2 cc. of procaine hydrochloride. The area to be operated was dried and painted with 1:1,000 tincture of merthiolate, and infiltrated.

A vertical incision was made in the alveolar gingiva between the root of the left lateral incisor and the impacted cuspid, extending from the gingival crest to the floor of the vestibule. The gingival margin was freed to the mesial of the right first bicuspid and a flap laid back. Overlying bone was removed, the crown exposed, and the adherent tooth follicle removed. The impacted cuspid was then elevated from its attachment. The deciduous cuspid was next removed, and an opening made in the labial plate to deliver the odontoma, which was removed as fourteen separate denticles, some resembling miniature cuspids with enamel and cementum.

Roentgenograms were taken immediately following the operation to confirm complete removal of the odontoma. An iodoform gauze dressing with sulfathiazole paste was placed in the wound, and the flap sutured. The patient was kept in the sickbay for 24 hours, a cold compress applied externally for several hours, and mild postoperative sedation prescribed. The



5. X-ray photograph of denticles removed; note root canals and pulp horns.

6. Photograph of eleven of the fourteen denticles removed.

day following the operation the patient was discharged to duty. No postoperative sequelae were observed. The dressing was removed after 48 hours and the sutures after 4 days. Follow-up roentgenograms taken 24 days after operation showed healing to be progressing satisfactorily. Although the labial aspect of the incisor roots had been laid bare by the removal of the impacted cuspid, these teeth responded to vitality tests.

AERO-SALPINGOTYMPANITIS

WITH DELAYED VESTIBULAR SYMPTOMS
REPORT OF A CASE

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Teed[1] in 1943 made a study of the factors producing obstruction of the auditory tube in submarine personnel and concluded that the most common difficulties encountered in exposures to increased air pressures at different levels are caused by the inability to equalize pressure in the ears due to obstruction of the eustachian tube. Since publication of this report a case of aero-salpingotympanitis with delayed vestibular symptoms has been observed at this activity, which is presented because it is featured by the fact that the diver recompressed himself in search of relief from pressure discomfort.

Case report.—A 24-year-old diver was admitted to the sickbay with the chief complaint of vertigo. On the previous day he had made a dive of 45 feet, remaining submerged for 15 minutes. He had a slight head cold and he said that he had been somewhat deaf in his left ear since early childhood. His preliminary dive provoked an increasing stuffiness in the left ear with further diminished auditory acuity. No pain was experienced, but because of the induced otitic discomfort this man took it upon himself to take 50 pounds of pressure shortly after his first dive, in the hope of allaying the discomfort and stuffiness in his left ear. Vertigo developed 4 hours after this so-called *recompression*, and once it became apparent, it became progressively unbearable until his admission to the sickbay 16 hours later.

Pertinent objective physical findings revealed a tendency to reel and to fall forward and to the side of the involved ear. There was definite "past pointing" to the side opposite the involved ear. Otoscopic examination revealed a retracted left tympanum, and negative results from a Valsalva maneuver (left) with no perforation or fluid levels seen. The membranes of the upper respiratory tract showed an acute catarrhal inflammation. The right tympanum appeared normal. All tendon reflexes, including the papillary reflex, were normal. Findings of urinalysis and hematologic studies were well within normal limits.

No definitive therapy was instituted. Attempts to reinflate an inflamed ostium with vestibular disease would not have been practicable and specific drug therapy was not indicated. At the end of 48 hours all symptoms of vestibular disturbance had subsided with no objective sequelae.

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[1] TEED, R. W.: Factors producing obstruction of auditory tube in submarine personnel. U. S. Nav. M. Bull. 42: 293-306, February 1944.

COMMENT

This case presents several interesting aspects: (1) The absence of pain; (2) the latent development of progressive vestibular signs with profound vertigo; and (3) the antecedent history of deafness and coexistent otitic disease with acute catarrhal inflammation of the membranes of the upper respiratory tract.

It is an established fact that the myringa is supplied with sensory corpuscles. It is possible that coexistent and antecedent otitic disease in this case could, in the process of scar deposition, have obliterated the pain corpuscles. The air and fluid trapped in the middle ear at the time of the first dive was not compressible in the middle ear. It is probable, therefore, that the suction pump action in the ear with a nonpatent tubal ostium developed a greater vacuity, with the capillaries of the ear expanding to the point of rupture. It is believed that this occurred within the inner ear to produce the preponderant vestibular signs, to the complete overshadowing of any symptoms of middle ear disease. While there is no proof, it is believed that volume pressure relationships were disturbed in the endolymphatic channels by increases in pressure within the equilibratory mechanism, and that this was caused by trapped air, transudation of serum, and possibly hemorrhage into the semicircular canals.

This diver himself undertook to correct a condition of induced stuffiness in the ear incurred by a primary dive of 45 feet by subjecting himself, without benefit of medical counsel, to an additional 50 pounds of pressure, thereby producing progressive clinical vestibular symptoms. In the absence of coexistent otitic disease, pain would have been a prominent symptom before signs of inner ear disturbance became apparent. In this case the added pressure and blood vessel dilatation, with possible eventual rupture, were brought about by an increasing vacuum producing pathologic changes in the vestibular apparatus.

Shilling and Everley[2] have observed suppurative otitis media and mastoiditis to follow tubal obstruction. Possible causative factors in the inability to equalize pressures are: (1) Heterotopic lymphoid tissue; (2) lymphoid hyperplasia in and about the fossa of Rosenmüller with extensions as far as the middle ear; (3) previous scarring of the tympanum from previous otitic disease; (4) deafness due to heterotopic lymphoid tissue rather than pressure trauma; and (5) mandibular overbite, occluding the fossa of Rosenmüller.

[2] SHILLING, C. W., and EVERLEY, I. A.: Auditory acuity in submarine personnel. U. S. Nav. M. Bull. 40: 664-686, July 1942.

This case is reported for the purpose of emphasizing the appearance of delayed progressive vestibular signs in a diver who was not instructed in the fallacy of adding pressure to air pressure already trapped in an abnormal ear in the presence of concomitant respiratory infection. By the obliteration of heterotopic lymphoid tissue by x-ray therapy, the correction of septal deviations, careful adenoidectomy and tonsillectomy when indicated, and, specifically, relief of eustachian tube obstructions, better physiologic conditions for withstanding pressure will be attained.

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PENICILLIN-INOCULATED GAUZE IN TOPICAL THERAPY

Forty-seven cases of surface infection were treated with Penicillium notatum-inoculated gauze dressings and crude penicillin. Twenty-five cases healed and 13 improved during treatment.

The types of cases included leg ulcer, chronic endocervicitis, pilonidal-sinus wound, mastectomy wound, carbuncle, burn of neck, peroneal wound and ulcerative stomatitis.

Chronic or mixed infections did not respond so well as did acute infections or those infected with but one strain of a penicillin-sensitive organism.

Because of the difficulties associated with preparing crude penicillin and mold-inoculated gauze, only purified penicillin for the treatment of cases of surface infection should be used.—MYERS, R. S.; ALDRICH, R. H.; HOWARD, R. W.; WALSH, R. A.: Use of gauze inoculated with Penicillium notatum or impregnated with crude penicillin in treatment of surface infections. New England J. Med. 231: 761-764, December 7, 1944.

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HONEY OINTMENT

Since the outbreak of war, it has been necessary to rely on native materials as substitutes for certain drugs. The use of a honey ointment, made from 80 percent of honey in lard, in the treatment of chilblain, chilblain ulcers, ordinary ulcers and small wounds is recommended.

Honey contains chiefly sugars, small amounts of formic acid, sulfur, chlorine and other metallic elements. Its bacteriostatic property is attributed to its high sugar content; the rapid subsidence of passive congestion and edematous swelling in lesions is due primarily to its hypertonicity.—YANG, K. L.: Use of honey in treatment of chilblains, non-specific ulcers, and small wounds; preliminary report. Chinese M. J. 62: 55-60, January-March 1944.

MIOSIS FROM EXCESSIVE INGESTION OF VITAMIN A OVER A PERIOD OF FORTY DAYS

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Recently editorial opinion was expressed[1] that excessive and prolonged consumption of vitamin A is not considered to be hazardous. Specifically it is stated that, "A hundred thousand units of vitamin A daily seems a moderate dosage."

Reference is also made to a report by Lehman and Rapaport[2] who mention a single dose of 2 million units of vitamin A given as a test for visual deficiency, and these authors themselves gave from 100,000 to 200,000 units daily for months to children with no discernible bad effect.

In view of these statements it would not appear that the young man to be cited here, who ingested 7 million units of vitamin A, consumed an unprecedented amount of this vitamin. However as no similar miosis has apparently been previously observed, and as the evidence clearly points to the direct causal relationship between the vitamin ingestion and the "pin-point" pupils in this instance, the explanation in this case may consist of unusual sensitivity to vitamin A.

Case report.—A 17-year-old male applied at a Navy recruiting station on 5 August 1944 for voluntary enlistment. General physical and neurologic examination revealed no abnormality except for the striking appearance of the pupils, both of which were extremely miotic, being "pin-point" in diameter. The visual acuity was 10/20 in each eye. Morphine addiction was denied, as well as the use of any miotic agent.

The following history was obtained: Throughout a 40-day period the boy had ingested approximately 7 million units of vitamin A. His daily consumption of vitamin A during the 2-week period prior to his appearance at the recruiting station had been 250,000 units. Since from 5,000 to 6,000 units per day is considered an adequate amount of this vitamin, it is apparent that he had consumed between thirty and forty times the average maintenance dosage required by any normal individual who is not suffering from a definite avitaminosis.

The boy stated that a druggist had advised him to take vitamin A over this period of time, in the quantity mentioned, with the purpose of correcting

[1] Vitamin A for acne vulgaris. Queries and Minor Notes. J.A.M.A. 126: 202, September 16, 1944.

[2] LEHMAN, E., and RAPAPORT, H. G.: Cutaneous manifestations of vitamin A deficiency in children. J.A.M.A. 114: 386-393, February 3, 1940.

what an optometrist, some weeks previously, had diagnosed as a slight degree of myopia. At no time did this young man ever notice any diminution of night vision. The optometrist himself, however, had prescribed only corrective muscular exercises.

The boy was immediately instructed to discontinue taking vitamin A, and 5 days after he was originally seen the pupils presented a normal appearance. Visual acuity in the right eye remained 10/20 but had decreased to 6/20 in the left eye. A thorough ophthalmologic examination at this time revealed no abnormalities and confirmed the degree of visual acuity which was found at the recruiting station.

The possibility of the miosis in this instance being due to some factor other than the excessive and prolonged ingestion of vitamin A was considered, but ruled out after investigation. The boy was most emphatic in stating that no drops of any kind were instilled into his eyes by himself or anyone else, and he vehemently denied having taken any medication whatsoever except the vitamin A. There seems to be no legitimate doubt, therefore, that the miosis resulted solely from his ingestion of vitamin A.

Unscientific and promiscuous prescribing of any potent medication is to be deplored, as the possibility of permanent structural damage, as well as temporary functional alteration, must always be considered. In addition individual idiosyncrasies and various degrees of sensitivity should make mandatory proper conservatism. The pharmacologic axiom that any type of medication which is capable of exerting a beneficial action can also be instrumental in producing noxious effects should never be forgotten.

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EFFECTS OF COOKING ON SALMONELLA IN EGGS

In cooking experiments with reconstituted eggs heavily inoculated with salmonella organisms it was found that the bacilli were all destroyed in egg powder cooked as scrambled eggs and omelettes, and in sponge cakes, custards, and muffins, but boiling ducks' eggs in the shell for shorter than 8 minutes would not make an infected egg harmless.

The present position would seem to be that we cannot entirely exonerate dried eggs from the possibility of acting as a vehicle for the spread of salmonella poisoning, although the risk is probably small. Actually outbreaks in this country of salmonella food-poisoning associated with dried eggs are not unknown during the present war, although none has apparently been the subject of a scientific paper.—Editorial: Eggs and salmonella infections. Brit. M. J. 2: 760-761, December 9, 1944.

ACUTE BOWEL OBSTRUCTION SECONDARY TO REGIONAL ENTERITIS

REPORT OF A CASE

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Captain (MC) U.S.N.R.
and
LEO M. ZIMMERMAN
Lieutenant Commander (MC) U.S.N.R.

Obstructive phenomena are present at some time during the course of regional enteritis in about one-third of the cases, according to Fallis (*1*). The manifestations may vary from borborygmus and colicky abdominal pains to complete obstruction. The latter is more commonly seen as part of the third or fourth stages of the disease. Acute obstruction, especially in the complete absence of any antecedent history suggestive of intra-abdominal disease, as in the case to be presented here, is probably very rare.

Interest in regional enteritis dates from the description of the clinical entity by Crohn and his associates in 1932. Prior to that time cases of nonspecific inflammatory lesions in the ileocecal region were considered to be tuberculous. As early as 1700 Morgagni described necropsy findings in a case of apparently regional enteritis. In 1893 W. J. Mayo reported a group of nontuberculous inflammatory lesions of the ileocecal coil.

Crohn's original publication defined regional ileitis as a distinct pathologic involvement of the terminal 4 or 5 feet of ileum, limited by the ileocecal valve and marked by chronicity and variability in its bizarre clinical picture.

Bargen (*2*) and Brown and Donald (*3*) suggested the term regional enteritis as being more comprehensive because of the frequency with which segmental lesions of a similar nature were found elsewhere in the gastro-intestinal tract. Ginzburg and Garlock (*4*) stress limiting surgical consideration to what they choose to call distal ileitis, as was emphasized in the original presentation of the subject, and believe there is a sharp distinction pathologically and prognostically between the localized and the diffused forms of intestinal involvement.

Unfortunately nothing definite is known as to the causes of the disease. A causal relationship to mesenteric adenitis has been

suggested. Experimentally, intestinal lesions have been produced in animals by injecting irritating and sclerosing material into the mesenteric and subserous lymph vessels of this region. The preexistence of upper respiratory infection has been noted, and the possibility of an unusual type of tuberculosis is receiving attention.

The disease is characteristically one of young adults, with a slight preponderance of males in a ratio of about four to three (*1*).

The clinical picture is usually divided into four stages (*5*). The onset is apt to be insidious, with fatigue and weight loss as predominant features. The first stage is marked by abdominal discomfort which may be vague or may simulate acute appendicitis. Symptoms closely resembling ulcerative colitis are apt to usher in the second stage. Intermittent diarrhea and constipation, colicky abdominal pains, asthenia, and anemia, often are striking signs. Remissions are frequently encountered up to this time in the course of the disease.

In the third stage, as a result of proliferative and stenosing factors, obstructive phenomena begin to make their appearance and may run the gamut to result in complete obstruction. As a rule the condition is slowly progressive and this stage may merge with the fourth and final stage wherein either acute obstruction or perforation complicate the picture. In the case of perforation, either abscess or fistula formation is the likely outcome. Sepsis and debility are the terminating factors ordinarily.

It has been said that we do not diagnose conditions of which we do not think. This adage is applicable in the condition under consideration. Its vagaries of symptomatology probably account for the fact that many cases are not recognized and are often diagnosed as acute appendicitis or acute intestinal obstruction. Bargen states, "It is a local, highly destructive, inflammatory disease, associated with a well defined clinical entity which should be considered whenever a patient presents himself with intestinal symptoms, the nature of which are not promptly apparent when the usual laboratory tests are made."

In the case reported here regional enteritis had not been considered among the diagnostic possibilities and the patient was subjected to laparotomy in the belief that the condition was one of acute intestinal obstruction of appendiceal origin.

Case report.—A fire controlman, first class, aged 28 years, was first seen at sick call on 19 June 1943, complaining of severe cramp-like abdominal pain, vomiting, and obstruction. He had been in the Navy 3 years, and this was his first admission to the sick list in that time, and aside from occasional constipation he had considered himself entirely well. Because of constipa-

tion and abdominal discomfort he had taken some mineral oil, without benefit. During the night he experienced increasingly intense, crampy abdominal pain accompanied by vomiting, and there was no evacuation.

Physical examination revealed a well-developed, well-nourished white male, obviously suffering acutely from abdominal pain. The vomitus was dark brown and of offensive odor. The abdomen was moderately distended and auscultation revealed distinct hyperperistalsis. There was generalized sensitivity over the entire abdomen without rigidity. Acute abdominal tenderness was elicited on deep palpation in the right lower quadrant. No palpable masses were delineated. The heart and lungs were normal. Aside from an oral temperature of 100.4° F., the physical findings were not pertinent. The urinalysis was entirely negative. Blood count revealed 17,500 leukocytes, with a differential count of 84 percent polymorphonuclear leukocytes, 2 percent lymphocytes, 2 percent monocytes and 12 percent band forms.

The patient was prepared for emergency laparotomy, 5-percent dextrose being administered intravenously and, using procaine hydrochloride intrathecally, the abdomen was entered through a right paramedian incision. A clear, straw-colored fluid was noted on opening the peritoneum and a dilated loop of ileum presented.

Exploration revealed the obstruction to be at the iliocecal junction, where a firm mass, primarily in the mesial wall of the ascending colon, was found. The last few inches of the ileum showed thickening of the walls and injection of the serosa, but the primary seat of the lesion was in the wall of the colon, from which site the induration spread into surrounding structures. The obstruction at the ileocecal valve was complete.

The diagnostic possibilities presented by this gross appearance were (1) regional enteritis, (2) hypertrophic tuberculosis of the cecum, and (3) carcinoma of the cecum. Because of the acute obstruction, an ileo transverse-colostomy was decided upon and carried out by the side-to-side technic. The ileum was not divided because of the obstruction, as it was deemed unwise to close the distal end of the ileum as would have been ncessary had the bowel been sectioned. The primary objective was to relieve the obstruction, and a simple short-circuiting procedure offered the best chance for this as well as to lay the groundwork for future resection. Following completion of the anastomosis the appendix was removed.

Continuous drainage was maintained by means of the duodenal tube, and 5-percent intravenous dextrose and 1,000 cc. of 0.8-percent sulfanilamide in physiologic saline hypodermoclysis were administered in the first 24 hours. A careful check was kept on fluid intake and output. The patient's postoperative course was uneventful. The wound healed by primary intention and on the fifth postoperative day the patient was allowed to sit up. On the sixth postoperative day he was transferred to an advance base dispensary, but his progress and disposition was followed.

The patient entered a Naval hospital on the mainland 4 weeks after operation. At that time he was in good general condition, ambulant, and without subjective complaint. The pulse rate, temperature and blood pressure were within normal limits. The laparotomy scar was firmly healed, although there was still some tenderness along its course and there was resistance beneath it. There was no abdominal distention, and peristaltic sounds were normal. The bowels were moving regularly without the aid of laxatives.

Laboratory examinations yielded negative results except that the stools showed occult blood. X-rays of the chest and of the upper gastro-intestinal

tract taken with the aid of a barium meal disclosed no abnormality. Roentgenographic examination with barium enema revealed a stoma between the ileum and the proximal one-third of the transverse colon. There was some fixation and tenderness in this region. The cecum was irregular in outline. The terminal ileum was pencil-like in appearance. The roentgenologist expressed the opinion that the lesion was more suggestive of tuberculosis than of so-called regional ileitis.

The patient was prepared for operation by the administration of succinylsulfathiazole, 0.25 gm. per kilogram of body weight daily, divided into six doses and continued for a period of 8 days. The operation was performed on 4 August 1943, using spinal anesthesia. Incision was made through the old scar.

There were recent extensive adhesions throughout the peritoneal cavity. The terminal ileum, cecum, and ascending colon were thickened and inflamed, and there was a large, firm, irregular mass in the ileocecal region. No tubercles were visible. The mesentery was greatly thickened and infiltrated, and was studded with hyperplastic lymph nodes.

An entero-anastomosis between the ileum and transverse colon was done, providing an adequate stoma which permitted diversion of the ileocecal flow.

The nature of the process could not be determined with certainty by gross examination, and resection was done. After liberating the mass from the adherent bowel loops and omentum, clamps were applied to the ileum and the transverse colon, close to the ileocolostomy. That portion of the bowel between the clamps, comprising the terminal ileum, cecum, and ascending colon, was removed. The ends of both the small and the large bowel adjoining the enterocolostomy were closed and inverted with two rows of sutures. The abdomen was closed without drainage.

Convalescence was rapid and uneventful. There was no postoperative vomiting, or distention, and solid food was permitted on the second postoperative day. The wound healed by primary union, and the patient was walking about freely at the time the sutures were removed, 7 days after the operation. He went on leave 12 days after operation, and was returned to full duty 4 weeks later. There has been no further digestive disturbance.

Pathologic examination revealed the following. The specimen removed measured 205 mm. in length and consisted of the cecum and ileum, including the ileocecal valve. Just below and partly including the ileocecal valve, the wall was remarkably thickened and infiltrated, almost occluding the lumen. There was a small area of ulceration of the mucosa. Cut surfaces of this indurated portion were white, fairly firm, glistening, and dotted with small areas of yellow. A number of lymph nodes were embedded in the accompanying fatty tissue. These ranged up to 10 mm. in their greatest diameter. Their cut surfaces were reddish gray and slightly bulging.

Microscopically the wall of the cecum was markedly thickened, with a proliferative inflammatory reaction. In areas there was active granulation tissue with much capillary proliferation, and an intense cellular infiltration, chiefly neutrophils, eosinophils, and lymphocytes. In other areas there were large foci of cellular infiltration composed chiefly of lymphocytes. There was fibroblastic proliferation in various stages of maturity. Infrequently a foreign-body giant cell was noted. There was no evidence of neoplasia. Section of the regional lymph nodes showed a nonspecific inflammatory hyperplasia. The histologic changes were consistent with those of (1) subacute and chronic colitis, (2) subacute and chronic ileitis, and (3) hyperplastic lymphadenitis.

COMMENT

The prognosis in regional enteritis leaves much to be desired. According to Brown and Donald it is better to use the term "well" rather than "cured" in referring to the status of a patient with regional enteritis. Out of a group of 178 cases reported by these authors, 82 or 46 percent had been operated upon one or more times previously. The over-all mortality for the entire series was 19 percent, with 16 postoperative deaths. Seven of these deaths occurred following the simple short-circuiting procedure. It may be that this operation was reserved for those cases presenting a poor risk, thus accounting for the relatively high mortality. Ginzburg and Garlock report no mortality in 54 cases subjected to ileocolostomy with exclusion, and are strong in advocating this operation as the one of choice in the management of regional ileitis. They report 8 cases in which secondary exploration or resection revealed healing in the previously diseased loop of bowel.

Periods of remission and exacerbation characterize the disease and cases remain quiescent following nothing more than appendectomy, while others show evidence of recurrence even following extensive and occasionally multiple resections.

The treatment of regional ileitis at present can be said to be definitely surgical, with a preponderance of opinion in favor of resection either primarily or in two stages. In the acute stages a conservative attitude is strongly recommended, opening and closing the abdomen without manipulation of the acutely inflamed intestine. It is well known that some of these cases subside or at least remain without clinical manifestations. When the intestines are extensively involved, resection is undoubtedly the choice in the chronic phases. When obstruction is complete, as in this case, relief of the obstruction by the quickest and least traumatizing method is the treatment indicated.

The method chosen in the case reported here has given uniformly satisfactory results. The question as to secondary resection becomes an individual problem in each case. Resections in the presence of acute obstruction are very risky and should be avoided. It was the bowel obstruction that was threatening this patient's life and demanded prompt relief. Under the existing conditions, Wangensteen drainage did not appear indicated.

SUMMARY

A case of acute intestinal obstruction caused by regional enteritis is reported. There was no history of abdominal disease.

Acute intestinal obstruction is a rare complication of regional enteritis.

Familiarity with the management of all types of surgical emergencies is mandatory on the part of the Naval medical officer.

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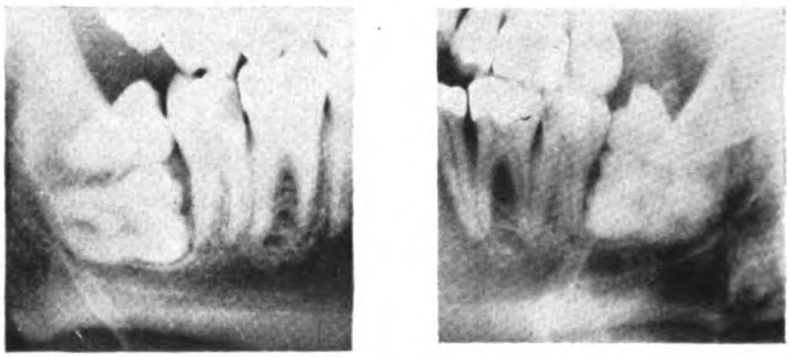
BILATERAL IMPACTION OF MANDIBULAR THIRD AND FOURTH MOLARS



The presence of an impacted mandibular fourth molar in a horizontal position is very rare but the presence bilaterally of two molars in a horizontal position is most unique. This condition was seen in a white male, age 25, who came to the Naval Dental School, complaining of pain in both mandibular third molar regions. The clinical picture was that of an average, incomplete, unerupted mandibular third molar in position of partial impaction against the distal crown of the second molar. However, the radiographic examination revealed two molars on each side in a horizontal position of impaction. Both were well developed and almost equal in size to a normal mandibular third molar.

This condition is not usually associated with the mandibular third molar, but is not infrequently found in connection with the maxillary third molar.—BRADLEY, J. L., Lieutenant Commander (DC) U.S.N.

TRAUMATIC TEMPOROMANDIBULAR ARTICULATION SYNDROME

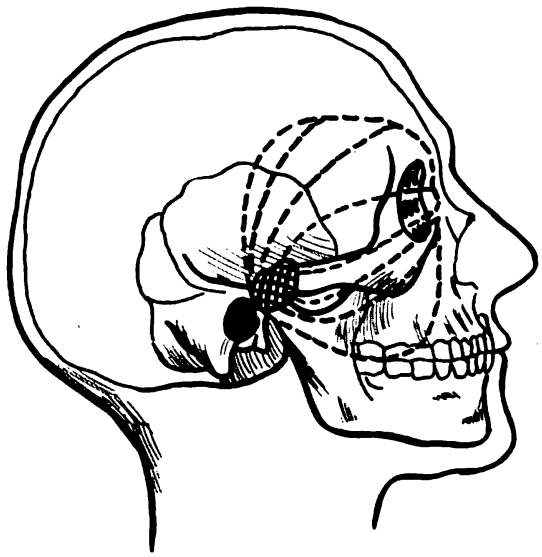
HOMER C. VAUGHAN
Lieutenant (DC) U.S.N.R.

It is well known that differences of barometric pressure due to changes of altitude affect the middle ear and mastoid mechanism. This condition, known as aero-otitis media, varies in degree and intensity with each individual, depending on such factors as the health of the nasopharyngeal area, the presence of middle ear infection, and the individual threshold of irritability.

During attacks of aero-otitis media the individual is instructed to chew gum vigorously, to move the mandible from side to side far beyond its normal range, to open and close the jaws frequently, and to bring the tongue forward and press it firmly against the roof of the mouth. This abnormal and unusual voluntary movement, varying in degree with the nuisance value of the attack of aero-otitis, sometimes traumatizes the temporomandibular joint and adjacent structures in such a manner as to develop a recurring group of symptoms best referred to as a traumatic syndrome. This condition frequently occurs following excessive exercise of the mandible.

Usually there is pain over the temporomandibular articulation, developing into a "trigger area," about one centimeter in diameter, located approximately one centimeter above and in front of the superior border of the tragus, and radiating superiorly, anteriorly and inferiorly (not posteriorly) to include the eye, the maxillary sinus, the maxillary teeth and the maxillary musculature. It is usually unilateral, and in some instances, as a later development, the patient complains of gastro-intestinal symptoms which are psychogenic in nature. The pain is usually described as gnawing, fluctuating in intensity, and lasts from 1 to 7 hours. There is an absence of any ear disturbance or complaint. This syndrome usually terminates in from 3 to 7 days.

Case report.—A dental officer complained of pain in the region of the right temporomandibular joint. It was continuous, gnawing, and fluctuated sufficiently to make him very much aware of its presence. It radiated superiorly, anteriorly, and inferiorly to include the entire temporal area anterior to the ear, the eye, sinus, and mixillary teeth of the right side. The patient said that finger pressure on a spot about one centimeter above and in front of



Schematic drawing showing the relative position of the "trigger areas," the heavy disc over the condyle; and the referred area indicated by the dotted lines.

the superior border of the tragus gave momentary relief. The pain lasted from 10 minutes to 2 hours, with paroxysms. It seemed to recur oftener at night, although it was also intense at other times, particularly in the morning.

The pain started when the patient was en route from Corpus Christi by automobile to San Francisco. It had its incipiency in the state of Colorado where the patient was troubled with aero-otitis media to an extremely annoying degree. During an attack he started vigorous gum chewing, and large scale movements of the mandible, and in doing this he had adopted a side-to-side rocking motion, along with opening and closing, in an effort to equalize the air pressure on either side of the tympanic membrane. Smoking seemed to make the condition worse[1]. He sought relief with salicylates and phenacetin compound tablets. With the subsiding of the active symptoms of aero-otitis media he became increasingly concerned about this pain, in the belief that he might be developing a "tic" or migraine.

Upon arriving at his Naval station, he was examined in the eye, ear, nose and throat department, and no abnormalities were found. The sinuses were transilluminated, and the eustachian tubes inflated and were found to be negative. Oral examination showed the mouth to be in excellent condition; the teeth were well cared for and in unusually good occlusion. Only the third molars of the affected side were missing.

COMMENT

With the tremendous amount of traveling of military personnel by various means through areas differing widely in barometric pressure, the incidence of this traumatic syndrome has increased. While the predisposing cause has been primarily aero-otitis media, any strained and unusual excursions of the mandible can induce these symptoms.

The range of movement is seldom the same for both condyles;

[1] Any movement which raises the tongue firmly against the soft palate is more helpful in relieving aero-otitic symptoms than is the sucking motion, with dropping of the tongue as in smoking.

the meniscus does not, and cannot in many instances, follow the full range of movement which the condyle head is capable of executing, especially when it is under the influence of greater voluntary action, as exemplified in these cases. As a result the tissues adjacent to and included in the temporomandibular articulation will suffer fatigue and traumatization due to the impingement and stretching, giving rise to this traumatic syndrome.

Since the range of movement is not the same for both condyles, the articulation accustomed to the least amount of movement will usually exhibit the pain, for it is here that the strain of this excessive movement will create the greatest degree of trauma. When the extreme range is approximately the same for both condyles, which is seldom the case, a bilateral joint syndrome may become established, but in every instance one side will manifest more intense pain than the other.

Treatment consists of sedation, preferably with a barbiturate, and in advising the patient to restrict the movement of the mandible, and to limit the type of food ingested for 3 or 4 days to that most easily masticated. When the acute episodes of pain are sufficiently severe, ½ cc. of 2-percent procaine hydrochloride very slowly and carefully infiltrated over the "trigger area" is indicated.

Because of psychogenic symptoms, particularly of the gastrointestinal tract, sometimes associated with this syndrome, care should be taken to keep the patient's mind off the condition and to emphasize the benign although painful nature of the syndrome.

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EFFECTS OF HONEY OINTMENT

Honey ointment has the following effects: (1) Rapid subsidence of passive congestion and edematous swelling, hence it is particularly effective in cases of chilblain, chilblain ulcers and similar conditions; (2) stimulating epithelization and granulation tissue formation rapidly, especially during the early stages of treatment; (3) in some cases there is rapid diminution of local pain; (4) the presence of a moderate amount of seropurulent discharge does not interfere with the effectiveness; (5) there is no need of frequent change of dressings, especially when the lesions are clean and dry; and (6) materials for its preparation are cheap and easily obtainable.—YANG, K. L.: Use of honey in treatment of chilblains, non-specific ulcers, and small wounds; preliminary report. Chinese M. J. **62**: 55-60, January-March 1944.

EMERGENCY SURGICAL MEASURES AT AN ADVANCE BASE

A CASE OF CRUSHING INJURY TO THE PELVIS

MERLYN G. HENRY
Lieutenant Commander (MC) U.S.N.R.

The following case is reported because it is illustrative of emergency surgery in an extremely isolated Naval base where, with a limited supply of medical equipment, it was necessary to perform an operation under major handicaps. There were no sterile surgical gowns, masks, or caps, and no drain tubes on the station. The operating room was a Quonset hut. Only small sterile hand towels were available with which to drape the patient. There were no surgical lights and there was no autoclave, only a small sterilizer. A piece of garden hose was utilized as an indwelling cystostomy tube.

Case report.—The patient was admitted at 2130 in severe shock. He had been driving a jeep at 35 miles per hour when it struck a soft shoulder of sand and tipped over on top of him.

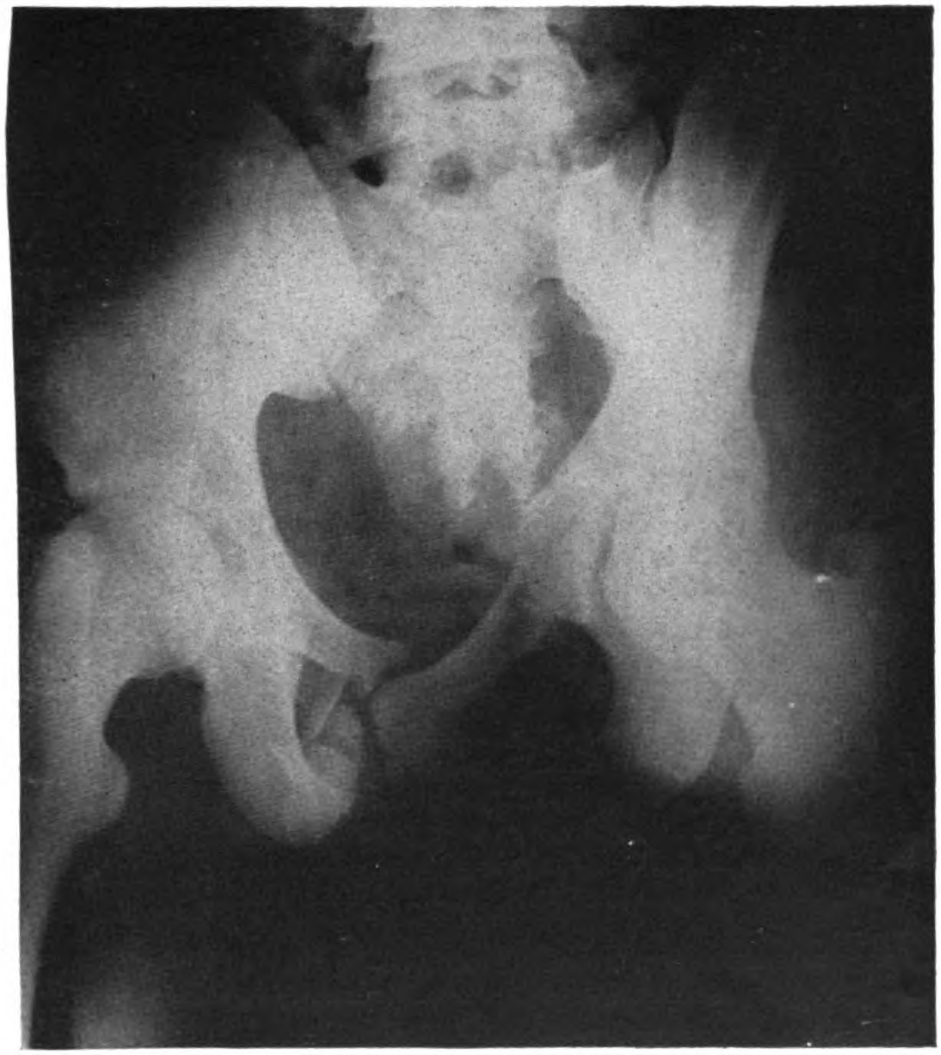
Upon admission his blood pressure was 70/40, temperature 97° F., pulse rate 110, and respirations 26 per minute. He was semicomatose. There was a tender swelling in the right groin; the swelling was increasing but no pulsation was detected. The patient was unable to void. Immediate catheterization yielded some blood but no urine. The catheter was passed with great difficulty and encountered an obstruction at the neck of the bladder.

Morphine sulfate, grain ¼, and scopolamine, grain 1/150, blood plasma and physiologic saline solution were administered. Ephedrine, grain ¾, and caffeine sodium benzoate, grains 7½, were also given.

Immediate x-ray examination of the lower abdomen and pelvis showed the entire right half of the pelvis crushed inward. Fracture extended from the iliac crest through both rami of the ischium and the pubis was split into five fragments. The ischium was crushed inward. The pubis was completely crushed with overlapping sharp bone edges.

Emergency operation was performed. The anesthetic employed was 2-percent procaine hydrochloride. When the lower part of the abdomen was opened a large amount of bloody urine gushed forth. The bladder was filled with blood and was blue-black in color. It was completely torn away from the pelvic framework, and severely lacerated at the bladder neck where the catheter was hanging out through the lacerated opening, never having entered the bladder. It was difficult to visualize the operative field clearly without a suction machine to control the bloody urine.

The original catheter was removed and was passed from within through the prostatic urethra, past the laceration, and out through the penis. The bladder was closed in layers, using interrupted chromic No. 1 catgut sutures, around a drainage tube improvised from a garden hose. The bladder was



Roentgenogram of pelvis showing extensive multiple comminuted fractures with great displacement.

suspended from the abdominal wall. Sulfonamide crystals were sprinkled in the wound after obtaining thorough hemostasis, and a continuous gauze packing was placed in the anterior space, extending to the pubic bone fragments where there was profuse hemorrhage. The abdomen was closed in layers with interrupted chromic catgut sutures.

Because of the large amount of extravasation of urine into the tissues and into the right side of the scrotum, an incision was made in the scrotum and a Penrose drain was stitched in place. The postoperative condition of the patient was much improved, and his condition improved steadily through the night with continuous administration of blood plasma and physiologic saline solution.

On the following day the patient was awake and cheerful, completely out of shock, and was transferred by plane to a Naval hospital 270 miles away. It was necessary to remain with him and to administer blood plasma en route. He arrived at the hospital conscious and in good condition. No infection developed and no complication resulted from the surgical measures. Four months after the operation the patient was up in a wheel chair.

CHEMICAL BURN OF THE PENIS

REPORT OF A CASE

BENJAMIN F. HOOPES
Lieutenant (MC) U.S.N.R.

This case is reported as an illustration of the diagnostic difficulty which may be encountered when a patient treats himself for a penile lesion. Attention is called to the beneficial effect obtained by anti-syphilitic therapy on the delayed healing of a chemical burn caused by the self treatment.

Case report.—The patient was admitted on 9 May 1944 with a second-degree chemical burn of the distal two-thirds of the penis. He admitted three sexual exposures during the preceding 4 months. About 1 week after the last exposure on 15 April he developed small lesions over the penis, scrotum, and the abdomen. These lesions itched considerably, particularly at night, and on three occasions he applied an analgesic balm, obtained from a friend, as treatment for the penile lesions. When questioned concerning these lesions he said that one on the shaft of the penis was somewhat larger and different in appearance from the others. He also complained of hoarseness of 3 days' duration.

Examination showed a second-degree burn of the distal two-thirds of the penis with marked induration of the foreskin and edema of the entire penis and scrotum. The scrotum, thighs, abdomen, arms and axillary folds were covered with scabies-like lesions.

Three darkfield examinations made of scrapings from the burn area were found negative for the Treponema pallidum. The blood Kahn reaction was also negative. The blood count and results of urinalyses were not remarkable.

The scabies-like lesions of the body and extremities were treated with 15-percent sulfur ointment once a day for 3 days with considerable improvement. The burn was treated with compresses of warm saline solution and the patient was given sulfathiazole by mouth, 3 gm. daily for 10 days, after which sulfadiazine was administered in equal dosage for 9 days.

Under this treatment there was little change in the appearance of the burn, and the patient's temperature spiked daily to 101° or 102° F. for 10 days. Compresses of potassium permanganate in 1:8,000 solution were applied, and later dry heat, by placing a heat cradle over the patient. However these forms of local treatment did not appear appreciably to change the appearance of the infected burn, and a paste of zinc peroxide was applied daily for several hours. This cleared up the secondary infection of the burn but no signs of epithelization appeared.

On 5 June the patient developed a maculopapular rash which rapidly became generalized, and lesions were found on the palms of the hands and soles of the feet, but none in the mouth. A blood Kahn reaction at this time was four-plus, substantiated on repetition of the test.

Antisyphilitic therapy was begun and within 3 weeks the burn was completely healed. The skin lesions had disappeared by 3 July and the hoarseness of the patient's voice had almost disappeared when he was seen on 19 July.

COMMENT

It is believed that this man probably had a primary luetic lesion which could not be identified after he had sustained a chemical burn of the penis. As would be expected, the result of a blood Kahn test at that time was negative. After the scabies-like lesions disappeared, the patient developed the florid secondary skin lesions of syphilis. The burn area epithelized with remarkable rapidity after antiluetic treatment was started, and the eschar was pliant and freely movable. The rapid healing of the burn made it unnecessary to graft skin on the penis.

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ROOT NEURITIS VS. APPENDICITIS

There is another syndrome which frequently is mistaken for appendicitis and for which patients are operated upon needlessly.

Most of these patients have hyperesthesia over the posterior primary division of 9, 10, 11, 12D or L1 nerves. This does not occur in acute appendicitis. With the patient in the prone position, with the erector spinae muscles completely relaxed, careful palpation down both sides of the spinous and as far laterally as the tips of the transverse processes from the cervical to the sacral regions frequently adds much information. Almost constantly, an area of deep tenderness to the right of the spinous processes of 10, 11, 12D or L1 is found. This area is usually at the point of emergence of the posterior primary division of the affected segmental nerve, which is just lateral to the spinal articular facets. Pressure over this sensitive area not infrequently may produce the pain of which the patient complains, shooting into the region of the right iliac fossa.

Moreover, these patients do not look ill, as does the patient with acute appendicitis. The temperature may be normal or in the region of 99° Fahrenheit. The leukocyte count may be normal or up to 11,000 or thereabouts.

Procaine hydrochloride block of the affected root relieves many cases, but the symptoms return in others.—MURRAY, G.: Root neuritis vs. appendicitis. Canad. M. A. J. 51: 309–312, October 1944.

MEDICAL AND SURGICAL DEVICES

MODIFIED STOKES STRETCHER

FOR RESUSCITATION BY THE EVE METHOD

PAUL ASHLEY
Lieutenant (MC) U.S.N.R.

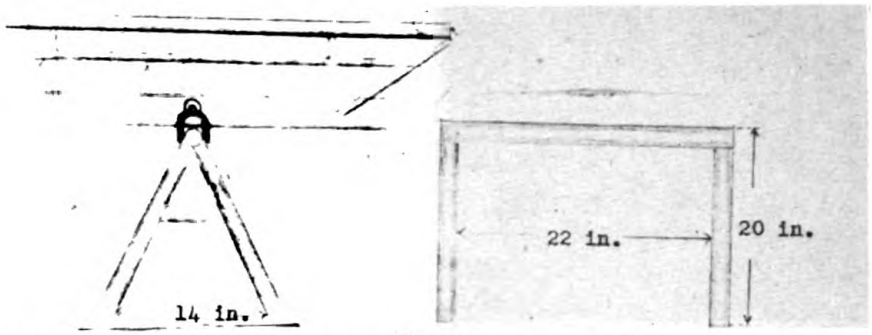
For performing resuscitation by the Eve method the apparatus to be described was devised. A simple apparatus which would be instantly available was desired because many of the crew of this ship were exposed to the hazard of being overcome by immersion in water during side-cleaning, painting and welding over the side, and such duties.

The Stokes stretcher, being the type in which the patient may most easily be secured, was considered most suitable for modification for this purpose. One of the stretchers stowed on the bulkhead just amidships of the sickbay ward was modified as described and shown in the accompanying illustrations.

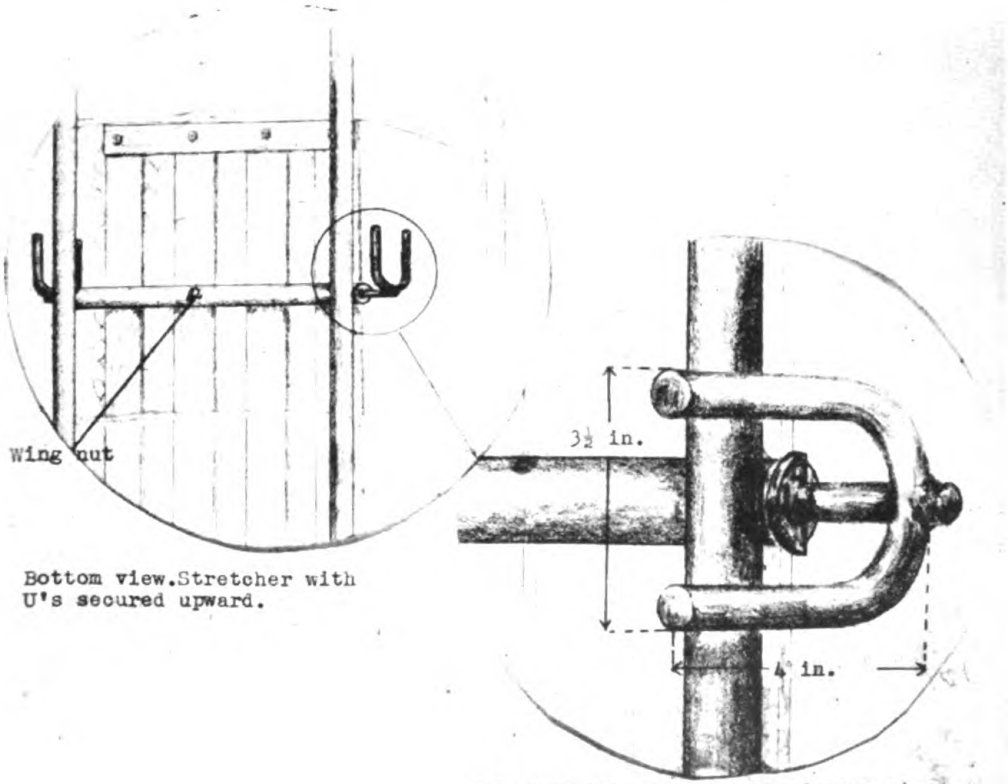
The trestle which is used to support the stretcher is stowed in the ward which is manned day and night. Thus both stretcher and trestle are readily available at all times. All material used may be obtained on shipboard.

The trestle is made of a length of 2-inch iron pipe, and then the balance point of the loaded stretcher is determined by resting it upon the trestle. At this balance point a pipe of ⅜-inch diameter is welded transversely to the lateral supporting struts of the bottom of the stretcher. A steel rod, 18 inches long and ½ inch in diameter, is inserted in this crosspipe, and to each end of the rod a U-shaped piece of stock steel rod, ½ inch in diameter, is welded. To keep the transverse rod from slipping sideways, one-half of a ¾-inch steel washer is welded to the rod on each side of the entrance of the pipe. A wingnut inserted in the side or bottom of the transverse pipe may be tightened to hold the rod, with the U's pointing downward or up along the side of the stretcher as desired.

The design has been worked out so that the stretcher may still be used as usual for transporting patients, and that the change-over process may be completed quickly. To facilitate this there are no separate parts to be lost or misplaced.



Side view.Stretcher on trestle. Front view.Trestle.



Bottom view.Stretcher with U's secured upward.

Enlarged view of one end of apparatus with U's secured downward.

—Official U. S. Navy Photo.

When the need arises the stretcher and the trestle are quickly transported to the patient, while the prone pressure method of resuscitation is being used. The patient is then lifted into and secured in the stretcher. The wingnut is secured with the U's pointing downward, and the stretcher is placed on the trestle. The U's keep the stretcher from sliding and the alternate elevation and depression of the head may be accomplished with ease.

When the stretcher is not in use for this purpose, the U's are secured upward alongside the wire netting and it may be used for transporting patients in the ordinary way.

FRACTURES OF TOES

A SIMPLE METHOD OF TREATMENT

IRVING KLOMPUS
Lieutenant (MC) U.S.N.R.

Many fractures of the phalanges of the toes are seen at this Naval activity, these ranging in severity up to the most severe compound, comminuted type, which latter are treated by reduction, immobilization in plaster, or by traction devices. The minor cases are by far the more common, and are treated very simply.

The patient is instructed to bring in an old shoe with a good sole. The toe is cut out as shown in the illustration and a metatarsal bar about ⅝ of an inch high applied across the sole. The toe involved is usually bandaged, or sometimes just a heavy woolen sock is worn. The patient is returned to duty at once, as there is now no weight bearing on the affected toe. Physiotherapy is instituted in a few days and continued twice a week for a maximum of two or three weeks.

This method of treatment is of value for several reasons:

1. No time is lost from duty.
2. Standard textbooks often pass over the treatment of these

fractures as unimportant, or recommend splints or casts which interfere with the performance of duty.

3. Healing and callus formation are prompt, and no residual symptoms remain to cause claims for compensation.

4. The method of treatment is simple and can be applied by persons with little or no medical training.

Seventy-five cases of fractured phalanges have been treated at this activity in the past 6 months. It is of interest that no person wearing safety shoes has reported to us with this injury. In spite of a campaign to induce the universal use of these shoes, many workers remain unconvinced of their value until taught by personal experience.

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HINTS TO MEDICAL OFFICERS ON PLACING A SHIP INTO COMMISSION

The prospective medical officer should:

Arrive at least 4 weeks prior to the date set for placing the ship in commission.

Obtain a first class and chief pharmacist's mate.

Study the blueprints and be familiar with the location of equipment to be placed in the sickbay area.

Have a daily inspection of work accomplished the day before.

Obtain an allowance list from the supply officer of the things to be furnished in the hull allowance, general supplies, or other bureaus.

Check the medical supply invoices, and start the property ledger.

Don't open the Medical Department supplies from medical stores prior to commission.

When supplies are brought aboard, break them out and store them in an orderly manner, make them secure for sea and inspection.

Give each corpsman a job.

Break out health records and check for needed immunizations.

Start a filing system. These points will insure that by the time the ship has finished her shakedown cruise the Medical Department will be in excellent condition for military inspection.—JOHNSON, W. R., Lieutenant (MC) U.S.N.R.

NEEDLE FRAGMENTS

A METHOD OF REMOVAL

WALTER W. DALITSCH
Lieutenant Commander (DC) U.S.N.R.

Although serious complications may not result from permitting a needle fragment to remain in the tissues, it would seem best to remove it if surgery for such removal is not too formidable a procedure.

A needle fragment may become a focus of infection or foreign-body irritation. Stainless steel needles are not subject to corrosion, with solution and absorption. Needle fragments may wander as a result of muscle movements, and thus threaten vital structures such as important blood vessels and nerves. A lost needle fragment is usually a source of mental disturbance to both the patient and surgeon and may be blamed for subsequent distress, whether related or not. The loss of a needle fragment is a fertile source of litigation and consequent damage to professional reputation and prestige.

For all of the above reasons it would seem desirable that removal should be attempted.

Operations for removal have been described frequently in the literature. Success is dependent to a great degree on the size and location of the fragment, on accurate localization, and on the skill, experience and judgment of the surgeon.

Localization depends on accurate roentgenograms taken from anteroposterior and lateral directions. By such films one may get an approximate but inaccurate idea of the position of the needle in relation to bony landmarks. That such x-ray appearance is inaccurate and often misleading is readily appreciated when one takes repeated views with the soft tissues under various degrees of tension, as would occur during an operation for removal. The soft tissues are readily displaced and moved and the needle fragment is likewise moved with the tissue in which it is embedded. Thus the relationship of the foreign body to bone is altered and often becomes misleading. Incision and exploration under these circumstances may be tedious, lengthy, and often unsuccessful.

To lessen the inaccuracy of roentgenograms it has been suggested that a long hypodermic needle be inserted into the tissues

as close to the fragment as can be estimated, and that roentgenograms be taken with this guide needle in place. Then the inserted needle is used as a landmark to follow for directing the incision and exploration.

Roentgenograms taken with small dental films placed intra-orally and in close proximity to the involved area are much more accurate than larger films used outside of the mouth. More definite outline of structures can be obtained with less distortion of size, shape and relationships.

Electronic appliances have been devised to detect and to reveal by amplification the presence of a metallic foreign body. They are not always available, and are not applicable to many situations requiring their aid.

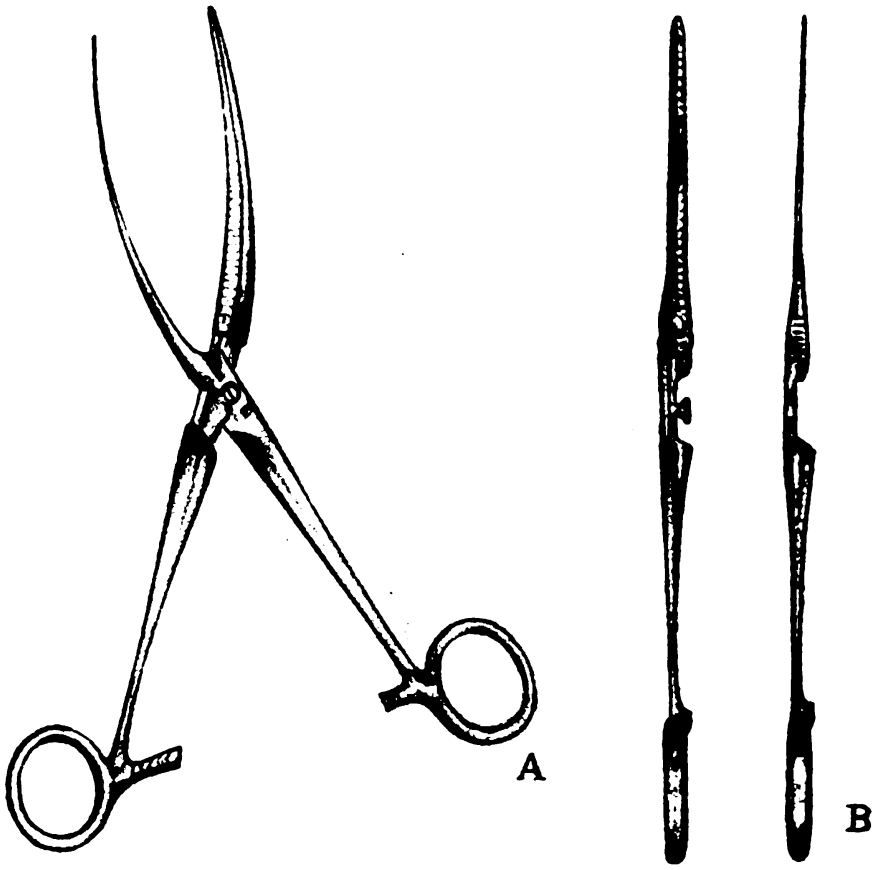
Small fluoroscopic screens mounted on a handle for intra-oral work, are of considerable help in visualizing foreign bodies. By their use the loss of time incident to taking roentgenograms is avoided. They permit repeated visualization during the course of an operation.

METHOD

The procedure advocated in this paper utilizes the principle of clamping and fixing the soft tissues surrounding an embedded needle fragment or foreign body. The tissues, together with the embedded needle fragment, are securely held by means of a special "tissue-fixing" forceps. Roentgenograms are then taken which disclose an unvarying relationship of needle fragment to the blades of the special forceps. This relationship is maintained during all the necessary surgical procedures of exposing and exploring the clamped area and the removal of the fragment.

The special tissue-fixing forceps is in the form of a lock clamp (figs. 1A and B). This is a modification of an obsolete form of acupressure clamp. One prong of the forceps is needle shaped and tempered to a spring-like elasticity. The opposing prong presents a hatch-marked, concave surface.

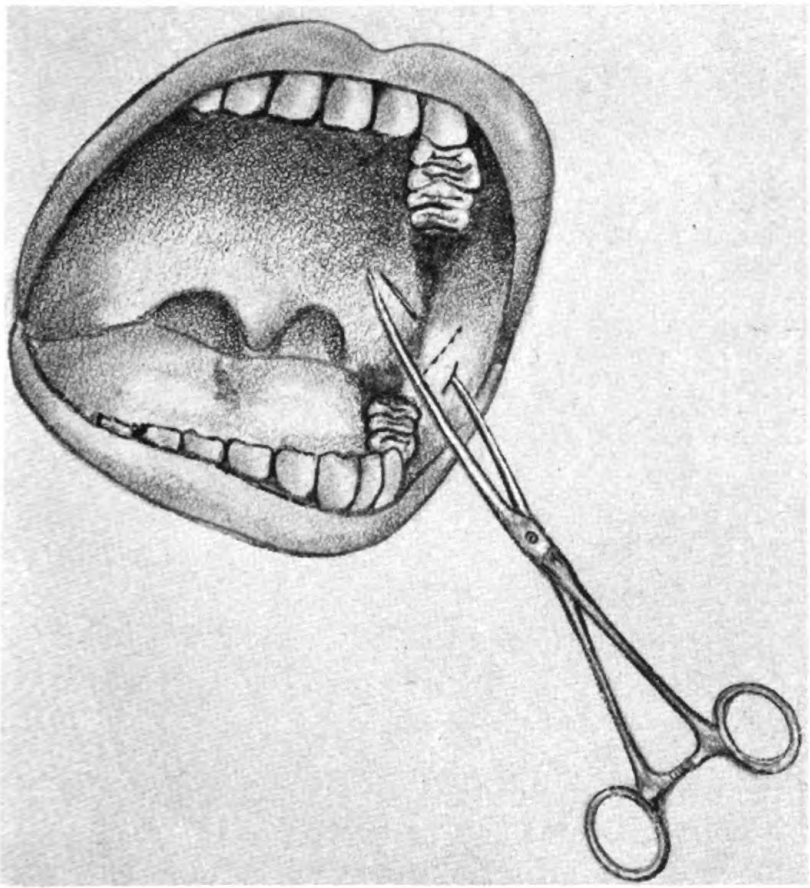
The needle-shaped blade is inserted into the soft tissues in the same manner as is the hypodermic needle used when making a mandibular injection. A special effort is made to slide the needle-shaped prong in close proximity to the bone along the medial aspect of the ramus of the mandible. An endeavor is made to place this prong between the bone and the area of soft tissue in which the needle fragment is supposed to be lodged. The point of this prong is directed to emerge beyond this area (fig. 2). The forceps is assembled by placing the concaved-bladed prong on the surface of the mucous membrane over the involved area and lock-



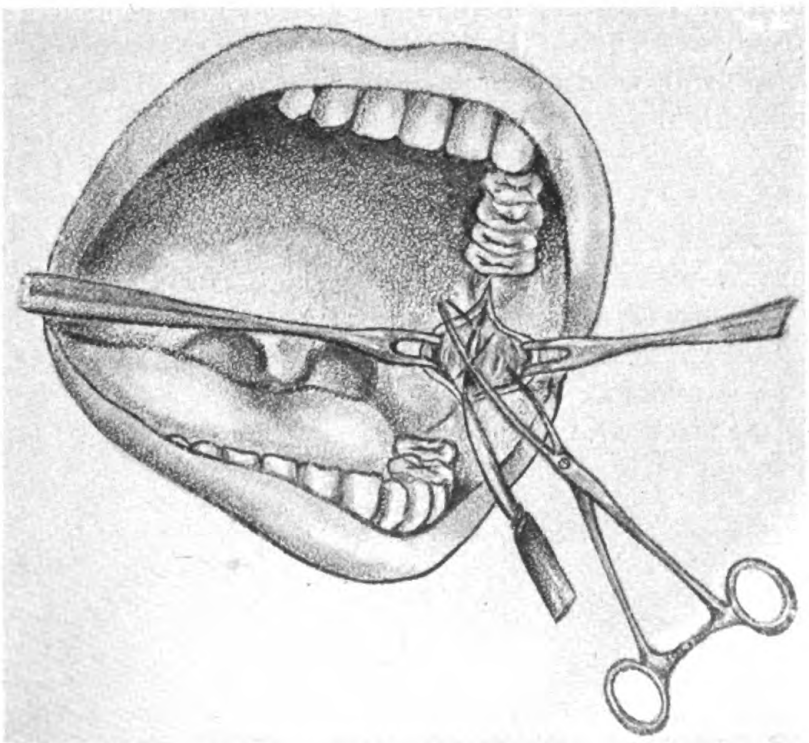
1A. Forceps assembled. 1B. Left—Blade with hatched concave face for holding interposed tissue. Right—Needle-shaped blade for transfixing soft tissue.

ing the two blades (fig. 2). Thus all the tissue between the two prongs is held firmly fixed and if the needle-shaped prong has been placed correctly, the broken needle fragment will also be fixed and held firmly in the clamped portion of soft tissue in which it is embedded. While the enclosed tissue and needle fragment are thus clamped, there is little or no chance for the fragment to become displaced in relation to the clamp prongs. There is little chance for the fragment to be forced deeper and lost during x-ray or surgical manipulations.

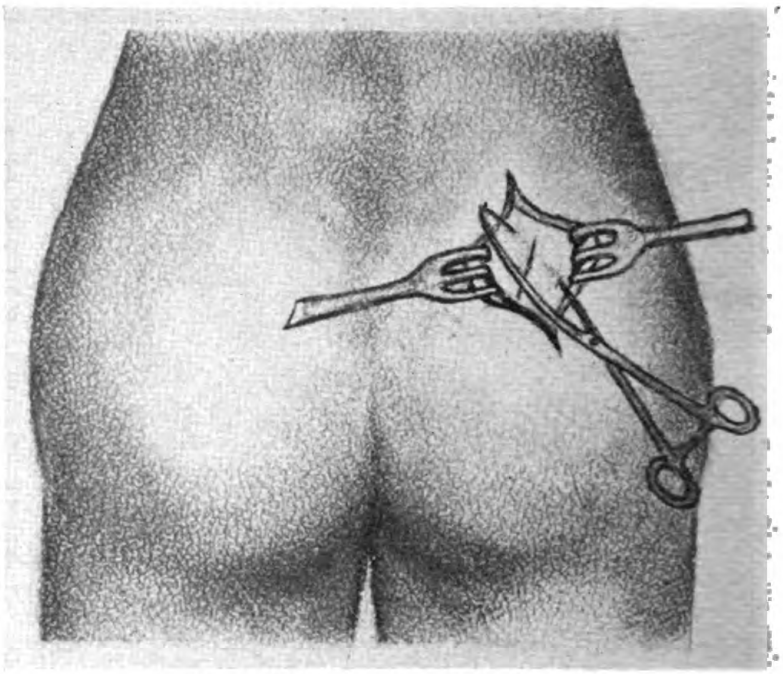
Roentgenograms with the tissue-fixing forceps clamped in place are now taken, both lateral views with dental films and antero-posterior views with occlusal films. This will show the broken needle fragment in its relation to the prongs of the forceps in a fixed and unchanging position. If the broken needle fragment is shown to be in a position other than clamped between the jaws of the forceps, a new insertion of the forceps is necessary to attain the desired result.



2. Forceps grasping area of soft tissue in which foreign body is embedded.



3. Exposure and delivery of needle fragment.



4. Use of forceps in gluteal region.

The grasp of the forceps is useful in permitting traction, giving better access to the operative field. The broken needle fragment, being firmly secured in the grasp of the clamped area, will not be displaced during the incision, retraction and other necessary manipulations, and is readily exposed and removed (fig. 3).

Figure 4 shows the method used in removing a portion of a hypodermic needle which had broken off and was lost in the gluteal region.

SUMMARY

A method for facilitating the removal of a broken needle fragment is presented. Definite localization and fixation is obtained by the use of a special tissue-fixing clamp.

Displacement of the fragment and its movement into deeper areas is avoided.

Mutilation of tissue by excessive dissection in hunting for the fragment is kept at a minimum.

PLASMA ADMINISTRATION IN SEVERE SHOCK

HENRIK W. SZYLEJKO
Lieutenant, junior grade (MC) U.S.N.R.

When a patient is in severe shock he needs plasma, and plasma in a hurry, especially if the state of shock has existed for any considerable length of time. This was the case with many of the casualties brought aboard our converted LST during the first 4 days of the invasion of Normandy.

In severe shock, veins are so collapsed that it is often difficult to find a usable vein and even more difficult to get into it. Many times in such cases plasma will not flow at a satisfactory lifesaving rate. Attempts then are usually made to utilize veins in other locations than the elbow, often with valuable time lost or with failure. The cutting down on a vein is a last resort.

The usual small-bore needle and the pressure of gravity alone may not give the lifesaving rate of flow needed. By introducing positive pressure, gratifying results can be obtained from a previously poorly working setup.

The use of either of the following described simple methods enables one to force plasma through a small-bore needle at any desired rate of delivery.

1. A hemostat and a large sterile needle and syringe are all that is needed. The needle of a large syringe is inserted into the tubing approximately 12 inches above where the plasma needle is inserted into the vein.

The tubing is then clamped off by a hemostat just below this insertion, and plasma is drawn from the plasma bottle into the syringe (fig. 1).

When the syringe is full, the clamp is shifted to the tube above the syringe, and the plasma in the syringe is injected back into the tubing and into the vein with such force and speed as is considered desirable (fig. 2).

This process is rapidly repeated until the plasma bottle is emptied.

2. An alternate method is to create positive pressure in the bottle by attaching a large sterile syringe to the air-vent (inlet tube) of the plasma bottle and injecting air (fig. 3).

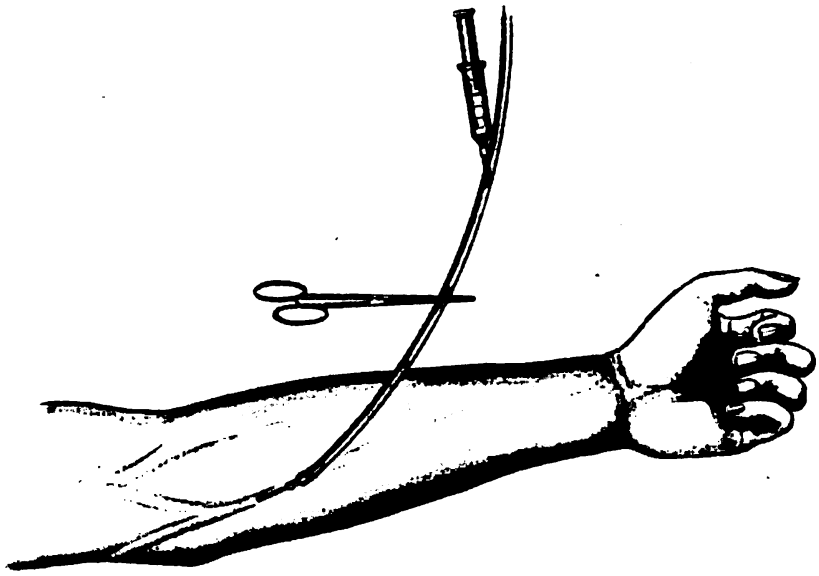


Figure 1.

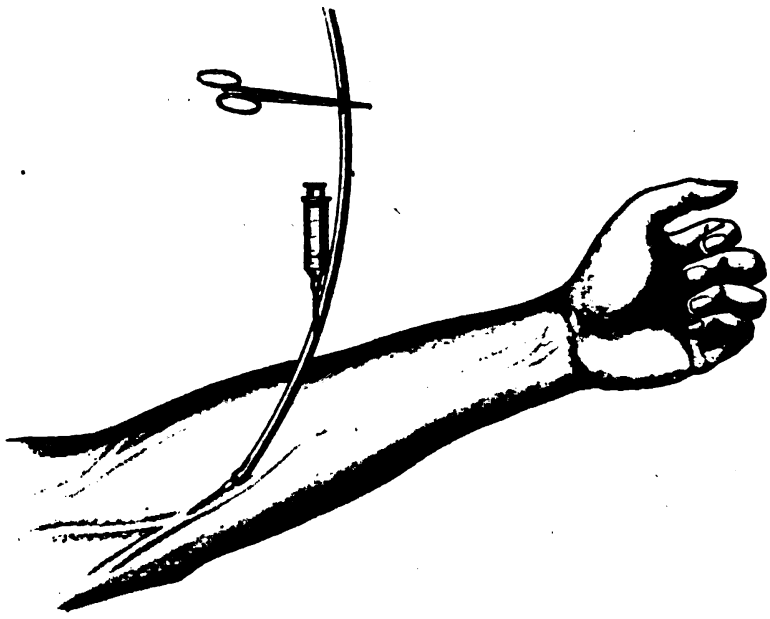


Figure 2.

There are five fundamental physiologic factors maintaining the normal blood pressure: (1) Viscosity; (2) volume; (3) elasticity of the vessels; (4) force from behind, or heart action; and (5) capillary resistance.

To combat a sustained fall in blood pressure, prompt administration of plasma is paramount. Much has been written on the

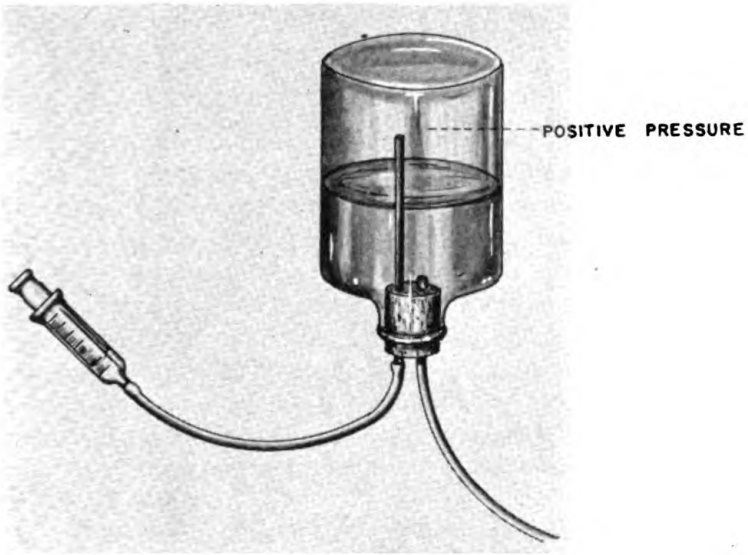


Figure 3.

eparation and preservation of plasma, very little, however, on
most important aspect—its administration.
The described simple procedures were used on our severe shock
ients. Although many of our casualties came aboard in shock,
one patient died.

⚓ ⚓

ELECTROCARDIOGRAPHIC CHANGES IN MUMPS

Two isolated cases of epidemic parotitis accompanied by electrocardiographic evidence of complete heart block are reported. In a subsequent study of 104 consecutive cases of epidemic parotitis in adults, evidence of myocardial involvement was observed in 16 instances (15.4 percent). In all but 2 patients the electrocardiographic changes were transitory and of short duration.

From the present study myocardial involvement in mumps is not a rare event, and electrocardiographic changes are similar to those observed in rheumatic fever. Moreover the occurrence of delayed A-V conduction time in epidemic parotitis casts further doubt on the specificity of this finding and raises the question of its reliability in the diagnosis of rheumatic fever. It is added confirmation of the belief that the myocardium is susceptible to involvement not only in rheumatic fever and mumps but also in other forms of generalized bacterial or viral infections.—ROSENBERG, D. H., Lieutenant Commander (MC) U.S.N.R.

⚓ ⚓

NEOSTIGMINE IN CHRONIC NEUROMUSCULAR DYSFUNCTION

Improvement in range of motion, relief from pain, and increase in strength and endurance may occur rapidly in cases of disability following trauma, of hemiplegia and related neurologic conditions, and of chronic rheumatoid arthritis and subacromial bursitis after administration of neostigmine. Most of the patients suffered from severe neuromuscular dysfunction for a long period of time, did not have spontaneous remissions, and had failed to improve with other types of therapy. The mechanism of action is not established. The inhibitory action of neostigmine on cholinesterase at the synapses in the central nervous system as well as at the myoneural junction may be of importance.

The routine dosage was 2 cc. of neostigmine methylsulfate 1:2,000 solution, together with atropine sulfate, grain 1/100 or grain 1/150. The atropine was used to eliminate the unpleasant parasympathetic side effects of the neostigmine.—KABAT, H.: Studies of neuromuscular dysfunction. I. Neostigmine therapy of neuromuscular dysfunction resulting from trauma. II. Neostigmine therapy of hemiplegia, facial paralysis and cerebral palsy. III. Neostigmine therapy of chronic rheumatoid arthritis and subacromial bursitis. Pub. Health Rep. 59: 1635-1650, December 22, 1944.

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EFFECT OF VITAMINS ON WOUND HEALING

A study was made of the effects of many substances on the acceleration of the healing of wounds when applied topically to uniformalized wounds in normal rats. The substances studied were vitamins A, C, D and E, thiamine hydrochloride, nicotinic acid, riboflavin, calcium pantothenate, pyridoxine, biotin, hydrosulfosol, biodyne, urea-sulfathiazole ointment, amino acids, adenosine, liver extract, cod liver oil, a vitamin mixture and sesame oil. The effect of sulfamerazine used in conjunction with most of these substances was also observed. No definite benefit was derived from the use of any of these substances, as judged by frequent observations of the wounds, their strength and the microscopic changes.—WILLIAMS, R. H., and BISSELL, G. W.: Effect of topical application of vitamins and some other chemicals on healing of wounds. Arch. Surg. 49: 225-227, October 1944.

EDITORIALS

A PLEA FOR SULFONAMIDES

With the advent of penicillin sulfonamides have lost prestige to such an extent that therapy is now thought of mostly in terms of penicillin. This is unfortunate for although the production of penicillin has been accelerated to the point where it is no longer necessary to be niggardly in its use, still a one-drug therapy is headed for disappointment. As reports of failures and limitations appear in the literature it becomes clear that the day of panacea is not yet upon us.

A similar situation occurred in the heyday of sulfonamides. In the evaluation of sulfonamides, emphasis upon the drugs' limitations had a tendency to shake confidence in their effectiveness.

However the sulfonamides have a positive place in modern therapy which becomes more firmly established as knowledge of their mode of action broadens.

To discard these drugs as inadequate when certain prerequisites have not been fulfilled reflects upon the therapist rather than lessens the agents' usefulness. Misdirected confidence moreover has brought about a compromise of the efficacy of topical sulfonamides which is not altogether merited and which would not have occurred if circumspection and intelligence in their application had been exercised.

These conditions are not met by haphazard dusting of the drugs into a wound.

As the mode of action of sulfonamides becomes intelligible the complex nature of the problem reveals how overreaching and foolhardy were expectations regarding their activity and how unfair the evaluation of their effectiveness.

At present there appear to be only two incontestable fundamental facts regarding the action of sulfonamides, their inhibiting effect upon bacterial multiplication and the antagonism to this property exhibited by certain substances. The mechanisms accountable for these two phenomena are potentially numerous and admit of many variables influencing the drugs' action, attention to some of which would certainly have reduced considerably many recorded drug failures, particularly on topical application. The absorptive nature of sulfonamide action underscores the fu-

tility of pouring an unmeasured quantity of crystals into a les

Bacterial growth-inhibition by sulfonamides appears to ob the law of mass action which requires that the inhibition be versible and that it be directly related to inhibitor concentrati If the action of sulfonamides is a surface adsorption phenomen drug concentration materially affects the inhibition property. T substantiates Holman's[2] observations that neglect of meticul rubbing of the drug into every tissue interstice of the wound area accounts for many therapeutic failures. Surface adsorpt presupposes particulate dispersion which is defeated by dr caking and massing in wound pockets.

Furthermore acidity and alkalinity materially influence surf adsorption. Quantitative studies have established that sulfo mide activity in urine is increased as the pH is raised. The e fects of wound pH on any topical medicament is deserving cons erably more investigation. However in the case of sulfonamid sufficient evidence is produced to show that the active form of t sulfonamides is in the ionized particle,[3] and that at a pH 6.8, t times more drug is needed than at pH 7.8 for equivalent resul Again at the higher pH, ten times as much of the drug exists ions.

Other evidence seems to affirm that a definite number of mo cules of sulfonamides must be present per bacterium for eff tive growth inhibition.[4] Numerous investigators moreover ha pointed out that in the presence of a constant amount of sulfo mide, the inhibition of bacterial growth is inversely related to t number of organisms present and that as the size of the inocul is increased a greater amount of sulfonamide is required to p duce the same inhibition.[5]

Consideration of the many known sulfonamide antagonists, the other hand, further emphasizes the importance of the dru concentration in topical sulfonamide therapy.

Despite the diffusion properties of sulfonamides when tak orally, it must be remembered that local concentration is mu lower under this method of administration than when the co pound is inserted directly into the wound. Accordingly topi application insures drug concentration to a degree not attain

[1] HENRY, R. J.: The Mode of Action of Sulfonamides. Vol. II. Josiah Macy Foundation, New York, 1944. p. 148.

[2] HOLMAN, E.: Working rules in field, some general points of interest. U. S. N. M. Bull. 42: 275-283, February 1944.

[3] FOX, C. L., JR., and ROSE, H. M.: Ionization of sulfonamides. Proc. Soc. Exp. Biol. & Med. 50: 142-145, May 1942.

[4] HENRY, R. J.: The Mode of Action of Sulfonamides. Vol. II. Josiah Macy Foundation, New York, 1944. p. 153.

[5] LIBBY, R. L.: Activity of chemotherapeutic agents. J. Bact. 40: 733-745, November 1940.

by other routes of administration, a point which places sulfonamide therapy by means of chewing vehicles as discussed by Pfeiffer elsewhere in this BULLETIN, p. 695, on a logical basis.

Emphasis in the past on the advantages of oral administration of sulfonamides has been to the disadvantage of topical use of these drugs. Each method of administration, however, has advantages and disadvantages;[6] the rational procedure is to combine them so as to summate the advantages and minimize the disadvantages.

[6] Editorial Annotation: Diffusion of sulphonamides into wounds. Lancet 2: 726, December 2, 1944.

POSTOPERATIVE ATELECTASIS

The character of a postoperative convalescence frequently depends upon some small precautionary step taken at the time of the operation. This is not always under the immediate purview of the operating surgeon. Too often a brilliantly executed procedure is marred by a ragged postoperative course brought about by a breach in technic on the part of an assistant at the operating table.

Every surgeon has experienced mental ease in the knowledge that at his patient's head is a well trained and skilled anesthetist, someone who understands the physiology of an anesthetized person and who is alert in coping with respiratory problems as they arise.

Too frequently the responsibility of postoperative pulmonary complications is dismissed with the administration of a few inhalations of carbon dioxide at the end of the operation. It should be remembered, however, that decreased pulmonary ventilation is only one factor in bronchial complications. Despite the respiratory stimulating property of carbon dioxide and its effectiveness on mucus this agent cannot be expected to relieve mechanical obstruction.

Slight suction in many instances will deftly remove a bronchial mucous plug which no amount of inhalation therapy or expectorant medication can touch. The modern use of intratracheal methods of anesthesia calls for familiarity with catheterization of the trachea and should prove no difficulty to any qualified anesthetist.

Too much emphasis however cannot be put upon adequate endobronchial drainage of the anesthetized patient. Inadvertence to this factor is the principal cause of unfortunate sequelae. Simple

lowering of the head of the operating table 10 degrees to conform to the normal posterior slope of the trachea of a patient in a supine position will effect dependent drainage of the bronchial tree, forestall excessive accumulation of mucus, facilitate aspiration, and should be resorted to, particularly in every protracted abdominal operation. The gooseneck aspirator should not be limited in its use to tonsil operations but rather should become an essential instrument in the equipment of every anesthetic outfit.

Prevention of postoperative complications, on the other hand, involves attention to many details before as well as during an anesthesia. The practice of deep preoperative sedation may be conducive to conditions which are safer to avoid. The reduction of salivary secretion during induction of anesthesia doubtless contributes in no small measure to a smoother induction. Moreover it is possible that the usual atropine type of drugs may cause the secretion to dry so tenaciously that the ciliated epithelium is unable to budge it from the bronchial tree and pass it up the trachea. The patient is thus preoperatively exposed to an atelectasis.

Smoking prior to an anesthetic is also not without considerable danger, against which the patient should be warned. Heavy smokers frequently have secretion accumulated in the tracheobronchial tract, as Mousel has demonstrated.[1] The morning cough of smokers is a physiologic mechanism to rid the pharyngeal, tracheal and bronchial passages of inspissated secretion. Administration of preoperative medication to smokers may aggravate the retention of the offending material, whereas smoking just prior to induction has a tendency to neutralize the effects of premedication and brings about an increased production of secretion.

The high incidence of pulmonary complications following operation as reviewed by Thompson in this BULLETIN, p. 757, is apparently not an exaggeration of the situation, especially if the many undetermined postoperative elevations of temperature are considered. That the majority of these are frank atelectasis is evident from an appreciation of the factors just discussed. That cure can be effected by catheter tracheal suction is equally true. However prevention is more important and may be accomplished by giving consideration to those physiologic principles which bring about blocking of the air passages.

Atelectasis comprises 90 percent of postoperative pulmonary complications, but 90 percent of atelectasis is caused by inattention to small mechanical details in the anesthetic induction of the surgical patient.

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[1] MOUSEL, L. H.: Postoperative atelectasis; anesthetist's part in diagnosis and treatment. J.A.M.A. 115: 899-902, September 14, 1940.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.
(For review)

HEART DISEASE, by *Paul Dudley White, M.D., Lecturer in Medicine, Harvard Medical School; Physician to the Massachusetts General Hospital, Boston.* 3d edition; completely revised and reset. 1025 pages. The Macmillan Co., New York, publishers, 1944. Price $9.

This book is probably the best text on heart disease in any language. It is the result and summation of years of personal experience. The literature covered is world-wide.

The material is divided into four parts: (1) Cardiovascular Examination; (2) The Incidence, Causes and Types of Heart Disease; (3) Structural Cardiovascular Abnormalities; (4) Disorders of Cardiovascular Function. This is a most logical classification and is the type of advance that has helped to clarify the confusion which existed in the older books on heart disease.

Many new sections have been added to the third edition, of which "The Range of the Normal Heart" is especially good. An appendix, "An Outline of the Evolution of Our Knowledge of the Heart and Its Disease," will delight the historically minded.

Throughout the book there are quotations from the literature of landmarks in cardiology. These serve the double purpose of presenting important clinical descriptions of disease in the original and also of forming an adequate historical background.

Although the book is excellent there are minor faults in arrangement and in statement of fact. Some examples follow.

Chapters 7 and 9 are "Cardiovascular Roentgenology" and "Electrocardiology," respectively. Too much space is devoted to dry tabulations. The enumeration of all the abnormalities of the heart and aorta observed in the different x-ray views, and the listing of electrocardiographic abnormalities, are encyclopedic.

A few simple, well-chosen illustrations of important conditio could profitably replace all this.

On page 337 the author writes, "The electrocardiogram is oft normal in rheumatic heart disease." This is not the case if fr quent records are taken. They are then practically 100 perce abnormal.

In chapter 20, page 474, the emphasis is rightly placed on t importance of definitions and nomenclature of coronary heart di ease. Nevertheless after reading the chapter one remains co fused. For example coronary artery occlusion with myocardi infarction is a different clinical and pathologic entity from my cardial infarction which does not result from coronary occlusio This distinction is not drawn clearly.

Many of the photographs of the heart, for example figures 9 96, and 98, would be clear if labeled.

Mitral valve disease is described, beginning on page 608, cha ter 25. Yet for the characteristic murmurs one is referred t figure 15 and to chapter 5. This means turning pages and maki a search. How much better it would have been to have refer to the exact page on which figure 15 appears and to the exa page in chapter 5 in which the murmur is discussed. Preferab the murmur should have been described in detail on page 61 where the signs of mitral valve disease are presented, and on a simple description given in chapter 5 which concerns itself wi auscultation of the heart in general.

The reviewer disagrees with the statement (chapter 31, pa 827) that nearly one-fourth of all cases of angina pectoris sh an apparently normal heart by all methods of examination. angina pectoris due to organic coronary artery disease is mea then this percentage is an exaggeration. This statement has oft been quoted, particularly in court litigation.

Hubert Mann of New York was one of the first to establish t present accepted nomenclature of left and right bundle bran block. White has overlooked him entirely and given too mu credit to Frank Wilson.

The book is not well bound; pages have a tendency to fall ou

In conclusion, this book of more than 1,000 pages contain wealth of well-organized knowledge which is presented in a cle attractive, even entertaining style.

TEXTBOOK OF GYNECOLOGY, by *Emil Novak, M. D., F.A.C.S., Associat Gynecology, The Johns Hopkins Medical School; Gynecologist, Bon Sec and St. Agnes Hospitals, Baltimore.* 2d edition. 708 pages; illustrated. T Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price $8.

Any book by Emil Novak on the subject of gynecology wou be certain to attract attention. It was chiefly on this account th

the first edition of this book, published in 1941 under the title "Gynecology and Female Endocrinology," became familiar so quickly to all gynecologists. Actually, however, it was intended to serve primarily as a textbook for students and a reference for practitioners not necessarily specializing in the care of women.

The subject matter was there and arranged according to this plan of the author. For example the book discussed office gynecology, reproductive physiology, and endocrinology exhaustively, with a clear presentation of related histopathology. It omitted descriptions of gynecologic operations for the entirely valid reason that students in undergraduate years and general practitioners are not interested or concerned with details of operative technic.

The title of the book, however, seemed to confuse many who should have been the ones to be most interested in it. From the title it was assumed that the work was highly technical and specialized in its scope, and thus it was somewhat disappointing to those who acquired it on that account, while many of those who should have benefited most failed to acquire it.

In this second edition, Novak shortens the name to a "Textbook of Gynecology," which is precisely what it is and an incomparable one. Much of gynecology is nonsurgical, but it is usual with most textbooks to find them overloaded with descriptions of surgical technic to the exclusion of the other aspect.

The reviewer has emphasized the scope of this excellent book rather than its details in order properly to recommend it, since he believes the first edition was misunderstood to a large extent when presented to the profession.

The author has now amplified his original text, in addition to his extensive revision, by including a chapter on female urologic conditions related to gynecology.

The illustrations are excellent, but vary greatly in type because so many have been borrowed. It may be objected that there is a preponderance of photomicrographs of lesser interest to the practitioner than illustrations of clinical conditions, but those are invaluable to the student. There are many excellent color photographs.

Novak's discussions of office procedures, of organotherapy for endocrine disturbances, and of sterility are outstanding. The bibliography with each chapter is ample for collateral reading.

This book is warmly recommended, particularly for students and general practitioners. Similarly no specialist in gynecology could fail to profit from it.

THE MEASUREMENT OF ADULT INTELLIGENCE, by *David Wechsler, Chief Psychologist, Bellevue Psychiatric Hospital. Assistant Clinical Professor of*

Medical Psychology, New York University College of Medicine. 3d edition. 258 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price $3.50.

Wechsler speaks of this as the "war" edition of his Measurement of Adult Intelligence, and it is aimed primarily toward increasing the usefulness of his work for those occupied with applied psychometrics in the military services. The first two editions of the book were well received because of the practicality of the methods described. The present revision contains a number of changes which will be found particularly in the chapters dealing with "Diagnostic and Clinical Features" and "The Problem of Mental Deterioration." He describes mental deterioration as "the conspicuous falling-off or loss of primary intellectual abilities," but notes that this definition is much broader than the one usually accepted by psychiatrists and neurologists. Some changes have been made in the scoring of certain parts of the scale and there is also a bibliography of the most important studies utilizing the Wechsler-Bellevue scale published up to March 1944. The scale has now been employed at the Bellevue Psychiatric Hospital, the Court of General Sessions of New York City, and the Queens General Hospital for more than five years, and thus the author has had the benefit of various reports and communications concerning its shortcomings and its advantages.

In general the contents are divided into three parts. Part One discusses the nature and classification of intelligence and consists of six chapters. In it the author stresses the need for an adult intelligence scale rather than dependence upon the use of children's scales for older individuals. The concepts of mental age and I.Q. are discussed as are the concepts of mental deficiency. The problem of mental deterioration, i.e., "the conspicuous falling-off or loss of primary intellectual abilities," is gone into rather thoroughly.

Part Two discusses the Bellevue intelligence scales and the selection and description of the tests and their methods of standardization. In Chapter 10 entitled, "Limitations and Special Merits," the author discusses quite satisfactorily the various objections and criticisms which he has met regarding the use of the scale. The diagnostic and clinical features are discussed in Chapter 11.

The third part of the book consists of a manual of instructions on the use of the Bellevue intelligence tests, and ends with a bibliography of the various studies with the Wechsler-Bellevue scale. There are several appendixes, one discussing "Special Statistical Methods," and the other outlining Intelligence Quotients Tables.

The widespread interest in rehabilitation programs for returning veterans and the contemplated postwar educational opportunities which will be offered to them, necessitate careful vocational selection of the candidates. This volume should prove valuable to psychiatrists and psychologists concerned with the psychometric aspects of the problem.

FOUNDATIONS OF NEUROPSYCHIATRY, by *Stanley Cobb, A.B., M.D., Bullard Professor of Neuropathology, Harvard Medical School; Psychiatrist in Chief, Massachusetts General Hospital.* 3d revised and enlarged edition of the work formerly known as A Preface to Nervous Disease. 252 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price $2.50.

It is recognized throughout the medical profession that a basic familiarity with psychiatry is an advantage for every physician, whether he be in general practice or in a specialty. To the busy practitioner or medical officer the acquisition of this familiarity seems like an impossble undertaking, especially if he has had superficial contact with psychiatrists who have gone far afield from general medicine. This book furnishes nearly an ideal answer to this problem, because no physician can fail to be more effective than before in his profession if he reads and digests the material in this small volume. It is suitable, as well, for the young medical officer just beginning his specialization in neuropsychiatry. Like any book that Stanley Cobb has written, it is firmly grounded on sound physiologic data, and the ideas about nervous and mental disorders are clearly and simply expressed and free from dogmatism masquerading under the guise of "scientific exactness."

This book represents a third edition, although the first one had the title of "A Preface to Nervous Disease." Like its predecessors it takes up the subjects of the autonomic nervous system, segmental and suprasegmental aspects of the cerebrospinal nervous system, motor integration and locomotion, functional localization, cerebral circulation, the cerebrospinal fluid, general and special neuropathology, neuritis, epilepsy, consciousness and the "mind-body" problems. In addition an entirely new chapter has been added on psychologic concepts important in medicine. The newer developments in all these fields have been incorporated in this revision.

In the past, psychiatry has tended to drift away from medicine, but in recent years there is a wholesome movement back to the medical fold. As the medical findings incident to selective service have clearly emphasized, the problem of mental disease is far too great to be solved by psychiatrists as specialists. Therefore just as it is very desirable that every psychiatrist keep in mind that he is a doctor first of all, so it is desirable that every doctor have

more than a nodding acquaintance with psychiatry in order that his patients may have adequate treatment with all of their needs considered. This book is strongly recommended as profitable reading for any physician.

DISEASES OF THE NERVOUS SYSTEM, Described for Practitioners and Students, by *F. M. R. Walshe, O.B.E., M.D., D.Sc., F.R.C.P. (Lond.), Hon. D.Sc., Nat. Univ. Ireland, Physician in Charge of the Neurological Department, University College Hospital, London.* 3d edition (reprint). 350 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price $4.50.

After criticising most of the modern textbooks on neurology as being too complex, the author sets out to write a concise and simple book for the benefit of the student and practitioner.

The first part of the book is devoted to anatomy and physiology of the nervous system from the clinical and practical standpoints. This section is replete with recently acquired neurophysiologic data. Although these may be of value to the student of neurology, they seem to be too advanced for the practitioner. Just as the author rightly intimates in the preface, a book should be simple and contain well established facts. Therefore when controversial points or new concepts are added to the text, they tend to make the reader feel somewhat uncertain and doubtful as to whether the material presented has been accepted as standard.

The second part of the book is devoted to clinical neurology; a descriptive account of the more common diseases of the nervous system is contemplated. Many of the descriptions are truly short and to the point. However in some instances they seem to be too condensed and uninformative. One cannot paint a clinical picture of a neurologic disorder merely with a few words, no matter how masterful a writer the author may be. For the sake of brevity some of the rarer maladies of the nervous system have been omitted as planned, and rightly so. Nevertheless in his attempt to be concise he forgot to mention some important conditions such as epidural hemorrhage, which can be remedied surgically, the syndrome of carotid sinus, and the subject of fracture of the skull and its implications. A long paragraph is devoted to cysticercosis of the brain as a cause of epilepsy but very little space is given to the symptoms and convulsive manifestations of hypoglycemic states. The chapter on psychoneuroses was so abbreviated that its omission would not be noticed.

In general the book is masterfully written. It is abundant with modern trends and concepts in anatomic, physiologic and clinical neurology. However, because of the compactness of this information and the brevity of the copy, the book is hardly useful to the medical practitioner.

SEGMENTAL NEURALGIA IN PAINFUL SYNDROMES, by *Bernard Judovich, B.S., M.D., Instructor in Neurology, Graduate School of Medicine, University of Pennsylvania; and William Bates, B.S., M.D., F.A.C.S., F.I.C.S., Professor of Surgery, Graduate School of Medicine, University of Pennsylvania; foreword by Joseph C. Yaskin, M.D., Professor of Neurology, Graduate School of Medicine, University of Pennsylvania, Philadelphia, Pa.* 313 pages; 178 illustrations. F. A. Davis Co., Philadelphia, Pa., publishers, 1944. Price $5.

Any treatise which furthers our knowledge of the cause and treatment of pain is certainly valuable. Many have been written, and while none appears to answer the problem in its entirety, most aid in furthering our knowledge of the subject. The subject of the nature, cause, and treatment of pain is being publicized in lay magazines in recent years and this only emphasizes the fact that the physician must be better acquainted with its various ramifications. There is nothing quite so demanding as the relief of acute or chronic pain.

This author emphasizes particularly the treatment of the obscure and chronic type of pain which so frequently bedevils the patient and attending physician. The relationship of pain as related to posture is dealt with at considerable length. This is undoubtedly of importance, although one gains the impression that it is somewhat overemphasized and that postural correction is considered as too often a simple cure-all. The chapters on the relief of the obscure abdominal type of pain so commonly observed in individuals usually termed as neurotics, appears likewise to be almost too simple an explanation, and the relief offered too uniformly great for such a complex problem.

The subject of low back and sciatic nerve pain is discussed quite thoroughly. This subject is one with which medical officers have had considerable experience, inasmuch as it is too repeatedly a problem at sick call. While various types of paravertebral and nerve blocks by different types of needled medications are frequently effective in relief of pain in this area, as described in the several chapters, it must likewise be remembered that in many instances such relief is either temporary or entirely ineffective. Nevertheless in chronic or prolonged acute pain in which an accurate diagnosis fails to be forthcoming, such treatment appears well worth while, provided alcohol and other forms of medication are not indiscriminately injected by an inexperienced operator.

The chapter on trigeminal neuralgia is an excellent one, as is that on the control of pain in malignancy. In the latter the use of intraspinal ammonium sulfate is stressed and the results of relief of pain conservatively appraised.

A valuable part of this treatise is contained in those chapters on the technic of infiltration of the various nerves, nerve

roots and their components in the many anatomic locations. The indiscriminate use of drug injections, particularly alcohol, into or near nerve tissues without a well founded anatomic knowledge is very rightfully condemned.

Experience in clinical medicine has taught us that conditions generally diagnosed as neuralgias, except for trigeminal neuralgia, are usually quite resistant to treatment. This volume reveals means of treatment which undoubtedly are of value in selected cases.

SURGICAL DISORDERS OF THE CHEST, *Diagnosis and Treatment*, by *J. K. Donaldson, B.S., M.D., F.A.C.S., Major, Medical Corps, Army of the United States; Diplomate American Board of Surgery; Associate Professor of Surgery and In Charge of Thoracic Surgery, University of Arkansas School of Medicine; Surgical Staff, St. Vincent's Infirmary and Visiting Staff, Baptist Hospital, Little Rock, Arkansas.* 364 pages; illustrated with 127 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1944. Price $6.50.

A book of this size is inadequate to treat the subject under consideration thoroughly. It is, however, comprehensive in its scope in an abbreviated form. That is, all phases of the subject under consideration are included, many very lightly dwelt on. It is written in a manner that is digestible by the general surgeon and medical student. The illustrations are in keeping with a book of this type. In general it is a résumé in simplified form of surgical disorders of the chest as given in more comprehensive works and periodicals.

This book is based on very little original work or experience of the author. A limited book on this subject necessarily is lacking in detail, especially in regard to pathology, physiology and diagnosis. Treatment, surgical technic in particular, cannot be accepted as sufficient for the instruction of a medical officer actually engaged in chest surgery. The surgical treatment of several conditions is gone into too thoroughly for a book of this nature, but not completely enough to satisfy the above requisite. Examples of this are surgical treatment of carcinoma of the esophagus and of the lung, and thoracoplasty.

Chest surgery of war wounds is not given special consideration. I cannot agree with the author that there is no difference in the treatment of civilian and war wounds, except in that the fundamental surgical and pathologic principles are the same. That does not take into consideration the environment of battle conditions—the nature of wounds due to high explosives with the greater destruction of surrounding tissue, with accompanying ischemia and arterial spasm, and the often unavoidable delay in receiving anything except emergency treatment.

The chapter entitled "Exemplary Roentgenologic Patterns"

could well be eliminated. The chapter on postoperative complications and anesthesia should be studied thoroughly by every general surgeon.

It has often been said that we should never criticize a work until we have read the preface and determined the purpose of the author. The preface includes the following:

1. This book has been written with the primary hope that it might fill a need of general practitioners and general surgeons, medical students, residents and internes for a somewhat epitomized volume dealing with fundamental advances, some of which have not appeared in book form.

2. The objectives of the text have necessitated the attempt to exclude unnecessary detail, longer statistical and historical reviews, lengthy controversies and massive bibliography.

3. Some space has been devoted to surgical technic which none but the experienced chest surgeon would attempt to execute. This detail has been included in the belief that it would enable the reader, even though he would not perform such operations himself, to evaluate more fully the logic of many difficult surgical procedures which he might otherwise consider as undertakings of unduly radical nature.

It is considered that the author has accomplished his purpose. It is to be borne in mind, however, that this volume cannot replace more comprehensive works on this subject. The book would be a valuable addition as an abbreviated reference that readily brings to the attention of the general surgeon a composite picture of surgical disorders of the chest.

HYDRONEPHROSIS AND PYELITIS (PYELONEPHRITIS) OF PREGNANCY, Etiology and Pathogenesis, An Historical Review, by *H. E. Robertson, M.D., Section on Pathologic Anatomy, Mayo Clinic, Rochester, Minnesota.* 332 pages; 11 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1944. Price $4.50.

The author begins with an anatomic study of ureteral relationship, giving emphasis to the pressure effect of the enlarged pregnant uterus and the exposed pelvic ureter with the iliac artery or belly of the psoas muscle receiving the impingement of the ureter. He carries on with an exhaustive survey of the learned teachings, findings, and discussions of this subject for nearly two centuries past, and leads up to a well balanced exposition of such factors as the influence of the nervous system, blood chemical ratios, and the vitamins. In passing he pays due respect to the probable effect of hormone.

He offers interpretations of intravenous urography in hydronephrosis, and of the phenomenon of ureteral reflex, concluding with a summation of the end-results of hydronephrosis and of pyelitis in pregnancy.

Pertinent statements are quoted as follows: "This hydronephrosis is usually without noticeable signs and symptoms" and "There

is no good reason to conclude that either toxemia of pregnancy or eclampsia are in any way related to this hydronephrosis."

It is a well-composed, well-written book and terminates with a concise and thorough discussion and conclusion by this pathologist, unsurpassed for his keen discernment and vivid interest in his field.

A table of 974 references concludes the book.

X-RAY EXAMINATION OF THE STOMACH, A Description of the Roentgenologic Anatomy, Physiology, and Pathology of the Esophagus, Stomach, and Duodenum, by *Frederic E. Templeton, M. D., Head of the Department of Roentgenology, The Cleveland Clinic.* 516 pages; illustrated. The University of Chicago Press, Chicago, Ill., publishers, 1944. Price $10.

The very extensive bibliography is evidence that the author covered the field of x-ray and fluoroscopic visualization of the upper digestive tract thoroughly, from the year 1910 through 1943.

The use of the filming fluoroscope is emphasized and explained in detail as to apparatus, examination, and interpretation.

Normal anatomy and physiology of the pharynx, esophagus, stomach, pylorus, and duodenum are correlated with the roentgenologic aspects. Thorough coverage of the normal is illustrated by 64 reproductions of x-ray films.

The pathologic findings in the upper digestive tract are covered in full and in most instances are verified by gastroscopy, operation or autopsy. The chapters on inflammations, peptic ulcer, and neoplasms are especially instructive. The author places little emphasis on differential diagnosis; the section covers only 11 pages.

In the Index of Names one finds most of the outstanding leaders in the field of roentgenology.

The book as a whole contains a wealth of information and is a valuable addition to the library of those interested in x-ray, especially in the gastro-intestinal field.

AESCULAPIUS IN LATIN AMERICA, by *Aristides A. Moll, Ph.D., Secretary-Editor of the Pan American Sanitary Bureau, Washington, D. C.* 639 pages; 179 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1944. Price $7.

This book records the many important contributions to medicine made by the Spanish and Portuguese colonies in the New World and the numerous and enterprising nations which have arisen from them. The book is valuable and timely, for there is too little known in this country on the history of medicine in Latin America. For example it is not realized by most medical men that such important conditions as mountain sickness, yaws, yellow fever, pinta, Carrión's disease and Chagas' disease were first described in Latin America. The New World also gave us such outstanding

drugs in the history of therapeutics as quinine, cocaine, and ipecac and such important adjuncts of pharmacy as cacao and vanilla.

Dr. Moll covers more than these subjects. The teaching of medicine, hospitals, fees, general practice, pharmacy, women in medicine, the various medical specialties, military and naval medicine, public health, the introduction of smallpox vaccination, physicians as political leaders, as poets, scholars, and scientists, are all given a place. There is an extensive and informative appendix containing a medical chronology of Latin America; a bibliography arranged by countries, and an index of subjects and one of names. The numerous illustrations are excellent and are such as a historical work of this character should include. Altogether it is a most useful addition to medical history.

OCCUPATIONAL THERAPY IN THE TREATMENT OF THE TUBERCULOUS PATIENT, by *Holland Hudson, Director, Rehabilitation Service, National Tuberculosis Association; and Marjorie Fish, O.T.R., Director of Professional Courses in Occupational Therapy, Columbia University.* 317 pages. National Tuberculosis Association, New York, publishers, 1944. Price $3.

This is a fine book which can be utilized for two purposes: (1) As a guide for students in occupational therapy; and (2) as a refresher for occupational therapy graduates in the field. The manner of presentation affords a foundation study of tuberculosis starting with a description of the bacillus, the nature of the disease, and symptoms to be noted. The application of occupational therapy is well presented. Also the chapter devoted to the student training program is worthy of praise. On the basis of its merits it is recommended that this book be added to the library of all therapists, both potential and otherwise. It would also benefit all personnel concerned with treatment of tuberculous patients.

CORRECTIVE PHYSICAL EDUCATION, by *Josephine Langworthy Rathbone, Ph.D., Associate Professor of Physical Education, Teachers College, Columbia University.* 3d edition, reset. 275 pages; illustrated. W. B. Saunders Co., Philadelphia, Pa., publishers, 1944. Price $3.

One is impressed by the wide scope of this book. The illustration of practical application of principles laid down makes this subject, which is otherwise uninteresting to laymen as well as many doctors, inviting to the eye—and it may be said, opens a new avenue of interest in the subject.

The details of anatomy and physiology are sufficient and well enough presented to invite further study.

It is felt that this book has real value as a reference book and should be of special interest to those attempting to teach physical education and physical therapy to those whose background has not been furnished with knowledge of anatomy, physiology and kinesiology.

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HEPATITIS BY FEEDING ICTEROGENIC MATERIAL

In an experiment on the transmission of infectious hepatitis three different samples of serum containing the icterogenic agent were inoculated intracutaneously into five human subjects, and the disease was produced in three after incubation periods of from 56 to 70 days. Other samples of serum and also specimens of feces (and urine) were fed to nine human subjects, and the disease was produced in five after an incubation period of from 20 to 84 days by both of these materials.—HAVENS, W. P., JR.; WARD, R.; DRILL, V. A.; and PAUL, J. R.: Experimental production of hepatitis by feeding icterogenic materials. Proc. Soc. Exper. Biol. & Med. 57: 206-208, November 1944.

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PLASMA THERAPY IN LOBAR PNEUMONIA

The intravenous administration of plasma during the course in 18 cases of severe pneumonia provoked a rapid subsidence of toxemia and prostration paralleling a striking rapidity of resolution of exudate as compared with control cases.

The observations recorded suggested that the favorable results of plasma therapy reported for poliomyelitis and acute orchitis may be the result of the withdrawal of fluid exudate into the circulation as here tentatively interpreted for pneumonic exudates.

If so it would seem that the intravenous use of plasma may open a large and important field in the management of exudative lesions of different kinds.—FISHER, S. M.; ANDRUS, P. M.; and STEPHENS, R. W.: Observations on effects of intravenous plasma on course of lobar pneumonia. J. Canad. M. Serv. 2: 11-17, November 1944.

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MILIARIA RUBRA IN THE TROPICS

Miliaria rubra as seen in the tropics assumes a complex role. In common with other ordinarily simple eruptions, it tends to become extensive, severely pruritic and occasionally stubbornly rebellious to therapy.

During a period of 3 weeks over 150 cases of miliaria were seen at this division field hospital. Twenty patients required hospitalization or curtailment of duty. In an endeavor to hasten the return of these men to duty an alcoholic solution of tannic acid has been used with surprisingly good results.

Twice daily 4-percent tannic acid in 60-percent alcohol is sponged on the involved areas and allowed to dry, after which the skin is dusted with talcum powder. Under this treatment the eruption rarely persists beyond 48 hours. Recurrences have been few and of a minor nature.—SHELTON, J. M., Lieutenant (MC) U.S.N.R.

PREVENTIVE MEDICINE

Captain T. J. Carter, Medical Corps, United States Navy, in Charge

DDT

PRACTICALITY OF USE DURING INVASION

JOSEPH B. LOGUE
Captain (MC) U.S.N.
and
HUGH V. O'CONNELL
Lieutenant Commander (MC) U.S.N.

From experiences during the recent invasion of a small island by a Marine division, several valuable lessons were learned in the uses and limitations of dichloro-diphenyl-trichlorethane (DDT) as a means of controlling insect vectors. Because it had not been used before during an invasion, nor on such an extensive scale, there was no precedent to aid in planning for its use except some limited experiments which had been conducted in rear areas.

It was only a short time before D-day that it was learned that DDT was available in amounts sufficient for at least the early control of insect vectors. Consequently the plans had to be drawn up rapidly. The use of DDT in this operation was experimental, and an endeavor to work out a practical solution to the problem prior to and during the actual invasion. Several valuable lessons were learned, both positive and negative. It is the purpose of this paper to present the program as we planned it, point out its shortcomings as well as its advantages, and offer suggestions and recommendations in the hope that they may be of some value to others who may be confronted with the same or similar problems.

For the purpose of supplying early coverage of the island objective, with an effort to eliminate flies and mosquitoes by the use of DDT, the plan called for three means of dissemination, hand spraying, power spraying and aerial spraying.

Three sanitary squads were organized, each consisting of fifteen Marine enlisted personnel plus one hospital corpsman from the Epidemic and Malaria Control Unit. These squads were each equipped with 10 chemical decontamination spraying apparatus and 250 gallons of 5-percent DDT in Diesel oil. One squad was assigned to each of the three assault regiments. Their mission was to go ashore as soon as the tactical situation permitted and begin the spraying of dead bodies, open ration cans, slit trenches, pools of water and all other fly and mosquito breeding and poten-

Spraying a swamp with 5-percent DDT.

tial breeding places. The squads plus their equipment were loaded aboard the same ships as the respective combat teams to which they were assigned.

A power sprayer, paint type, was mounted in the back of a one-ton truck. The attachments of the sprayer were so altered that the intake hose could be connected directly to a 55-gallon drum instead of the standard 5-gallon paint container. This spraying apparatus was to be landed as soon as the tactical situation permitted, to supplement the hand spraying. This type of sprayer gives a very fine mist and is ideal for spraying in and around galleys and living quarters.

Prior to embarkation all jungle hammocks were treated with a 5-percent DDT in kerosene, using the paint type power sprayer. The truck, together with 150 gallons of 10-percent DDT mixture, was loaded aboard an LST. An L-4 (Cub-type) plane equipped with a spraying apparatus was also loaded aboard an LST to be landed and aerial spraying begun just as soon as an area had been secured from which the plane could operate.

The island to be invaded was roughly 2 by 5 miles in area. The northeast quarter was mostly low and swampy, with considerable dense undergrowth. The north central area was mostly sharp coral ridges, the highest being 200 feet. The rest of the island was relatively flat, with a rather sharp rise out of the ocean to an average of about 40 feet above sea level.

Forty-eight hundred pounds of DDT was available for use on

this operation. It was thought that this amount might be adequate for the early control of mosquito adults and larvae and for the control of flies until permanent camp sanitary facilities could be installed. Prior to embarkation, 4,500 pounds was mixed in solution and carried in 55-gallon fuel drums. Of these, 15 drums were made up to five percent in Diesel oil for use by the sanitary squads. One hundred pounds was dissolved in kerosense to spray the jungle hammocks and the rest was made up to 10 percent, with the addition of tetrachlorethane. This was loaded aboard one of the troop ships for transportation to the combat area.

The sanitary squads were called ashore and arrived on the beaches between H-plus-3 and H-plus-5. The beachhead was about one and a half miles long and one-third had been secured by each of the three assault teams. There was a wide coral reef barrier which extended offshore about five hundred yards and it was necessary because of low tide to transfer the men and equipment from LCVPs to LVTs at the reef's edge. The sanitary squads encountered considerable difficulty in transferring the full 55-gallon drums, and it was necessary for one squad to leave theirs in the LCVP. However all squads got ashore with the spraying equipment and enough DDT to last them for two or three days. They followed the assault teams as they advanced and did an excellent and thorough job of spraying all potential fly and mosquito breeding places. They thoroughly sprayed the clothing of the dead and the area surrounding, including grass, shrubbery, leaves, unburied ration cans, scattered food, open latrines and areas of standing water. They continued to operate with the assault teams until D-plus-6, when part of them were recalled to respray the rear areas, which by that time were congested with supporting troops and equipment and were showing evidence of fly breeding.

The remainder of the Malaria and Epidemic Control Unit came ashore on D-plus-2 with the bulk of the DDT supply. However because of the difficulty encountered in unloading the LSTs at the reef barrier, the truck with the power sprayer and the Cub plane were not landed until D-plus-10. Consequently that part of the program which called for the power sprayer and aerial spraying did not get underway until much later than had been planned.

On D-plus-9 the first combat planes landed, and with the first group was a TBF equipped for aerial spraying. The plane was serviced, and on the morning of D-plus-10 the first aerial coverage of the occupied area, which was the southern half of the island, was accomplished. On the morning of D-plus-12 the TBF was damaged in taking off, and two replacements were ordered.

On D-plus-16 two TBMs with spraying attachments arrived, and they were used for the periodic spraying of the main island and two smaller adjoining ones. The Cub plane was not used except to spray two small peninsulas.

In the meantime the sanitary squads continued to function, doing local spraying until D-plus-23. All units and bivouac areas were visited and an attempt was made to get the areas cleaned and policed. At first nearly all units were lax and did not make any great attempt at instituting sanitary measures in their camps. The publicity attendant on the use and effects of DDT caused the personnel to neglect fundamental sanitary principles, and to call for DDT spraying instead of performing the elementary sanitation work themselves.

The campaign did not go according to schedule and consequently there was much congestion of personnel and equipment on the narrow beachhead. There were innumerable opened ration cans and other food containers lying along the beach. On the narrow sandy beach, slit trenches were numerous, but farther inshore the sandy beaches changed rapidly to hard coral and it was impossible to dig slit trenches or latrines with hand tools and the troops in their haste did not properly dispose of human excreta. For the first few days, with so many troops bivouaced on the narrow beach, it was almost impossible to institute satisfactory sanitary measures, and this area was in a few days to become the source of much fly breeding.

The main source of fly breeding was the bodies of the enemy dead. Most of the island was of solid coral formation. It was very difficult to dig graves with hand tools, and heavy equipment for that purpose was not immediately available. There were many dead bodies beyond the front lines where it was impossible to spray or bury them until many days after landing. It is believed that early aerial spraying could have prevented this breeding.

Later conditions improved; fly-proofed heads were installed, garbage pits were dug, the dead were buried, aerial spraying instituted and the general policing of the areas gradually progressed. Considerable DDT in a 2.5-percent solution was distributed to the various units for local spraying, and the pressure sprayer continued to visit camps to spray galleys and mess tents.

No mosquitoes other than culex were encountered on the main island, although aëdes were reported present on an adjacent island, taken by an Army division. The Japanese apparently had an Aëdes ægypti control program and had rid the main island of that disease vector. It was impossible to do any extensive surveying for the first few days, but by questioning various units it

was found that pest mosquitoes were present in large numbers, particularly in the northwest section of the island. After the first aerial spraying, the same units reported the absence of mosquitoes.

After the island had been secured and it was possible to conduct more extensive surveys, some localized mosquito breeding was encountered in the northeast swampy area where there was considerable dense overgrowth. Some breeding was also found in shell holes, bomb craters, and in some cases in abandoned tin cans and other containers around Japanese installations. However very few adult mosquitoes were seen or caught and at no time were additional control measures considered necessary.

Flies constituted the most serious problem. The spraying of DDT alone held mass breeding in check for several days. By D-plus-14 the blow-flies (calliphoridae) were noticeably increased. A few days later the house-flies (muscidae) began to appear, but never in great numbers. Flesh-flies (sarcophagidae) appeared still somewhat later. Biting midges (chironomidae) began to appear in localized areas near the swamp; DDT spraying apparently had no effect on this species.

No disease occurred that could be attributed to flies or mosquitoes. About D-plus-20 there was an outbreak of gastro-enteritis which was usually mild in nature. The first cases appeared in the front-line areas and gradually spread to the rear. The much maligned fly was considered to be a possible factor in the spread of this condition. The more likely source was contamination of mess gear from clouds of dust and the lack of proper facilities, or inability due to combat conditions to cleanse and boil the mess gear properly. There were no fatalities and most cases cleared up in from 24 to 48 hours.

The island was sprayed in its entirety several times, but due to so many variables it was impossible to make an accurate estimate of the effect on the adult fly population. The breeding areas remained and although there was evidence of the destruction of large numbers of flies by this method, they continued to hatch out in great numbers and were ever present. Because of the frequently changing weather and heavy rains there was probably little residual DDT and the aerial spraying to be at all effective had to be repeated often.

SUMMARY

1. DDT is a valuable chemical for the control of mosquitoes during an island invasion.

2. DDT is valuable as an aid in controlling flies but is not a substitute for ordinary sanitary measures.

3. Sanitary squads are necessary for the early spraying to get a heavy concentration of DDT on fly-breeding and potential-breeding areas. The squads should have sufficient personnel properly to cover the area and should come from the combat regiments to which they are attached. Each squad should be equipped with ample spraying equipment, but half the sprayers should contain straight Diesel oil, so that shallow graves, bodies, and latrines can be heavily soaked in order to destroy the fly larvae. These squads should land with the assault troops.

4. A division should have three power sprayers mounted on ¼-ton trucks (jeeps) as a means of spraying galleys, tents, and buildings, and to cover completely the areas not possible for the sanitary squad to control.

5. Cub-type planes are impractical for large scale spraying.

6. Sanitary measures should be instituted early. It is impossible to control flies in a combat area unless the unit commanders are held in strict accountability for the sanitation in their areas. It is absolutely essential that all dead bodies be buried, that food, food containers, tin cans and human excreta be disposed of promptly and properly. If these elementary sanitary measures are not complied with, it will not suffice to prevent flies by DDT or any other known chemical treatment.

The golden hours of sanitary control are lost if the combat troops do not or cannot make an effort to control their areas. The assumption that they do not have time or personnel is preposterous, regardless of how strenuous the enemy resistance. The first few days of combat constitute the critical period. All the sanitary control measures instituted after the fighting has ceased will not repair the ravages of malaria, dengue, dysentery, and other diseases which are contracted in the first few days.

The burial of enemy dead is a job that requires a definitely established burial organization equipped with material for disposing of thousands of bodies as quickly as possible. These units must be organized and equipped in the staging area, and not after landing.

7. The DDT solution for the sanitary squads should be carried in 5-gallon oil cans for easy handling.

8. The aerial spraying for the control of mosquitoes and as an adjunct in helping control flies must be done early. With equipment such as the TBFs and TBMs, it seems advisable to begin aerial spraying from carriers prior to and during the assault phase and not wait until such time as the planes may operate from captured air fields.

WATER SANITATION

I. WATER QUALITY STANDARDS[1]

JOHN C. GEYER
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The term "safety" as applied to a potable water supply indicates in a general way the degree of reliability of the sanitation measures used to assure a supply of continuing high sanitary quality. The safety of a water depends on many things: The protection of the source; the purification processes used and the excellence of their design and operation; the design, maintenance and operation of pumping stations, reservoirs and distribution systems; and the absence of cross-connections or the absence of any possibility of establishing temporary cross-connections.

The safety of a water supply is judged by applying both of two equally important routine procedures: (1) Periodic critical sanitary surveys of all physical features of a water system and an investigation of operation and maintenance practices; and (2) routine laboratory analysis of the quality of water throughout the system.

In order to interpret the results obtained in the laboratory some idea of what the quality of the water ought to be is required, and this requirement implies the establishment of standards. Standards may be numerical and receive wide adoption or they may remain in the realm of general ideas used by the individual to judge significance of various departures from "normal" laboratory results.

Any discussion of water quality standards must be based on a clear-cut distinction between the two types of standards used in water sanitation practice. These two types are: (1) Standards for classifying and certifying water supplies on the basis of numerous past laboratory results, and (2) standards for judging the current safety of a water supply from each individual test result as it becomes available.

[1] This article is the first of a series presenting information on various phases of water sanitation. The safety of a potable water supply depends on the uninterrupted maintenance of water sanitation measures. Therefore quality standards are discussed, assuming that the most important use of water analyses is in checking the excellence of sanitation measures, rather than for judging the potability of individual samples.

STANDARDS FOR CERTIFICATION

The standards adopted by the U. S. Public Health Service 25 September 1942 for drinking and culinary water supplied by common carriers in interstate commerce are used throughout the United States for certification of water supplies and for judging the past performance of water sanitation measures. The numerical values specified in the Public Health Service Standards are such that communities with supplies of somewhat better than average quality can readily qualify to furnish water for common carriers. In preparing these standards it was reasoned that persons from such communities are entitled to be served, while on interstate travel, water equal in quality to that which they receive at home. The limits specified in the Public Health Service Standards are presented with some slight modification in wording.

The standard portion of water for the application of the bacteriologic test may be either:

(a) Ten milliliters (10 ml.) or

(b) One hundred milliliters (100 ml.).

The standard sample for the bacteriologic test shall consist of 5 standard portions of either:

(a) Ten milliliters (10 ml.) or

(b) One hundred milliliters (100 ml.) each.

In any disinfected supply the sample must be freed of any disinfecting agent within 20 minutes of the time of its collection.

The bacteriologic quality shall be in accordance with numbers 1 and 2, listed below, when 10-ml. portions are used, and with numbers 3 and 4 when 100-ml. portions are used.

1. Of all the standard 10-ml. portions examined per month, in accordance with the specified procedure, not more than 10 percent shall show the presence of organisms of the coliform group.

2. Occasionally three or more of the five equal 10-ml. portions constituting a single standard sample may show the presence of organisms of the coliform group, provided that this shall not be allowable if it occurs in consecutive samples or in more than:

(a) Five percent of the standard samples when 20 samples have been examined per month.

(b) One standard sample when less than 20 samples have been examined per month.

Provided further that when three or more of the five equal 10-ml. portions constituting a single standard sample show the presence of organisms of the coliform group, daily samples from the same sampling point shall be collected promptly and examined until the results obtained from at least two consecutive samples show the water to be of satisfactory quality.

3. Of all the standard 100-ml. portions examined per month in accordance with specified procedure, not more than 60 percent shall show the presence of organisms of the coliform group.

4. Occasionally all of the five equal 100-ml. portions constituting a single standard sample may show the presence of organisms of the coliform group, provided that this shall not be allowable if it occurs in consecutive samples or more than:

(a) Twenty percent of the standard samples when five or more samples have been examined per month.

(b) One standard sample when less than five samples have been examined per month.

Provided further that when all five of the standard 100-ml. portions constituting a single standard sample show the presence of organisms of the coliform group, daily samples from the same sampling point shall be collected promptly and examined until the results obtained from at least two consecutive samples show the water to be of satisfactory quality.

In *physical quality* the water shall have a turbidity less than 10 ppm (silica scale), a color less than 20 (standard cobalt scale), and shall be free of objectionable tastes and odors.

The *chemical quality* will ordinarily be satisfactory if lead does not exceed 0.1 ppm and fluoride does not exceed 1 part per million. Salts of cadmium, arsenic, selenium, barium, hexavalent chromium, heavy metal glucosides or other substances with deleterious physiologic effects shall not be allowed in the water supply system. Ordinarily analysis for these substances need be made only semiannually, or less frequently. If, however, there is some presumption of unfitness because of these elements, frequent determinations for the element in question should be made. The following chemical substances should not occur in excess of the following concentrations:

	Parts per million
Lead	0.1
Fluoride	1.0
Copper	0.2*
Iron and manganese	0.3
Magnesium	125.
Zinc	15.
Chloride	250.
Sulfate	250.
Phenolic compounds	0.001
Total solids	1000.
Total solids preferable limit	500.

* The limit on copper was raised by the U. S. Public Health Service from 0.2 ppm to 3.0 ppm in 1942. Adherence to the old USPHS limit of 0.2 ppm is conservative.

Since the significance of these limits is different for the various chemicals, judgment must be used in their application. For example the permissible limit of lead should not be exceeded in any supply used for considerable periods of time by the same individuals. On the other hand, iron and manganese contents greatly in excess of the stated limit will result only in undesirable laundry, vegetable, and plumbing fixture stains. Permissible limits of chemicals in water to be used for high pressure boiler feed will be much lower than those stated above. The analyses used to determine the bacteriologic, physical, and chemical characteristics of water should be made in accordance with the Standard Methods for the Examination of Water and Sewage, American Public Health Association, or (in cases not covered by the latter) in accordance with the Official and Tentative Methods of Analysis, Association of Official Agricultural Chemists.

Those concerned with water sanitation or interested in a full discussion of the Public Health Service standards should obtain a copy of Reprint No. 2440 from the Public Health Reports, entitled "Public Health Service Drinking Water Standards and Manual of Recommended Water Sanitation Practice." The standards appeared in Public Health Reports, vol. 58, No. 3, January 15, 1943.

Efforts to use the Public Health Service standards as a guide in judging the current operation of a filter plant or the immediate safety of a supply when bad samples appear lead to a certain amount of confusion. The standards are not designed for such use. The plant operator or the sanitary officer must, therefore, adopt his own standards or principles to guide his immediate action when test results are bad. Unfortunately the difficulty in judging the significance of a single bad sample and also in deciding what, if anything, should be done about it, is so great that no uniform rules or practices have developed. The problem is complex. The most important reason for testing water, however, is to determine from day to day whether or not water sanitation measures are functioning properly.

In the case of bacteriologic analyses of filtered and chlorinated water the following information may be of use in interpreting laboratory results and in deciding the proper course of action when bacterial densities are abnormal.

Well-trained and technically-skilled filter operators have found that with careful plant operation, water which almost never shows a positive tube in the presumptive test for the coli-aerogenes group can be produced. It is common practice to attempt to confirm positive tubes, but since positive presumptives can be prevented, good operators feel that the safest practice is preven-

tion. When this practice is followed the value of confirmation tests becomes more or less academic. When a single positive tube occasionally appears in the five comprising a standard sample, the operator might take no action other than checking recent plant records in order to see that chlorine residuals had been continuously adequate. However, if several tubes of a sample showed positive, or if single positives appeared rather frequently, chlorination certainly would be stepped up. If it were believed that chlorination had been reasonably adequate when the positive tubes occurred, a vigorous search would be made for the source of trouble.

It is difficult for the person responsible for the safety of the supply to decide at what minimum contamination, as indicated by the coli-aerogenes test, users should be warned to boil or chlorinate the water before drinking it. A majority of positive tubes in consecutive samples would normally be sufficient evidence of a serious breakdown in water sanitation to justify emergency action.

British "Standards" are designed for use in judging the safety of a water supply from current tests. The following paragraphs are from the British "Standards."

Experience so far acquired suggests that the majority of water bacteria producing the "presumptive coli reaction" are "true coli" and that no serious hardship to water suppliers in this country is involved in regarding the "presumptive coli reaction," without further differentiation, as an index of faecal contamination, unless this assumption is grossly discrepant with other information. The reaction is always a sign of undesirable possibilities.

*** * * When the "presumptive coli" reaction indicates that the water frequently contains these organisms in such numbers as (say) 10 or more per 100 ml. it may be assumed, without further differentiation of species, that the sources of supply are exposed to serious and possible dangerous pollution, and a careful investigation of the condition of the source should be made, the water meanwhile being regarded as unsuitable for domestic use.**

*** * * If a water known to have been originally polluted but subsequently purified by storage, filtration and/or chlorination, shows more than an occasional rise in the "presumptive coli" count, an investigation into the efficiency and working of the purification plant should be undertaken. Efficient chlorination should yield a water free from "presumptive coli" in 100 milliliters. Making allowance, however, for experimental error, whether in sampling or otherwise, a probable "presumptive coli" count of 2 per 100 ml. may be allowed in 10 percent of the chlorinated samples without further question.**

This latter paragraph indicates the tendency to demand a higher standard of quality when judging plant operation than is set by the U. S. Public Health Service for certification of supplies. A "presumptive coli" count of 2 per 100 ml. in 10 percent of the samples is an average density of 1 per 500 milliliters.

The British "Standards" appear in a manual entitled "The

Bacteriological Examination of Water Supplies," Bulletin No. 71, Ministry of Health Series, His Majesty's Stationery Office, 1934, parts of which are reproduced in section XIX, Appendix I of the "Standard Methods for the Examination of Water and Sewage" published by the American Public Health Association.

It is common practice to run total plate counts on water. The significance of these tests is even more difficult to assay than that of the coli-aerogenes test. The Public Health Service Manual of Recommended Water Sanitation Practice says concerning bacteriologic examination:

The bacteriological examinations which have come to be recognized generally as of most value in the sanitary examination of water supplies are:

1. The count of total colonies developing from measured portions planted in agar or gelatin plates and incubated for 48 hours at 20° C.

2. A similar count of total colonies developing on agar plates incubated for 24 hours at 37° C.

3. The quantitative estimation of organisms of the coliform group by applying specific tests to multiple portions of measured volume.

Of these three determinations, the test for organisms of the coliform group is almost universally conceded to be the most significant because it affords the most nearly specific test for the presence of fecal contamination. Only this test has been included, therefore, in the bacteriological standard recommended, as neither the 37° C. nor the 20° C. plate count would appear to add information of sufficient importance, for the purpose of these Standards, to warrant their inclusion in the required examination. The omission of plate counts from the Standards is not to be construed, however, as denying or minimizing their importance in routine examinations made in connection with the control of water purification processes.

Nothing further is said concerning plate counts.

However, in the case of filtered and chlorinated supplies, total plate counts will remain low as long as all water sanitation measures are effective. When a sanitary defect does develop, high plate counts may be the first and sometimes the only laboratory indication.

The British "Standards" state that:

The colony count, as has already been indicated, is of value chiefly when carried out on the same supply at regular intervals over long periods. In such circumstances an increased count always requires explanation.

It is generally conceded that the 24-hour 37° C. plate count is a better indicator of contamination than the 48-hour 20° C. count. In the best operated filter plants the 24-hour 37° C. plate counts average between 2 and 10 per ml. and consistently remain below 50 per ml. When plate counts exceed this limit the operators will begin to look for the reason. This, of course, does not mean that water showing plate counts of over 50 per ml. is unsafe to drink, but rather that the count is higher than it should be if all sanitary barriers are functioning.

Occasionally 200 colonies per ml. is used as the limit at which an explanation is required.

Plate counts running into thousands of colonies per milliliter in filtered and chlorinated water should always be judged to indicate sanitary defects even though tests for the coli-aerogenes group are negative.

The foregoing discussion has been related in a general way to municipal filter plant operation. In most municipal plants the water is chlorinated to provide a free residual of 0.2 to 0.4 parts per million after contact periods ranging from 10 to 30 minutes. Usually no effort is made to maintain residuals throughout the distribution system. This is mentioned because of the tendency in military establishments to demand free chlorine in all parts of the distribution system.

If the distribution system is free of sanitary defects water which enters it in a pure condition will remain pure and the maintenance of chlorine residuals throughout the system is unnecessary from the public health viewpoint. Residual chlorine in all parts of the water distribution system materially increases the safety of a supply. However the presence of residual chlorine in the system has one disadvantage, it tends to destroy the bacteriologic evidence of sanitary defects until these defects develop to dangerous proportions.

The substitution of prophylactic chlorination of a distribution system for sound water sanitation measures may be compared with the substitution of suppressive atabrine for mosquito control. Prophylaxis may be the only practical protective measure under combat conditions. In established bases and stations, prophylaxis can be used to attain a greater factor of safety but ought never be used in place of good sanitation.

Subsequent articles will present information concerning water samples and sampling procedures, sanitary defects in water systems, sterilization of water mains, and other phases of the general water sanitation problem.

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PENICILLIN STANDARD SET

Action to procure world-wide uniformity in notation and dosage of penicillin was taken recently at a Conference for the Standardization of Penicillin in London. The conference decided upon a pure crystalline preparation of a sodium salt of penicillin G as the international standard, and defined the international unit as the penicillin activity contained in 0.6 micrograms of the international standard.—Pennsylvania M. J. 48: 361, January 1945.

LOW BACK PAIN IN NAVY YARD WORKERS

ITS RELATION TO OSTEO-ARTHRITIS

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During the course of a year in the dispensary sickbay of one of the larger Navy Yards a considerable number of claimants for back injuries were seen. There were two prominent features about their claims: (1) The persistence of symptoms for long periods (weeks, months, or years) despite adequate treatment; and (2) disproportion of injury (mild) to resulting symptoms and disability.

Special reactions such as the Kernig, Goldthwait, Campbell, Lasèque, Gaenslen, and others, gave, in a large number of cases, positive signs of pathosis in the lumbar, sacral, or sacro-iliac regions. Consequently a radiologic examination of the spine of every claimant for back injury was done.

An analysis of 100 consecutive back injuries (sprains, contusions, strains) disclosed a condition of osteo-arthritis in approximately 50 percent of the cases. The radiologic findings suggested more detailed questioning about attacks of similar nature occurring previous to the present injury. The replies frequently disclosed histories of former attacks of low back pain and disability without any relationship to injuries. The type and degree of involvement of the vertebrae or sacro-iliac joints indicated the chronicity of the ailment. The patients were informed of the causes of their symptoms, thereby curtailing their visits to the sickbay and obliging them to seek the help of their family physicians or civilian clinics.

The table shows eight cases, cited as typical examples of alleged back injuries, but proved by radiography to be osteo-arthritics. In each will be noted the comparative mildness of the injury which is the basis of a disability claim.

The average age of the 50 patients who had osteo-arthritis of the lower spine was 42.8 years; the youngest 16, and the oldest 60 years.

Most of the patients examined and treated for back injuries before the survey began had been regular visitors to the sickbay

Case No.	Occupation	Age (years)	History of injury	Preliminary diagnosis	Radiologic findings
1	Plumber	49	While tightening bolts	Sprain of lumbosacral region	Moderate osteo-arthritis with lipping of articular margins of all lumbar vertebrae.
2	Mechanic	45	While carrying 65-lb. weight	Muscular strain of right lumbar region	Minimal osteo-arthritis of left sacro-iliac articulation.
3	Shipfitter	43	While lifting an angle bar	Sprain of right sacro-iliac region	Minimal osteo-arthritis of third and fourth lumbar vertebrae.
4	Electrician	43	While pulling a cable	Sprain of right sacro-iliac joint	Spur formation of articular margins of second and third lumbar vertebrae.
5	Driller	48	When doing overhead drilling	Sprain of right lumbosacral region	Minimal osteo-arthritic changes of fourth and fifth lumbar vertebrae, spurs of superior and inferior articular margins.
6	Mechanic	49	When lifting a heavy object	Muscular strain of left lumbar region	Marked left lateral scoliosis of lumbar spine, greatest curvature at the lower dorsal vertebrae, extensive osteo-arthritis of the lumbosacral articulation, and narrowing of the intervertebral spaces.
7	Mechanic	53	Slipped when descending stairs	Sprain of left sacro-iliac region	Old bone destructive process at inferior articular surfaces of first lumbar vertebra and bone regeneration. Moderate lipping of first, second, and third lumbar vertebrae.
8	Shipfitter	38	When working on blowers, a pail of bricks fell from overhead and hit him on the back	Contusion of lumbosacral region	Minimal osteo-arthritis of third and fourth lumbar vertebrae.

for weeks, months, or even years, but neither adequate reason for curtailing their visits nor explanation to give them concerning the real cause of their complaint, was available.

In the larger Navy Yards the number of patients complaining of back injuries averages about 150 per month, with an approximate total for all yards of 18,000 per year. Inasmuch as 50 percent of the claimants are chronic osteo-arthritics, the early discovery of their real condition by radiography would result in: (1) A saving of Federal compensation money; and (2) a saving of thousands of man-hours by advising the patients concerning their complaints and the inadequate relation of their complaints to their injury.

SUMMARY

1. A large number of back injuries in Navy Yards are proved by radiologic examination to be chronic cases of osteo-arthritis.

2. Radiologic examination of all cases of low-back injuries would save time, personnel, and subsequent compensation.

3. On applying for Navy Yard positions, candidates should be questioned regarding the condition of their backs and the suspected ones should be radiographed.

STATISTICS

HEALTH OF THE NAVY

The statistics (annual rates per 1,000) appearing in this summary were compiled from data contained in monthly reports of communicable diseases received in the Bureau for the months of July, August, and September 1939-1944:

ENTIRE NAVY

Year	All causes	All diseases	Injuries and poisonings	Communicable diseases		Venereal diseases
				A	B	
1939	377	325	52	3	59	93
1940	436	386	50	16	104	82
1941	386	338	48	15	82	51
1942	395	341	54	12	110	37
1943	411	361	51	15	99	24
1944	283	239	43	8	58	20

FORCES ASHORE

1939	380	330	50	2	78	48
1940	417	367	50	13	114	51
1941	401	352	49	22	95	31
1942	390	344	47	14	116	26
1943	420	371	50	17	108	19
1944	293	254	40	10	64	19

FORCES AFLOAT

1939	376	322	54	4	49	117
1940	453	403	50	19	96	108
1941	372	324	48	9	70	72
1942	406	333	73	9	92	66
1943	377	322	56	8	65	45
1944	253	198	54	3	40	22

NOTES ON OUR RESERVE CONTRIBUTORS

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Wald, Oscar, Lieutenant Commander (MC) USNR (*Low Back Pain in Navy Yard Workers*, p. 890). M.D., Fordham University School of Medicine, 1914. Intern and house physician, Jewish Maternity Hospital, New York City, 1914; private practice, New York City, 26 years; visiting physician, tuberculosis department, Gouverneur Hospital, New York City, 1914–19; obstetrical staff, Coney Island Hospital, Brooklyn, N. Y.; instructor in anatomy, New York Medical College, Flower and Fifth Avenue Hospitals, New York City, 1932–34.

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WASHINGTON, D. C.

NAVMED 112

COVER PHOTOGRAPH

The Navy Hospital Corpsman's devotion and fidelity in standing ever-ready to ease pain and suffering of his fighting comrades is epitomized in this section of a mural painted by Lieutenant Samuel Bookatz H(S) U.S.N.R. for the Hospital Corps School, U. S. Naval Hospital, Portsmouth, Va.

—Official U. S. Navy Photo.

Lieutenant Samuel Bookatz attended the John Huntington Polytechnic Institute, 1928-31, and the Cleveland School of Art, 1931-35. After graduating from the Cleveland School of Art in 1935 with a degree in portraiture, he was awarded a scholarship to the School of the Boston Museum of Fine Arts, where he studied under Alexandre Jacovleff, 1935-37. He received honorable mention in the Prix de Rome in 1937. He was awarded the James William Paige Scholarship for 2 years' study abroad (1937-39) and studied at the American Academy in Rome, 1938, Collorossi School of Fine Arts, Paris, 1938-39, and Grande Chaumiere School of Art, Paris, 1938-39. His work has been included in exhibitions in Rome (1938), Paris (1939), and in art museums in the United States. Lieutenant Bookatz is a member of the National Society of Mural Painters and of the Artists League of America.

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THE BUREAU OF MEDICINE AND SURGERY

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated.

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PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

In order that each service contributor may receive due credit for his efforts in preparing matter for the BULLETIN of distinct originality and special merit, the Surgeon General of the Navy will send a letter of appreciation to authors of papers of outstanding merit.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

ROBERT C. RANSDELL, *Editor,*
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TABLE OF CONTENTS

CLINICAL NOTES

MEDICAL AND SURGICAL DEVICES

Page

EDITORIALS

BOOK NOTICES

PREVENTIVE MEDICINE

U. S. NAVAL MEDICAL BULLETIN

VOL. 44 MAY 1945 NO. 5

SPECIAL ARTICLES

CASUALTY HANDLING AFLOAT

PRACTICAL PROBLEMS

GEORGE R. DUNLOP
Lieutenant (MC) U.S.N.R.

Modern amphibious warfare has introduced new problems, associated with the mass transfer of the wounded and with their treatment in congested, hot, humid quarters. For a better appreciation of these problems and to expedite the care of the wounded aboard ship under these conditions the following suggestions are presented, based on the experience of the medical department of an attack transport which participated in two major military operations in the Central Pacific area. Two hundred thirty-two casualties were cared for and later transferred to other ships.

In approaching an operational area, time is available for preparations which are easily handled by means of a "check-off" list. Such a list becomes longer and more valuable with experience, and will lend itself to an orderly attention to details. The following is an example of such a list used aboard this ship and will vary with different types of transports.

"D" minus three:

1. Stock sickbay with canned fruit juices.
2. Sterilize all operating room linen and large quantities of four-by-four dressings.
3. Issue morphine Syrettes to all officers.

"D" minus two:

1. Check water tanks in the dressing stations.
2. Check all cargo lights in the dressing stations, sickbay, and troop officers' quarters.
3. Cover all mattresses with waterproof and fireproof covers.

"D" minus one:

1. Check universal donor list and the location of these donors at general quarters.
2. Make up fresh x-ray developing solution.
3. Check all gear for lowering and hoisting patients.
4. Break out extra oxygen bottles from storerooms.
5. Secure extra G.I. cans for areas where patients are to be dressed.
6. Check supplies of procaine and of sterile soap solution.
7. Issue reserve linen from storerooms.
8. Move portable operating tables to sickbay area.

"D" day:

1. Bleed a few donors.
2. Discharge all patients from the sickbay.
3. Place all slings for hoisting patients out on deck.
4. Prepare troop officers' quarters for receiving patients.
5. Move x-ray machine and supplies to "collecting station."
6. Start casualty log.

"D" plus one:

1. Administer tetanus shots to all casualties.
2. Start casualty reports.

After the debarkation of the troops the medical department must be ready to receive casualties at once and in large numbers. These casualties may be brought alongside in boats from the parent ship or in boats from other ships. Hoists, davits, and slings are not uniform and equipment must be available, in advance, to hoist casualties from boats of every type that might be used in the operation, without interfering with priority unloading. If boat crews from other ships have not been well trained in attaching the Mills–Harris litter sling to stretchers, time will be saved by sending a pharmacist's mate over the side to assist. If a boat approaching the ship flies a signal indicating she carries casualties, the officer-of-the-deck will have time to arrange for the use of a lee davit and pass the word over the speaker system for stretcher bearers.

The selection and proper use of a "collecting station," where patients may be sorted and roentgenograms made, will do more than perhaps any other single measure in expediting the care of the wounded. On many transports the sickbay area is below the main deck and casualties must be lowered by slings on stretchers. Improper distribution will cause unnecessary work and confusion, to say nothing of the discomfort suffered by the patient. It is convenient to divide casualties into the following three groups:

1. Ambulatory. It is better to send these to troop quarters near a battle dressing station.

2. Stretcher patients who do not need major operations and who are not in shock. These are sent to such a compartment as the troop officers' quarters.

3. Stretcher patients who need or may need major operations or who are in shock. These are best sent to the sickbay.

If these or comparable precautions are not taken, the sickbay may be filled quickly, and later if patients with abdominal injury arrive there may not be tables on which to place them. Every attempt should be made to reduce the rearranging of patients to a minimum. Patients who have been operated upon and who require gastric suction should always be placed in the upper bunks, or the siphon will not work. On the surface these are all simple and obvious precautions but unless they are discussed with the pharmacist's mates in advance, errors will be made and patients will be moved unnecessarily.

There is a natural tendency to rush patients through the "collecting station," because of the pressure of additional casualties arriving on board. If roentgenograms are omitted at this point, patients and dressings may be disturbed unnecessarily later on for the purpose of obtaining information. It would seem better to allow a patient to lie on a stretcher on deck or in a passageway a few minutes longer (provided he is not bleeding or in shock) than to move him out of his bunk the next day for an x-ray examination, or to remove a fresh dressing because at the time it was changed in the "collecting station" no diagnostic description was put down on his record. Casualty tags have not been of much help in determining the extent of a patient's wounds. The usual diagnosis is "gunshot wound of the chest, leg," etc. Instead a chest wound may actually mean a hemothorax, compound fracture of the scapula, and through-and-through perforation of the lung. Most casualties have some variation in their wounds which will differentiate them from the group, and these differences should be made a part of the record.

It is helpful to have a member of the supply department in the "collecting station" to remove personal belongings from the patients, and put them in properly marked envelopes for safe keeping. Another enlisted man can tag shoes for storage.

As soon as casualties in shock or impending shock are received aboard, they are treated. Much time can be lost in cutting down on veins, and attention is called to the intrasternal and the corpora cavernosa routes.

Before any debridement or major operation can be performed the patient must be cleaned. The casualties are usually covered with blood, dirt, sand, and hair, all of which must be removed from the region of the wound. In the average sickbay there are only one or two operating rooms of small size, and it is not practical to prepare the patient in these compartments, or in his bunk. It has been helpful to have two or three tables in a passageway,

each under a cargo light, where clothing can be removed, the patient washed, and the area about the wound shaved. These "clean up" tables may be the small portable operating table supplied by the Navy, or narrow wooden tables of convenient height, made by the ship's carpenter. Set up adjacent to these tables is a stand supplied with all the equipment necessary for this procedure, such as white soap, basins of water, stacks of cut unsterile bolt gauze, sterile castile soap solution (for washing around wounds), hydrogen peroxide (for removing old blood), alcohol, ether, razors, bandage scissors, adhesive, bandage, sterile gauze, and sterile applicators with cotton.

Preoperative patients can be receiving fluids and blood as the corpsmen are washing and preparing them. Such arrangement will keep unnecessary traffic out of the operating compartments and the tables can be used later for routine dressings.

An organized transfusion team, composed of two trained corpsmen, is almost a necessity. It cannot be too often reiterated that there is no substitute for whole blood in the treatment of a hemorrhaging patient. Forty blood transfusions were given with only one reaction, a minor chill. The transfusion team can be made responsible for typing and cross matching the donors, drawing the blood and administering it to the patient. These corpsmen may be delegated to clean and sterilize all intravenous sets both for blood and other fluids as soon as they are used.

The transfusion set used aboard this ship was designed by a crew member[1] and has certain advantages over that in the Supply Catalog. An empty 1,000-cc. sterile saline parenteral bottle is autoclaved in a cloth bag closed by a draw string. A donor (negative-pressure bulb, adapter, tubing and 16-gage needle) and a recipient set (filter, tubing, and two 16-gage needles) are wrapped separately in muslin and autoclaved. Two donors can be bled into this bottle. The negative-pressure bulb is thrust through one diaphragm of the rubber stopper and the glass adapter through the other. After the blood is drawn it is stored in the icebox, still in its sterile cloth bag, until ready for use. To administer the transfusion the filter is thrust through the same hole formerly occupied by the negative-pressure bulb, and an "air vent" needle inserted through the stopper into the attached glass tube. It is an advantage to store blood in 1,000-cc. lots, as large amounts are usually needed. Donor and recipient sets are best autoclaved separately as they are not often needed at the same time. This method has reduced to a minimum the amount of required tubing and equipment.

[1] W. A. Monroe, Pharmacist's Mate, first class, U. S. Naval Reserve.

As assault troops move nearer Japan the use of night soil becomes more prevalent, increasing the incidence of gas gangrene and of guillotine amputations. It has been demonstrated that if these amputations are done hastily, actually more time is lost, and the patients suffer from additional hazards and discomfort. The surgeon who takes time to shave properly the entire leg above the operative level, secure good hemotasis and apply adhesive traction at the time of the original dressing, will save his patient unnecessary transfusions and early, painful dressings a few days later.

While the more seriously injured patients are being prepared for operation the work of wound debridement can go on under local anesthesia, using trays set up with a few necessary instruments.

On "D" day all instruments are sterilized and laid out in the operating room. From this supply, debridement trays can be set up, using a sterile sponge forceps to conserve rubber gloves. With the use of sulfonamides, wounds have been debrided up to 48 hours after injury, and in a few instances as late as 78 hours. Packs are not used. They "cork" the wound, interfere with drainage and cause the patient additional pain. The relief of pain when a vaseline gauze pack is removed from a wide open wound is impressive even to the bystanders.

After debridement, few wounds are of a type whose margins will approximate. It is wise to remember that any pack is a foreign body only to be used for hemostasis or to keep a wound open whose margins would otherwise fall together and prematurely seal.

Much lost time will be saved if the medical officer will understand that fractures are to be comfortably splinted and wounds debrided, but no time spent in trying to aline fragments. Thus many unnecessary and time-consuming roentgenograms will be saved. One plate alone will be sufficient for the purpose of confirming the diagnosis of a fracture.

Casts and spicas should be applied to afford safe and comfortable transportation until the patient can be placed in a hospital for reduction of his fracture. Some fractures can be reduced easily because of the paralyzing effect of the impact of shell fragments or bullets on the muscles and should be done at the time of applying the cast. Reduction requiring the insertion of pins under anesthesia, however, had best be left for the orthopedic surgeon in the landbased hospital, or on the hospital ship, unless the conditions aboard ship are most favorable for this type of definitive treatment.

Skin traction is safe and easy to apply. Strong molded plaster splints will protect the circulation and give access to the wounds.

All circular casts should be padded and split to avoid a possible Volkmann's contracture.

Having received and sorted the casualties and completed the definitive treatment, new problems present themselves. The ship's laundry must be organized in advance to handle large quantities of linen, even if the needs of the rest of the ship must be temporarily ignored. Preparations should be made at once to transfer all casualties to another ship on short notice. It is embarrassing for a medical officer suddenly to be asked to transfer one or two hundred casualties in a few hours, and to find that his records are not complete. The exigencies of war do not respect convenience.

The oral administration of the sulfonamides is usually started at once and notwithstanding circulating "water boys," and alkalies by mouth, these patients will persist in showing the presence of sulfonamide crystals in the urinary sediment in a comparatively short time. Under the pressure of work, daily examinations of the urinary sediment are not practical, and the drug has been stopped at the end of 72 hours if the wound is still clean. In wounds suspected of heavy contamination or showing early infection, the drug is continued and the urinary sediment examined daily. An alkaline urine is reported to reduce renal complications. When alkalies cannot be taken by mouth, it is suggested that one-sixth molar sodium lactate intravenously be administered. The fact remains that the temperature and humidity of a ship's sickbay in the Pacific area are high, and it is difficult to maintain an adequate fluid balance.

In reviewing these experiences it is believed that the dressings were changed too often, which introduced the chances of additional contamination and added materially to the nursing care. The average dressing, held in place by adhesive or bandage, did not stay in place as long as would ordinarily be expected. Because of the extreme heat, the skin streams with perspiration, and even though the adjacent area had been cleaned thoroughly, it is quickly covered with beads of perspiration during the interval required to cut a piece of adhesive. After being faced with the necessity of having had to dress some wounds several times a day, the corpsmen were instructed to cut the adhesive in advance, place the dressing, then wipe the adjacent area with ether and immediately apply generous lengths of adhesive. This may appear to be a minor matter, but medical officers who have worked in the steaming compartments of a ship's sickbay have seen dressings drop off wounds 10 minutes after they have been applied. If the original dressing is put on with great care much time and effort will be saved in the end.

First-aid treatment of soft tissue wounds on the beach usually

consists in pouring on a thick coating of sulfanilamide powder and applying a battle dressing. At the end of 3 days the wound is frequently occluded with a thick covering of dried blood, serum and sulfanilamide powder. This crust is surprisingly adherent and in some instances interferes with the drainage of the wound. It has seemed expedient to switch to a sterile ointment[2] after 2 or 3 days. This softens the adherent crust and favors drainage and better healing. The uninstructed corpsman will usually continue to dust these wounds with sulfanilamide powder as he did at the initial dressing.

When the order is received to evacuate all casualties to another ship or station, records and casualty lists should be up-to-date. The Army tag should be tied to the clothing of the wounded man and any x-ray films placed on his person. Ships that transfer all records and roentgenograms in one bundle may do their patients an injustice. As the patients are hoisted aboard the next ship, the "sorting officer" cannot thumb through an envelope full of records to get the necessary information, and often the patient is not aware of the nature of his own injuries. The argument is used that if x-ray films are left with the casualties they may be lost. It is surprising how often books, writing paper, and toilet articles are transferred in the blanket of the patient without mishap. If a roentgenogram is available the medical officer, sorting the casualties, is able to get an immediate impression of all fractures, or visual evidence of foreign bodies. If the films are not on the person of the patient, it may be assumed that they were not taken.

After witnessing two mass evacuations of casualties, involving over 20 ships, the value of having a medical officer in attendance when patients are received aboard the transfer ship cannot be minimized. He is in a position to call out the diagnosis as each case is hoisted to the deck, and those patients needing oxygen, gastric suction, catheter drainage, antigas-toxin, and the like can be singled out for prompt attention. Unnecessary and time-consuming questioning of the patients is thereby avoided.

SUMMARY

Casualty handling in the hot, humid quarters of a ship's sick-bay presents the medical officer with a characteristic series of "bottlenecks."

1. A "check off" list can be used as the ship approaches the operational area.

[2] CRONKITE, E. P.; DEAVER, J. M.; and DUNN, W. W.: Preparation and uses of 6-percent sulfanilamide ointment. U. S. Nav. M. Bull. 42: 1407-1409, June 1944.

2. Lack of uniformity in craft carrying casualties must be anticipated, and plans made to unload any variety of boat.

3. As patients are sorted in the "collecting station," x-ray films and descriptive diagnoses should be made to avoid unnecessary rehandling.

4. The utilization of "clean up" tables will expedite the preparation of patients for dressings and operations.

5. A simple transfusion set is described, together with the duties of the transfusion team.

6. Attention to hemostasis and the application of skin traction at the time of guillotine amputation will save the patient unnecessary transfusions and early painful dressings.

7. Wound debridement can proceed while casualties are being prepared for major operations.

8. Packs in open debrided wounds are seldom indicated.

9. Adequate immobilization of fractures with padded casts, splints, and skin traction is usually preferable to the more time-consuming attempts at reduction. Definitive treatment of fractures can be delayed until evacuation to a hospital.

10. When urinary sediments cannot be watched, sulfonamides by mouth had best be discontinued at the end of 72 hours. Large doses of alkalies are necessary to change the reaction of the urine.

11. More time and care should be spent on the original dressing done aboard ship.

12. Wounds dusted with sulfanilamide powder should be dressed with a sterile ointment on the third day.

13. Records and roentgenograms should be on the person of each casualty when he is evacuated.

⚓ ⚓

HR FACTOR

Hr factor is the factor present in the agglutinogens determined by the genes rh, Rh_o, Rh" and Rh_3. Hence only persons belonging to type Rh_1 (provided they belong to genotype Rh_1Rh_1 or Rh_1Rh') or type Rh' (rare genotype Rh'Rh') can possibly be Hr negative. Persons belonging to any of the other six Rh blood types are uniformly Hr positive. The common idea that infants with hemolytic disease due to the Hr factor are always Rh negative is wrong; such infants must in fact always be Rh positive.—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

CASUALTIES DURING AMPHIBIOUS COMBAT OPERATION

NATHANIEL H. MATROS
Lieutenant Commander (MC) U.S.N.R.

Within a 72-hour period 340 casualties came aboard this amphibious transport (APA) during a recent combat operation. There were 310 Navy and Marine and 30 Army personnel, 220 of whom came aboard in the space of 4 hours, 8½ hours after the commencement of the action. Over 200 of these cases were considered major casualties, and their transfer was effected from amphibious tanks to small craft and in turn to the transport. Most of the patients were in a state of dehydration and shock and many were considered critically ill. The enemy fire encountered was mainly from mortar shells, which are notorious for producing multiple and bizarre wounds.

After a quick evaluation, the patients were segregated into groups according to urgency of treatment. General measures were instituted, such as the administration of intravenous fluids, serum, and whole blood transfusions. Elevated temperatures, in a good many instances, subsided upon the administration of saline. Only emergency operative procedures were followed at this time. More definitive measures were undertaken on the 12-day return voyage.

Open wounds.—There were 505 open wounds, many patients having suffered multiple hits. Copious amounts of sterile water and saline were sluiced through these wounds. Foreign material such as pieces of shrubbery, clothing, or shell, and unattached bone fragments were removed. Only evidently devitalized tags of tissue were cut away. The wound was then frosted with microcrystals of sulfanilamide, a loose vaseline gauze pack was inserted, dry gauze placed over this, and a plaster cast applied. Some casts had to be removed in a few days either because of sudden elevation in temperature or excessive drainage. It was noted at this time that the greater surface of the wound was clean, and a clear line of demarcation was present between gangrenous and healthy tissue. Gangrenous tissue was then cut away at this line without the use of an anesthetic; the surface was again frosted with sulfanilamide powder, a vaseline pack was inserted and the wound covered with dry gauze. Finally a new cast was applied. Upon inspection of some of the larger wounds at the end of 12 days it

was noted that almost all were clean and ready for secondary closure or other plastic procedures. The results of this form of conservative debridement were impressive.

Many of these patients had tendons and nerves exposed, some of which were severed. Whenever possible the ends were approximated. If this was not practicable at the time, the severed ends were anchored into the wound.

Only those shell fragments which were easily accessible or which might be expected to cause subsequent trouble, such as those in or near joint spaces or in body cavities, were removed.

Fractures.—Sixty fractures were treated. Although these were of the compound variety it is recalled that in most instances the projectile, traveling diagonally, pierced the skin at a level different from the site of fracture. Consequently for practical purposes, the reduction of the fracture was essentially the same as for any closed fracture. In the majority of cases some type of splinting and traction apparatus was applied until the patient was out of shock, after which further reduction and immobilization were completed by the use of plaster casts.

Hanging casts were used for fractures of the humerus. It became apparent in one of these cases that a Kirschner wire through the distal fragment with traction on a Thomas splint in conjunction with the hanging cast would have been the better procedure. It so happened that this patient also suffered a fracture of the femur and being a bedridden patient would rest his fractured arm on the edge of the bunk, nullifying the effect of the hanging cast.

Fractures of the femur, most of which were of the comminuted type, were reduced on a portable fracture table (table and necessary fittings were fabricated by the shipfitters and engineering force), and the usual double hip spica was applied.

If re-evacuation to hospital ships or shore hospitals is contemplated in from 3 to 4 days, the usual type of traction in Thomas splints will suffice; but when a longer interval of time (in this case 6 days in the combat area and 12 days underway) is spent on a rolling, pitching ship, experience has taught that a more stable form of traction and immobilization is indicated. The double spica cast in hip and upper leg fractures is strongly recommended. This method has many other important advantages, such as the ease with which patients can be moved and turned, the convenient use of bed pans, and the ease of re-evacuation. And above all, the patients without exception, after the application of these casts, are more comfortable and happier, making narcotics and sedatives unnecessary.

The day previous to transfer to the shore hospital x-ray checkup revealed maintenance of reduction in almost all cases. It is

recognized that a number of these cases, especially the compound comminuted fractures, will have to have subsequent surgery and manipulation.

There were four fractures of the jaws, two of the mandible, and two of the maxilla. These were all reduced with satisfactory occlusion of the remaining teeth and immobilized by simple wiring. All had sufficient teeth missing to allow for adequate nutrition. As a precaution against the aspiration of vomitus it is imperative to have a corpsman on continuous watch with these patients to be on the lookout for any signs of nausea and vomiting, from seasickness or other causes, and to divide the immobilizing wires immediately if these symptoms occur.

Amputations.—Ten amputations were performed: Two arms, three legs, one foot, and four fingers. The indications for the operations included extreme maceration, loss of soft tissue and bone of the extremity, gangrene, and spreading infection.

The guillotine type of procedure was used in all cases. The amputation bed was frosted with sulfanilamide crystals, a loose vaseline dressing was applied, and with traction on the flaps the dressing was secured with an elastic bandage. Skin traction was maintained by means of adhesive straps and a Thomas splint—a few turns taken on a Spanish windlass to maintain tension. Four of these had to be redressed on the fifth and sixth days. They presented the same picture as the other open wounds. Small areas of slough were trimmed away and the previous type of dressing was applied. Some of these, despite a healthy appearing flap, will undoubtedly need further elective procedures for the better fitting of prosthetic appliances.

It was believed that refrigeration treatment (chopped ice surrounding the extremity and secured by rubber sheeting) in the questionable amputation cases made the patient feel more comfortable, limited the infection, and helped restore viability to some of the tissue.

Chest and neck injuries.—There were 12 cases of penetrating wounds of the chest. They exhibited the usual symptom complex.

Treatment was conservative in this group with the exception of one. In this case open operation was done at the Army field station to control massive hemorrhage of the pulmonary artery. In the other 11 cases, oxygen was administered to those patients who suffered respiratory embarrassment. The wounds were plugged to stop the sucking of air, and aspiration was done only when indicated, as for example when the mediastinal shift became distressing. Shell fragments were removed only if readily accessible. All these patients, with one exception, were afebrile on arrival in port. Some of these patients with chest wounds may be

expected to have the usual sequelae and complications.

It is interesting to note that on the sixth day one of these patients exhibited acute right-sided abdominal symptoms. An x-ray picture in the upright position revealed a collection of fluid in the right thoracic base. After partial aspiration of some blood and serum his abdominal symptoms subsided.

There were three patients with serious shell wounds of the neck. In one a tracheotomy tube had to be placed because of almost complete closure of the larynx caused by hematoma and edema. The tube was ready for removal at the end of 12 days. Aspirations and cleansing of the tube several times a day were necessary.

The second patient had a wound on each side which marked the passage of the shell through the entire neck with perforation of the trachea. He was brought aboard very cyanotic with emphysema of both sides of the face and upper chest. Oxygen was immediately administered and a tracheotomy was thought necessary. Upon removal of the first-aid pressure dressing it was noted that air whistled out from both lateral wounds and that in a short time the emphysema decreased and breathing became easier. No tracheotomy was necessary and in 8 days the wound seemed entirely healed and the patient was ambulatory.

Consideration of chest wounds from the standpoint of air flow is helpful in their therapeutic management. In the sucking type the wound should be as closely sealed as possible. In the blowing type only a loose dressing should be applied. And in patients in whom a to-and-fro passage of air is noticed the end of a tube can be secured into the wound with the other end placed under water level in a bottle. All the previously mentioned types should be closely watched, as sudden changes may occur because of healing or plugging by tissue tags or exudate.

The third patient received his shell fragment through the teeth; it tore the tongue into ragged segments and traversed the floor of the mouth, finally lodging under the skin to the left of the cervical spine. He came aboard cyanotic because of a hematoma and of edema of the tissues of the neck. Bleeding was controlled, and when the tongue fragments were pulled forward and his excitability had been controlled with morphine, his breathing became easier and a proposed tracheotomy was postponed. A silk suture secured the tags of the tongue to the anterior teeth. Because of the maceration of his tongue the patient could utter only a few grunts. On the ninth day the slough from the tongue and mouth came away, leaving a clean surface, but was immediately followed by vigorous bleeding from the lingual artery, control of which was accomplished by approximating the torn edges in the floor of the

mouth and reconstructing the tongue. At this point the return of articulate speech was dramatic. In fact the patient had not lost his thick Italian accent.

Abdominal injuries.—There were three cases of multiple penetrating wounds of the abdomen. One presented a complete removal of a section of the upper abdominal wall through the peritoneum, with the serosa of the stomach injured and a portion of the edge of the liver gouged out. The weakened stomach area was reinforced, the rent in the liver sutured, sulfanilamide crystals were placed in the opening, and peritoneum and muscle closure was accomplished around a soft drain. The skin wound was left open to granulate and will probably subsequently need a graft.

The other two patients suffered extensive pelvic wounds in addition to the abdominal wounds. One had had a laparotomy performed at the Army field station, closing a perforation of the bowel. A generalized peritonitis was present.

The third, in addition to extensive pelvic fracture and abdominal perforation, had an extravasation of urine retroperitoneally caused by an extraperitoneal tear of the bladder. A laparotomy was performed to close the perforation in the bowel and bladder, and an indwelling catheter was inserted. Suction by means of Miller-Abbott tube was employed in all three cases.

Eye injuries.—There were 12 eye injuries. These were caused by small pieces of foreign material and shell fragments, and by burns. All were washed diligently several times a day, foreign material was removed, a cycloplegic instilled, and an anesthetic ointment applied.

A diagnosis of unilateral blindness was made in one patient who had suffered multiple shell fragment wounds of the left eye. The eye was enucleated on the ninth day because the good eye exhibited signs of beginning conjunctivitis with possible sympathetic ophthalmia. Three days after enucleation the socket appeared clean and the conjunctivitis in the remaining eye had cleared.

Burns.—There were five burns of various degrees. The treatment used in addition to general measures was a sluicing of the area with sterile water, doing very little debridement (unopened clean blisters were left undisturbed), and frosting with sulfanilamide crystals. Sterile vaseline gauze, a layer of machinist's waste, and an elastic pressure dressing were applied. All these wounds were healing well at the end of 12 days and will need no further treatment.

Some doubt has been entertained regarding the advantage of sulfonamides in an ointment. It seems obvious that the amount of the drug which is absorbed and which maintains the blood

level is only that which is on the surface of the ointment in direct contact with the raw tissues. It has been noticed that in some of the prepared unguents large conglomerate masses of crystals are present which are not only unabsorbable but act as a gritty abrasive to already raw and insulted tissue. For these reasons it is thought that if additional sulfonamide protection is needed after the initial frosting with the drug, it can be given by mouth, or refrosting can be done when the area is redressed.

Head injuries.—These ranged from ordinary scalp wounds to compound fractures of the skull, none of which, however, were depressed. Only one of these patients suffered cortical irritation and involvement of motor area with resultant paralysis of the left side. All wounds were allowed to remain open, and with conservative therapy all these patients convalesced uneventfully. The paralysis in the one case gradually diminished and on the day of debarkation the patient walked with cane support and had a fairly strong grip in the left hand.

Blast concussion.—Thirteen cases of blast concussion were seen. Most of these occurred in tank personnel whose vehicles received near hits. They were all placed under observation for 5 days, and watched closely for internal symptoms. None of these cases were serious and before the ship was moved the men were returned to duty.

War neurosis and combat fatigue.—There were five patients who fell into this category. They were disorientated and emotionally unstable. Sedation in adequate amounts controlled most of the symptoms, and after the ship left the combat area these men were able to be up and about under moderate surveillance.

Anesthesia.—The types of anesthesia which were employed were sodium pentothal six times, spinal three times and 1-percent procaine nerve block infiltration in all the other cases.

Local anesthesia was the choice in these cases, because of the various degrees of shock. It was employed with good results and with few exceptions in almost all the fracture and amputation patients. There were no apparent anesthetic accidents.

General treatment.—All open wounds were assumed to be infected, and some form of sulfonamide therapy either locally, orally, or intravenously was employed. The drug was discontinued when the temperature remained near normal. There were no drug reactions in this group.

Penicillin was not available during this operation but lack of it presented no great handicap as its use was not considered except in two patients with chest wounds. These probably are now receiving this treatment at a hospital.

All open wound cases received a booster of tetanus toxoid. Two cases with a doubtful diagnosis of gas gangrene received several doses of gas bacillus vaccine. In both cases the emphysema, odor, pain and temperature subsided in 5 days. No laboratory proof of the diagnosis was available.

Over 175 liters of intravenous fluid, usually in the form of 5-percent dextrose in normal saline, 54 units of plasma, 10 units of serum albumin (to patients with chest injuries who exhibited any signs of edema of the lung), and 13 whole blood transfusions, were administered.

Regarding transfusions, a list of donors was always available which gave the type and recent Kahn reaction. Two persons of each type stood by at all times. Cross matching was done and blood was available in from 20 to 40 minutes. Two donors of this group were found to be incompatible by cross matching and were not used. There were no apparent reactions.

Vitamins were administered to all bed patients and to those on limited diet.

Ambulant patients assisted in distributing food trays, bathing patients and in keeping the sickbay areas cleaned.

Deaths.—There were six deaths in this group: They occurred in two patients with abdominal wounds, one of whom had extensive pelvic injuries and the other in addition suffered extensive laceration of the bladder; the patient with the chest injury and pulmonary artery; and three patients suffering from extensive multiple lacerations, two of whom in addition suffered almost complete avulsion of the leg.

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ERYTHROBLASTOSIS FOETALIS

The Rh factor is of special clinical importance when blood transfusions are indicated for women and infants. It has been shown that 91 percent of mothers of infants affected with erythroblastosis were Rh negative, in contrast to the usual 14 percent in the general population. Also, the majority of the affected infants and their fathers were Rh positive. It is theorized that the Rh-positive fetus stimulates the production of Rh agglutinins in the mother's blood, and that these iso-agglutinins from the maternal circulation traverse the placenta into the fetal circulation. In the fetus, the anti-Rh or iso-agglutinins produce either hemolysis or suppression of the erythroblast maturation, thus the name erythroblastosis foetalis.—TURNER, O. E.: Investigation of transfusion reactions. Pennsylvania M. J. 47: 1071–1076, August 1944.

MEDICAL OBSERVATIONS ON SEABEES IN THE JUNGLE

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A detachment of Seabees, participating in the amphibious operations and occupation of a jungle island in the South Pacific area, encounters many problems for whose solution the medical department is responsible. The medical officers' duties range from the establishment of rules for safe daily living to the diagnosis and treatment of medical and surgical cases. Although the patients observed and treated in this sickbay included Navy base personnel, Marines, and Army infantry and artillerymen, the following report confines itself to the group of Seabees involved. The findings are typical of any group of white men occupying a jungle island in the South Pacific for the first time.

Seabees have not received the training given combat troops. They are on the average ten years older than Army or Navy combat groups. They are not as readily acclimated, nor are they as well prepared to withstand the heat, humidity, and the increase in accidents attending their work in the jungle. They are confined to shore duties and must stand the rigors of military camp life. Physical requirements are frequently lower than the standards of other military branches. For this reason more medical problems arise.

The Seabee unit was occupied in building landing docks, roads, signal towers, repairing small craft, erecting radio towers, power stations, and building camps and equipment-dispersal areas, communication stations and Naval base shore installations. During these operations the weather that prevailed was either very hot and humid, or cloudy and rainy. The humidity was always over 70 percent and the temperature ranged from 75° to 110° Fahrenheit. The ground was soft, muddy, and slippery.

In many cases hazards were man-made. For instance, in making clearings and thereby removing small supporting trees and vines, many large trees rooted close to the surface were weakened and would fall when moved by a slight pull or by wind. This would endanger men, quarters, and buildings. Occasionally new experiences created problems. When the island had an earthquake, two men were injured racing for foxholes because they thought

explosions were taking place. Immediately after dark, men were not allowed to leave their quarters or to talk, and this induced considerable nervousness and apprehension. Sleep was frequently interrupted by night alerts and bombings. Work was carried on only by day, but this was always a 7-day week composed of 9- to 12-hour working days.

Early camp sites were wet, low, and densely covered with impenetrable jungle, but were used because of their proximity to the beachhead. The permanent camp with its larger tents and better built foxholes reduced the exposure of the men to water, rain, and flak, and gave them a better feeling of security. To avoid marking the permanent camp locality from the air, it was necessary to maintain the high foliage and overhead growth, at the expense of reduction of sunlight to a very low penetration. Foot trails, auto tracks, and roads distributed promiscuously or trees destroyed at will changed the contour of the overhead foliage and were quickly noticed from the air or in reconnaissance photographs.

There was no better way for the medical officer to gain the knowledge of actual hazards and working conditions than to view the jobs and the conditions under which the work was done. The men had a greater respect for and confidence in the medical officer if he knew the names and uses of the equipment. For example, a man would find it difficult to follow orders when the job superintendent told him to set a pile in salt water 5 feet deep, while the medical officer ordered him to keep dry. But with a knowledge of working conditions the medical officer could advise changes of duty and regulate the time spent on one job by an individual.

Although the original camp site was chosen with an eye to convenience of operation, the medical department had an opportunity to help choose the permanent site and arrange the plan of the camp. Water supply, distribution of Lyster bags, refuse disposal, location of heads, drainage, general living conditions, laundry, insect control, camp site clearance, rat control, and recreation necessities were all connected with the work of the medical department.

To be kept dry and free from rodents and land crabs, perishable food had to be stored in tents high off the ground. Special rooms thoroughly screened overhead and on all sides were the only answer to rat-proofing.

Water for hastily constructed showers was pumped directly from upstream, chlorinated, and delivered to overhead pipes. It was deemed necessary to chlorinate the water because often it would get into the mouth while showering. Waste water was directed into a nonused arroyo. As a fungus preventive, bichloride of mercury (1:2,000) foot baths were kept in all the showers,

and footboards were made loose and movable so that they could be washed daily and exposed to the sun whenever possible. Showers were used only in daylight hours to avoid undue exposure to mosquitoes. Open urinals were built with a screen in the pipe to dissuade tiny pest flies and other insects from breeding there. Sumps were made to collect drainage water from the galley. A laundry was set up on the beach to utilize sunlight for drying.

The medical department inspected clothing weekly. Shoes, whose life in water and coral is about three weeks, were constantly repaired and replaced. As the entire base was under medical supervision of this department, it was necessary to institute antimalarial measures such as stipulating the hours for wearing complete clothing and establishing regulations for refuse disposal, swimming, and drainage projects.

The medical department must assume an unusual amount of responsibility in this type of unit. However the corpsmen, when properly supervised and trained, are able to carry out many procedures and inspections. It was found that the men cooperated better and responded well to the situations encountered when they were told the reasons for doing things and the sequelae of the hazards present. At no time was it necessary to cajole, drive, or urge them. Working hours were rarely counted and no one complained of the work.

ORGANIZATION OF THE MEDICAL DEPARTMENT

The medical department of a Seabee unit should be highly mobile, even to a greater degree than are other departments. Ordinary packing of equipment and supplies in nailed boxes was not sufficient. All containers had to be tightly built and lined with waterproof paper. Boxes needed hasps, which could be locked if necessary, and hinges to facilitate re-use. The problem of the department was to set up small, quickly usable sickbays. Each container was labeled with a serial number which was recorded with its individual inventory. Gear was so arranged that a small number of boxes could be opened to provide enough initial supplies for from 7 to 10 days. Since there was always danger that one or more containers would be lost or misplaced, it seemed reasonable to divide the stores so that small amounts of different substances could be found in several different places. By packing fragile and essential equipment in the ambulance and sending it with the first echelon, these items were made readily accessible. The ambulance itself was used as a sickbay, because its use as a vehicle was limited until later when roads were built.

Often the work parties were widely separated, making it im-

perative to give first-aid supplies to the corpsmen. The essential supplies included were: Cotton, tape, alcohol, elastic bandage, antiseptic solutions other than iodine, individually wrapped small gauze pads and battle dressings, phenol and calamine lotion, hyoscine tablets, acetylsalicylic acid, codeine, phenobarbital, a small suture set, morphine Syrettes, vaseline or boric acid ointment, cascara tablets, atabrine, wire splints, roller gauze bandages, sulfanilamide powder, paregoric, brown mixture, peroxide, aromatic spirits of ammonia, rubber tourniquet, a plasma set, a 2-cc. hypodermic syringe, needles and sterile procaine hydrochloride solution, 2-percent cocaine or butyn solution, an eye patch, sun glasses, halazone tablets, and sulfathiazole tablets. These items take very little room.

A coral-decked 16- by 50-foot tent was erected as the first hospital. An adjacent group of tents in a cleared area served as sickbay, storage facilities, and dressing stations. No effort was made at first to segregate soldiers, Marines, or Navy personnel, even though the sickbay accommodated well over 200 callers a day. However records were kept of all names, diagnoses, and treatments in so far as was possible under the circumstances.

CHEMOTHERAPY

The sulfonamide drugs were usually administered concomitantly with soda and large amounts of water. No deleterious effect of any kind except slight gastro-intestinal disturbance was noted, nor were there any sequelae, such as anemia, leukopenia, or kidney ailments detected after 11 months.

Dusting the powder on superficial wounds or lacerations was only moderately effective. Repeated dustings and accumulations of the material very often acted as a plug over the wound. Best results were obtained by sulfathiazole or sulfadiazine administered orally in doses of 2 gm. initially, 1 gm. 2 hours later and 1 gm. every 4 hours day and night until the wound was healed, then 1 gm. four times a day for from 2 to 10 days. Even indolent pyogenic folliculitis and skin ulcers improved readily with this regimen.

Although the most readily obtainable sulfonamide was sulfathiazole, sulfadiazine when available was the first choice. To apply the sodium salts a blower with a tapered blunt-tipped glass tube outlet was constructed.

FOOD PROBLEMS

Men of the Seabee class working long and arduously under difficult conditions with little recreation require considerably more

food than is ordinarily adequate for combat groups. The high carbohydrate, high protein, low fat Army rations used for land-based Naval activities are tiresome and difficult to vary. In movements of the unit and for the first several days after the amphibious landing, sea rations obtained. These rations, although monotonous, were sufficiently nutritious. Over a long period of time, however, this food is too highly concentrated and causes considerable gastro-intestinal discomfort and some diarrhea. Tea might be substituted for coffee in some rations. American canned beef stew is not as popular as the coarser Australian brand.

After galleys were built the menu improved; supply difficulties, however, resulted in some malnutrition. One multiple-vitamin capsule was issued to each man daily and an attempt was made to acquire fresh fruits and vegetables on the island. These were carefully washed in 1:1,000 potassium permanganate. Coconut milk and meat were used whenever possible. Although fish are plentiful in these waters, fishing on a large scale requires not only equipment but also skill and time. Dynamiting in shallow waters frequently brings hundreds of fish to the surface, but the objection is that the blast often ruptures the bladders and intestines of the fish, contaminating their flesh. In addition such fish must be cleaned immediately.

MALARIA AND MALARIA CONTROL

Some projects for malaria control would have taken too many manpower months to accomplish, and some recommended work could not be done at all. Often defiles within the camp confines had to be pumped rather than ditched to achieve drainage. Men working in the jungle would stir up insects when walking through tall grass, weeds, water pockets, and surface irregularities, even in the daytime. Clothes could rarely be kept permanently tight or insect-proof, and infected natives made conditions always ideal for reinfection.

As symptomatic treatment in malaria is unsatisfactory, all possible malarial symptoms such as headaches, malaise, gastro-intestinal complaints, backaches, and unexplained fevers were viewed with suspicion. In addition to being an infection reservoir the man with the plasmodium in his blood is a ready candidate for other infections. Many known carriers of malaria are asymptomatic, afebrile, and apparently free from the organisms, but develop another infection, whereupon the latent malaria flares up.

Insect repellent was a part of each man's equipment and the personnel was continually urged to use it. Many, however, used it reluctantly because of its offensive odor and its irritation to the eyes if accidentally introduced. All the men wore long sleeves and

trousers between 1700 and daylight. The use of head nets and gloves was a rarity rather than the rule. The gloves were too heavy and hard to dry and the nets were cumbersome to wear during hard labor. Valuable adjuncts to insect control were the dungarees or coveralls, which all men and officers wore. Not only did this clothing blend in with the jungle, but in addition it covered the entire body except the hands and face. The chief objections to these clothes, however, were their weight and warmth, and their heaviness when wet. Short, light rubber boots for all the men were sorely needed for ankle protection and dryness.

Freon aerosol bombs were available in small quantities but these were efficient only when the treated space was practically closed. Since all quarters were open and exposed to the air, the only plausible areas that could be treated were within the mosquito bed nets, in foxholes, and in small spaces prior to undressing. Coconut flies and houseflies are little affected, and many mosquitoes survive around the fringe of the area included. Ants succumb very quickly, but they are not as troublesome as other insects. In our experience and in the absence of the newer insecticides, the regular issue insecticide diluted with kerosene was the most lasting and satisfactory.

Treatment of malaria is actually exaggerated suppression. Suppressive doses of ¾ grain of atabrine were given daily for 6 days, and 1½ grains on the seventh day. Later this was increased to 1½ grains daily. Those men in whose blood the plasmodium was demonstrated, even though they were asymptomatic, were treated with at least 4½ grains of atabrine daily for 1 week, then 1½ grains daily. Those with symptoms, whether febrile or not, were given complete bed rest and antimalarial treatment.

In over 200 cases of malaria treated here, bed rest for from 3 to 5 days along with intensive antimalarial treatment restored 92 percent of the men to full duty. The remainder of the treatment was given while the men were ambulatory. Relapses and malarial fatigue were infrequent. The value of additional rest, as in the 10- to 12-day treatment, therefore, was questionable. One remarkable feature was the rarity of Plasmodium falciparum infections; they constituted but 3 percent of all the cases seen. It is believed that this may be due to the greater sensitivity of this species to atabrine and its possible complete removal by the suppressive treatment, or to its early eradication by the curative doses.

During active malaria, symptom complexes have been observed simulating appendicitis, coronary disease, and a number of so-called independent syndromes with and without fever. Muscle pain and objective findings such as edema of the extremities or blurring of vision were common and frequent. This was true of

vivax as well as falciparum infections. An example is the case of a shipfitter, third class, 27 years of age. While working from a cramped sitting position, he experienced lancinating pain in the back. The symptoms were characteristic of a radiculitis at the twelfth dorsal vertebra. He had had no illnesses, fever, or even a cold for the previous 5 months. The patient was uncomfortable and apprehensive and responded very poorly to opiates by injection or orally. After 2 days of symptomatic treatment blood smear was found to be positive for P. vivax, and routine quinine and atabrine treatment was instituted with prompt and continuous recession of pain, malaise, and general discomfort. This man was able to resume his regular duties after 7 days, while taking 3 grains of atabrine daily. This case illustrates an afebrile syndrome far removed from the general concept of malaria.

There is no outstanding advantage in prolonged treatment of acute malaria in the field. With the exception of remarkable cases, such as cerebral malaria and blackwater fever, and those with multiple infections and recurrences, the majority of cases can be speedily and fully suppressed and the patients returned to duty without danger to themselves or their companions. A more appropriate time can then be chosen for getting rid of the parasite.

At this activity all men, including their replacements, have been kept on suppressive treatment for the past year, regardless of the malaria incidence of the particular station. Hemoglobin determinations and blood counts made on 40 men who had been on suppressive atabrine therapy for over 12 months, and who had become intensively pigmented, revealed important abnormalities. Few cases of malaria developed.

There were no falciparum infections for 5 months and no complications of malaria for 8 months. No deaths due to malaria occurred despite approximately 50-percent seeding, and no toxic effects from atabrine were seen for 12 months. It is believed that no man's health was permanently affected because of this antimalarial program.

EXPERIENCES WITH NATIVES

The natives live in thatched straw houses and cook in a central unit in fire pits dug in the ground. These people are essentially monogamous, but a woman's value often drops when it is found she is no longer capable of childbearing. Girls are often sold for certain kinds of shells, or traded for animals. Each tribe is highly communal, supporting a chief who shares in the produce and luck of his tribe. All are expert swimmers and canoeists.

During childbirth five or six women assist the mother. Convalescence is limited to a few days until the patient feels well

enough to work. Most mothers nurse their infants, and coconut milk is given after one week of life.

With few exceptions the men are reliable. Their work consists of fishing and hut building, while the women do the larger share of all work. The men, however, can be hired to do manual labor.

The native's garb consists of loose apron-like, sleeveless, knee-length dresses for the women, and abbreviated sarongs of cloth or pressed bark for the men. No head coverings are used. Mixed bathing is the rule, and no embarrassment is shown by the women when they are observed in the nude. Promiscuity is unusual and no venereal diseases are noted.

With a little effort the natives can be studied and managed. The medical department can exert a tremendous influence on the natives by treating the sick.

To anticipate and give early treatment for many diseases the natives were observed at the native sickcall or clinic which was held three times a week. Because proximity of our men to the natives resulted in the spread of filariasis, malaria, and yaws, it was deemed wise to segregate the natives as much as possible. Our friendship with them gave us an excellent excuse to control their segregation.

Soon we gained enough prestige to take blood tests, to use needles and give treatment for yaws. Malaria was found to be hyperendemic, filariasis endemic, yaws moderately prevalent, and tropical ulcers and upper respiratory infections common. Because there were no laboratory facilities available, it was necessary to dispatch blood smears by boat to a base and then by plane to a rear area for diagnosis. This procedure was deemed worth-while to avoid unnecessary treatment. Careful examinations and some therapeutic tests, such as giving neoarsphenamine for indolent sores and quinine and atabrine for unexplained fevers, often helped in making a diagnosis. More and more reliance was placed on the gross appearances, color of mucous membranes, and the physical findings.

Because many native guides were used by the Army to track down Jap remnants and explore as well as occupy the strategic points on the island, these natives so used were quartered separately and given heavy suppressive doses of atabrine. All were cooperative and took the medications gladly. No ill effects were noted from atabrine given to several native pregnant women even though the doses were large.

DERMATOSES AND MILIARIA

Tropical ivy plants caused many of the contact dermatoses. Occasionally these dermatoses were attributable to the handling

of bark and vines on the mahogany, teak, oak, and other hardwood trees.

Severe cases of miliaria and early fungus infections, often extending over the entire body, were treated routinely by diligent scrubbing with soap and warm water. Itching was controlled by ½-percent phenol and 10-percent alcohol in calamine lotion. In areas such as the axillae, contact with opposing surfaces of the skin was prevented by inserting and lightly taping the regular emergency battle pad. When possible, exposure to sunlight was advised. For stubborn eruptions of the shins and feet or hands a mixture of 2-percent iodine, 5-percent salicylic acid, 1-percent boric acid, 3-percent potassium iodide, and 50-percent alcohol was used.

Many times patients would complain so bitterly about the "sticking and prickly" sensation of the skin when moving about, that sedatives had to be prescribed. When the skin became inflamed and rough, as in the cases of miliaria, a solution of bichloride of mercury grain ½, resorcin grains 30, and alcohol 50-percent was used. This could be modified with camphor and menthol for pruritus. Chronic fungus infections of the fingers were greatly relieved by cold boric acid soaks and 3-percent coal tar ointments applied twice daily. Two cases of frank eczema responded well to applications of an ointment composed of equal parts of zinc oxide and boric acid.

Many cases of dermatitis were self limited and circumscribed. Those aggravated by sweat and moisture responded well to a mixture of glycerin 10-percent, precipitated sulfur 3-percent, zinc oxide 5-percent, and phenol 1-percent in water. The best prophylaxis as well as curative measure consisted of frequent hot water baths, changes of attire, and exposure to sunlight.

The majority of the conditions were fungus dermatoses of the auditory canals, ulcers, lymphadenitis, and adenitis of various areas. The original miliaria was a predisposing factor for many of the ulcers. There appeared to be a thinning of the skin of the extremities or lack of circulation due to edema. Moreover slight scratching or even rubbing with the palm of the hand often removes enough of the epidermis to cause painful indolent abrasions, subcutaneous hemorrhage, or ulcers which persist for from 2 to 6 weeks even if they are not secondarily infected. Symptomatic relief must therefore be given. The most common area involved was the lower third of the lower extremities, since these parts are most often exposed to water and trauma. In all cases in which there was more than small circumscribed local involvement, sulfadiazine and sodium bicarbonate were given enterally. Alkaline washes served as the best local cleansing agent.

Fungus infection of the skin of the external auditory canal became more prevalent as the men ventured farther inland and bathed in various streams. Following exposure the warm dark cavity of the canal remained damp for days and gave the fungus opportunity to grow. Some patients remained asymptomatic but in the majority the symptoms included severe edema, exquisite pain, and a debris-filled canal. Hot-water bottles to the face and full-strength metacresyl acetate applied to the ear on a wick and kept moist were the best means of reducing the swelling. Later, wicks soaked in saturated boric alcohol were applied twice daily for from 3 to 5 days. For associated myringitis, or the rarer otitis media, sodium sulfadiazine was dusted into the canal with a blower; in milder cases a 10-percent solution was instilled on wicks. Because cerumen seemed to provide a natural safeguard to the drum, it was never removed unless considered the basis for loss of hearing or discomfort. When necessary 10-percent sodium carbonate solution was used to soften the concretions. When there were mixed infections, sulfathiazole or sulfadiazine was given by mouth. Potassium permanganate in a solution of 1:8,000 was used for washing out the ear and 70-percent alcohol was employed for subsequent drying.

A great number of the ear afflictions were skin infections involving the external canal. The auricle was rarely involved, although regional adenopathy often existed. These cases responded well to dry heat and sulfonamide administration in the usual dosages. Three patients with severe cases were treated at a Naval base hospital approximately 8 weeks following infection. No diminution in hearing resulted even though all these patients had had a myringitis.

TROPICAL ULCERS

One of the most troublesome conditions encountered was tropical ulcers. Because of the lack of sunlight in the camp and the torrential rains, the ground was continually muddy and the living quarters remained wet and dark. Clothes could rarely be dried, and the skin was almost always wet and dirty. Fungus grew so abundantly on all vegetation that it transplanted itself to canvas, leather, shoes, clothing and even to the skin.

While the tropical ulcers did not often cause total disability, they were frequently very painful and were the basis of cellulitis, adenitis, and lymphadenitis. Healing was greatly retarded when the men worked in cramped positions with their clothes wet and skin dirty. Working or swimming in sea water seemed to aggravate ulcers, probably by destroying the protective crust.

Trauma, sunburn, and sweating predisposed the skin to ulcers.

Abrasions produced by coral were another chief cause for many of the sores, especially of the legs and hands. Coral appeared to be a locally poisonous substance not tolerated by human skin. In addition there was invasion of the wounds by secondary organisms.

There were no facilities for laboratory studies or cultures. However in a series of 400 cases of skin ulcers several facts became apparent. Most sores appeared on the lower extremities. Almost all were secondarily infected. Topical applications of sulfonamides were of no value unless used very early or very late when necrotic tissue was at a minimum. Alcoholic azochloramid, 1:1,500, was effective when applied as a wet dressing. A gauze bandage with a window limited the field and protected the surrounding skin. Boric acid ointment on this gauze acted as a dam and also relieved itching of the skin surrounding the ulcer. Elevation of the foot and hot saline packs were of especial value when the ulcer became large or deepened. Sulfathiazole by mouth helped relieve the cellulitis and reduce the healing time.

Many sores refused to heal regardless of therapy. Copper sulfate solutions seemed to be beneficial in cases of ulcers resulting from encounters with fungi. Bichloride of mercury solutions were remarkably beneficial as hot soaks applied to large areas when the fungi ulcers became multiple, but this may have been due to the heat of the water. It was necessary to avoid overwetting, as maceration of the skin prevented healing. Often dry heat from a light bulb helped to "crust" a sore. An elastic bandage was used in cases with complicating adjacent varicosities, however mild.

MENTAL AND NERVOUS CONDITIONS

There was a very low incidence of the various psychoneuroses and psychoses among both the Navy and Army personnel. This may have been due to previous screening, but it would seem probable that these men were unaffected by the duty until a much later period. Also so far as could be determined no injuries were self inflicted or incurred because of a sudden mental collapse or onset of a mental aberration. As the pace slackened, however, the long, dark nights and the silence from dark to dawn began to have an effect. The necessity of keeping everyone busy became more apparent.

DIARRHEA

Diarrhea can be more incapacitating than a broken bone. During the early days of cold sea rations, six men had acute gastroenteritis with diarrhea, fostered by the nervousness and tension of approaching the unknown. One man had a fever of 103.2° F. and had 30 stools in 24 hours. Cascara sagrada, 4 tablets, was

given and after the first induced bowel movement, paregoric was administered in initial doses of 15 cc. and two subsequent doses at 2- and 4-hour intervals respectively. Tincture of belladonna 8 minims and codeine sulfate grain 1 were given to control the cramps.

The steady downpour of rain, the urgent need for foxholes, and the immediate unloading of equipment and building of shelters necessitated keeping the afebrile patients ambulatory even though they could not do regular duty. Fires could not be started, food had to be consumed cold, and quarters were often wet. These afebrile sick men, therefore, were permitted to work for an hour or two at a time on their gear and quarters.

Diarrheas are a common problem in most new moves and the most important consideration is to segregate the afebrile, the febrile, those with gross blood in the stools, and those whose cases are so severe that they are apt to develop dehydration.

Diarrhea found here was usually the predominant symptom of acute gastro-enteritis. The associated cramps, loss of appetite, and dehydration added to the debility. At the height of the campaign it was urgent to control the symptoms as fast as possible. For severe cases 2 gm. of sulfathiazole was given and repeated in 2 hours, then every 4 hours. Paregoric and bismuth in some cases, and lead acetate and opium in others frequently controlled the cramps and discomfort in two or three doses.

Of 75 cases so treated no ill effects or toxic side reactions were noted. The average loss of time per man was 24 hours. All but five in this series could take care of themselves. In cases where the anal opening became inflamed, good results were obtained by washing the skin with ether or carbon tetrachloride and applying zinc oxide ointment.

SURGICAL PROBLEMS

It is not too difficult to achieve a sterile operating field under so-called "impossible" field conditions. Within a few days after landing a laparotomy was performed. The surgery was an 8- by 10-foot space in the main tent, enclosed by a muslin screen. The operating table was constructed of scrap lumber. The lights were gasoline lanterns and were ample for any purpose, except that they were very fragile and required mantles and cleaning very frequently.

Because the assistants had difficulty avoiding contamination, they scrubbed but were not required to keep aseptic. Forceps were kept in cresol solution and were used to handle dressings and instruments. A gasoline autoclave served to sterilize the packs. When the autoclave was unavailable the bake oven was used.

Patients with broken bones had to be splinted and sent to another island for x-ray study. Ankle sprains and strains were routinely injected with procaine hydrochloride and immediate motion was initiated with excellent results.

After the first few weeks most of the surgery was of a minor nature. Gunshot wounds, severe lacerations, burns, and injuries were washed, debrided, dusted lightly with sulfanilamide crystals, dressed, and lightly sutured for approximation, and the patients were hospitalized. Those patients not evacuated were observed to be singularly free from infection.

Burns in this series were at a minimum, although there were several severe cases in the Army unit. In all cases the patients were given morphine ½ grain. Vaseline pressure bandages were applied to burns involving the face; other areas were sprayed with paraffin petrolatum. The latter treatment, easily supervised by untrained personnel, accomplished suppression of pain and minimal infection. Tannic acid paste was not used except in some first-degree burns and sunburn and then only on small areas.

Administration of morphine produced no untoward reaction. The patient was watched continuously after sedation and each dose was recorded by bending the tin morphine Syrette and attaching it to the patient's clothing in the manner of a laundry tag to warn against repeated dosage.

In one instance a severely burned soldier was given morphine, his burns were dressed with vaseline wax bandages, and 500 cc. of plasma was administered. The patient, evacuated by boat and plane on a trip exceeding 6 hours, arrived in good condition. He made an uneventful recovery from second- and third-degree burns covering 60 percent of the body surface.

In all extensive cases of burns a course of sulfadiazine was administered to prevent an indolent ulcer or a cellulitis, and salt was given by mouth in all cases in which plasma was required. Plasma tubing was carefully cleansed and re-used for intravenous instillations. In one instance this same equipment was used to improvise a Wangensteen suction tube.

CATARRHAL FEVER

Catarrhal fever was constantly present, as a natural result of exposure. Cases of adenitis, tonsillitis, folliculitis, and sinusitis were eliminated from this diagnosis. Catarrhal fever was treated symptomatically with bed rest, abundant liquids and antipyretics. Codeine sulfate grain 1, and also aspirin-phenacetin-caffeine tablets, 15 grains every 4 hours, were given. Coughs were primarily nasopharyngitic conditions and were treated by atropine 1/150

grain twice a day, along with small doses of codeine and acetylsalicylic acid.

ALLERGIES

Allergic conditions included anaphylactic shock, hives, insect bites, gastritis, urticaria, and some types of sinusitis. It was assumed that some of the urticarias were on the basis of nervousness or foods. A greater number were the result of insect, scorpion, spider, rat and stingray attacks. Insect bites were often extremely incapacitating. For example, an arm bite could cause edema, burning, itching, and severe pain over the entire extremity within a period of 20 minutes. The patient would usually evidence pallor, cold sweat, dizziness, and exhaustion. One man was in such an incoherent condition that 30 minutes passed before it could be learned what had happened to him.

Chronic recurrent urticarias were treated with calamine lotion containing camphor, menthol, and alcohol. Calcium lactate was used in the diet because of the shortage of milk, cheese, and meat. Ephedrine was scarce. Treatment of allergic sinusitis was confined to magnesium sulfate by mouth, morphine, neosynephrin hydrochloride by hypodermic injection, and topical applications and sedatives. Care was taken not to overdose the patient, so that he could be aroused during the night in the event of air alarms or attacks.

EYE CONDITIONS

Eye conditions encountered were blepharitis, conjunctivitis, foreign bodies, iritis, and retinitis. The catarrhal conjunctivitis, traumatic conjunctivitis, and blepharitis cases were benefited largely by warm saline and boric acid washes, and 5-percent argyrol instillations twice a day for from 10 to 15 days. The more stubborn cases of this type were further treated by dusting fine sodium sulfadiazine powder into the conjunctival sac. Patients with retinitis and iritis were sent to the rear for special treatment after a short period of observation. Infra-red light rays seemed to affect many of the men working in sunny areas, and often consecutive tests would show progressive impairment of visual acuity.

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HR TESTS

Hr tests are tests with anti-Hr serum.—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

PRACTICAL TECHNIC FOR HEMORRHOIDECTOMY

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Rectal surgery is frequently necessary at advance base dispensaries, but as special instruments are usually lacking the surgeon must use the best available substitute. The instrument of choice is usually the Kelly clamp, which has disadvantages. Often the cut edges begin slipping from under the edges of the clamp, and soon there is bleeding and separation of tissue surfaces that should be approximated.

To obviate such a contingency and insure a good result when the operation is performed under the handicap of using the instruments found in the usual surgical outfit for field units, a slight deviation from the usual technic of clamp and ligature hemorrhoidectomy is described. If the cut edges are going to slip out from under the edges of the clamp, it seems logical to place the suture before cutting tissue. Then if slipping should occur, the tissue is already secured and can be approximated by drawing up on the running suture at the time of removal of the clamp. This, in effect, is retrograde hemorrhoidectomy. The method has several advantages.

At the start of the operation, after thorough gentle dilatation of the sphincter, a racket-shaped segment of perianal skin is excised. The apex of this is continued as a narrow corridor through the length of the anal canal. Above the pectinate line the internal portion of the hemorrhoid is identified and elevated with Allis forceps. The Kelly clamp is then placed along the base, the clamp being directed along the longitudinal axis of the rectal canal. There is often redundant tissue extending beyond the end of the clamp.

The next step is the placing of a guy suture at the upper pole, including whatever redundant tissue is present, and leaving the ends long. Linen or heavy silk is used for this purpose. This step serves two purposes: (1) To keep the tissue under control, because by means of the guy suture the area can readily be brought into view and within reach of instruments should there be bleeding; and (2) to ligate the main source of venous blood into the hemorrhoid.

An over-and-over chromic suture is started, as is done in the usual clamp and ligature operation. After the upper end has been secured, and the loops begin to fall over the Kelly clamp, the upper pole is freed by incision, cutting with the knife along the upper surface of the clamp, down to the level of the last suture bite. Suturing is then resumed for a short distance and again the tissue above the last loop is cut. Proceeding in this manner the entire length of hemorrhoidal mass is completely ligated and excised, the suture line ending just above the pectinate line.

Thus whatever tissue, freed by incision, might slip out from beneath the clamp is already transfixed by the suture and is entirely under control. When the Kelly clamp is finally loosened and removed beneath the tightening suture, the edges that may have separated are gently brought together. When they are adequately approximated, the chromic suture is tied and cut. Final inspection of the segment may then be made by exposure of the region and gentle traction on the guy suture. Assured that hemostasis and approximation are satisfactory, the long ends of the guy suture are cut, leaving the knot in place. This procedure is repeated for each hemorrhoidal mass present.

The advantages of this method are that there is little bleeding, there is accurate approximation of tissue edges, and a good result is assured. Practically the only disadvantage is the possibility of cutting the suture loop when incising the hemorrhoidal mass. This must be constantly guarded against, or there will be the annoyance of having to start the chromic suture over again. If this happens often enough the technic will suffer because of faulty execution. However once the technic has been mastered there is little danger of the knife slipping.

PENICILLIN IN WEIL'S DISEASE

Nine strains of Leptospira icterohaemorrhagiae (the causative organism of Weil's disease) and one of L. canicola (the cause of another form of leptospiral infection of men and dogs) were found sensitive to penicillin, which has a lethal as well as an inhibitory effect on multiplication.

Penicillin has a curative action on leptospiral infections in guinea pigs, provided administration is begun very soon after infection.—ALSTON, J. M., and BROOM, J. C.: Action of penicillin on leptospira and on leptospiral infections in guinea-pigs. Brit. M. J. 2: 718-719, December 2, 1944.

SILK TECHNIC IN APPENDECTOMY

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The advantages of early ambulation after major surgical operations have been well established; complications are fewer and return to full duty status is prompt. Such a program depends, however, upon uncomplicated rapid healing of the wound and upon a technic of wound closure which forestalls herniation. The following appendectomy technic has been employed during the past year with gratifying results.

Suture material.—Fine black silk twist No. 3 or size A is used throughout with the exception of the peritoneal closure where a continuous suture of No. 000 chromic catgut is utilized. For the subcuticular skin closure fine rustless steel wire (36-gage) may be preferred, notwithstanding its difficulty in handling. Cotton thread is satisfactory, although, size for size, it is not as strong as silk. Black thread permits increased visibility without demonstrable irritation and there is no advantage in using the more expensive specially-prepared "surgical silk."

Ordinary silk thread is wound on a board which has been previously rubbed with a small amount of equal parts of vaseline and beeswax. It is then wrapped in muslin and autoclaved (fig. 1). This provides a well-lubricated hank of silk which is cut at the operating table and a separate strand, approximately 18 inches in length, is handed to the surgeon for each tie and suture. A single size is used throughout. Where greater tensile strength is occasionally required, such as the crushing tie on the appendiceal stump, a double strand is employed. The technic of suturing is facilitated if the easily-threaded French spring-eye needles (half-circle curve, with a diameter of about ½ inch) are available.

Preparation of patient.—Spinal anesthesia is ideal for surgery of acute processes within the abdomen. The excellent relaxation of the abdominal wall and the diminished contractions of the bowel allow the removal of dangerously diseased appendixes with a minimum amount of trauma and manipulation. Pontocaine-dextrose, metycaine, and procaine solutions are all satisfactory anesthetic agents. The patient is given nembutal, grains 1½, an hour before operation and a hypodermic of morphine grain ½

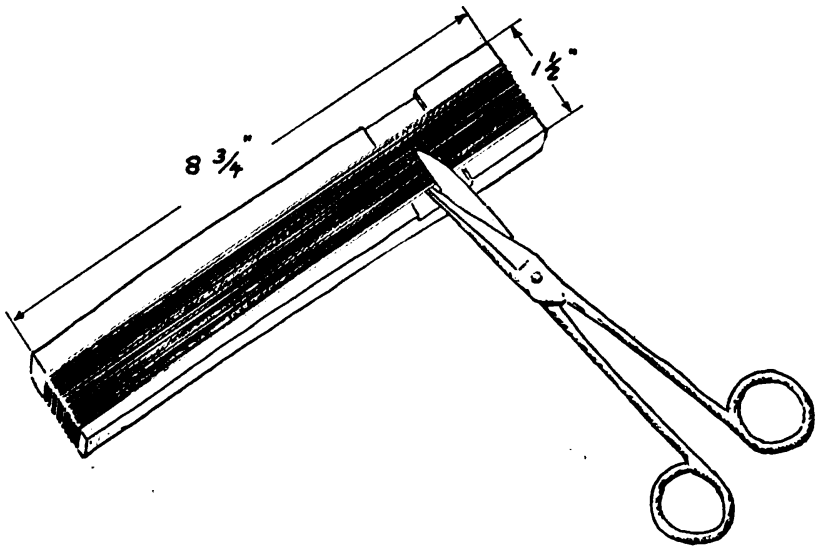

Figure 1.

with scopolamine grain 1/150 a half hour before operation. A brace is placed against the left side of the patient's chest and the table is tilted to the left (fig. 2A). This allows the viscera to fall away from the site of the incision and is especially valuable in the rounded obese type of abdomen and in patients with the appendix in a retroperitoneal position. When the table cannot be tilted the position can be obtained by sandbags beneath the patient. The skin is scrubbed with soap and water on gauze sponges followed by a similar scrub with 70-percent alcohol. The skin is painted with tincture of zephiran and a mark for the incision is made with methylene blue so that the skin towels may be placed close to the wound.

Incision.—The incision is almost horizontal, following accurately the easily-visualized skin cleavage lines, and extends as far medially as the edge of the rectus sheath (fig. 2B). The level is usually slightly above the anterior superior iliac spine. It is modified, however, according to indicated position of the appendix. When a retrocecal appendix is suspected the incision is placed about 2 inches above the anterior superior spine in order to allow extension laterally into the flank. The incision as a rule need not be longer than 2 or 3 inches (fig. 2C). Superficial bleeders are secured with fine-pointed hemostats but are not tied. After the deep fascia has been exposed, moist laparotomy pads are placed in such a way that the inner edges may be folded under in the wound to wall off the subcutaneous fat and prevent gross contamination should pus be encountered. The four towel clips which secure these pads grasp the fat and subcutaneous fascia and thus avoid added trauma to the skin. The external oblique muscle and

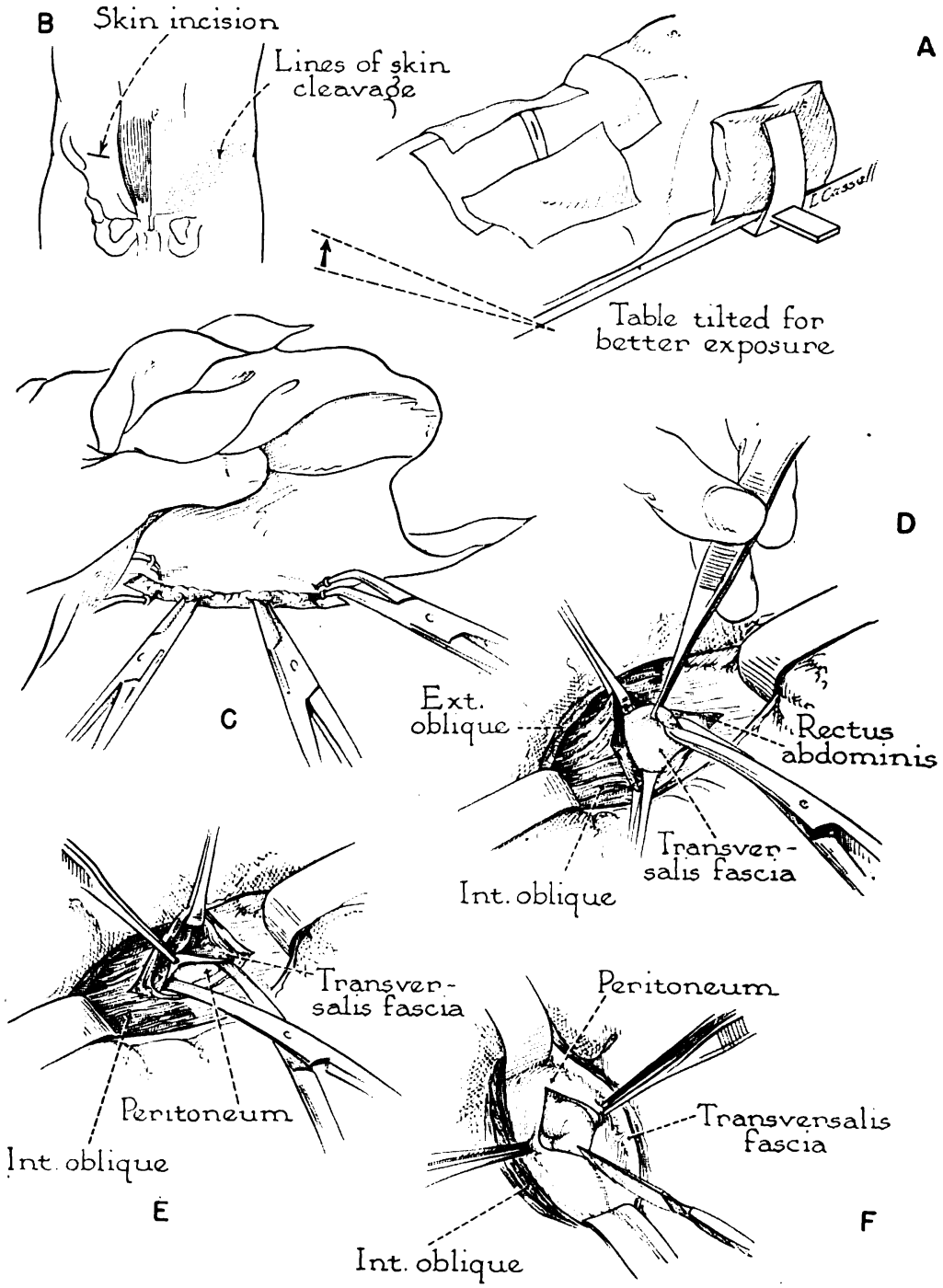

Figure 2.

aponeurosis is split in the direction of its fibers at a point ¾-inch medial to the anterior superior spine. The fascia propria of the internal oblique muscle is incised for one inch just lateral to the rectus sheath, thus avoiding the vessels which lie deep in this muscle toward the anterior superior spine, and the two edges of the internal oblique are lifted up with deeply-placed Allis forceps

(fig. 2, D, E, and F). The underlying transversalis fascia appears as a shiny white layer. This is picked up and incised with the tip of the dissecting scissors which are used to separate on all sides the transversalis fascia from the underlying peritoneum. The transversalis fascia is retracted and a small incision is made in the peritoneum.

Removal of appendix.—The appendix is removed and its base ligated with a double strand of silk; single strands are employed for tying the severed vessels of the meso-appendix. Considerable care is taken to cauterize thoroughly the appendiceal stump with phenol and alcohol. Two instances have been observed in which peritonitis developed about a week after operation and exploration revealed the source of the infection to be a small abscess at the site of the appendiceal stump.

Where feasible the stump is buried by a purse-string suture placed in the wall of the cecum in such manner that the small vessels of the meso-appendix, which frequently run along the wall of the cecum into the appendix, are included in the tie. In all cases in which infection of the appendix is mild or questionable, the terminal ileum is explored for a Meckel's diverticulum. The peritoneal cavity is drained only when considered absolutely necessary, as, for example, when necrotic tissue or insecure closure of a gangrenous stump is encountered. Sulfonamide is placed in the peritoneal cavity only when a verified peritonitis is found.

Closure.—The peritoneum is closed with continuous No. 000 chromic catgut with care not to include the transversalis fascia. The edges of the internal oblique are lifted up with Allis forceps causing the cut edges of the transversalis fascia to stand out sharply so that they may be sutured as a separate layer (fig. 3G). The placing of interrupted fine silk sutures is facilitated by leaving the ends long and having them held by an assistant until the suture line has been completed. The fascia propria of the internal oblique and the external oblique muscles are sutured in turn, the moist gauze pads are removed and the superficial artery forceps are released without tying (fig. 3, H and I). The superficial fascia is sutured and the skin edges are approximated with a very superficially-placed subcuticular stitch (fig. 3, J and K). The ends of the subcuticular suture are held taut so that the thread in the wound will remain fixed in a straight line and thus more easily be removed (fig. 3, L and M). A small wisp of moist gauze is placed over the wound and the ends of the suture are anchored to the skin between adhesive squares. A folded gauze pad 3 inches long and 1 inch thick is placed over the wound and covered with several 4- by 8-inch dressings, the whole being strapped tightly

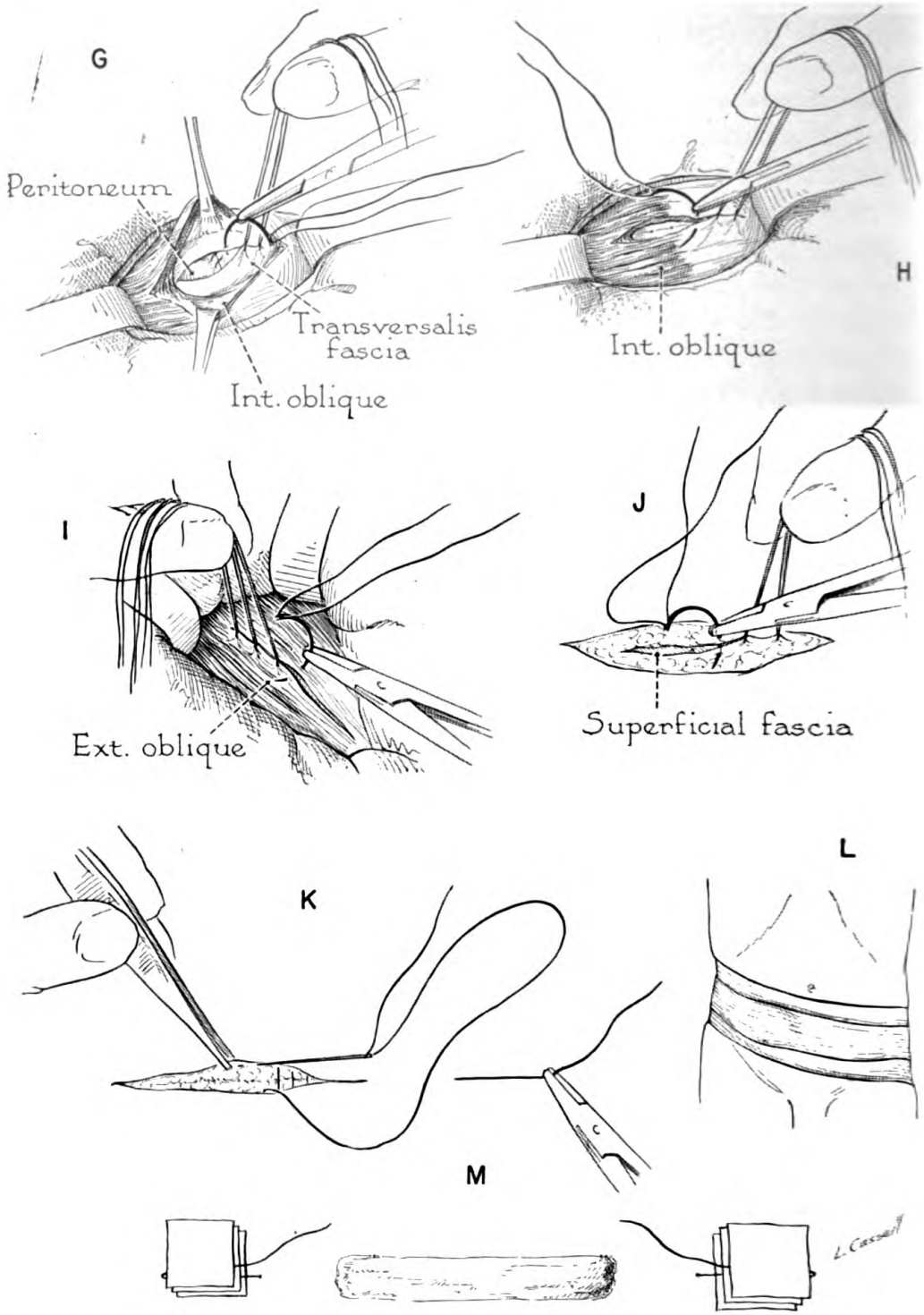

Figure 3.

in place with wide adhesive strips to provide firm pressure and local immobilization. This is important in preventing the occasional wound hematoma.

Modified technic in cases of contamination.—Sulfonamide powder is used locally only where obvious purulent contamination has

occurred, in which instance it is sprinkled lightly and a small Penrose drain is placed superficial to the fascia. The skin is closed loosely with interrupted silk and the wound covered with warm moist boric dressing. This is renewed as often as necessary for 3 or 4 days.

Postoperative care.—No restrictions are made regarding activity or diet except in cases of peritonitis. As a rule the patient is out of bed and partaking of the regular house diet on the first postoperative day. Spinal puncture headache has been a rare complaint and its occasional occurrence has been unrelated to posture. Elevation of the foot of the bed consequently has been discarded. If the patient is unable to void during the early postoperative period, he is assisted to his feet and even walked to the head before catheterization is considered. On the third or fourth postoperative day all dressings are removed except for the small wisp of gauze directly over the wound, and the subcuticular suture is removed. Several narrow strips of adhesive are applied to keep the small gauze strip in place so that its fibrinous adherence to the skin edges will prevent their separation. On the fifth or sixth day the strips are removed and the patient is allowed to take a tub or shower bath.

The time of return to duty depends upon the required activity involved. Men are allowed to attend studies as early as from the seventh to tenth day but are excused from their physical fitness program for an additional two weeks.

RESULTS

A total of 200 consecutive cases were operated upon using the aforementioned technic. There were no fatalities and there were no wound complications of any kind. All wounds healed without infection, hematoma or accumulation of serum.

Sulfonamides were used in only 16 instances. In the 10 cases of ruptured appendix, a sulfonamide was placed in the peritoneal cavity, sprinkled in the wound at operation, and administered intravenously and by mouth for various periods postoperatively. In five cases of gangrenous nonruptured appendix it was given to the patient by mouth when signs of peritonitis developed postoperatively.

It seems apparent that wound complications are more surely avoided by a meticulous surgical technic than by reliance upon chemotherapy.

For the sake of convenience, the complications are analyzed by groups according to the severity of the pathologic process found at operation. The three cases of Meckel's diverticulum (one gan-

grenous, two noninflamed) in this series were discovered at operation. Each of these patients made uncomplicated recovery.

Appendix gangrenous and ruptured.—In the 10 patients with this complication, the appendix was removed and sulfonamides were used both locally and systemically. A drain was left in the peritoneal cavity in only one patient, but in all a superficial wound drain was employed and the wound treated with warm moist dressings. Three patients developed intra-abdominal abscesses, two of which gradually subsided spontaneously, whereas the other was finally evacuated through the wound. There were no other complications.

Appendix gangrenous but intact.—In the 25 patients with this complication the appendix was removed in each and the wounds closed with subcuticular suture. There were 4 complications: Three tonsillitis, acute, and 1 catarrhal fever, acute.

Appendix acutely inflamed with coating of fibrin.—There were 44 patients in this group. The appendix was removed and the wounds closed without drainage. There were 2 complications: One a mild cystitis following catheterization, and the other a generalized peritonitis which localized in a pelvic abscess and finally subsided spontaneously. This complication may have been caused by the unusual virulence of the causative organisms, because the patient was admitted with a fever of 101.8° F. and a leukocytosis of 30,500. The appendix was removed cleanly at operation.

Appendix acutely inflamed without fibrin.—There were 57 patients in this group and 3 complications occurred: Two pharyngitis, acute, and 1 tonsillitis, acute.

Appendix not acutely inflamed.—There were 64 patients to whom this diagnosis was applied. There were 6 complications: Two tonsillitis, acute, and 1 each of bronchopneumonia, scarlet fever, mumps, and orchitis, acute, nonvenereal.

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RH BLOCKING SERUM (ANTIBODY)

Rh blocking serum (antibody) is a serum capable of reacting with blood containing the Rh factor but without producing agglutinations, though blocking the action of subsequently added anti-Rh serums; i. e., Rh-positive blood treated with Rh blocking serum can no longer be agglutinated by anti-Rh serum. To date, blocking antibodies of only one specificity have been found, namely, anti-Rh_o.—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

COTTON SUTURE MATERIAL IN HERNIAL REPAIR

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Meade and Ochsner[1] in 1939 advocated the use of cotton sutures and in 1940 reported an exhaustive study of suture material, demonstrating the superior qualities of cotton for wound closure. They emphasized the ease of sterilization, the pliability, satisfactory tensile strength, reliability of the knots, decrease in tissue reaction, and more satisfactory wound healing than with silk or catgut.

At McIntire Dispensary the use of cotton sutures for all wound closures has been entirely satisfactory in the hands of a rapidly changing surgical staff. In 1943 and the first 6 months of 1944, 20 surgeons, with an average duty period of a little more than 3 months each, used cotton suture material for hernia repairs on 1,675 patients, and experienced little difficulty in adjusting to the characteristics of cotton. A series of 293 herniorrhaphies done with catgut, before cotton sutures were adopted, is used as a basis of comparison.

The tenets of Halsted[2] were followed in the use of cotton, as he prescribed for silk: (1) Only interrupted sutures were used; (2) coarse suture material was avoided by the use of a larger number of fine sutures; (3) a dead space was never bridged; (4) the combined use of absorbable and nonabsorbable sutures was avoided; and (5) transfixion sutures were used to allow ligation with finer material.

Number 24 spool cotton was used for suturing the conjoined tendon in the repair of inguinal hernias, and for any other tissues that required tension. Number 50 spool cotton was used for ligatures, for the skin, and for buried sutures not requiring the tensile strength of No. 24. All sutures grasped small amounts of tissue and were placed close together. The use of a 10-inch suture for each stitch speeded the work. The use of dry sutures is preferred. Meade and Ochsner showed that the tensile strength of cotton increased when moist; the increase in strength after tying the knots

[1] MEADE, W. H., and OCHSNER, A.: Spool cotton as suture material. J.A.M.A. 113: 2230-2231, December 16, 1939. IDEM: Relative value of catgut, silk, linen and cotton as suture material. Surgery 7: 485-514, April 1940.

[2] HALSTED, W. S.: Ligature and suture material; employment of fine silk in preference to catgut and the advantages of transfixion of tissues and vessels in control of hemorrhage. J.A.M.A. 60: 1119-1126, April 12, 1913.

is a safety factor. Ochsner advocates the use of quilting cotton in preference to the No. 24.

One thousand nine hundred sixty-eight patients operated on for all types of hernias, single and multiple, were included in this study. The 1,675 in whom cotton suture material was used showed less wound induration than did those closed with catgut; hematomas occurred in 31 (1.85 percent); serum developed in 8 (0.47 percent); wound infection occurred in 9 (0.54 percent).

In the group of 293 repaired with catgut, hematomas occurred in 15 wounds (5.1 percent); serum developed in 15 (5.1 percent); wound infection occurred in 5 (1.7 percent).

Cultures were taken of all fluid that exuded from the operative wound; when the fluid appeared purulent even though the cultures were negative, the wounds were classified as infected. Most of the infected wounds healed promptly after opening for adequate drainage. The presence of suture material in the discharge was not observed. One of the infected wounds developed a persistent draining sinus that required exploration and excision. The sinus extended through a thick layer of fat to a stitch in the subcutaneous fascia. The suture was firmly in place and had allowed no separation of the fascia. One strand had been cut close to the knot, while the other end had been left unnecessarily long.

Most of the infected wounds which were opened wide enough to allow adequate inspection revealed the deep fascia layers undisturbed, with the wound infection confined to the subcutaneous layers. It is very probable that some of the stitches in the subcutaneous fascia included an excess amount of fat and thereby produced necrotic tissue and either a sterile or secondarily infected abscess. Deep stitches in the subcutaneous fat should not be used to obtain hemostasis.

The patients were all returned to duty without a recurrence of their hernias, but no further follow-up has been attempted. Patients with indirect inguinal and small direct hernias have been returned to duty 28 days after the operation. The time was shorter for umbilical and epigastric hernias, but was increased to 35 or 40 days for large direct or ventral hernias and for recurrent hernias. When possible all patients were allowed out of bed to void on the first postoperative day.

The saving in cost of suture material was not the primary factor in choosing cotton, but is considered an added advantage. The estimated saving to the Navy for this series of hernia repairs was approximately a thousand dollars. The ease of transportation, procurement, and sterilization is an obvious advantage for war surgery.

It is significant that the use of cotton sutures was satisfactory in the hands of a score of surgeons, the great majority unaccustomed to its use. Only a few days were necessary for obtaining proficiency. Those accustomed to the use of heavy catgut had more difficulty with cotton than did the others.

There is some evidence to indicate that wound complications decreased with experience, but many of the skin closures were done by hospital corpsmen, acting in the capacity of surgical assistants, with equally good results.

SUMMARY

1. A study of 1,968 hernia wounds has been presented.

2. The use of cotton suture material in 1,675 cases proved consistently satisfactory in the hands of a rapidly changing group of operators.

3. Wound complications were reduced by the use of cotton sutures.

4. The saving in cost of suture material was approximately one thousand dollars.

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RH TYPING

Rh typing is the classification of individuals within one of the eight Rh types with the aid of anti-Rh_o, anti-Rh′, and anti-Rh^w serums. Note the distinction between "Rh typing" and "Rh testing."—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

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ASPIRATION BIOPSY IN THYROID DISEASES

The direct method of tissue examination always stands as the final diagnostic criterion of many diseases.

A method of histologic diagnosis of thyroid disease based on a micrometric examination of the thyroid acinar cells has been devised and utilizes the dimensions of the cells themselves, and not the general architecture of the gland. It can be used with very small amounts of tissue and hence permits aspiration biopsies for the direct diagnosis of thyroid disease.

The following standards indicate that: An average cell height of over 8.1 microns indicates toxicity in nodular goiters; an average cell height of over 7 microns indicates toxicity in diffuse goiters, and an average cell height under 7 microns indicates a normal gland.—LIPTON, R. F., and ABEL, M. S.: Aspiration biopsy of thyroid in evaluation of thyroid dysfunction. Am. J. M. Sc. 208: 736-742, December 1944.

SURGICAL TREATMENT OF THE POSTTRAUMATIC PAINFUL EXTREMITY

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During the past few years increasing recognition has been given to a variety of vasomotor disturbances arising in the extremities as the result of trauma. Service injuries have afforded additional impetus to study and treatment of the disabling sequelae that are based on sympathetic overactivity in both its acute and chronic forms.

The acute variety is perhaps most characteristically seen in association with Volkmann's ischemic contracture, peripheral arterial embolism, and wounds and lacerations of the major arterial vessels. The value of prompt local treatment combined with paravertebral block, repeated as often as indicated, and with periarterial stripping when surgical exploration is necessary, has been firmly established. This discussion is largely concerned with the chronic stages of the disturbance: The cold, painful, edematous extremity with or without Sudeck's atrophy, which may progress if neglected to advanced trophic changes, bony ankylosis, and to the serious psychiatric sequelae that result from intractable pain.

The sequence of events in many of these cases follows a fairly uniform pattern. There is often only a minor injury to the extremity—a contusion, soft-tissue hemorrhage, or joint sprain which initiates the reflex cycle, and after a variable interval, usually from 2 to 4 weeks, signs of autonomic dysfunction appear. This is not meant to imply that Sudeck's atrophy and allied disorders are not seen following fractures, particularly of the carpal and tarsal bones, but they are strikingly absent following major fractures of the long bones of the extremities, and severe injuries to the main vascular and nerve trunks. As Böhler[1] has pointed out, this paradox doubtless stems, at least in part, from inadequate local treatment, lack of immobilization, and the desire for a rapid return to duty that influences the handling of the so-called minor injuries.

Another condition in this group is vasomotor instability. Der-

[1] BÖHLER, L.: The Treatment of Fractures. Authorized English translation by M. E. Steinberg. Wilhelm Maudrick, Vienna, 1929.

mographia, increased histamine flare, emotional lability, and exaggerated flushing and sweating reactions are often observed. It appears that the receptive groundwork for this posttraumatic syndrome has been laid in the personality reaction type and in a hyperreactive autonomic nervous system.

There is general agreement, as Miller and de Takats[2] have shown, that the initial stages of the reflex pattern are manifested in a pronounced vasodilatation with hyperemia and increased limb volume. The stimulus is provided by actual sensory nerve damage or by the products of tissue destruction, or both; the Loven reflex, acting through posterior root vasodilating fibers is then established in the traumatized part. At this time the onset of pain, edema, and reluctance to move the affected extremity should provide a warning, and within a few weeks the spotty osteoporosis of the neighboring bones, which Sudeck[3] first described, may become evident. The picture thus far is scarcely a disease entity, but rather almost the exaggeration of a normal physiologic response. In many instances it undoubtedly subsides spontaneously; in others satisfactory immobilization of the part with weight bearing when possible, repeated blocking of local afferent impulses by procaine hydrochloride, and subsequent physical therapeutic measures will arrest this vasodilatation stage.

In other instances, however, the condition passes into the chronic phase of excessive vasomotor activity in which sympathetic efferent fibers become the effector mechanism of a self-perpetuating reflex pattern. The extremity becomes cold and hyperhidrotic, pain is intensified often to a burning causalgic nature, and active motion is carried out with difficulty if at all. The skin is shiny and atrophic, occasionally slightly cyanotic, and the circulatory deficit may be apparent not only in constriction of the arterioles but also in spasm of the main arterial trunks. Roentgenographic examination often indicates a superimposed osteoporosis of disuse which partially or entirely obscures the spotty atrophy of the preceding stage.

The reason for this transition is obscure. At least part of the answer will lie in the future fields of psychosomatic medicine. Mention has been made of the trend to generalized emotional and vasomotor lability as a basic conditioning factor in these cases, and the importance of cortical influences, particularly in respect to functional fixation on the affected part or extremity, must not be overlooked. However psychotherapy alone, although an important

[2] MILLER, D. S., and DE TAKATS, G.: Posttraumatic dystrophy of extremities: Sudeck's atrophy. Surg., Gynec. & Obst. 75: 558-582, November 1942.

[3] SUDECK, P.: Über die akute entzündliche Knochenatrophie. Arch. f. klin. Chir. 62: 147-156, 1900.

adjunct in treatment, as in the first case to be cited here, has failed to alter the fundamental vasospastic disorder. Another factor in this transition appears to be an overcompensatory response of the autonomic nervous system in its effort to restore equilibrium in the affected extremity of these sympathicotonic individuals.

It is therefore physiologically unsound to conceive of this reflex pattern persisting for months and years as the result of ceaseless and unvarying stimuli of a chemical or a humoral nature which locally affect the afferent fibers in the once traumatized area. Central autonomic overactivity, some of which appears to stem from the highest levels of the nervous system, gradually supersedes in importance these local influences. When the pattern has been firmly established, only complete interruption of the appropriate sympathetic fibers will be curative, and no lasting effect can be anticipated by local block, temporary paravertebral infiltration, or by periarterial stripping.

The following two cases illustrate these therapeutic factors:

CASE REPORTS

Case 1.—A Marine corporal, 20 years old, was admitted on 3 April 1944. In May 1940 he had sustained severe contusions of the left leg and a sprained ankle without subsequent hospitalization. Shortly thereafter he had experienced intermittent burning pain in the left lower leg and foot which had persisted and increased up to the time of admission. The left foot had been cold and numb for the past two years. Activity and cold damp weather exacerbated the symptoms, and recently the patient developed a decided limp in the left leg.

Examination showed a limping gait with coldness of the left leg below the mid-thigh level. This increased distally to a temperature difference of 3.5° C. on the dorsum of the left foot as compared to the right. The left dorsalis pedis pulsation was absent, and that of the left posterior tibial was somewhat diminished. There was a shiny, bluish hue to the skin of the left foot. No redness or blanching with change of position of the extremity was elicited. All muscle groups of the left leg were hypertonic and resistant to passive manipulation and there was tenderness over the tarsal bones and the lower anterior tibial crest.

X-ray studies of both legs and both feet did not show any evidence of bone change or arterial calcification. Paravertebral infiltrations of the left lumbar sympathetic chain gave complete relief of pain with resumption of normal arterial pulsations and an occlusive index of 1° centigrade. Relief persisted for the duration of the procaine action only, with no lasting benefit observed. In the psychiatric service neurocatharsis, suggestion, and hypnosis under barbiturate sedation was carried out for 1 month. The patient's gait improved slightly and hypertonus was lessened, but there was no essential change in the circulatory status.

Two months after admission left lumbar sympathectomy was done, with

the patient under continuous spinal anesthesia. The extraperitoneal approach was used with resection of the second and third lumbar ganglia and adjacent rami. This was followed by complete relief of pain; the foot was warm and dry and the patient was able to resume a normal gait. The denervated level for sweating was just above the left knee, and arterial pulsations were normal. After 16 days' convalescence the patient was returned to full duty.

Case 2.—A Marine corporal, 24 years old, was admitted on 15 June 1944. Six months prior to admission he had sustained contusions of the right leg and foot when the extremity was pinned under an overturned G.I. can. Three weeks later there was lancinating pain and swelling of the right foot, and upon exercise there were crampy pains resembling intermittent claudication in the right calf muscles. The leg and foot became progressively more painful and were cold and sweaty to the touch. The pavex apparatus as well as other exercises, and application of external heat gave no lasting relief. The patient was able to sleep at night by hanging the foot over the side of the bed for about 20 minutes, causing temporary venous occlusion. For a month before admission he had walked with a cane and a decided right-sided limp.

Examination showed a 210-pound male who walked with a limping gait, holding the right foot in equinovarus position. The right lower extremity was cold and hyperhidrotic from the upper thigh distally, with the usual increase in temperature differential in the peripheral portions. The foot was somewhat dusky in color, showed pitting edema, and both the dorsalis pedis and posterior tibial pulsations were reduced to about one-half their normal volume. There was early atrophy of disuse of the thigh and calf muscles, with diminution of the right knee jerk.

Roentgenographic examination revealed evidence of diffuse demineralization of the bones of the right tarsus with increased trabeculation. Almost obscured by this diffuse process were spotty zones of atrophy in the talus and navicular bone. Spinal injections of procaine hydrochloride were followed by almost normal vasodilatation in the right leg.

On 19 July, using continuous spinal anesthesia, right lumbar sympathectomy was done, including resection of the first, second and third lumbar ganglia, designed to interrupt the vasomotor flow to the level of the upper thigh. Postoperative response of the patient was excellent; there was marked remission of pain and improvement in gait. Active exercises improved quadriceps atrophy and at 3 months postoperatively there was x-ray evidence of recalcification of the bones of the foot. On 30 October he was asymptomatic and returned to full duty.

These two cases are characteristic of a type of vasomotor disorder that follows extremity injury, with or without bone atrophy. The determinants affecting bone involvement would appear to be both the severity and the duration of the initial hyperemia. It is likely that once spotty atrophy has been initiated, subsequent spasm of the nutrient vessels supplying the bone circumscribe these zones with greater clarity on the roentgenograph. The pain, however, is almost entirely vascular in origin, and is disseminated over widespread somatic and sympathetic afferent pathways; hence relief through interruption of these pathways by the neurosurgeon involves extensive rhizotomy or cordotomy with greater risks.

A striking feature is the degree of vasospasm that can be maintained in arteries of medium caliber such as the dorsalis pedis. This vasospasm can at times be partially influenced by periarterial sympathectomy, but an incomplete procedure is not justified when complete denervation can be obtained by means of operation that carries a risk no greater than that of appendectomy.

The time factor in hospitalization of service cases should be considered before embarking on prolonged regimens of medical therapy without reasonable prospect of success; when the necessary data are available a rapid but considered decision should be made as to the indications for and against surgery. With reasonably rigid criteria and care in selection of cases, gratifying results may be anticipated in the treatment of this posttraumatic syndrome.

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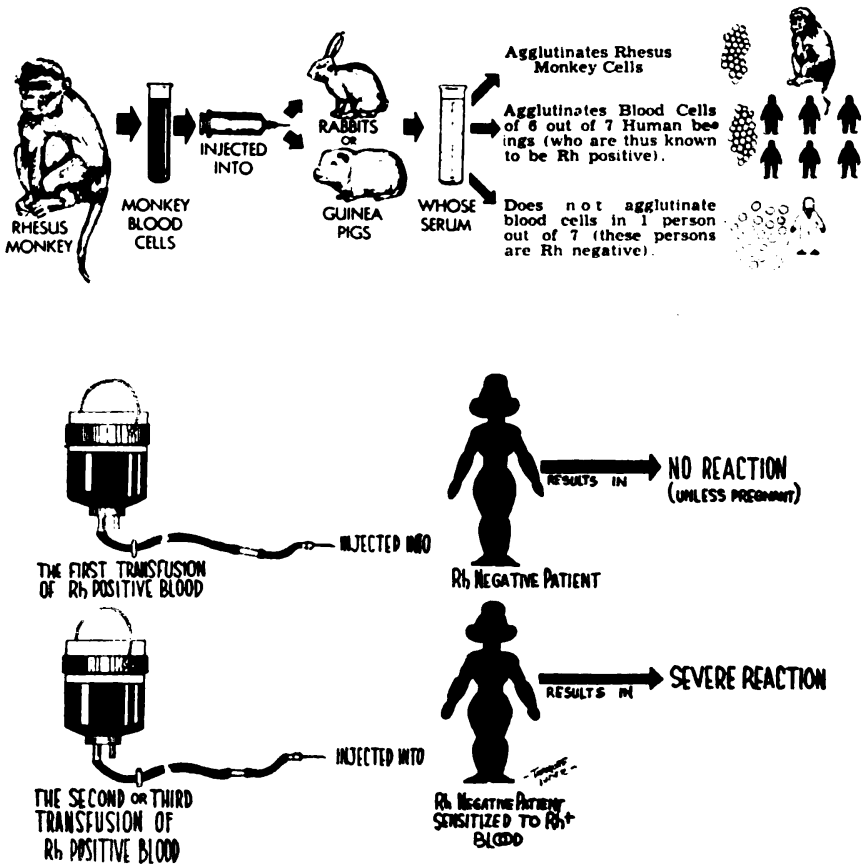
RH FACTOR SIMPLIFIED



Clinical Medicine 51: 388, December 1944.

PELLEGRINI-STIEDA DISEASE

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Pellegrini, in 1905, was the first to describe this syndrome. He believed it to be either the result of a periosteal proliferation, directly connected with the medial femoral condyle, or an osseous metaplasia of the ligaments. In 1908 Stieda reported the condition as rather the result of a fracture of the medial epicondyle of the femur, with tearing of the muscle attachments. Koing in 1909 proposed an avulsion of the periosteum as the probable cause of the calcification, and called attention to a "fractureless callus formation." Another suggestion was made by Ternler, who localized the calcification between two muscles, the vastus internus and the adductor magnus. Since absorption is poor in this area, he stated that the calcifications could develop from small hematomas there.

By 1913 Ewald decided that following trauma there is an extravasation of blood and synovial fluid into the internal lateral ligament which later becomes calcified. However, Schüller and Weil, reporting the syndrome in 1923, called attention to trauma in the production of metaplasia in the connective tissue. Paschetta's impression, recorded in 1932, was that a secondary increase in the calcium metabolism, brought about by the injury, could produce this condition.

Callen, in 1937, maintained that the Pellegrini-Stieda syndrome cannot be called a clinical entity, but rather a manifestation of posttraumatic changes in the knee, common to other joints as well. He stated further that fatty degeneration, thought by some to precede calcification, might be the cause for the delay in the x-ray appearance of the calcific deposits.

In general most writers agree that the condition is posttraumatic. It has also been compared with myositis ossificans, essentially a metaplasia of ligamentous tissue to bone.

Anatomy.—The tibial collateral ligament is a broad flat band in the true capsular plane. Its upper end has extended flat attachment over the medial epicondyle of the femur; some fibers may be traced upward into the adductor magnus tendon, and the ligament has been regarded as formed, in part at least, from an original tibial insertion of this muscle. Distally the ligament is attached to the tibia; the superficial fibers descend to below the

level of the tibial tuberosity; deeper fibers have a shorter course from the tibia to the femur (and vice versa), the deepest of all having an intermediate attachment to the medial meniscus. Posterior to the upper part of the main band, shorter fibers reach the edge of the tibial condyle immediately above the principal insertion of the semimembranous tendon. A downward expansion from this tendon reaches the shaft of the tibia, partly under cover of the posterior border of the main band (the medial inferior geniculate vessels and nerve running forward between them) and partly blending with this border of the ligament.

Diagnosis and clinical symptoms.—There are no pathognomonic symptoms. A history of injury to the knee joint, followed by pain, swelling, tenderness in the medial aspect, and restricted motion of the joint is a good indication of the possibility that the syndrome is present. In cases of sprains or contusions, if the above-mentioned symptoms are present beyond the usual period of recovery, this pathologic condition should be considered. Serial x-ray studies should be made in all such cases.[1]

The extent of the disability is dependent upon the type of injury, the degree of ligamentous involvement, and the trauma to the structures entering the knee joint itself. Patients seen many months following the initial injury may complain of limitation of motion and weakness and discomfort of the leg, causing a disturbed function. Secondary arthritic changes may also be present. Early cases show a swelling of the soft tissues at the inner aspect of the knee. Several weeks later a calcified mass will be noted on palpation. The calcification, if present, is firm, slightly movable, but not adherent to the overlying skin. Atrophy of the thigh and calf muscles is sometimes apparent although not very common.

The x-ray finding is fairly characteristic. The shadow is usually directed vertically in a crescentic shape, lying adjacent to the medial femoral condyle, with a soft-tissue gap between the calcification and the distal end of the femur. The lesion is best seen in the conventional anteroposterior view.

Differential diagnosis.—Associated conditions which may cause internal derangement of the knee joint, such as joint mouse, fracture or cyst of the meniscus, rupture of a cruciate ligament, avulsion of the tibial spine, detachment of the tubercle, isolated injury of the medial collateral ligament and other tendon or bursal structures are important to consider, according to Kulowski.[2] One must

[1] STEIN, G. H.; GLADSTONE, N. H.; and LOWRY, F. C.: Pellegrini-Stieda syndrome. Mil. Surgeon 93: 167-172, August 1943.

[2] KULOWSKI, J.: Pellegrini-Stieda's disease; report of one case surgically treated. J.A.M.A. 100: 1014-1017, April 1, 1933.

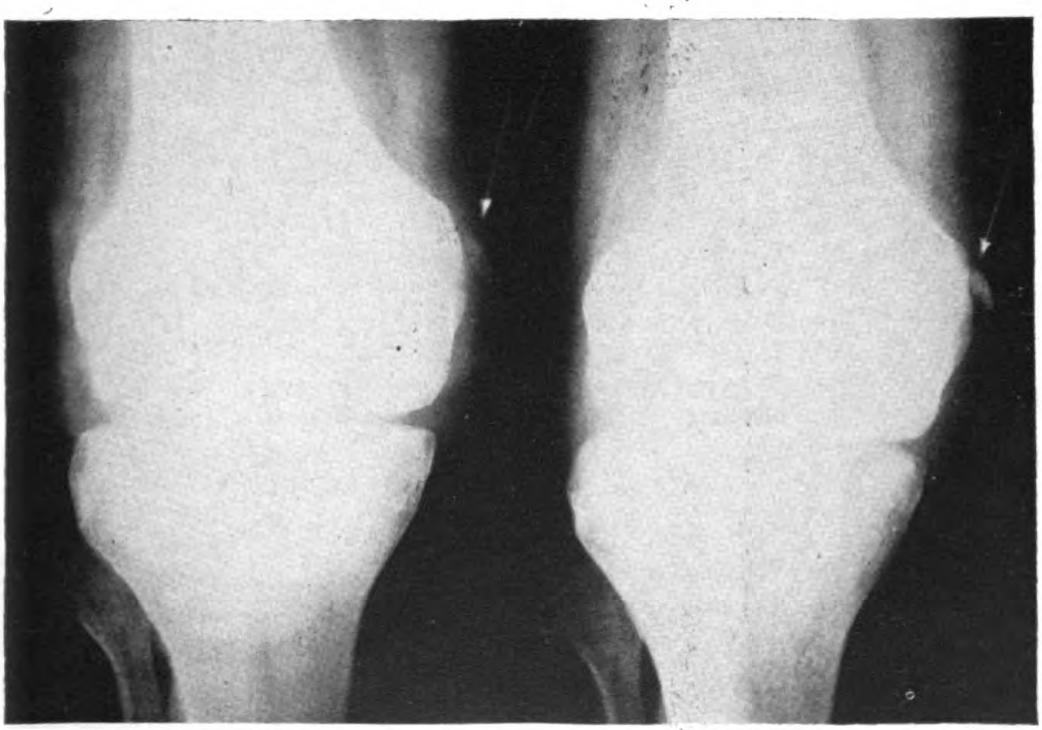
also bear in mind in the differential diagnosis the possibility of a tendinous ossificans traumatica.

CASE REPORTS

Case 1.—A 29-year-old man was seen on 20 January 1944, complaining of pain and disability of 24 hours' duration in the left knee. The onset of symtoms followed an accident in which the patient fell, striking the left knee on the deck of the ship. That night he experienced pain over the medial aspect of the left knee associated with swelling and difficulty in walking. There was no "locking" of the knee joint.

The past and family histories were essentially negative. Systemic examination showed nothing remarkable. The patient walked unsupported but with a limp on the left side. The left knee was ⅞ inch larger than the right. There was no atrophy of the thigh. The range of motion of the left knee was from 150 degrees extension to 70 degrees of flexion. Beyond this range attempts at further motion caused pain in the joint. The medial aspect of the knee joint was tender. Abduction of the leg caused some discomfort in the region of the tibial collateral ligament. An x-ray taken at this time did not reveal any evidence of pathologic changes. Examination of the blood showed 10.4 mg. of calcium per 100 cc. of serum.

At examination 3 weeks after the injury a small tumor-like mass was palpated over the medial condyle of the femur; the mass was tender, firm and apparently attached to the deep structures in this region. X-ray examination



1a. Case 1. Roentgenogram taken approximately 3 weeks after injury shows beginning crescentic calcification in the region of the adductor tubercle.

1b. Case 1. Roentgenogram taken approximately 6 months after injury showing the progress of the calcification.

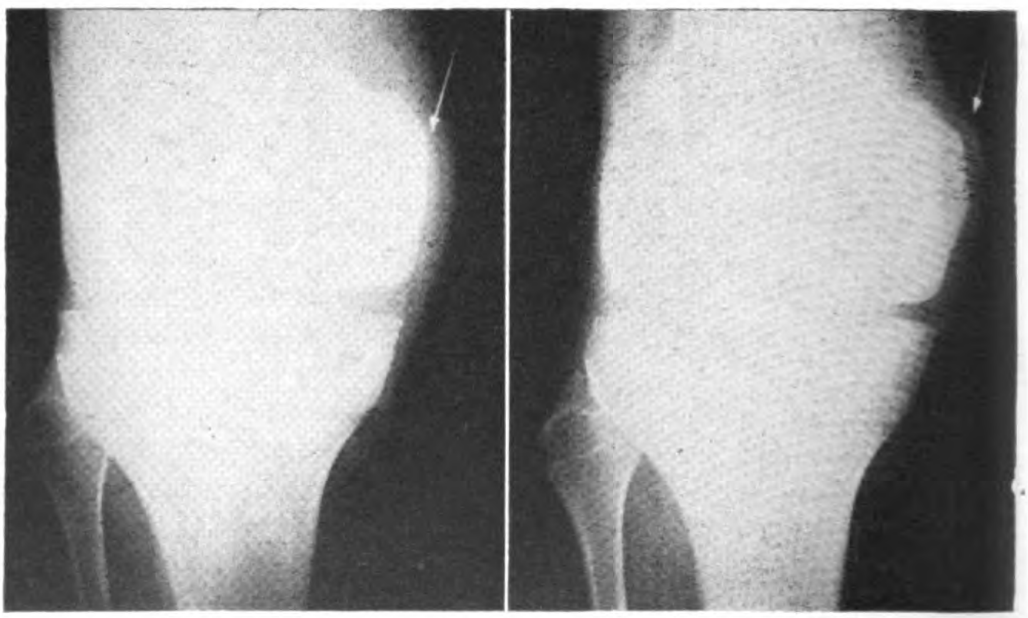
at this time revealed evidence of beginning crescentic calcification in the region of the adductor tubercle (fig. 1a).

Treatment consisted of infra-red ray, diathermy and application of an elastic bandage. Approximately 6 months later the knee joint showed no swelling, the pain was nearly gone, there was motion within the normal range and no tenderness, although a firm mass apparently attached to the deeper structures could readily be palpated. X-ray examination at this time showed a definite crescent-like calcification in the region of the adductor tubercle (fig. 1b). Surgery would seem to be the logical approach at this time, since a maturation point, so to speak, has been reached.

Case 2.—The patient, 52 years of age, was seen on 21 June 1944, complaining of pain and disability in the left knee of 3 days' duration, after he had fallen, striking his left knee against a hatch. Two days later he had experienced pain over the internal aspect of the knee joint associated with swelling and difficulty in walking. As in the previous case there was no "locking" of the knee joint.

The patient's past and family histories were irrelevant. Physical examination showed the patient to be a moderately well developed and well nourished male apparently in good health except for the local condition. Systemic examination showed nothing remarkable. The left knee was ¾ inch larger than the right in circumference. There was no atrophy of the thigh. The range of motion of the left knee was from 140 degrees extension to 70 degrees of flexion. Beyond this range attempts at further motion caused pain in the joint. The medial aspect of the knee joint was tender. Abduction of the leg caused some discomfort in the region of the internal collateral ligament. X-ray examination at this time did not disclose any abnormality (fig. 2a).

Treatment, as in the previous case, consisted of infra-red rays, diathermy



2a. Case 2. Three days after injury there was no roentgenographic evidence of calcification in the region of the adductor tubercle.

2b. Case 2. One month after injury shows evidence of beginning crescentic calcification in the region of the adductor tubercle.

and elastic support. Approximately one month later the knee joint showed remarkable improvement; swelling, pain and tenderness were practically absent, although a mass firm and attached to the deeper structures could be palpated. Motion was within the normal range. Blood calcium determination showed 10.8 mg. per 100 cc. of serum. X-ray examination revealed a beginning crescent-like calcification in the region of the adductor tubercle (fig. 2b).

Three months later the patient was asymptomatic but the condition of the knee was unchanged. As there is no definite calcification at this time, operative precedures are not recommended in this case until an adequate "maturation" has been obtained.

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RH INCOMPATIBILITY

Rh incompatibility is based on difference with respect to one or more of the Rh factors.—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

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FURTHER STUDIES ON GRAMICIDIN S

A strain of Bacillus brevis isolated from Russian soil has been investigated in detail, and a crystalline product of high antibacterial activity, named gramicidin S, has been prepared from the sediment obtained after the acidification of fluid cultures. This substance, which has the properties of a polypeptide, invites immediate comparison with gramicidin and tyrocidine, the crystalline polypeptides with antibacterial properties which Dubos and Hotchkiss prepared from cultures of a strain of B. brevis. Like tyrocidine, but unlike the gramicidin of Dubos, gramicidin S acts at almost equally high dilutions against gram-positive and gram-negative bacteria, but it apparently differs from tyrocidine in retaining its activity against gram-negative bacteria in nutrient broth. No evidence is given whether, like tyrocidine, it is inhibited by blood and serum. Since these substances are insoluble in water there is no question of systemic use in therapeutics. Both the substances of Dubos are, however, of low toxicity to tissue cells relative to their antibacterial power.

From the brief report of a clinical trial of gramicidin S in a wide variety of local infections the results appear to be promising.

Apart from the possible clinical applications of gramicidin S, among which the control of local infections with gram-negative bacilli is the most desirable, the addition of a new member to the very small group of crystalline polypeptides which are biologically active is of considerable theoretical interest to the biochemist. —Soviet gramicidin. Lancet 2: 759, December 9, 1944.

TYROTHRICIN THERAPY IN POSTOPERATIVE PILONIDAL CYSTS

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The spectacular results obtained with penicillin, a mold extract, have stimulated investigators to seek similar naturally occurring bacteriostatic and bactericidal substances. Dubos (*1*) (*2*) (*3*) (*4*) (*5*) (*6*) of the Rockefeller Institute was led to investigate the occurrence of various antiseptic constituents of soil. One of these, a product of Bacillus brevis, strain BG, an anaerobic, sporulating, gram-positive bacillus, was found to be bactericidal to gram-positive organisms, even including the Corynebacterium diphtheriae (*7*). Hence the name gramicidin.

Chemistry.—When Bacillus brevis, strain BG, is cultured in peptones aerobically, the addition of acid yields a precipitate which is readily divisible into a water-soluble and an alcohol-soluble fraction. It is the latter which contains the bactericidal component. Precipitation of the alcoholic extract with saline yields the product known commercially as tyrothricin. Tyrothricin is, however, not a pure substance and can in turn be separated into gramicidin, which is acetone-soluble, and tyrocidine which is insoluble (*4*).

Commercial tyrothricin is then a mixture of these two substances containing from 15 to 20 percent of gramicidin and 40 to 60 percent of tyrocidine. Both these substances are bactericidal but differ considerably in their mode of action and in their properties, as shown in the accompanying table.

A perusal of this table demonstrates that tyrocidine is primarily an antiseptic, like chlorine or the metallic poisons (*8*). Gramicidin, on the other hand, is selectively bacteriostatic. Gramicidin is the active principle of tyrothricin.

Disadvantages of gramicidin.—This substance is ineffective in wounds caused by gram-negative organisms, particularly bacilli (*9*). It is valueless in protozoal infections (*10*). It does not aid the action of penicillin (*11*). It is highly toxic but the toxic dose is many times the bacteriostatic dose (*8*). Poor circulation in an individual inhibits its action (*8*). It does not diffuse into tissues (*9*).

In mixed infections with large numbers of gram-negative

Comparison of tyrocidine and gramicidin

Properties and action	Tyrocidine	Gramicidin
1. Specificity	Non-specific, affecting gram-positive and gram-negative organisms.	Gram-positive almost exclusively.
2. Protoplasmic poison	Yes	No.
3. Oxygen uptake of living cells	Destroyed	Undisturbed.
4. Metabolic activity of living cells	Destroyed	Undisturbed.
5. Morphology of cells	Destroyed	Undisturbed.
6. Effect of presence of tissue extracts	Inhibits action	Inhibitedslightlyif at all.
7. Value in vivo	Practically none	Useful.

organisms, gramicidin is relatively ineffective. Even gram-positive organisms that are usually rapidly destroyed by tyrothricin are not damaged. This may be due to a protective action of the gram-negative organisms which prevents the action of the substance on susceptible strains (*11*). In addition, gramicidin-resistant gram-positive strains may develop while the patient is under treatment, much as sulfonamide-resistant and penicillin-resistant strains develop in the course of treatment with these drugs.

Gramicidin is ineffective orally (*12*). It will not function as an intestinal antiseptic even in the presence of gram-positive organisms, such as Lactobacillus acidophilus, which is highly susceptible to gramicidin action in vitro. In-vivo doses as much as 160 times as large as the in-vitro bacteriostatic dose failed to destroy the organism (*12*). Gramicidin is strongly hemolytic and cannot be used intravenously, intramuscularly or subcutaneously (*13*) (*14*). It is highly insoluble and can destroy organisms only when it comes into direct contact with them. All these characteristics limit its field of usefulness to topical action.

Advantages of gramicidin.—The nature of the drug is such as to render it useful in sharply limited conditions. Certainly a therapeutic agent which can protect a mouse from 10,000 fatal doses with as small a quantity as 1 microgram should not be arbitrarily dismissed without thorough investigation. Heilman and Herrell (*15*) find that gramicidin is five times as effective as penicillin in pneumococcus and Streptococcus faecalis infections. It has been found valuable in the preparation of areas for grafting (*16*). It has been used successfully in the treatment of external wounds contaminated with sulfonamide-resistant strains of Streptococcus pyogenes. In the two cases reported by Francis (*18*) there were satisfactory blood levels of various sulfonamide drugs but no evidence of diminution in the infection. Gramicidin rapidly rendered the wounds sterile.

In quantities as high as 5 micrograms per cubic centimeter of tissue culture, gramicidin does not inhibit the migration of lymphocytes or macrophages or inhibit the normal growth of fibro-

blasts (*19*). Leukocytes are unaffected (*13*). Since war wounds are largely contaminated by gram-positive organisms (*9*), and since the proper treatment of such wounds includes the wide debridement of the areas without suturing, they are rendered peculiarly susceptible to tyrothricin therapy. Accessible infections caused by gram-positive organisms in the presence of normal circulation have been rendered sterile by as little as two treatments (*9*). Sterility of wounds is followed by healing with amazing rapidity when the circulation to the part is not impaired. Sprayed in the throat of scarlet fever carriers, gramicidin rendered many bacteria-free (*19*).

Tyrothricin is supplied in 2-percent solution in 95-percent alcohol. One cubic centimeter of this substance diluted with 60 cc. of sterile distilled water yields a concentration of 33 mg. per 100 cubic centimeters. This is usually effective but may be increased to 50 mg. per 100 cc. in resistant cases.

The rapid healing of infected wounds under tyrothricin therapy in other parts of the body suggested the use of this medicament in the treatment of pilonidal cysts. Such an approach seemed reasonable inasmuch as the cyst produces symptoms only when complicated by infection and because the area is amenable to the topical application of tyrothricin. It was accordingly used in two cases of persistent, draining sinuses after numerous operative attempts to correct the condition had failed.

CASE REPORTS

Case 1.—A seaman, first class, had been hospitalized almost continuously since October 1943 when a radical operation had been performed elsewhere for the extirpation of a pilonidal cyst. The wound failed to heal and the patient was again operated upon at another station in February 1944. On 20 April, when the patient was first seen at this facility, the wound was still grossly infected and there was considerable discharge. Microscopic examination of smears of the exudate revealed the presence of a mixed infection, most of the organisms being gram-positive. Facilities were not available for accurate identification of the various bacteria.

The wound, which measured 2 inches by 1 inch and was from 1 to 1½ inches deep, was treated by wet dressings, including magnesium sulfate and Dakin's solution. On several occasions chemical cauterization was done. On 31 May, despite daily treatment, the condition had not changed appreciably. The following day the wound was packed with gauze wet with tyrothricin in suspension of 33 milligrams to 100 cubic centimeters. The wound was repacked and from 15 to 20 cc. of tyrothricin used in this manner each day.

Ten days later the wound was clean and granulation had commenced. These daily dressings were continued until 28 June when the patient was discharged as cured. He has since been transferred and has been instructed to notify this station should there be a recurrence. One month after his discharge there was no evidence of any sinus. The patient was not confined to bed at any time during this period and continued his usual duties.

Case 2.—This patient was first operated upon for pilonidal cyst in November 1935. The wound drained continuously until April 1936 when he was again subjected to surgery, but the wound continued to drain and the patient was under constant treatment until September when the wound apparently became quiescent. A small sinus persisted, however, and the area became painful and swollen, and was operated upon in September 1938. Two weeks later a new sinus appeared 2 inches from the original wound and this in turn was extirpated. Drainage persisted until December, when the patient again entered a relatively asymptomatic period.

From then until July 1942 he was fairly comfortable but the sinus was still present. In July drainage became profuse and the area was very painful. In September surgery was again resorted to and the patient was under active treatment until December when he again became comfortable.

In June 1944 the patient had a recurrence of all his previous complaints. The sinus had doubtless been open during this quiescent period, as he had been classified unfit for military service because of persistent pilonidal cyst.

On 23 June a large abscess cavity was opened about 2 inches from a small sinus in the region of the posterior anal commissure. The cavity was connected with the sinus orifice by a direct path. The abscess, approximately 1 by 2 by 1½ inches in size, was loosely packed with gauze saturated with tyrothricin in solution of 33 milligrams to 100 cubic centimeters. Examination of a smear made at that time disclosed a variety of gram-positive cocci. The patient was discharged from the hospital on the following day and resumed his usual occupation, but returned for daily dressings of tyrothricin-impregnated gauze packing. On 3 July culture of the wound exudate showed it to be sterile. Seventeen days later the wound was entirely healed and there were no sinuses for the first time in almost 9 years.

No conclusion of course can be drawn from observations made on only two cases, but they are reported because of the striking results obtained in refractory cases of a condition which causes much loss of manpower throughout the service.

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HR REACTION

Hr reaction is the result of the Hr tests, namely either Hr positive or Hr negative.—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

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DEFINITION OF VITAMINS

According to an older definition, a vitamin is a catalytic substance indispensable in animal or human nutrition. It cannot be synthesized in their organisms but must be obtained from plants. Now we know that all plants, likewise, require certain vitamins and that many of them are heterotrophic and must obtain their vitamins from an external source. This certainly is true of most cryptogams. In this metabolic relationship to the higher plants, fungi and bacteria show a striking similarity to animals. Today vitamin would be defined "an organic substance, the need for which results from the loss of the capacity for its synthesis, whose action is catalytic, quantitative and markedly specific." This excludes the many inorganic biocatalysts such as Fe, Cu, Mn, Zn, Mo, etc., the action of which is quite similar.—MURNEEK, A. E:. Vitamins in our food. Science 100: 557-562, December 22, 1944.

PATHOLOGIC ASPECTS OF APPENDIX IN MILITARY PERSONNEL

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This study is based upon the first 500 appendixes removed at a Naval dispensary and at a station hospital during a period of 15 months. The material has been analyzed statistically in a brief manner as a background for presentation of some comments and morphologic concepts.

The pathologic classification used was: (1) Foreign bodies; (2) acute inflammation (catarrhal, diffuse, suppurative, gangrenous, recurrent, and healing); (3) healing acute recurrent; (4) chronic; (5) healed (simple, with partial or with complete obliteration of the lumen); (6) neurogenic; (7) mucocele; (8) tumors; and (9) no pathologic diagnosis.

Pathologic conditions were as follows:

Foreign bodies.—These consisted of fecaliths, vegetable seeds, parasites, and metallic objects. Fecaliths are common, and associated conditions range from acute catarrhal to acute gangrenous appendicitis with perforation. In this small series perforation was more commonly associated with a fecalith than with any other change in the appendix. Pinworms (Enterobius vermicularis), roundworms (Ascaris lumbricoides), and hookworms (Necator americanus) are often seen in the lumen. There may be no reaction in the wall, or there may be a localized inflammation where the pinworms burrow through the mucosa into the muscle coat.

Acute inflammation.—This was catarrhal, diffuse, suppurative, gangrenous, and recurrent acute in type. Macroscopic changes seen in the catarrhal type were slight swelling, moderate hyperemia, and thickening of the mucosa with accumulation of mucus on the surface. Microscopic changes were hypersecretion of mucus, cloudy swelling of mucosal epithelium, edema of the coats, and collections of polynuclears in the lumen, on the surface epithelium and around the glands.

Gross changes seen in the diffuse type were swelling of the viscus, distention of the serosal blood vessels, softening of the wall, presence of a thin layer of fibrin on the serosa, and mucopurulent material in the lumen. Microscopic changes seen included

ulceration of the mucosa, edema and hyperemia of all coats, widespread infiltration of all portions by polynuclears, involvement of adjacent fat, and the presence of a layer of fibrin enmeshing polynuclears on the serosa.

In the suppurative type macroscopic changes were generally the same as those seen in the diffuse types but with more extensive mucosal ulceration, separation of the walls, degeneration of mucosa and a thicker layer of exudate on the surface. Microscopically there was nearly complete absence of mucosa due to ulceration, with diffuse and focal infiltration of all coats by polynuclears, and a thick layer of exudate on the surface.

In the gangrenous type the macroscopic changes were in general those of the suppurative form, with a disintegration of the walls, absence of mucosa, a dilated lumen filled with pus, and extensive involvement of attached fat. Microscopic changes seen consisted of absence of mucosa, ulceration of the wall, necrosis of muscle and fat, thrombophlebitis and acute exudative arteritis.

In the recurrent acute type there is in addition to any of the gross changes seen in the aforementioned acute inflammatory types a white thickening of the walls, adhesions on the surface, kinking of the organ, and close attachment of omentum. Microscopic changes may include a decrease in the thickness of the mucosa, fibrosis of the submucosa, and strands of fibrous tissue attached to the serosa.

Healing acute recurrent.—There is evidence of a preceding attack in the fibrous connective tissue deposit in the submucosa, muscle coat and serosa. Healing is manifested by newly formed connective tissue, with proliferation of fibroblasts, formation of young blood vessels and a change of cell type to lymphocytes and large monocytes. Superimposed upon these may be any degree of acute inflammation.

Chronic.—This type is diagnosed infrequently and depends upon the presence of lymphocytes, eosinophils, plasma and endothelial cells in the various coats.

Healed. (1) Simple.—In the submucosa and on the serosa is a deposition of fibrous tissue, with moderate vascularity and some compact masses of lymphocytes in these scarred areas. (2) With partial obliteration of the lumen.—There is a fibrous reaction with growth into and occluding the lumen of the distal one-third or half of the appendix, with narrowing of the remaining portion, accompanied by atrophy or partial disappearance of glands and of the lining epithelium and with diminution in size of the lymphoid follicles. (3) With complete obliteration of the lumen.—The process cited above continues to the stage where there is no lumen.

Neurogenic.—This is a change described by Masson, who believes that in the reaction to the inflammation there may be an increased number of nonmedullated nerve fibers in the appendix.

Mucocele.—This infrequent alteration is associated with occlusion of part of the appendiceal lumen, while the lining epithelial cells continue to secrete mucus. Finally the wall is sufficiently thinned out to permit dilatation.

Tumors.—Adenocarcinomas do occur but with great rarity. Carcinoids are seen more often. In the latter structure the uniform, deeply stained cells form pseudo-acini in the mucosa, the submucosa and other portions of the wall. The former arise in the mucosa and show different-size acini lined by high to low columnar mucus-secreting cells of various sizes, shapes and staining reactions.

No pathologic diagnosis.—This term is reserved for the group in which no gross or microscopic change is seen. It indicates that there is no anatomic evidence for the clinical picture which presented itself and justified excision of the organ.

METHOD OF STUDY

All of the material is fixed in 10-percent formalin for 24 hours or longer. The tissues are placed in the fixative as soon after removal as is possible. Routine sections, 3 to 4 mm. in thickness, are cut from the proximal, middle and distal thirds. Staining is done by hematoxylin and eosin, Masson's modified tetrachrome method, or both.

In so far as possible the appendixes were taken consecutively. Those removed incidentally when gynecologic surgery or hernial repair was done were excluded. The greater proportion of material from the Army base is explained by the larger size of the field. When the Navy dispensary opened, it had no laboratory facilities to study tissues, so the material was studied at the Army hospital. However the diagnoses were made by the same pathologist. A positive anatomic diagnosis was made if there was any question, and no final attempt was made to correlate any other laboratory data with the anatomic change.

Analysis of 500 excised appendixes

Types	Both units	Station hospital	Naval dispensary
Acute and chronic	224	150	74
Miscellaneous	12	9	3
Healed	108	91	17
No pathologic diagnosis	156	126	30
Total	500	376	124

COMMENT

Since a clinical diagnosis of appendiceal disease is assumed to be the justification for operation in each case, it is seen from the accompanying table that there is an apparent 30-percent inaccuracy of diagnosis, as 156 of the 500 excised appendixes showed insufficient change to justify any form of pathologic diagnosis. Although it may be possible to have physiologic appendicitis, such an occurrence is most unlikely.

One hundred eight appendixes were considered to have sufficient change to be listed under the various types of healed appendicitis. This group makes up approximately 20 percent of the total. The question is immediately raised whether these appendixes are associated with signs and symptoms. It may be that some are. In all likelihood they are, however, quiescent. The basis for this statement is that: (1) No one has proved that proliferation of scar tissue can be recognized clinically by the various senses; (2) there is no indication of compression of nerves; (3) no evidence of inflammation is found; and (4) large numbers of appendixes studied routinely at autopsy and taken out incidentally during other operations show all of the changes of healed appendicitis and are theoretically asymptomatic.

Two hundred twenty-four, or 45 percent, were definitely altered, the vast majority falling into the various acute forms. Only 11 were of the chronic type, and they presented the classic picture of acute appendicitis clinically.

In the miscellaneous group are included two cases of Enterobius vermicularis (pinworm) infestation, which gives an incidence of less than one-half of 1 percent. Various authors have reported from 1- to 30-percent involvement. Two carcinoids (one included under acute diffuse appendicitis as this change was also present) are listed in the miscellaneous category. The tendency now is to consider these as low-grade adenocarcinomas. The remaining 9 appendixes contained fecaliths.

Perforation occurred in only seven of the appendixes, five of them containing fecaliths. The point of penetration was at the compressed wall adjacent to the impacted mass.

No death occurred in the series and only two cases of peritonitis developed. In one of these it was necessary to do an ileostomy because of intestinal obstruction.

There was no seasonal variation.

Several points may be raised. First, on the basis of the morphologic changes in the appendix, only approximately 50 percent of the patients could have had clinical acute appendicitis. This implies a diagnostic accuracy of a similar percentage. Although

this is in keeping with the mean average of clinical diagnostic acumen for all disease, still it is expected that for acute appendicitis it would be much higher than 50 percent. But the ability of a surgical staff is no stronger than its least capable men. Hence there are always a certain few who are prone to diagnose the presence of appendicitis on insufficient findings. In the present series this observation has been substantiated on several occasions when a series of anatomically normal appendixes were excised by the same surgeons. It should be mentioned at this time that the same individuals are prone to make a postoperative concurring diagnosis on the presence of serosal injection of the appendix only.

In the majority of hospitals, in keeping with the rules of the American College of Surgeons and the American Medical Association, the decision as to the final diagnosis rests with the pathologist. It is assumed that his interpretations will be somewhat more objective. On the other hand, he may be guided by rules which are too rigid or too loose. By adhering to fundamentals in morphology there is the least chance of error. In the present emergency some institutions are discontinuing the practice of preparing sections for histologic study. There is no justification for this as long as the necessary equipment is available. The gross diagnosis of appendiceal disease has a high percentage of error.

Some of the operations were performed for what is known as an interval appendix—a condition obtaining during that period of quiescence between the alleviation of symptoms and the expected subsequent attack. One flaw is present in this rationale: Who can say when or if there is to be a recurrence? Are the chances in its favor? As healing progresses and fibrosis occurs, there is less likelihood of a repetition. The importance of this from the military point of view is obvious. The deaths from appendicitis and its complications have been higher in rural than in urban areas. When away from hospitals and surgeons the facilities for correct treatment are not available. Many military personnel will find themselves in this situation. Hence there are those who believe in removing the appendixes of persons who have had previous attacks. This is probably the proper assumption, but who is going to interpret the previous history and say definitely that an attack of acute appendicitis has occurred.

Contrast this with the loss of time and hospital costs for appendectomy in a large number of cases in which there is no evidence of preceding disease or only that of a healed lesion. In this particular group there were 264 such cases. Allowing for a loss of 14 days per patient, this adds up to about 3,700 days. True, there is a great loss of man-days of work in the services for other reasons,

and this may not be considered too seriously. Although it is not possible to rule against the removal of doubtful acutely inflamed appendixes, there is some right to question its value.

Seven of the appendixes had already perforated. This is a small group. Nevertheless it is assumed that this happened in the presence of what is considered to be adequate medical care. There are many extenuating circumstances, as the patients may not have complained until actual rupture occurred. The author knows of two cases in which the complication developed while the patient was in a ward.

Undoubtedly the use of sulfonamides locally and systemically prevented a larger number of complications.

Actually the problems of appendiceal disease in the military services do not differ materially from those in civilian life. The major items to be considered are the age groups, the loss of man-days, and the question of transportation of troops away from localities where surgery is readily available. Another consideration is the inaccuracy of diagnosis. If competent medical officers are going to err so often, what of corpsmen who are only superficially acquainted with the processes of disease?

CONCLUSIONS

A review of 500 appendixes removed from military personnel is presented, and the following conclusions are drawn.

1. The accuracy of clinical diagnosis is thought not to be as high as it should be.
2. The frequency of Enterobius vermicularis infestation and of carcinoids is similar to that found in civil life.
3. There are no seasonal variations in incidence.
4. Only seven appendixes in this series were perforated.
5. There was no death in this series.

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RH SENSITIZATION

Rh sensitization is the act of becoming sensitive to the Rh factor. This may occur in one of two ways; namely, as a result of a transfusion of Rh-positive blood or as the result of pregnancy with an Rh-positive fetus. Natural sensitivity to the Rh factor does not occur; and only 1 in 25 to 50 Rh-negative persons exposed to the Rh antigen by transfusion or pregnancy becomes sensitized.—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

HYALURONIC ACID—A TISSUE POLYSACCHARIDE

SOME EFFECTS ON ERYTHROCYTES[1]

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During a study of the hemagglutinative properties of human serum, we considered the possibility that a polysaccharide might be related to the production of cold agglutination. This was suggested by the reported findings that a cold agglutinin in the serum of a patient with Raynaud's syndrome (*1*) and a serum polysaccharide present in active pulmonary tuberculosis (*2*) both had the mobility of gamma globulin in the electrophoretic field. Since we were unaware of any demonstration that the cold agglutinating substance so often present in serum is gamma globulin, it seemed of value to note the effects on erythrocytes of a polysaccharide of human origin.

To determine whether or not a polysaccharide could produce cold hemagglutination, we studied the action of one such compound, hyaluronic acid, on erythrocyte suspensions. This is a polysaccharide of high molecular weight which has been found in vitreous humor (*3*), synovial fluid (*4*), umbilical cord (*5*), skin (*6*), a human mesothelioma (*7*), and in the capsules of hemolytic streptococci (*8*). Apparently this substance is required for the agglutination of decapsulated beta-hemolytic streptococci with 0.5-percent acetic acid (*9*). It was felt that hyaluronic acid might reveal properties common to other polysaccharides of human origin.

METHODS

One-percent and 0.5-percent solutions of the sodium salt of hyaluronic acid were prepared in normal saline. The solutions were opalescent and slightly viscous. Small quantities were then tested against 2-percent suspensions of thrice-washed human (Type 0), rabbit, guinea pig, and sheep red blood cells. The tests were performed with the polysaccharide alone, and in the case of human cells with mixtures of the polysaccharide and human

[1] From the Department of Epidemiology, U. S. Naval Hospital, Treasure Island, San Francisco, California.

serum. After 1-hour periods of contact between the cells and polysaccharide (at 5° C., at room temperature, and at 37° C.), the former were examined in small test tubes with the low-power objective of the microscope, and in hanging-drop preparations.

The effect of hyaluronic acid on the cold hemagglutinin titer of human serum was studied by adding 1 mg. of the salt (0.1 cc.) to 0.1 cc. of a human serum with a high cold hemagglutinin titer (1:1,792) from a case of primary atypical pneumonia. Serial dilutions of the 0.2 cc. of serum and polysaccharide solution were made in equal amounts of saline in small test tubes. Two-tenths of a cubic centimeter of a 2-percent suspension of washed Type 0 cells was then added to each tube, making final dilutions of 1:8 to 1:2,048. The tubes were shaken and the suspensions were examined directly with the low-power objective of the microscope after standing for 1 hour at room temperature, after 3 hours' refrigeration at 5° C., and after 1 hour at 37° centigrade.

In addition, small amounts of the salt (0.2 mg. in 0.02 cc.) were added to a series of dilutions of a human serum with a lower titer of cold agglutinins (1:224). The tubes were examined as previously described.

RESULTS

1. *The effect of hyaluronic acid on human Type 0, rabbit, guinea pig and sheep red blood cells.*—When 0.05 mg. of sodium hyaluronate in 0.01 cc. of normal saline was added to 0.3 cc. of a 2-percent suspension of fresh human erythrocytes, numerous aggregates of from 3 to 5 cells were observed after shaking the tubes and examining them with the low-power objective of the microscope. A hanging-drop preparation of the suspension showed marked rouleau formation, the red cells forming long chains by adhering along their flat surfaces. Large aggregates resembling agglutinated masses of cells were formed by the folding of the rouleaux and their adhesion to one another. After incubation at 37° C. and refrigeration at 5° C. for 1 hour, similar results were obtained. Increasing the amount of the polysaccharide to 0.1 mg., 0.25 mg., and 0.5 mg., progressively increased the degree of rouleau formation. With 0.25 and 0.5 mg. of the salt, many of the cells became crenated and formed amorphous masses in 1 or 2 hours.

Similar results were obtained with 2-percent suspensions of fresh rabbit and fresh guinea pig red blood cells. However no rouleaux were formed with sheep cell suspensions (prepared about 48 hours after bleeding), despite observation for 4 or 5 hours.

2. *The effect of human serum and hyaluronic acid on human*

Type 0 cells.—Five-tenths milligram of polysaccharide (0.05 cc.) was added to a mixture of 0.1 cc. human serum, 0.25 cc. normal saline, and 0.2 cc. of a 2-percent suspension of "0" cells. A mixture of 0.1 cc. serum, 0.3 cc. saline and 0.2 cc. of cells served as a control. The tubes were shaken and allowed to stand for 1 hour at room temperature. At the end of this time, marked sedimentation had occurred in the tube containing the polysaccharide and only a slight amount in the control. Examination of the suspension showed marked rouleau formation in the tube containing the sodium hyaluronate and none in the control. Similar results were obtained with 0.05 mg. of the salt. Incubation at 37° C. for 1 hour and refrigeration at 5° C. for the same period did not alter the degree of rouleau formation. In the presence of serum the cells were more resistant to crenation by polysaccharide.

3. *The effect of hyaluronic acid on the cold agglutinin titer of human serum.*—When 1 mg. of sodium hyaluronate was added to 0.1 cc. of human serum containing large amounts of cold hemagglutinin and a titration of this mixture was made, rouleau formation was noted in the dilutions up to 1:32 after 1 hour at room temperature. This did not occur in a series of dilutions of the serum alone. After refrigeration for 3 hours at 5° C., agglutination of the erythrocytes was detected in both series in dilutions up to 1:512. Incubation of the cold agglutinated suspension for 1 hour at 37° C. caused the hemagglutination to disappear, but the rouleaux were still present in dilution up to 1:32 in the series containing hyaluronic acid.

The addition of 0.2 mg. of polysaccharide to each of the dilutions of a serum containing a moderate titer of cold hemagglutinin (1:224) caused a slight amount of rouleau formation in each tube at room temperature but did not increase the cold hemagglutinin titer after 20 hours at 5° centigrade.

COMMENT

The above findings indicate that the sodium salt of hyaluronic acid, a polysaccharide, produces the rapid formation of rouleaux in saline suspensions of fresh human (Type 0), rabbit, and guinea pig red blood cells. However older sheep red blood cells were not similarly affected, indicating a certain degree of specificity of the phenomenon. Human serum did not enhance or inhibit the rouleau-forming activity of the polysaccharide against human "0" cells but retarded the crenation of red cells.

Rouleau formation has been described as the first stage of cold hemagglutination and it has been suggested that a relation exists between these two processes. We have found that the addition of

a rouleau-forming substance, hyaluronic acid, to human serum containing a cold hemagglutinin failed to influence the height of the titer, irrespective of whether this substance was added to the first dilution of the serum and diluted serially with it, or in equal amounts to each serum dilution. This would seem to indicate that rouleau formation and cold hemagglutination are independent processes.

Although we have no data indicating the significance of the rouleau-forming property of hyaluronic acid, this substance or some other polysaccharide may be a cause of rouleau formation in certain clinical states. Since there is a direct relationship between the size of rouleaux aggregated and the sedimentation rate of the erythrocytes (*10*), a serum polysaccharide may influence the latter. In fact Nungester and Klein (*11*) have shown that pneumococcus Type III specific polysaccharide increased the erythrocyte sedimentation rate. Meyer (*12*) has obtained similar results with hyaluronic acid. It is also likely that the latter is responsible for the formation of rouleaux by umbilical cord blood (*13*) since the umbilical cord is a rich source of the polysaccharide.

SUMMARY

A study of the action of the sodium salt of hyaluronic acid on erythrocyte suspensions revealed that this polysaccharide is a rouleau-forming substance. Its addition to human serum had no effect on the titer of cold hemagglutinins.

We are indebted to Dr. Karl Meyer of the College of Physicians and Surgeons, Columbia University, for his advice and for furnishing the sodium hyaluronate used in this study.

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ANTI-HR SERUM

Anti-Hr serum is serum capable of reacting with blood containing the Hr factor.—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

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TO THE PROSPECTIVE MEDICAL STUDENT

Don't take up the study of medicine in the hopes of getting rich, that is a wealth measured in gold and earthly assets. However, "riches" depend on one's ability to spend less than one earns and having saved, to have the ability to invest those savings wisely. Many a man became "rich" on the poor start of digging ditches for a dollar a day.

But you will become rich in the practice of the Healing Art, rich in joys that are unmeasurable. No other profession enjoys such extreme confidence of its clients, experiences the joy of presenting a mother with her new-born child, has the trust of the family with their very life and death. The community in which you live looks up to you and your advice is sought on multitudinous subjects, many of which you may know nothing about. Your name is not "Mister," it is "Doctor" to distinguish you from the other people. At least you are a small toad in the pond and according to your ability, you may be a big one. Medicine is full of riches.

So long as you are not lazy and behave yourself, you may never be rich, but in return you will never starve. The world will always have a place for you.—HARM, W. B.: To the prospective medical student. Detroit Med. News 36: 8, February 19, 1945.

ERYTHEMA MULTIFORME

A STUDY OF TEN CASES

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Ten cases of erythema multiforme were observed at a large Naval hospital, every case showing involvement of the oral mucosa either preceding or simultaneous with the generalized eruption. For this reason the dental officer was usually first consulted for treatment of "canker sores."

Erythema multiforme is a clinical entity the cause of which is unknown. The classic form of the eruption is heralded by a feeling of malaise, tingling and burning in the involved region, and occasionally pain in the joints, or sore throat lasting for from 24 to 48 hours. The eruption itself has typical features, is usually confined to certain areas, is benign in character, and prone to recurrence.

The lesions consist of bright red, round, or oval macules which rapidly become papular, vesicular, and bullous. The contents of the bullae may contain varying amounts of blood. Not infrequently the advancing border of a lesion becomes edematous, producing a new circular lesion about an old one, giving the appearance of concentric rings like a target. Because of this appearance these lesions have been designated as erythema iris (fig. 1).

The characteristic distribution of the eruption is on the dorsa of the hands and feet first, the region around the mouth and oral mucous membranes second, and the genitalia third. In those cases in which there is a reversal of the distribution on the hands and feet, with involvement of the palms and soles, association with lesions in the mouth and on the genitalia has been frequently noted (figs. 2 and 3).

The lips and the mucous membranes of the mouth and throat may be involved before the general outbreak or simultaneously with it, in which case the lesions are not so well defined, erosion and crusting rapidly supervene, and maintenance of the patient's nutrition becomes a problem. Lesions on the genitalia are confined to the glans penis. The conjunctiva is often involved.

1. Iris type lesions on backs of hands. Vesicular and crusted lesions of lips.

2. Lesions of the palms with extensive involvement of the lips and oral mucosa.

3. Lesions of the soles.

TABLE 1.—*Summary of admission data*

Patient No.	Age	Temperature (degrees F.)	Blood Kahn test	Duration of symptoms (days)	Mucous membrane involvement	Pre-admission diagnosis
1.....	30	98.6	Neg.	11	Yes	Erythema multiforme.
2.....	21	99.4	Neg.	6	Yes	Erythema multiforme.
3.....	18	102.2	Neg.	21	[1]Yes	Tonsillitis, acute
4.....	18	101.4	Neg.	12	Yes	Stomatitis.
5.....	27	99.4	Neg.	7	Yes	Herpes zoster.
6.....	17	100.6	Neg.	17	[1]Yes	Erythema multiforme.
7.....	32	100.2	Neg.	9	[1]Yes	Vincent's angina
8.....	20	100.4	Neg.	15	[1]Yes	Dermatitis.
9.....	20	99.0	Neg.	7	Yes	Erythema multiforme.
10.....	17	99.2	Neg.	6	Yes	Erythema multiforme.
Average..	22	100	Neg.	11.1		

[1] Conjunctivitis in addition to involvement of mouth.

The ten cases constituting the basis of this study were all observed during the spring months. Admission data on these cases are given in table 1.

The average age of these patients was 22 years, six of them being over 21 years of age, the eldest 32, and the youngest 17 years of age. There was no particular racial distribution and one Filipino and one Negro are included in this group. The average temperature on admission was 100° F.; in only one case was the temperature normal on admission. The pulse and respiratory rates were within normal limits. Results of a blood Kahn test were negative and cultures made from the mouth lesions showed only the usual saprophytic organisms.

Erythema multiforme is a self-limited disease of short duration. The average time spent in the hospital by these ten patients was 11 days; the longest duration of symptoms was 21 days, and the shortest 6 days. All recovered completely and were returned to duty.

Blood studies revealed a moderate leukocytosis in two cases and a moderate leukopenia in two cases. In two cases there was an increase in the eosinophils (6 and 10 percent). Examination of the urine yielded negative results in each case. Recurrent attacks are the rule and a helpful diagnostic point. One of the patients gave a history of recurrences every 3 months. The Filipino patient had had periodic attacks for 6 years, and patient No. 1 had had recurrent attacks for 10 years.

The fact that erythema multiforme poses some difficulties in diagnosis in the early stages is evident as only 50 percent of these patients were admitted to the hospital with the correct diagnosis. The original diagnoses on the other five cases included tonsillitis, acute; stomatitis; herpes zoster; Vincent's angina; and dermatitis.

It is hardly a coincidence that in all 10 cases there was a prominent involvement of the mucous membranes of the oral cavity

and the genitalia. The lesions were so characteristic and the site of predilection was so typical as to indicate a basis for diagnosis.

In the mouth the early erythematous macule was not noted at the time of admission to the hospital. By this time the superimposed blebs had ruptured to form large desquamated areas on the lips, buccal mucosa, tongue (especially the periphery where the erosions of a yellowish, necrotic nature and the indentations of the lower teeth were clearly marked), hard and soft palates, and the pharyngeal area. When the erosions were on or just inside the vermilion border and exposed to the air, they healed by crusting over.

Within the mouth where the bullae and erosions are protected from drying, the process of healing is considerably slower and crusting does not take place. Like those of aphthous stomatitis, the lesions of erythema multiforme are extremely painful, and intravenous feeding of the patient is frequently necessary to maintain nutrition. But unlike those of aphthous stomatitis, the erosions do not respond to orthodox treatment of "canker sores" such as alkaline mouthwashes, topical escharotics, and dietary control.

In addition to the classic type of erythema multiforme, a symptomatic erythema multiforme is recognized. It differs from the former type in that the eruption is more polymorphous, more extensive, often lacks the typical distribution, and does not recur regularly at certain seasons. This type may be precipitated by the ingestion of certain drugs, notably quinine, mercury, and the arsenicals, and less often iodine, bromine and phenolphthalein. Foods, such as stale meat, fish, and oysters may also precipitate an attack, as may septic processes of staphylococcic or streptococcic origin. The mechanism involved in the production of this type of erythema multiforme is that of a sensitization to the drug, to food protein, or to toxin produced by the bacteria, with a resultant reaction of the sensitized tissues and the production of a toxic eruption.

In the differential diagnosis, urticaria must be considered when the predominant lesion is papular rather than vesicular or bullous. When the clinical manifestations are severe and widespread, the eruption tends to simulate pemphigus. However in the latter condition the lesions arise on normal skin, while in erythema multiforme the bullae always arise on pre-existing erythematous macules.

Aphthous stomatitis, pemphigus, and syphilis enter into the differential diagnosis when the mucous membranes of the mouth, lips, and genitalia are involved. Darkfield examination of a specimen from these lesions should settle all doubt regarding syphilis.

The history of recurrent attacks, the large size of the lesions, and their superficiality and rapid evolution are helpful points in distinguishing between erythema multiforme, pemphigus, and aphthous stomatitis.

Treatment is largely empiric, inasmuch as a definite causative factor cannot be determined in each case. Search for foci of infection is always indicated. When the involvement of the mouth is severe and prolonged, parenteral administration of dextrose should be resorted to in order to supplement the diminished fluid intake. Intravenous injections of calcium gluconate, 1 gm. every 2 or 3 days, or sodium thiosulfate ½ gm. intravenously daily for 3 days and then every other day for a total of six doses may hasten the involution of the eruption. Locally, colloidal baths, followed by the application of a calamine lotion, are usually sufficient treatment for the cutaneous lesion. Frequent irrigation of the mouth with warm potassium permanganate in solution of 1:10,000 and continuous potassium permanganate dressings for lesions on the genitalia serve to keep these areas clean and hasten involution. Since the disease appears to run a self-limited course, prognosis is usually good, but the prognosis regarding recurrences necessarily varies with the cause.

SUMMARY

A study of 10 cases of erythema multiforme is submitted for the particular attention of dental officers, because of the early and frequent involvement of the oral mucous membranes. These cases are most frequently encountered in the winter and spring months, tend to recurrence, and run a self-limited course which can be influenced by proper treatment. The sites of predilection of the lesions, the associated involvement of the mucous membranes, and the character of the individual lesions are helpful features in making the diagnosis.

Erythema multiforme may be produced by a variety of causes. In the symptomatic variety, however, drugs, foods, and foci of infection should be considered.

⚓ ⚓

RH GENOTYPES

The six standard genes pair to yield twenty-one different Rh genotypes. These twenty-one genotypes in turn fall into eight phenotypes identical with the eight Rh blood types, because only eight distinct types of blood can be distinguished with the anti-Rh_o, anti-Rh′ and anti-Rh″ serums.—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

PNEUMONIA IN THE U. S. NAVY—1882–1942

PART I.—AS CAUSE OF ADMISSION TO SICK LIST

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Throughout the long history of the U. S. Navy, pneumonia has constituted a challenging problem constantly confronting the medical officer. Though vigorous efforts have been directed toward meeting this challenge, pneumonia is still a potent adversary yet to be conquered.

This study is a statistically historical account of the progress of the Navy's battle against the various forms of this disease. In order that a fuller, more comprehensive understanding of the statistical data may be attained, the writers have included a brief historical review of the development of diagnostic, preventive and therapeutic measures. The former two subjects appear here as background material to the study of pneumonia as a cause of admission to the sick list, and the latter, therapeutic measures, will be included in Part II, which will treat of pneumonia as a cause of incapacitation and mortality.

In 1881 both Sternberg and Pasteur reported finding lance-shaped cocci in human saliva, which were capable of producing septicemia in rabbits (*1*). Thus 62 years after Laënnec depicted the physical signs of pneumonia (*2*), the common causative agent of lobar pneumonia was seen and described. In 1884 Surgeon James Rufus Tryon, U. S. Navy, reported that in papers presented at the International Health Exhibit in London, medical workers were urged to investigate ". . . the causes of disease by the examination of bacteria, bacilli, micrococci and spirochaetae appearing in most of the infectious and contagious diseases . . ." (*3*).

Actual demonstration of the pneumococcus as the chief causative agent in lobar pneumonia was achieved by A. Fränkel and by Weichselbaum working independently in 1886 (*1*).

The first use of microscopic examination of the sputum in the diagnosis of pneumonia in the Navy was reported in 1890 (*4*).

Throughout this period, all cases of pneumonia in the U. S. Navy were diagnosed as *Pneumonia, unclassified* and it was not

until 1895 that the lobar pneumonias were given the diagnostic title *Febris pneumonica* and separated from the cases of bronchopneumonia, then entitled *Bronchopneumonitis.*

In 1896 the Naval Medical Supply Table was expanded to include bacteriologic and chemical supplies for laboratories (*5*). One year later a standard outfit of microscopes and accessories was distributed to all hospitals, ships and Navy yards, while bacteriologic and chemical laboratories were set up in Naval hospitals to aid in the diagnosis of pneumonia (*6*).

Though x-ray apparatus was installed in Naval hospitals during 1899 (*7*), its use in the diagnosis of chest conditions only gradually developed. In 1900 the U. S. Naval Hospital, Brooklyn, N. Y., reported ". . . an uncommon use of this instrument . . . in a case of suspected tuberculous deposit in the right lung. A normal boy about the patient's size was examined for comparison. The patient was then examined, and the deposit plainly made out and its presence verified by the stethoscope. In another case, a cavity could be plainly seen. The apparatus is in good order, and no burns have followed its use" (*8*).

In 1913 the "Diagnostic Nomenclature for the Medical Department of the United States Navy" was revised to classify the pneumonias into two main groups entitled *Lobar pneumonia* and *Bronchopneumonia.* In 1915 the term *Interstitial pneumonia* was added; in 1926, *Chronic pneumonitis (nontuberculous)*; in 1937, *Acute pneumonitis* and *Hypostatic pneumonia;* in 1942, *Primary atypical pneumonia, etiology unknown.*

It is evident that the history of the development of diagnostic methods is sparse enough, but the history of the development of preventive measures is even less satisfactory. Throughout the 61 years under study little more can be said for preventive measures than was stated in 1908 in the following words:

> Pneumonia is essentially a disease of modern overcrowded conditions . . . its prevention requires the exercise of all hygienic rules and the employment of all modern methods of sanitation (*9*).

In the statistical presentation to follow, the failure of these general principles to control effectively or reduce the incidence of pneumonia is quite evident. Much has been accomplished to lessen its deadliness, but as yet there is no means of preventing or forestalling its attack.

Table I presents the number of admissions and the annual admission rates per 1,000 average strength of the U. S. Navy for the various forms of pneumonia during the period from 1882 to 1942 inclusive. This table provides a total picture of service-connected admissions for pneumonia, and also indicates the

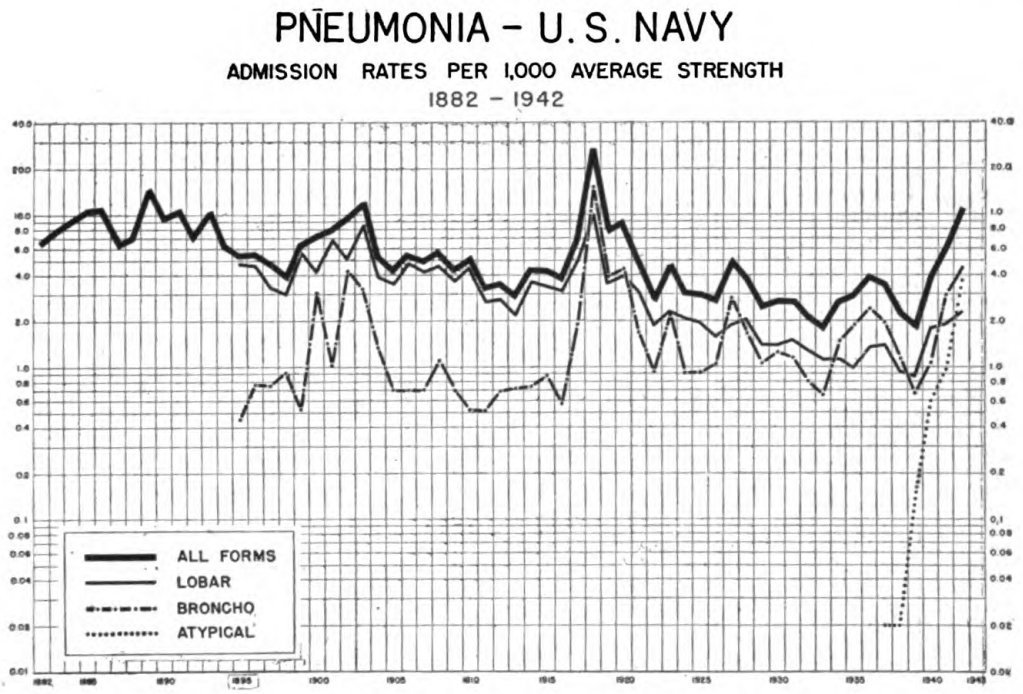

Figure 1.

changes in the nomenclature which have occurred through the years.[1]

Figure 1 is a graphic presentation of the admission rates per 1,000 average strength for pneumonia (all forms), lobar pneumonia, bronchopneumonia, and atypical pneumonia[2] in the U. S. Navy, 1882-1942.

It will be observed from the curve for pneumonia (all forms) that since 1889, following a period of increased incidence (1882-1889), there has been evidenced a slowly decreasing trend line interrupted by numerous peaks, only three of which are of amplitude sufficient to merit attention.

The first of these marked deviations from a decreasing trend took place during the years 1899 to 1903. An odd characteristic of this "hump" in the curve for pneumonia (all forms), causing it to extend through a five-year period, was the alternation of peaks of lobar and bronchopneumonia. It is difficult to offer any

[1] The term "admissions," unless otherwise specified, includes all cases admitted to the sick list as an "A" or an "ACD." An "A" is defined as any new admission for a disability that has developed or been incurred since entry into the service, which is unrelated to any disability for which the patient has been previously taken up on the sick list. An "ACD" is defined as any new admission on account of complication or sequela, including final disability.

[2] Though "atypical pneumonia, primary," was not officially included in the Diagnostic Nomenclature until December 9, 1942, acute pneumonitis was included beginning in 1937. It has seemed reasonably accurate to carry back to 1937 all "new" admissions (A) for acute pneumonitis and reclassify them as atypical pneumonia, primary. The "ACD" admissions for acute pneumonitis, however, have not been so reclassified and compiled.

TABLE 1.—PNEU

Admissions[1] and admissi

Year	Average strength	Pneumonia (all forms)		Pneumonia unclassified		Febris pneumonica		Lobar pneumonia		Bron pneu
		Number admis.	Rate per 1000	Number admis.	Rate per 1000	Number admis.	Rate per 1000	Number admis.	Rate per 1000	Numbe admis
1882....	10,631	68	6.40	68	6.40	.....	.....	.....	.....	
1883....	9,874	77	7.80	77	7.80	.....	.....	.....	.....	
1884....	10,948	97	8.86	97	8.86	.....	.....	.....	.....	
1885....	9,191	96	10.44	96	10.44	.....	.....	.....	.....	
1886....	9,188	98	10.67	98	10.67	.....	.....	.....	.....	
1887....	9,618	59	6.13	59	6.13	.....	.....	.....	.....	
1888....	9,955	70	7.03	70	7.03	.....	.....	.....	.....	
1889....	11,219	160	14.26	160	14.26	.....	.....	.....	.....	
1890....	11,768	110	9.35	110	9.35	.....	.....	.....	.....	
1891....	11,051	115	10.41	115	10.41	.....	.....	.....	.....	
1892....	11,775	83	7.05	83	7.05	.....	.....	.....	.....	
1893....	12,109	124	10.24	124	10.24	.....	.....	.....	.....	
1894....	12,520	77	6.15	77	6.15	.....	.....	.....	.....	
1895....	13,191	69	5.23	.....	.....	63	4.78	.....	.....	
1896....	14,196	77	5.42	.....	.....	66	4.65	.....	.....	
1897....	15,734	74	4.70	.....	.....	52	3.30	.....	.....	
1898....	23,986	94	3.92	.....	.....	72	3.00	.....	.....	
1899....	20,819	128	6.15	.....	.....	117	5.62	.....	.....	
1900....	23,756	171	7.20	.....	.....	99	4.17	.....	.....	
1901....	26,873	211	7.85	.....	.....	183	6.81	.....	.....	
1902....	31,240	292	9.35	.....	.....	158	5.06	.....	.....	
1903....	37,248	437	11.73	.....	.....	315	8.46	.....	.....	
1904....	40,555	211	5.20	.....	.....	156	3.85	.....	.....	
1905....	41,313	174	4.21	.....	.....	145	3.51	.....	.....	
1906....	42,529	234	5.50	.....	.....	204	4.80	.....	.....	
1907....	46,336	225	4.86	.....	.....	192	4.14	.....	.....	
1908....	52,913	302	5.71	.....	.....	243	4.59	.....	.....	
1909....	57,172	245	4.28	.....	.....	205	3.58	.....	.....	
1910....	58,691	297	5.06	.....	.....	266	4.53	.....	.....	
1911....	61,399	195	3.18	.....	.....	163	2.65	.....	.....	
1912....	61,897	215	3.47	.....	.....	172	2.78	.....	.....	
1913....	65,926	189	2.87	.....	.....	.....	.....	141	2.14	
1914....	67,141	292	4.35	.....	.....	.....	.....	242	3.60	
1915....	68,075	288	4.23	.....	.....	.....	.....	227	3.33	
1916....	69,294	259	3.74	.....	.....	.....	.....	216	3.12	
1917....	245,580	1,697	6.91	.....	.....	.....	.....	1,234	5.02	
1918....	503,792	13,574	26.94	.....	.....	.....	.....	4,990	9.90	
1919....	298,774	2,352	7.87	.....	.....	.....	.....	1,053	3.52	
1920....	140,773	1,235	8.77	.....	.....	.....	.....	556	3.95	
1921....	148,861	708	4.76	.....	.....	.....	.....	453	3.04	
1922....	122,126	341	2.79	.....	.....	.....	.....	226	1.85	
1923....	116,565	522	4.48	.....	.....	.....	.....	264	2.26	
1924....	119,280	356	2.98	.....	.....	.....	.....	246	2.06	
1925....	115,381	337	2.92	.....	.....	.....	.....	224	1.94	
1926....	113,756	307	2.70	.....	.....	.....	.....	178	1.56	
1927....	115,316	548	4.75	.....	.....	.....	.....	214	1.86	
1928....	116,047	435	3.75	.....	.....	.....	.....	237	2.04	
1929....	117,388	295	2.51	.....	.....	.....	.....	161	1.37	
1930....	117,453	314	2.67	.....	.....	.....	.....	162	1.38	
1931....	112,767	203	2.68	.....	.....	.....	.....	169	1.50	
1932....	110,717	231	2.09	.....	.....	.....	.....	139	1.26	
1933....	108,183	193	1.78	.....	.....	.....	.....	120	1.11	
1934....	109,383	288	2.63	.....	.....	.....	.....	123	1.12	
1935....	114,188	334	2.92	.....	.....	.....	.....	112	0.98	
1936....	124,408	474	3.81	.....	.....	.....	.....	165	1.33	
1937....	132,855	458	3.45	.....	.....	.....	.....	184	1.38	
1938....	139,216	308	2.21	.....	.....	.....	.....	129	0.93	
1939....	149,618	275	1.84	.....	.....	.....	.....	128	0.86	
1940....	202,614	787	3.88	.....	.....	.....	.....	367	1.81	
1941....	348,926	2,126	6.09	.....	.....	.....	.....	656	1.88	
1942....	833,920	8,987	10.78	.....	.....	.....	.....	1,896	2.27	

[1] Admissions include "A" (new admission) and "ACD" (admitted contributory disability).
* Includes all deaths from influenza uncomplicated by lobar or bronchopneumonia.

[U]. S. NAVY

[... per] 1,000 average strength: 1882–1942

[B]roncho-[pn]eumonia		Interstitial pneumonia		Influenzal pneumonia*		Chronic pneumonitis (nontuberculous)		Primary atypical pneumonia**		Acute pneumonitis#		Hypostatic pneumonia	
[Num]ber [adm]is.	Rate per 1000	Number admis.	Rate per 1000	Number admis.	Rate per 1000	Number admis.	Rate per 1000	Number admis.	Rate per 1000	Number admis.	Rate per 1000	Number admis.	Rate per 1000
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...	...	...	...	...	...	...	...	...	...	...	...	...	...
48	0.73	...	...	...	...	...	...	...	...	...	...	...	...
50	0.74	...	...	...	...	...	...	...	...	...	...	...	...
30	0.88	1	0.01	...	...	...	...	...	...	...	...	...	...
40	0.58	3	0.04	...	...	...	...	...	...	...	...	...	...
59	1.87	3	0.01	1	0.01 –	...	...	...	...	...	...	...	...
91	15.07	10	0.02	983	1.95	...	...	...	...	...	...	...	...
75	3.93	3	0.01	121	0.40	...	...	...	...	...	...	...	...
21	4.41	0	0	58	0.41	...	...	...	...	...	...	...	...
51	1.69	1	0.01	3	0.02	...	...	...	...	...	...	...	...
4	0.93	0	0	1	0.01	...	...	...	...	...	...	...	...
56	2.20	0	0	2	0.02	...	...	...	...	...	...	...	...
39	0.91	1	0.01	0	0	...	...	...	...	...	...	...	...
36	0.92	4	0.03	3	0.03	...	...	...	...	...	...	...	...
19	1.05	2	0.02	4	0.04	4	0.04	...	...	...	...	...	...
25	2.82	2	0.02	7	0.06	0	0	...	...	...	...	...	...
33	1.66	0	0	4	0.03	1	0.01	...	...	...	...	...	...
24	1.06	1	0.01	5	0.04	4	0.03	...	...	...	...	...	...
36	1.24	1	0.01	1	0.01	4	0.03	...	...	...	...	...	...
30	1.15	1	0.01	1	0.01	1	0.01	...	...	...	...	...	...
30	0.81	0	0	2	0.02	0	0	...	...	...	...	...	...
70	0.65	0	0	0	0	3	0.03	...	...	...	...	...	...
32	1.48	1	0.01	0	0	2	0.02	...	...	...	...	...	...
16	1.89	0	0	3	0.03	3	0.03	...	...	...	...	...	...
91	2.42	0	0	1	0.01	7	0.06	...	...	...	...	...	...
30	1.96	0	0	1	0.01	6	0.04	2	0.02	5	0.04	0	0
58	1.13	0	0	1	0.01	7	0.05	3	0.02	10	0.07	0	0
90	0.67	1	0.01	1	0.01	6	0.04	24	0.16	15	0.10	0	0
6	1.07	2	0.01	3	0.01	11	0.05	120	0.59	68	0.34	0	0
39	2.98	1	0.01 –	1	0.01 –	23	0.06	331	0.95	75	0.21	0	0
7	4.43	4	0.01 –	3	0.01 –	43	0.05	3,089	3.70	252	0.30	3	0.01 –

Includes new admissions for acute pneumonitis.
Includes only "ACD" admissions.

satisfactory explanation for this high incidence of pneumonia, since there was during that period no unusual prevalence of influenza or measles, no rapid increase in the number of unseasoned Naval personnel, and no increase in barrack living.

Following this period of increased incidence of pneumonia, there was again experienced a decreasing trend until the year 1917. In that year the Navy's strength increased from 69,294 to 245,580, with the bulk of the incoming personnel unseasoned men, unaccustomed to life in barracks or aboard ship. That same year witnessed outbreaks of measles, mumps, and cerebrospinal fever, these diseases rising to higher peaks than have been experienced during the succeeding 26 years. In 1918 there followed the influenza pandemic, and during that same year both broncho- and lobar pneumonia reached all-time high levels.

With the subsidence of the influenza pandemic, the pneumonia rates once more resumed a downward trend. This trend continued through the 20's and 30's, being interrupted by three relatively mild outbreaks of bronchopneumonia (1923, 1927, 1934-37).

Again in 1940, with a rapid increase of Naval strength and the increased exposure of unseasoned recruits to barrack life in training schools, the pneumonia curve swung upward. This rise continued through 1941, and in 1942 the admission rate for pneumonia stood at the highest point recorded since 1918. Contributing to but by no means accounting for this peak incidence of pneumonia was the recently recognized atypical pneumonia. This 1942 rise was also synchronous with sharp increases in the incidence of measles, German measles, and cerebrospinal fever, but most outstanding has been the rise to all-time highs of scarlet fever and streptococcic pharyngitis.[8]

Figure 1 also provides a very interesting comparison of the three most important types of pneumonia; namely, lobar, broncho- and atypical. Such a comparison, especially concerning lobar and bronchopneumonia, necessitates a division of the total 48-year period into two sections separated by the pandemic period of 1918.

During the first 24-year period, lobar pneumonia was undergoing a generally declining admission-rate level, but was consistently higher than bronchopneumonia. The difference in epidemic tendencies between the two diseases is also brought out by such a comparison. Whereas lobar pneumonia experienced only relatively

[8] Although comparable data for 1943 have not yet been completed, it is interesting to note from the reports available that pneumonia (all forms) appears to have undergone a slight decline to a rate of approximately 9.95 per 1,000 strength. Whether or not this is a true representation of the pneumonia experience for 1943 is impossible to ascertain. However the relative standings of the various forms of pneumonia may be determined with reasonable accuracy from such sampling and will be discussed in a later section of this paper.

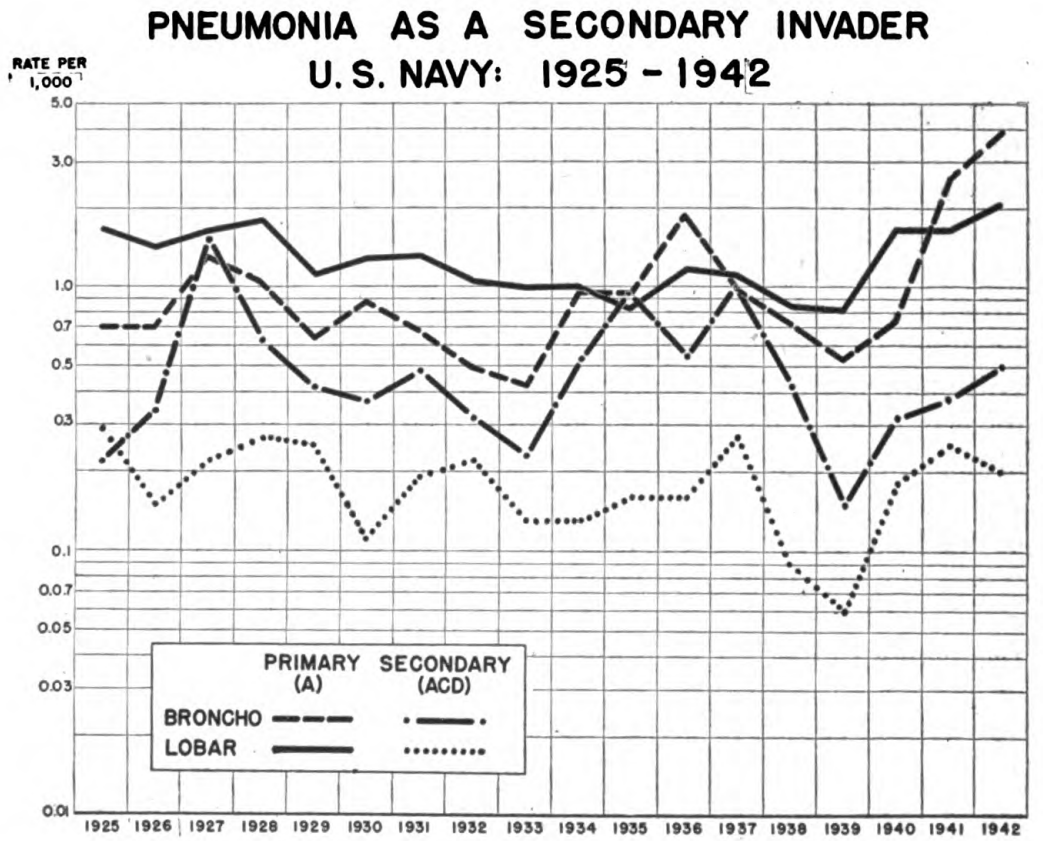

Figure 2.

minor fluctuations, in at least two instances, 1900, and 1902, bronchopneumonia underwent marked increases.

In 1917 bronchopneumonia rose at a rate more rapid than lobar, and in 1918 the rate of increase accelerated to such an extent that bronchopneumonia reached a point higher than that attained by lobar pneumonia (15.07 per 1,000 as compared with 9.90 per 1,000).

Following the pandemic of 1918, bronchopneumonia fell at a rate of decline more rapid than that of lobar, but leveled off on a plane slightly above that maintained in the first 24-year period. An accelerated rate of decrease in the trend line of lobar pneumonia tended to bring the two curves into closer approximation; the curve for bronchopneumonia in the period succeeding 1920 equalled or rose above that for lobar pneumonia in 1923, 1927, 1934-37, and 1941-42.

As was the case in 1917, rapid mobilization in 1940 again effected precipitous rises in all forms of pneumonia. Bronchopneumonia once more rose at a more rapid rate than lobar, causing the curve to surpass that for lobar pneumonia. Even though bronchopneumonia leveled off slightly in 1942, the curve for pneumonia (all forms) continued in an almost straight-line increase

because of a slight turn upward of lobar pneumonia and a continuation of the extremely rapid rise of primary atypical pneumonia.

In 1937, when acute pneumonitis was first made reportable in the U. S. Navy, the admission rate for this disease lay at the extremely low point of 0.02 per 1,000 strength.[4] The rate remained the same in 1938, but underwent a rapid relative increase in 1939 and has continued to rise since that time. In 1942 the rate for this infection stood at 3.70 per 1,000, well above the rate for lobar pneumonia but slightly below the rate for bronchopneumonia. Although pathologic specimens bear witness to the fact that this disease existed as far back as Civil War days, it is obvious that either improved radiographic facilities have succeeded in revealing many cases that previously would not have been so diagnosed, or that the disease has recently acquired an ability to spread which it did not previously possess. A characteristic of atypical pneumonia which is quite unusual is that it seems to occur with greater frequency in areas which habitually report a rather low incidence of the other respiratory diseases.[5]

Another approach to the problem of admissions to the sick list for pneumonia is to separate the "A" from the "ACD" admissions, study them individually, and compare one with the other. This phase of the investigation has been limited to only bronchopneumonia and lobar pneumonia, the role of the other forms being relatively minor (see table 1). Table 2 and figure 2 present the statistical picture of such an investigation.[6]

Whereas the curve for primary admissions (A) for lobar pneumonia is at a higher level than the curve for bronchopneumonia, the converse is true for the "ACD" or secondary admissions. The difference between the two diseases as regards tendency toward epidemicity is again here apparent. Both curves for lobar pneumonia appear to have undergone a moderate decline during this period, while those for bronchopneumonia showed no such trend.

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[4] It will be recalled that for purposes of this paper "new" admissions (A) for acute pneumonitis have been reclassified as primary atypical pneumonia.

[5] As was indicated earlier, despite incomplete reporting for 1943, the relative standings of broncho-, lobar, and atypical pneumonias may be forecast with a reasonable degree of accuracy. Even though the rates for both broncho- and lobar pneumonias fell in 1943, bronchopneumonia declined at a rate more rapid than that of lobar. This factor caused lobar pneumonia to equal bronchopneumonia (2.21 per 1,000 and 2.22 per 1,000 respectively), thus reversing the experience of the previous 2 years. On the other hand atypical pneumonia continued its precipitous rise, attaining the rate of 5.39, more than double the rate of lobar and bronchopneumonias combined. The rapid decline of bronchopneumonia, coupled with the rapid increase of atypical pneumonia, seems to lend additional strength to the theory that many pneumonias formerly diagnosed as bronchopneumonia are now more frequently diagnosed as atypical pneumonia.

[6] The "ACD" classification of admissions was not segregated from the "A" type until 1925, thus limiting this phase of the study to the period 1925-1942.

TABLE 2.—*Broncho- and lobar pneumonia, U. S. Navy. Admissions and admission rates per 1,000 average strength, "A" and "ACD" separately: 1925–1942*

Year	Average strength	Bronchopneumonia				Lobar pneumonia			
		"A"		"ACD"		"A"		"ACD"	
		No. adm.	Rate per 1000	No. adm.	Rate per 1000	No. adm.	Rate per 1000	No. adm.	Rate per 1000
1925	115,381	81	0.70	25	0.22	190	1.65	34	0.29
1926	113,756	80	0.70	39	0.34	161	1.42	17	0.15
1927	115,316	150	1.30	175	1.52	188	1.63	26	0.22
1928	116,047	120	1.03	73	0.63	206	1.78	31	0.27
1929	117,388	74	0.63	50	0.42	132	1.12	29	0.25
1930	117,453	103	0.88	43	0.37	149	1.27	13	0.11
1931	112,767	76	0.67	54	0.48	148	1.31	21	0.19
1932	110,717	54	0.49	36	0.32	115	1.04	24	0.22
1933	108,183	45	0.42	25	0.23	106	0.98	14	0.13
1934	109,383	104	0.95	58	0.53	109	1.00	14	0.13
1935	114,188	108	0.94	108	0.94	94	0.82	18	0.16
1936	124,408	234	1.88	67	0.54	145	1.16	20	0.16
1937	132,855	127	0.96	133	1.00	148	1.11	36	0.27
1938	139,216	99	0.71	59	0.42	117	0.84	12	0.09
1939	149,618	78	0.52	22	0.15	119	0.80	9	0.06
1940	202,614	151	0.74	65	0.32	331	1.63	36	0.18
1941	348,926	908	2.60	131	0.38	569	1.63	87	0.25
1942	833,920	3,283	3.94	414	0.50	1,729	2.07	167	0.20

During the recent mobilization period, "new" admissions (A) for bronchopneumonia rose more rapidly than did lobar, but the opposite seems to be true as concerns "ACD" admissions.

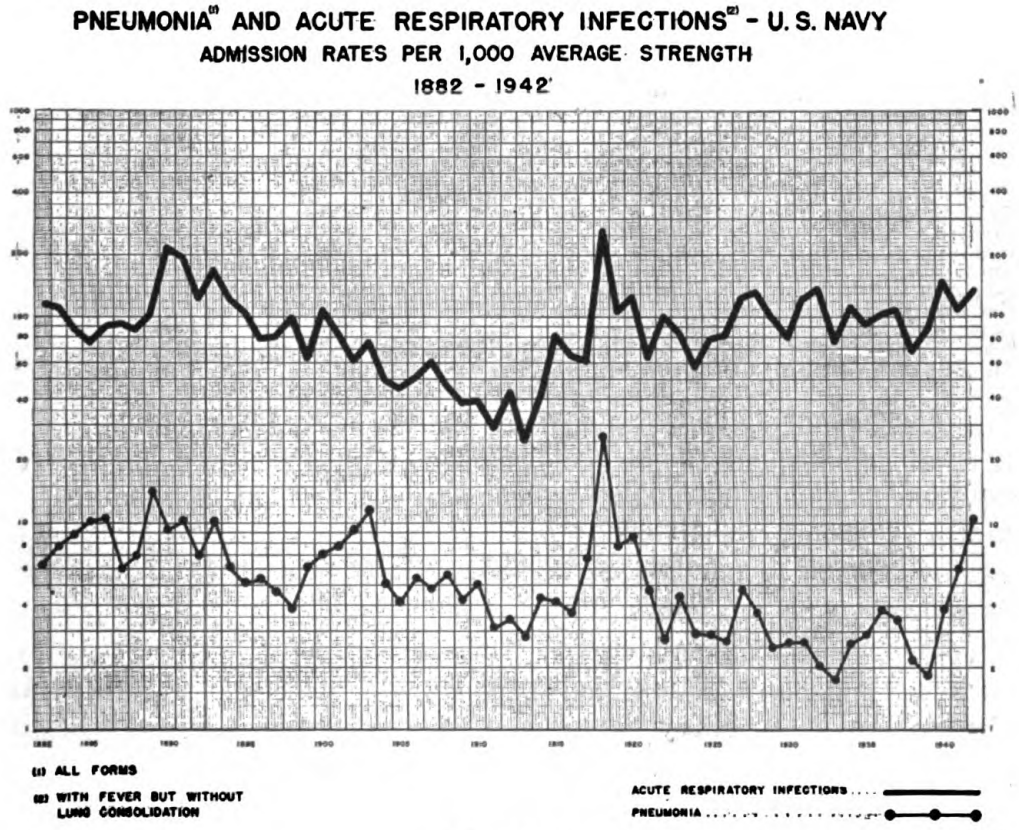

Figure 3.

Figure 3 illustrates that a general relationship is demonstrable between admissions for pneumonia (all forms) and acute respiratory infections with fever but without lung consolidation (influenza, acute catarrhal fever, grippe, etc.).[7]

TABLE 3.—*Pneumonia as a complication of other conditions, U. S. Navy: 1937–1942*

Primary condition complicated by pneumonia	Pneumonia admissions (ACD)									
	All forms		Broncho-		Lobar		Acute pneumonitis		All others	
	Number	Percent total	Number	Percent total	Number	Percent total	Number	Percent total	Number	Percent total
Total, all conditions....	1,617	100.0	824	100.0	347	100.0	425	100.0	21	100.0
Catarrhal fever, acute..	1,109	68.6	524	63.6	222	64.0	362	85.2	1	4.8
Bronchitis, acute.....	111	6.9	69	8.4	22	6.3	18	4.2	2	9.5
Influenza.....	69	4.3	46	5.6	18	5.2	4	0.9	1	4.8
Measles.....	58	3.6	46	5.6	5	1.4	7	1.6	0	0
Tonsillitis, acute.....	40	2.5	20	2.4	13	3.7	7	1.6	0	0
German measles.....	30	1.8	21	2.5	7	2.0	2	0.5	0	0
Appendicitis, acute.....	30	1.8	14	1.7	13	3.7	3	0.7	0	0
Scarlet fever.....	9	0.6	6	0.7	2	0.6	1	0.2	0	0
All other conditions....	161	10.0	78	9.5	45	13.0	21	4.9	17	81.0

TABLE 3a.

Primary condition complicated by pneumonia	Pneumonia admissions (ACD)									
	All forms		Broncho-		Lobar		Acute pneumonitis		All others	
	Number	Percent total	Number	Percent total	Number	Percent total	Number	Percent total	Number	Percent total
Total, all conditions....	1,617	100.0	824	51.0	347	21.4	425	26.3	21	1.3
Catarrhal fever, acute..	1,109	100.0	524	47.2	222	20.0	362	32.6	1	0.1
Bronchitis, acute.....	111	100.0	69	62.2	22	19.8	18	16.2	2	1.8
Influenza.....	69	100.0	46	66.7	18	26.1	4	5.8	1	1.4
Measles.....	58	100.0	46	79.3	5	8.6	7	12.1	0	0
Tonsillitis, acute.....	40	100.0	20	50.0	13	32.5	7	17.5	0	0
German measles.....	30	100.0	21	70.0	7	23.3	2	6.7	0	0
Appendicitis, acute.....	30	100.0	14	46.7	13	43.3	3	10.0	0	0
Scarlet fever.....	9	100.0	6	66.7	2	22.2	1	11.1	0	0
All other conditions....	161	100.0	78	48.4	45	28.0	21	13.0	17	10.6

A somewhat more detailed examination of these secondary admissions is provided by tables 3 and 3a. Here are presented the major primary conditions which have been complicated by the various forms of pneumonia. The period of study has of necessity been limited to the years 1937-1942.

As would be expected, except for acute appendicitis, the primary conditions consist of respiratory ailments included in Diagnostic Class VIII of the Navy Nomenclature (Diseases Transmissible by

[7] It is of interest to note that the frequency of "ACD" admissions of bronchopneumonia appears to be more closely related to fluctuations in the incidence of these acute respiratory infections.

Oral and Nasal Discharges). During the period under consideration there were 1,617 cases of pneumonia (all forms) reported as a complication or sequela. The majority of these cases occurred as secondary infections to acute catarrhal fever. Table 3a indicates that in all of the primary conditions, about one-half of the complicating pneumonias were bronchopneumonias, the remainder being rather evenly distributed between lobar pneumonia and acute pneumonitis. Only in acute appendicitis did the frequency of lobar pneumonia as a complication approach that of bronchopneumonia.

SUMMARY

1. The curve for pneumonia (all forms) in the U. S. Navy rose rapidly during the period 1882-1889, but since that time has shown a slowly decreasing trend line broken by three major peaks, 1899-1903, 1917-1920, and 1940-1942.

2. Reasons for the undue incidence of pneumonia (all forms), 1882-1889 and 1899-1903 are not apparent.

3. Reasons for the 1917-1920 peak of pneumonia (all forms) include:

(a) Rapid increase in unseasoned Naval personnel
(b) Influenza pandemic
(c) Unusual prevalence of measles

4. Reasons for the 1940-1942 peak of pneumonia (all forms) include:

(a) Rapid influx of unseasoned personnel
(b) Unusual prevalence of scarlet fever and streptococcal pharyngitis
(c) Unusual prevalence of measles
(d) Increased incidence of atypical pneumonia

5. In the 23-year period prior to 1917, the lobar pneumonia rate was much higher than it has been in the years succeeding 1917; the opposite is true for bronchopneumonia.

6. The rate for primary atypical pneumonia has increased from 0.02 per 1,000 strength in 1937 to 3.70 per 1,000 in 1942 (the rate for bronchopneumonia in 1942 was 4.43 and for lobar pneumonia was 2.27 per 1,000).

7. Navy figures lend further support to the following commonly-held assumptions:

(a) Lobar pneumonia occurs as a primary condition (A) much more frequently than does bronchopneumonia (except in years of sharp epidemics of bronchopneumonia).

(b) Bronchopneumonia occurs as a secondary condition (ACD) much more frequently than does lobar pneumonia or acute pneumonitis.

(c) The only disease in which lobar pneumonia approaches bronchopneumonia as a complicating condition is acute appendicitis.

(d) The only two diseases in which acute pneumonitis outweighs lobar pneumonia as a complicating condition are acute catarrhal fever and measles.

(e) Diseases most commonly complicated by pneumonia (all forms) in order of decreasing frequency are: Catarrhal fever, acute; bronchitis, acute; influenza; measles.

(f) Primary admissions for lobar pneumonia and bronchopneumonia follow an incidence curve seemingly independent of any other disease. On the other hand secondary admissions for bronchopneumonia appear to be closely correlated with acute upper respiratory infections.

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RH BLOOD TYPES

Tests with anti-Rh_o, anti-Rh′ and anti-Rh″ yield eight standard Rh blood types. The names of these types and their approximate frequencies among white persons in New York City are as follows: type Rh_1Rh_2, 13 percent; Rh_1, 54.5 percent; Rh_2, 15 percent; Rh_o, 2.5 percent; Rh′Rh″, 1 in about 10,000; Rh′, 1.2 percent; Rh″, 0.3 percent, and Rh–, 13.5 percent. There are striking differences in the distribution among different races; for example, in Negroes type Rh_o exceeds 40 percent; in Mongolian races Rh– is virtually absent, and so on.—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

STREPTOCOCCIC PNEUMONIA

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A study of pneumonia cases treated in the Navy Section of Wesley Memorial Hospital, Chicago, from September 1943 to May 1944, is reported because of the unusual disease types encountered and because of the criteria adopted as being necessary for discharge to duty.

There were 307 admissions for pneumonia and, with the exception of those cases complicated by pleurisy and intercurrent disease, the patients spent an average of 22 days on the sick list.

The total number of pneumonia cases was divided as follows: 1. Two lobar pneumonia cases due to pneumococcus, not typed. 2. Seventy-one cases of lobar pneumonia and 234 of bronchopneumonia. The latter group was apparently due to a virus infection on which was superimposed a beta-hemolytic streptococcus infection, and the division into lobar and bronchial types was on a clinical basis, x-ray examinations and physical findings determining the portion of lung fields involved. Virus infection was not proved in the laboratory, but the migratory character of lung involvement, the characteristic x-ray appearance, and a low granulocytic count during the first few days of disease followed later by an increase in the total white blood cell count with granulocytosis, all led to the assumption of virus disease.

Of the total number of streptococcic pneumonia cases, 40 were complicated by serofibrinous pleurisy; 17 of these were drained by means of rib resection.

Other common complications of streptococcic infection were present. There were two cases of pharyngitis, seven of otitis media, two of scarlatina, eight of rheumatic fever, one lung abscess, three cases of bronchiectasis, and one of pericarditis. The only death that occurred in this group was in a case of bronchiectasis. The patient lived for 5 months after transfer to a U. S. Veterans' Bureau facility.

Before March 1944 penicillin was not available in quantities sufficient to treat any except the most critical cases. After it became freely available it was used in the pleural cavity in 19 patients with serofibrinous pleurisy (beta-hemolytic streptococcus) without appreciable results.

Two outstanding instances in which patients having complications were treated with penicillin are cited as follows:

CASE REPORTS

Case 1.—A seaman, second class, 22 years of age, admitted with a diagnosis of bronchopneumonia, was unable to tolerate sulfonamide therapy because of its effect on his kidney function. On the eleventh day of his illness a pleuropericardial friction rub was noted, and on the following day 375 milliliters of light amber colored serous fluid was removed from the pericardium, which showed a pure growth of a beta-hemolytic streptococcus. Twenty-two hours later 80 milliliters of fluid was removed and 70,000 Oxford units of penicillin were injected into the pericardial sac. This was followed by intramuscular injections of penicillin for 1 week. Recovery was slow and uneventful and the patient was returned to duty after 5 months on the sick list, with no evidence of residual pericardial or cardiac disease.

Case 2.—An ensign was admitted to the sick list with a diagnosis of bronchopneumonia. On the tenth day after admission a left peripharyngitis was noted, and 3 days later the patient's rectal temperature rose to 108.2° Fahrenheit. The apparent cause of the complication was thrombi of the left internal and left external jugular veins. He was given 100,000 units of penicillin by slow intravenous drip.

Penicillin was continued for 1 week by intramuscular injection in the amount of 120,000 units during each 24 hours. Sixty-eight hours after thrombosis, an area of consolidation was noted in the upper portion of the lower lobe of the right lung. This was in turn complicated 10 days later by suppurative pleurisy which was drained by rib resection. A bronchopleural fistula resulted and closed after 6 weeks. This patient was estimated at 87-percent vital capacity at the time of his discharge, 160 days after admission. He is now on duty at sea.

It was found that rigid adherence to rules for discharge to duty was necessary and the following criteria were adopted:

1. Freedom from fever for a period of 1 week.
2. Normal white blood cell count.
3. Normal coagulation band (–1).
4. X-ray evidence of clear lung field and absence of the appearance of active pleural disease.
5. Vital capacity of over 70 percent of normal.

The coagulation band was adapted from the Weltmann test and is performed in the following manner: From a stock solution of 10-percent calcium chloride the following dilutions are made: (1) 0.02 percent; (2) 0.03 percent; (3) 0.035 percent; (4) 0.04 percent; (5) 0.05 percent; (6) 0.06 percent; (7) 0.07 percent; (8) 0.075 percent; and (9) 0.08 percent. Five milliliters of each dilution are added to each of nine Kahn test tubes, appropriately labeled, 0.5 cc. of unhemolyzed serum, to be tested, is added to each and the tubes are boiled in a hot water bath for 15 minutes. Immediately after boiling the flocculation is apparent and is

recorded as a coagulation band of the number corresponding to the tube in which flocculation is noted in the highest calcium chloride dilution.

A normal coagulation band is recorded as six or more, which indicates healing, while a coagulation band of five or less indicates an acute exudative process. The superiority of this test over the sedimentation rate has been well established.

The modification employed here appears advisable because of the finer gradations of change discernible near the "shift zone," and because of the extremely low percentage of upper- and lower-scale readings in the original Weltmann test.

Vital capacity readings were made by taking an average of four tests on the Jones basal metabolism machine as follows:

1. The motor-basal bellows are completely collapsed and the three-way valve is turned to the vertical position so that the valve is closed.
2. The tracing pen is inked and placed against the tracing sheet.
3. The clock is started to draw a short vertical line, marking the beginning of the vital capacity thrust.
4. The patient is instructed to fill the lungs completely with air, the three-way valve (pin horizontal) is opened, and the patient exhales as much air as possible.
5. The expansion of the bellows will drive the pen across the tracing sheet. The clock is then started to draw another vertical line to mark the end of the thrust. The distance between the two vertical lines measures the amount of expansion of the bellows, each ⅛ inch (in the Chicago area) of expansion representing 100 cc. of lung capacity.

The vital capacity readings on patients who had uncomplicated cases of pneumonia were above 88 percent at the time of discharge to duty, and in only three patients who had had rib resection did the vital capacity fail to reach 70 percent, which was regarded as the lower limit of normal. Two patients with markedly thickened pleurae remain at 37 percent and 39 percent of normal after 4 months on the sick list and will probably be recommended for survey from active duty. Another patient has improved by exercise; his vital capacity has risen from 50 percent to 64 percent of normal.

It is concluded that despite therapeutic results obtained by sulfonamide and penicillin therapy, pneumonia patients should be maintained on a sick list status, under careful observation, until the criteria listed here have been satisfied, in order to prevent recurrence of infection and to minimize the crippling effect of prolonged pleural disease.

OXYGEN CONCENTRATION IN OXYGEN TENTS

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This report is the result of a study made on oxygen concentrations in tents in use at the U. S. Naval Hospital, Philadelphia, Pennsylvania. Two hospital corpsmen were instructed in oxygen therapy technic and the use of the analyzer, then assigned the task of checking the oxygen concentrations in tents in use throughout the hospital. The two corpsmen were placed on opposite watches. Constant checkings were made from 0700 to 2100 daily, for a period of 3 weeks.

The purpose of the study was (1) to determine the oxygen regulation necessary to obtain a suitable percentage of oxygen for therapeutic use, and (2) to learn whether it is necessary to place a rubber sheet over the mattress.

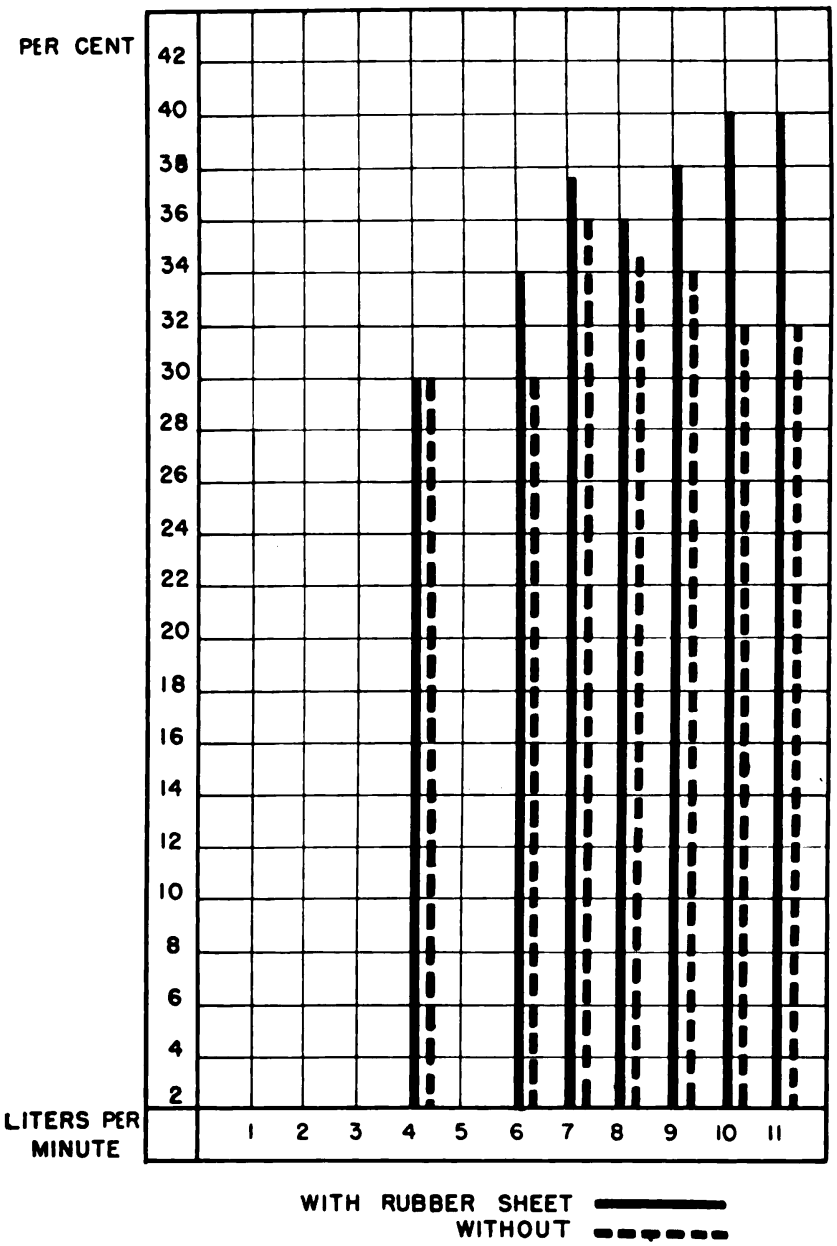
A total of 353 readings was made. This is not a large number considering the period covered; however in this interim there were fewer oxygen tents in use than is customary.

Analyses of oxygen concentration were made at the top of the tent, and also as low in the tent as possible. All things being equal, it would be expected that the lower sample would give a higher concentration of oxygen because oxygen is heavier than air. Frequently, however, the higher samples were of greater oxygen concentration. Improper tucking in of the tent or tears in the canopy were often found as causes of this discrepancy; however no corrected readings are available.

All ward personnel have been instructed to place rubber sheets over the mattress; however we found a number without them. The validity of the comparison was therefore questioned. It may be stated, nevertheless, that there was a consistent increase in oxygen concentration shown on those units having the rubber sheet. A study of the accompanying graph seems to indicate that at a flow of 4 liters per minute, it makes no difference if a rubber sheet is used or not, but as the oxygen flow is increased, the necessity for using a rubber sheet increases.

As a result of the study, the following suggestions are made:

1. That all nurses and hospital corpsmen be instructed in the manipulation of the oxygen analyzer, but that one corpsman, with a relief, be assigned to this detail. This corpsman shall likewise



Oxygen concentrations with and without rubber sheets.

be held responsible for the regular change of solutions and care of the equipment.

2. That all activities using oxygen tents be instructed to use rubber sheets over the entire mattress.

3. That "nightingales" be made from surveyed blankets for placing over the shoulders of patients to insure warmth and comfort.

4. That all gages be adjusted so that the oxygen flow per minute is not less than 10 liters, or that the ward medical officers prescribe the concentration of oxygen desired.

5. That oxygen concentrations be checked in both the upper and

TABLE 1.—*Oxygen concentrations obtained*

Oxygen flow per minute (liters)	Rubber sheet	No. of tests	Average concentration (percentage)
4	With	4	30
4	Without	2	30
6	With	60	34
6	Without	12	30
7	With	48	37
7	Without	11	36
8	With	160	36
8	Without	30	35
9	With	9	38
9	Without	5	34
10	With	5	40
10	Without	1	32
11	With	11	40
11	Without	3	32
12	With	1	38
12	Without	0	..

lower areas of the tent, and when the concentration of the lower sample is less than that of an upper area, a thorough examination be made of the apparatus for tears in the canopy, for improper tucking in, and for other leakages.

The accompanying tables summarize the findings.

TABLE 2.—*Results with old-type canopy*

Oxygen flow per minute (liters)	Rubber sheet	No. of tests	Average concentration (percentage)
6	With rubber sheet	1	40
7	do	3	41
8	do	2	40.5
11	do	1	46

For comparative purposes, the oxygen tent with the old-type heavy canopy was put into use several times. The table above shows these findings.

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ANTI-RH$_0$ HUMAN SERUMS

Anti-Rh$_0$ human serums are human serums (usually obtained from mothers of erythroblastic infants) which gave reactions paralleling the anti-rhesus serums; also known as standard anti-Rh serums.—WIENER, A. S.: The Rh blood factors. **J.A.M.A. 127: 294, February 3, 1945.**

TREATMENT OF MALARIA WITH ARSENICALS

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For many years various heavy metals, particularly the arsenicals, have been employed in the treatment of malaria. Revival of interest in this type of therapy is attributed to the necessity of finding substitutes for quinine. Because of its low toxicity, mapharsen is the most frequently used arsenical in antimalarial therapy and the number of servicemen treated by this means is large.

There are conflicting opinions regarding the efficacy of arsenicals as antimalarial drugs due to lack of uniformity in methods of treatment and comparison of results in noncomparable cases. As would be expected, there is a variation in response depending on the species of plasmodium involved, the duration of the disease, and the physical condition of the patient.

It is believed that arsenical preparations chiefly affect sporozoites and gametocytes, and are of value mostly in treating Plasmodium vivax infections. Opinions (*1*) (*2*) vary, but it is probable that the parasites are not completely eradicated from the blood stream by this therapy; hence in practice arsenicals are used in conjunction with quinine, atabrine, or some other antimalarial.

On the other hand some authorities believe that arsenicals are quite ineffective in malaria and should not be used at all because of the low therapeutic value and positive dangers. A less extreme point of view is held by Gibbs (*3*) who considers these drugs to be "minor curatives" but of value as antimalarials. One writer (*4*) states that between 25 percent and 50 percent of cases treated with arsenicals alone relapse. Tryparsamide (*5*), either alone or in combination with mapharsen, is said to be ineffective in removing parasites from the blood stream.

Goldman (*6*) on the contrary considers mapharsen immeasurably more effective than quinine for the treatment of malaria. He found that in over 90 percent of cases a single injection sufficed to terminate the malaria permanently. He recommends giving three or four injections to insure against recurrences. Cleveland and Turvey (*7*) agree with him essentially but suggest that an even larger number of injections will be necessary. Murphey (*8*) reports

good results from the use of sodium cacodylate intravenously, which is considered more effective than arsphenamine or stovarsol.

Late in 1942 the writer had an opportunity of treating 78 malarial survivors of a naval engagement. All were cases of the benign tertian variety, proved by blood smears, and therapy had been instituted at the onset of clinical symptoms. Some men received quinine alone, whereas others had a combination of quinine orally and mapharsen intravenously.

All these men had been exposed constantly and repeatedly to the bite of malaria-carrying mosquitoes while ashore after rescue from the water. They had no mosquito netting and no prophylactic medication for the 15 days they were ashore. Immediately after being evacuated, all were given suppressive therapy consisting of 0.2 gm. of atabrine on alternate days. The first case of malaria appeared 5 days later and new ones continued to develop during the following fortnight. Apparently the sole effect of the atabrine was to prolong the incubation period. It is interesting to note that the cases with the longest incubation period were generally milder in their course.

A routine method of treatment was adopted. It consisted essentially of bed rest and quinine sulfate orally, 0.65 gm. three times daily. It was intended that this final daily dose should be continued for at least 6 weeks. Of the three afebrile days preceding change to an ambulatory status, two were days on which a temperature rise should have occurred in an untreated case. A drug reaction consisting of a maculopapular rash developed in 2 patients but disappeared when quinine hydrochloride was substituted for quinine sulfate.

In a group of ten patients who had been tried on quinine with unfavorable results, mapharsen was given in addition to the quinine which the other men received. The mapharsen (0.04 gm.) was administered intravenously in a single dose to these men, all of whom had continued to have high temperatures after at least 3 or 4 days of quinine therapy. In all but one the temperature fell to normal within a few hours after the mapharsen injection and did not subsequently rise above 99° F. The exceptional patient showed mild cerebral complications and responded more slowly. It may be added that morphine sulfate was found to be a useful adjunct in many instances, as it made the patients much more comfortable during the paroxysms.

Seeing the excellent results obtained in these ten cases, it was decided to try the effects of mapharsen on three unselected patients. In all of them the mapharsen was given during the initial chill. This was done on the theory that more parasites at that

time would be outside the red cells and hence more susceptible to the effects of mapharsen. In none of these three patients did fever appear subsequently, so that it became possible to put them on ambulatory treatment after only 4 days in the sickbay. The average hospital period of the ten quinine-resistant cases after mapharsen therapy was 3½ days. For all other cases it was 6½ days.

It is suggested by the results obtained in this small group of patients that a combination of mapharsen and quinine sulfate makes a more efficacious treatment than quinine alone. Judging from the experience of others, it would be inadvisable to try substituting mapharsen for quinine. While it might work successfully in benign tertian malaria, other types are not cured by mapharsen alone. Estivo-autumnal malaria apparently requires quinine in addition to mapharsen. Because it may be confused with benign tertian malaria, one should use quinine and mapharsen in all cases of malaria, regardless of type.

Atabrine is at present widely used, both as a substitute for quinine and in conjunction with it. Mapharsen might well be used in the same manner with atabrine as with quinine. Most persons tolerate atabrine well, although toxic reactions occur with low frequency. Giving the drug with meals does not entirely eliminate the appearance of vomiting and diarrhea, so that it cannot be used on all persons.

Mapharsen, and to a lesser extent neoarsphenamine, can be used in malaria to good advantage. Mapharsen will abort the symptoms in practically every case. Its chief value is that it immediately cuts short the chills before the patient has become debilitated by the fever. Thus convalescence is shortened and the chance of recovery in critical cases is enhanced. Usually one sees no paroxysms after the arsenical injection, although an attack may occur on the same or following day before the fever ceases. Reactions to mapharsen are very rare. It is probably advisable to use at least four injections of 0.04 gm. at weekly intervals following the initial treatment.

A final word should be added concerning the application of this quinine-mapharsen therapy to aviators. In some cases when quinine alone is used, it may be permissible to allow flying in control of aircraft after the patient becomes asymptomatic. However when mapharsen is being given, aviators probably should be grounded, just as they are during antisyphilitic treatment.

SUMMARY

Mapharsen is seen to be of considerable value in the treatment of malaria. Its chief advantages are the following:

1. It stops the chills before the patient is weakened by the fever and the plasmodial toxins.

2. Patients recover their strength more quickly and return to work sooner than when quinine alone is given.

3. Mapharsen is effective even when quinine fails in some cases, particularly if quinine-fast organisms are present, or the quinine is for some reason not properly assimilated.

4. By this method of therapy the saving of quinine representing 2 days' dosage (4 gm.) for the average case of malaria is effected, resulting in a valuable conservation measure.

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PENICILLIN-LIKE SUBSTANCES FROM DERMATOPHYTES

Several members of the group of fungi occurring in clinical lesions of dermatophytosis were found to elaborate a factor antagonistic to certain other microorganisms.

This factor appeared to be similar to penicillin in the following respects: (a) Enhanced production on media containing corn-steep liquor, (b) spectrum of activity and behavior toward penicillin-resistant organisms, (c) sensitivity to pH and temperature, and (d) destruction by clarase.

The organisms were various strains of Tricophyton mentagraphytes obtained from lesions of the beard, upper lip, etc. of man, T. violaceum, T. tonsurans from the human scalp and Epidermophyton floccosum from the human foot.—PECK, S. M., and HEWITT, W. L.: The production of an antibiotic substance similar to penicillin by pathogenic fungi (dermatophytes). Pub. Health Rep. 60: 148-153, February 9, 1945.

PEPTIC ULCER IN NAVAL PERSONNEL

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Judging from autopsy findings peptic ulceration is fairly common, occurring with few or no symptoms and healing without recurrence, despite which there is a widespread belief among the medical profession that the disease is incurable.

The development of gastric and duodenal ulcer depends principally upon excessive action of the pepsin and hydrochloric acid in the gastric secretion. Most gastric ulcers are situated in that part of the stomach which has the greatest exposure to acid, i. e., the pylorus or the lesser curvature near the incisura angularis, rarely on the upper portion of the greater curvature, and very rarely in the dome of the fundus. Sometimes they occur in the cardia or in the lower end of the esophagus into which the acid juice may regurgitate. Duodenal ulcers are practically limited to the first few centimeters of the cap, on the anterior or posterior wall, where the acid chyme impinges before being neutralized by the alkaline intestinal contents.

Postoperative stoma ulcers indicate a poorly functioning gastroenterostomy, again due to excessive exposure of nonacid-secreting mucosa to the digestive juice. These ulcers also occur in the jejunal mucosa in close relation to the anastomosis, as the duodenal ulcer occurs near the pyloric ring. Ulcers of the ileum have been described in close relation to the acid-secreting mucosa of Meckel's diverticula. Such ulcers can be produced experimentally by transplanting portions of gastric wall into the ileum. Attention is called to the fact that the ulcer does not occur in that portion of the mucosa which secretes the acid but in neighboring parts which normally secrete an alkaline fluid. Matthews and Dragstedt (*1*), Mann and Williamson (*2*), and others have demonstrated this.

Hyperacidity is present after a test meal in a large proportion of cases of duodenal ulcer. True achlorhydria is very rarely seen in benign ulcer. Gastric analysis typically shows both a greater volume and a higher acidity by titration than is normal. However hyperacidity as determined by titration does not mean that the gastric juice is excessively acid. The normal maximum of from 0.5 to 0.6 percent hydrochloric acid is not known to be exceeded. The high acidity of the gastric contents is due either to the secre-

tion of abnormally large quantities of juice, or to a failure of the secretory rate to become reduced during the second hour, or to the delayed emptying of the stomach.

If it is accepted that acid gastric secretion is fundamental in the production of peptic ulcer, the cause of the disease must lie in abnormalities of gastric juice production and elimination from the stomach. The psychic stimulation of gastric secretions was demonstrated by Pavlov through sham feeding. He was also able to produce conditioned reflexes in his dogs so that lights, gongs, and other external stimuli started the gastric glands to secreting juice rich in pepsin and hydrochloric acid. Carlson (*3*) has shown by extensive observations upon a man with a fistulous opening into the stomach, definite conditioned reflexes for gastric secretion. It has also been shown that these psychic conditioned reflexes operate even with patients under hypnosis and do not depend upon consciousness.

Sippy showed by repeated aspirations performed upon patients with ulcer, particularly night aspirations, that continued secretion was the rule, rather than the normal intermittent secretion following ingestion of food. The effect of anxiety and strain is further evidenced by the abnormally high incidence of the disease in military personnel in both the British and American services during the last war and now in this war. The futility of returning these men to duty is also readily understood.

Mechanical stimulation of the gastric mucosa produces little or no secretory response. Meat ash, pure protein such as egg white, and carbohydrate do not excite the gastric glands. On the other hand, meat broths, meat juices and commercial extracts elicit copious secretion. Also the products of protein digestion, proteoses and peptones, are equally powerful.

Agreeably-flavored and attractive-appearing foods probably are effective through psychic mechanism. Fats definitely inhibit gastric secretion, apparently as the result of the stimulating action of soaps formed in the intestine. This inhibitory action appears to be effected by hormonal action. Whether a hormonal mechanism has a positive effect is still debatable and its importance has not been established. Among the drugs, histamine, alcohol, insulin, acetylcholin, mecholyl, pilocarpine, and nicotine are secretory stimulants, whereas atropine is a depressant.

The exact mechanism whereby pain is produced is not completely understood. Pain fibers of the normal gastro-intestinal tract are not sensitive to chemical or ordinary types of mechanical stimuli. However the fact that Palmer (*4*) could produce at will typical pain in ulcer patients by the introduction of approximately 300 cubic centimeters of 0.5-percent hydrochloric acid into the

empty stomach is indisputable evidence that acid is an important factor. Aspiration or neutralization of this solution promptly relieved the pain. Disturbances of the motor mechanism, pylorospasm, achalasia, increased gastric tone, or contractions or spasm of the duodenal cap have likewise been suggested, but the typical pain is not rhythmic. Pain has been present when the stomach is free from peristalsis and when barium can be easily pressed through the pylorus.

Clinically in addition to the so-called chemical type of distress of Palmer, there are other types of pain which can be distinguished often by careful history taking. A perigastritis or localized peritonitis may be present with deeply penetrating types of ulcer. Incidentally with this complication there may be a moderate or definite leukocytosis. The distress as described by the patient may be quite bizarre because of an associated spastic colon. This is a very frequent complication, particularly in patients who have been following their own self-prescribed medication and diets. Persistent questioning, especially of an intelligent patient, will often serve to differentiate these several different kinds of pain.

Obstruction of the pylorus may be of two types or mixed: (1) Due to inflammatory swelling when the lesion is in the region of the pyloric outlet, or (2) due to cicatricial contraction. The former occurs early in the acute episode and is characterized by the vomiting of the meal just eaten. The latter may occur weeks or months after the acute episode, and the vomitus characteristically contains food eaten several meals preceding the act of vomiting. There is also likely to be little if any distress or evidence of malnutrition. The mixed type of obstruction might be suspected in long standing recurrent cases, particularly of duodenal ulcers. Long standing obstruction with disturbed nutrition is a positive indication for surgical treatment. Early obstruction should always be treated medically until it is evident that nutrition cannot be maintained; this may be a matter of several months.

Frequent feedings tend to reduce the gastric acidity. Milk and cream not only bind acid, but because of the fat content also inhibit gastric secretion, stimulate expulsion of bile from the gallbladder, and stimulate pancreatic secretion which tends to reduce the acidity of the duodenal contents. The high caloric value of this mixture at the same time aids in maintaining body weight. Highly seasoned foods, extractives of meat, and alcohol are eliminated because of their secretagogue nature.

Alkali or buffer substance is administered at frequent intervals to neutralize the acid, and belladonna or atropine is given to reduce secretion. These measures suffice to permit healing of un-

complicated ulcer in from 3 to 4 weeks. They do not *cure* the patient of his ulcer. The cure lies in breaking the conditioned reflexes causing the disturbances in gastric secretion and gastric emptying which promoted the ulcer and interfered with its spontaneous healing.

The final healing of peptic ulcer as well as of functional dyspepsia depends not only upon immediate relief from mental and physical fatigue, but also upon correction of the patient's habits of worrying, excessive drinking and smoking, and irregular eating. Treatment consists of a program of re-education. The patient must be given insight into his anxiety state. It is time-consuming from the standpoint of the physician and often will tax his patience and understanding to the utmost. Rarely can the problem be approached abruptly with the patient; it requires tact, sympathy, and suggestion. In this lies the success of some and the failure of others. This is why Sippy insisted on treatment for at least a year, preferably for 18 months. The program properly carried out in large clinics has been successful in 65 percent of the patients. It explains the discouraging results of treatment in military services when the patient is returned to duty after a few weeks' treatment with all the situations responsible for his worries and anxieties still present.

The treatment used in this hospital is the original Sippy program. Healing of the acute or recurrent ulcer is the goal. There is neither the opportunity nor time properly to tackle the psychic factors or institute a prolonged therapeutic program.

As soon as the diagnosis has been established the patient is put to bed. All patients with positive or suggestive x-ray findings of ulcer, regardless of how atypical their distress may be, are treated, as well as all patients whose x-ray findings are negative but whose histories and laboratory findings suggest alterations in the gastric secretory mechanism.

Persistent, postprandial, localized, epigastric burning without x-ray evidence of ulcer should be as rigorously treated as if ulcer were present. Three ounces of half milk and half cream are alternated every half-hour from 0700 to 1900, with enough calcium carbonate, usually 15 grains, to control gastric acidity. From 1900 to 2100 calcium carbonate is given every half-hour and no food or milk and cream is allowed after 1900. Heavy magnesium oxide in the same dose is substituted often enough for the calcium carbonate during the day to insure one or two soft bowel movements daily. No sodium bicarbonate is used and the magnesium oxide is kept separate from the calcium carbonate because the requirements are variable and must be individualized. Calcium carbonate is preferred to aluminum hydroxide.

Every third day a soft feeding is added, so that at the end of the fifteenth day five extra feedings are being given, one every 2 hours, the last at 1600. These feedings consist of cooked cereals, soft cooked eggs, custards, cream soups, and ice cream. Small portions of toast and butter are allowed with each serving. Salt is not prohibited. As the number of feedings increases, a minimum of four eggs a day is planned. This provides a minimum of 1,800 calories and 40 gm. of protein on the first day, which is increased to approximately 2,400 calories and 70 gm. of protein on the fifteenth day. When there is night distress suggesting continued secretion, obstruction, or both, the stomach is aspirated nightly at 2100 until less than 50 cc. is obtained. Feeding for relief of pain should never be permitted. Smoking is prohibited.

After the eighteenth day the patient is permitted to be ambulatory if no complications are present. The program of milk-cream mixture and powders remains unchanged, but three small meals, breakfast, lunch, and supper, are allowed in place of the additional soft feedings. After 4 weeks of this ambulatory management, the patient gets an additional week with bland diet and powders every half hour postprandially for 5 doses before final disposition is made.

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RH GENES

Rh genes are the series of allelic genes which determine the various sorts of Rh agglutinogens and Rh blood types. The most common (the standard) genes are six in number: rh, Rh′, Rh″, Rh_0, Rh_1 and Rh_2. When discussing only the results of tests with the standard anti-Rh_0 serums, dividing persons into two types, Rh positive and Rh negative, only a pair of genes need be considered, Rh and rh. Obviously, Rh-positive persons may be either homozygous (genotype RhRh) or heterozygous (Rhrh), while Rh-negative persons are always homozygous (rhrh).—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

INTRAVENOUS SALICYLATES IN RHEUMATIC FEVER

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During the past year at this hospital intravenous salicylate therapy as recommended by Coburn[1] has been used in the treatment of rheumatic fever patients.

Our reasons for trying this method of treatment were:

1. A known dosage of salicylates can be administered to the patients by a method which does away with the possibility of some of the medication not being absorbed and of some of the medication being lost by emesis.
2. The oral administration of sodium salicylate in adequate dosage is unsatisfactory because of the side reactions.
3. Rectal administration of sodium salicylate is unsatisfactory because the cooperation of the patient cannot be obtained in numerous instances and medication is expelled.
4. The oral and rectal administration of sodium salicylate does not satisfactorily reduce the acute symptoms in a short period of time.
5. The intravenous administration of sodium salicylate promises a method which will give rapid reduction of the acute symptoms and possibly the curtailment of cardiac complications.

Since instituting this method of treatment sodium salicylate has been administered intravenously to 30 patients suffering with rheumatic fever. Inasmuch as acute rheumatic fever does not have a high incidence in this locality, it may be assumed that all but 4 cases were exacerbations of previously existing rheumatic fever. The 26 old cases gave histories of previous similar attacks ranging from a few months to many years. Twelve of these patients had mitral insufficiency at the time of their admission, probably due to one of their previous attacks of rheumatic fever. Of the 4 patients who had primary attacks of rheumatic fever none developed mitral murmurs during their hospitalization.

The cases reported in this series were followed routinely by accurate temperature readings, repeated sedimentation rates, chest x-rays, heart measurements, and electrocardiographs. Only the cases which could be definitely diagnosed as having rheumatic

[1] COBURN, A. F.: Salicylate therapy in rheumatic fever; rational technic. Bull. Johns Hopkins Hosp. 73: 435-464, December 1943.

fever are included in this series. Intravenous therapy was instituted on an average of 33 hours after admission to the hospital. There was an average of 13 daily doses of 1-percent or 1½-percent sodium salicylate per patient; the temperature returned to normal in an average of 4½ days; the joint symptoms were absent after from the second to the eighth day, the mean average being 4½ days. None of the patients showed any reaction to the drug other than minor complaints of tinnitus. When the sedimentation rate dropped, 33-percent salicylates were administered by mouth.

In reviewing the "Statistics of Diseases and Injuries in the United States Navy for the Year 1941," which are the latest available figures, we find that there were 7,266 individuals invalided from the service in that year. Of this number 233 were diagnosed as having rheumatic fever. There were in addition 112 individuals diagnosed as having mitral insufficiency, of which we may assume a goodly portion were on a rheumatic-fever basis. According to these records, 3.21 percent of the discharges were due to rheumatic fever. If the cases of mitral insufficiency are included, that figure will be raised to 4.75 percent of the discharges. In comparison it is interesting to note that poliomyelitis, a disease which is considered as being a menace to the health of our youth, was the cause of only 5 discharges, 0.068 percent, that year.

A disease with such a high comparative incidence as rheumatic fever, should be treated with the best means available so that the patient will have the shortest convalescence and the fewest complications possible. It is believed that the use of intravenous salicylate in adequate amounts as described by Coburn represents a decided advance in the treatment of acute rheumatic fever. As this series of cases is too small to allow adequate conclusions it is suggested that this method be followed in a large series of cases so that comparative results of the two methods of treatment can be obtained.

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ANTI-RHESUS SERUMS

Anti-rhesus serums are immune serums prepared in rabbits, guinea pigs, goats and other animals by injecting them with the blood of rhesus monkeys. The term applies to serums like the original experimental serums of Landsteiner and Wiener, which agglutinate the bloods of 85 percent of all white persons. WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

PROSTATITIS AND SEMINAL VESICULITIS AS COMMON CAUSES OF BACKACHE

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A frequent and elusive complaint in the Navy is that of backache. Usually the x-ray is not informative, and treatment by heat, analgesics or taping the back affords no relief. The purpose of this paper is to offer an approach to backache which in experience here has relieved a high percentage of cases.

Hinman states that 35 percent of all males have infected prostates. Culver (*1*), Kretschmer (*2*), Lowsley (*3*), Nicholson (*4*), Henline (*5*), and many others have stressed the various types of back pain caused by the chronically infected prostate. It is not intended to imply that all backaches are caused by this condition. It is, however, contended that no study of backache is complete until possible foci of infection in the prostate, seminal vesicles, and urethra have been eliminated. One of us (W.H.M.) has had opportunity to check the close relationship of backache and prostatitis while on dispensary duty and later in connection with a busy urologic service. The number of cases of backache relieved following treatment of coexistent prostatic infection was great. Attention was further directed to this condition while aboard ship. For a period of 5 months a backache clinic was held twice weekly. Each case was studied from every possible angle. This study is obviously incomplete because of the short time available for assembling complete statistical data.

With a ship's complement of 350, 28 patients (8 percent) reported to the sickbay complaining of backache. Of this number, 22 (78.9 percent) were found to have chronic prostatitis and vesiculitis. Seven of these were between 20 and 25 years of age, 9 between 25 and 30, and 6 over 30 years old. Following specific treatment, 20 of the 22 patients with prostatitis (90 percent) were completely or partially relieved of their backache and associated symptoms. There was 1 complete cure, 15 showed great improvement, 4 were slightly improved and in 2 instances there was no alleviation of symptoms.

Causes of prostatitis.—In this small group of patients 5 (18.6 percent) had a history of previous gonorrhea. Gonorrheal ureth-

ritis usually is not the causative factor in prostatitis. Various authors report an incidence of previous gonococcal infection in from 10 to 58 percent of cases. Nonspecific urethritis may be caused by such factors as leukorrhea in the female, trauma from urethral instrumentation, and distant foci of infection in teeth, tonsils, and from respiratory infections, furuncles, and intestinal tract disturbances such as constipation. Henline and others believe that organisms may enter the kidneys from the blood stream, and thence into the prostatic ducts. Irregular sex hygiene, overindulgence, prolonged sexual acts, physical and mental masturbation, and excessive indulgence in alcoholic beverages, all produce congestion of the prostate, thus predisposing to infection.

The normal adult prostate is composed of 5 lobes, each of which empties into the posterior urethra by some 60 ducts. Inflammation may be simple, involving the prostatic ducts and acini. In advanced cases sclerosis with adhesions and fixation of the gland may occur. Vesiculitis without involvement of the prostate is rare. The nerve supply to the prostate and seminal vesicles is chiefly by the sympathetic nerve fibers derived from the hypogastric plexus. These nerves may arise from the tenth dorsal to the third sacral segments. This explains the frequent occurrence of pain in the back, groin, loin, perineum, suprapubic region and thighs.

Symptoms of prostatitis and seminal vesiculitis.—Pain is most commonly located at one or both sacroiliac synchondroses. It is more often a dull ache, soreness or stiffness. Usually there is no tenderness on pressure. The pain may be referred to the lower or higher lumbar regions of the back.

Associated with the backache there may be dysuria, frequency, nocturia and urethral discharge. Sexual complaints are not so common in younger men; however frequent nocturnal emissions, premature ejaculations and loss of sexual power may be noted. Psychoneurotic disturbances are not infrequent. The combination of backache, sexual disturbances, loss of strength, nervousness and an anxiety regarding these symptoms may lead to a definite neurosis, particularly when no specific treatment has afforded relief. Other associated symptoms may be found, such as neuritis, myositis, iritis and rheumatic complaints. The distribution of symptoms and associated lesions in the present series of cases is shown by the tabulation on page 1004.

Diagnosis.—The presence of backache alone or in combination with any of these symptoms should direct attention to the prostate and seminal vesicles as possible causes. Diagnosis is made by: 1. Digital examination of the gland. This will detect gross

Symptoms in 22 patients with prostatitis.

Backache	22
Sacroiliac	11
Lumbar	8
Thoracic	3
Perineal pain	12
Groin pain	3
Thigh pain	5
Frequency	6
Nocturia	6
Dysuria	10
Decrease in power of stream	3
Frequent nocturnal emissions	1
Urethral discharge	5
Increased fatigability	5
Neurotic symptoms	3
Associated pain (fibrositis, etc.)	6
Associated lesions:	
Congenial lumbosacral anomaly	1
Hypospadia	2
Epididymitis	1
Pyelitis	1
Small meatus requiring meatotomy	13

changes, but apparently normal findings do not exclude the possibility of prostatitis. 2. Repeated analyses of the first and last 30 cubic centimeters of voided urine. 3. Microscopic findings in the prostatic secretion and ejaculation. This examination of the prostatic secretion eliminates the diagnosis of prostatitis only when repeated specimens are found normal. Very often no secretion is found at the meatus after prostatic massage. This may be due to excessive straining and forcing the secretion into the bladder. In such cases examination of the first part of the urine passed after massage will give accurate information. The presence of over 5 white blood cells or excessive debris in the high-power field is indicative of prostatitis.

4. The importance of endoscopic inspection of the posterior urethra has been stressed previously (*6*). Edema, granulations and polyps are frequently found in the posterior urethra in the presence of a normal gland and secretion. These pathologic changes may be responsible for the symptoms of backache, paresthesia, and mild urinary and sexual disorders. This is particularly true when the prostatic ducts are occluded by inflammation, and massage has not been preceded by diagnostic urethral dilatation.

Treatment.—Foci of infection must be removed and constipation corrected. A diseased epididymis should be removed, to eliminate a focus of infection and to prevent bilateral involvement.

Following diagnosis, urethral dilatation is begun, either alone or in combination with massage. In the presence of occluded prostatic ducts and the concomitant posterior urethritis, massage is of little value. A gradual and gentle dilatation of the posterior urethra to its maximal capacity by means of curved sounds is necessary. Dilatation is rarely complete until a No. 30 or No. 32 sound can be passed with ease. A small external urinary meatus precludes complete urethral dilatation, and in such cases a preliminary meatotomy should be performed.

Massage may be performed when the patient's bladder is full, checking the first ounce of urine before massage to detect beginning complications. The patient should void immediately following massage. Urethral dilatation is best performed by having the patient void and then instilling 200 cc. of a mild antiseptic solution, such as boric acid, through a soft rubber catheter. In either case the voided urine or voided antiseptic solution should be passed into a specimen bottle and carefully examined for debris or comma-shaped plugs, with or without visible blood on their ends. The latter represent plugs removed from the orifices of the prostatic ducts.

Massage should be done with a rolling motion of the finger with firm pressure toward the median sulcus of the prostate, as the ducts enter the urethra in nearly a perpendicular manner. The finger should be hooked over the supramontane and lateral borders of the gland, and all marginal adhesions freed. This is followed by a downward stroke on the urethra to empty the ejacutory ducts and sinus pocularis. Each vesicle is massaged and emptied in a similar manner.

Sulfonamide therapy was not used routinely. It was employed following urethral dilatation when complications were anticipated. It frequently has a salutary effect in reducing the infection after prostatic drainage has been secured.

Local heat, sitz baths and diathermy were employed more for the comfort of the patient than for definite therapeutic effect. Various rectal electrodes are not considered necessary for cure, and intraprostatic injection of antiseptics is considered unwise despite favorable reports by a few investigators.

The subjective complaints of backache and other concomitant symptoms are usually relieved early in the course of treatment, but cure is usually slow. Endoscopy is advisable during and at the end of the course of treatments. Fifty-percent phenol and glycerin is applied to the posterior urethra and followed by irrigation through the endoscope to remove residual infection and correct persistent pain unrelieved by dilatation or massage.

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RH AGGLUTININS

Rh agglutinins are the animal anti-rhesus agglutinins and are all of the same specificity (85 percent positive on white persons). The anti-Rh agglutinins of human serums have three different specificities corresponding to the three Rh factors, namely anti-Rh$_0$ (85 percent positive on white persons), anti-Rh′ (70 percent positive) and anti-Rh″ (30 percent positive).—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

 

NITROGEN IN BURNS

It has been calculated that if half the body of a man weighing 70 kg. and measuring 170 cm. in height was involved in a burn, there would be a loss of 3.8 gm. (the equivalent of 4,000 ml. of plasma or of 114 gm. of meat) to 19.9 gm. (equivalent of 2,000 ml. of plasma and 600 gm. of meat). Such figures can explain the striking weight loss which occurs in association with severe burns.

By giving a casein digest (amigen) orally, it was found possible to maintain patients in good condition with a minimum of transfusions in the severer case and none in the others. The casein digest was better tolerated and utilized than natural protein food and it appeared to be effective when meat feeding or plasma transfusion in the amounts required would have been almost an impossible task physically and economically. To feed their most severely burned patient sufficient nitrogen in the form of meat would have required a daily ingestion of about 2 kg., while to give the required amount of protein in the form of plasma transfusions would have required 23 units of plasma daily.—Nitrogen balance in burns. Nutrition Rev. 3: 2-3, January 1945.

URINARY FREQUENCY AMONG PERSONNEL AT SEA

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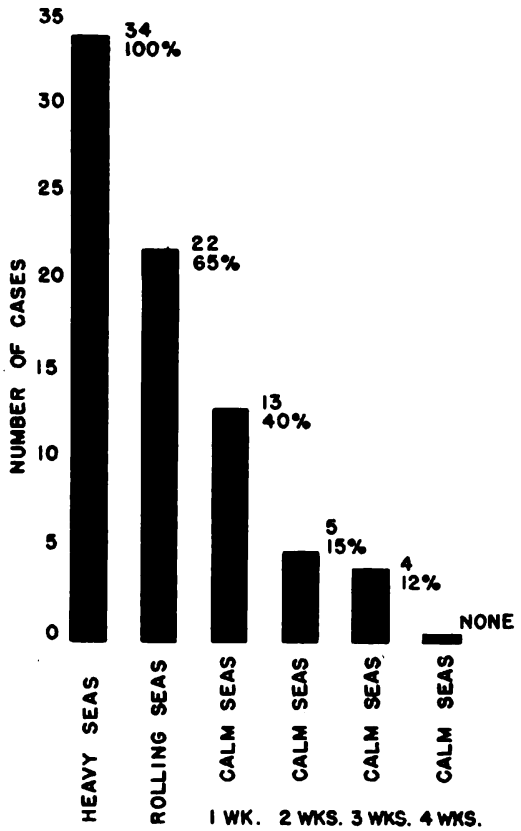
Over a period of 6 months a study of urinary frequency among the personnel aboard a destroyer was made. This study was initiated by the numerous complaints at sick call of inability to stand a 4-hour watch, and of disturbance of sleep because of urinary frequency. These difficulties created a real problem from the viewpoint of watch duty.

Out of two hundred seventy men, 34 (12.5 percent) complained of urinary frequency both diurnally and nocturnally while the ship was cruising in heavy seas. Nocturia was present in all and averaged 2 times, with a low of 1 and a high of five. Diuria averaged 8.4 times, with a low of 4 and a high of 15. All complained of severe urgency. Twenty-eight out of the 34 (82 percent) complained of actual pelvic pain, and 16 (47 percent) complained of incontinence upon attempting to refrain from urination throughout a watch period of 4 hours. There was no case of polydipsia and no correlation with seasickness.

The average duration of continuous sea duty before onset of symptoms was 7 months, with a low of 1 month and a high of 36 months. The duration of symptoms averaged 11 months, with a low of 1 month and a high of 8 years. Six out of the 34 patients complained of weight loss, with no discernible cause. The average loss was 15 pounds, with a low of 5 and a high of 25 pounds in less than a year. This was observed only among the more severe cases. Coffee drinking had little appreciable effect on the symptomatology.

The polyuria had a direct correlation with sea and weather. Every patient offered the observation that his frequency was most noticeable while the ship was in heavy seas. Twenty-two out of the 34 had considerable trouble in moderate seas. Thirteen out of the 34 continued to complain even after being in port, or after being in calm waters; 5 after 2 weeks, and 4 after 3 weeks of calm weather.

Further investigation was carried out while underway in heavy seas over a 2-month period. Three patients whose symptoms were most severe were studied. Each man was placed on a well-



Incidence of cases in relation to condition of the sea.

controlled low-salt, then in turn on a high-salt diet. There was no apparent effect on the symptomatology or urinary output. Intake was set at 2,100 cc. per day. The diet was caffeine-free and included a normal salt intake. The daily urinary output was found to equal and occasionally surpass the 2,100 cc. intake. This was observed over a 3-week period, and was correlated with the fact that all three men were losing weight (one having lost 20 pounds in the previous 6 months), and that all of the 34 patients had observed that they passed an unusually large amount of urine with each urination.

An attempt was then made to influence the symptoms by varying the amount of fluid intake, because with the use of distilled drinking water the possibility of mild dehydration as an underlying cause could not be ruled out. Increasing the intake, however, only served to aggravate the condition.

Urinary frequency among personnel at sea is apparently directly correlated with the motion of the ship. Discussions with medical officers of battleships and cruisers revealed the entity to be practically not recognized or at least not serious enough to cause the men to appear at sick call. This was also found to be the case aboard some destroyers operating in calm seas. However the con-

dition was found to be prevalent among most of the ships of this class and smaller, such as destroyer escorts and corvettes, operating under similar sea conditions.

The majority of these cases were not of serious significance. Some of them, however, involved impairment of the general health of the subject, and depreciated his value to the ship. It is recommended that under such conditions the men with relatively severe complaints should be transferred to a larger vessel, such as a cruiser or battleship.

SUMMARY

1. Urinary frequency among personnel at sea is found to exist as a distinct entity.

2. As such it has existed among 12.5 percent of the crew of this destroyer under certain conditions which are described.

3. The entity is characterized by nocturia (averaging 2 times), diuria (averaging 8.4 times), urgency, pain, incontinence, irritability, weakness, and loss of weight.

4. The condition is directly correlated with the motion of the ship in heavy and moderate seas and disappears completely after being in port or in very calm water for several weeks.

5. It is recommended that the patient with serious frequency and polyuria be transferred to shore duty or to a larger ship.

GELATIN AS A PLASMA SUBSTITUTE

Following the infusion of intravenous gelatin the erythrocytes exhibit pseudoagglutination, characterized by the formation of long and short, compact rouleaux. Even when these rouleaux are in close association their appearance is not that of clumping. The phenomenon of pseudoagglutination in no way interferes with the grouping of blood in patients who had had previous infusions of gelatin. In cross-matching the blood of patients who have received an infusion of gelatin, pseudoagglutination of varying degrees occurs in the normal donors' cells when mixed with such patients' sera. No such phenomenon is observed in suspensions of patients' cells in donors' sera.

Pseudoagglutination of erythrocytes, however, is less marked when a 5-percent glucose solution in water is added to the erythrocyte-serum suspension, and is abolished by the addition of a solution of 1-percent glycine saline to the erythrocyte-serum suspension and in no way interferes with the grouping or cross-matching of blood.—KOOP, C. E.: Gelatin as plasma substitute; effect of gelatin infusion on subsequent typing and cross-matching of blood, with method of eliminating phenomenon of pseudoagglutination. Am. J. M. Sc. 209: 28-33, January 1945.

UNUSUAL FEATURE OF RESPIRATORY INFECTIONS IN A SOUTH PACIFIC AREA

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At this Naval medical facility in the South Pacific area the number of patients admitted for complaints referable to the respiratory tract has represented an important fraction of the total number of admissions for all causes. If we exclude the surgical, EENT, dermatologic and psychiatric patients, the monthly admissions of patients with respiratory tract symptoms in the months of April, May and June of 1944 constituted from 16 to 32 percent of the "medical" admissions. The high figure (32 percent) for June is attributed to the fact that the incidence of malaria decreased sharply at that time.

In general, as might be expected in a tropical area, systemic manifestations of acute infection in these cases were not considerable. Even in the frankly pneumonic case the patient's temperature has usually not been high; rarely have temperature elevations been sustained for more than a few days, and in the past 4 months there has not been a death. Such complications as otitis media, cervical adenitis, and pleural effusions have not been seen among these patients admitted with respiratory tract diagnoses.

A high incidence of asthma and asthma-like manifestations were noted. By the term "asthma-like" is meant the presence of loud rhonchi over considerable areas of the chest wall, with cough, and with or without subjective difficulty in breathing. In at least 50 percent of the cases of catarrhal fever, acute bronchitis and bronchopneumonia seen here there have been such changes. There has also been a considerable incidence of frank bronchial asthma among the patients seen here, comparatively few of whom have given a history of asthma or other allergy; none of the patients considered as having asthma-like manifestations have given a history suggesting previous respiratory tract allergy.

In the frank asthma cases the usual manifestations as seen in such cases in the United States were noted. Abrupt onset of wheezing, cough, loud rhonchi in the chest, numerous eosinophilic cells

in the sputum, and eosinophilia, have been the rule. Marked pulmonary emphysema, however, has not been observed. The only notable feature was that few of these patients gave positive histories of previous episodes of allergy.

Of the cases diagnosed as catarrhal fever, acute bronchitis, and bronchopneumonia (at least 50 percent with asthma-like symptoms and all with mild systemic manifestations) many required hospitalization up to 3 and 4 weeks. There were usually, in addition to the cough and rhonchi, a small amount of mucoid sputum, never profuse, numerous sputum eosinophils, and an eosinophilia as high as 8 and 10 percent, without any increase in the total leukocyte count.

In the patients with asthma-like symptoms (even in the absence of clinical evidence of pneumonia) x-ray examination of the chest almost invariably disclosed accentuated peribronchial markings, often with small scattered areas in the lung fields suggesting the presence of pneumonitis or atelectasis.

Sulfonamide drugs did not affect the clinical course of these patients, nor did the usual cough medications prove effective. Adequate doses of ephedrine sulfate and potassium iodide were equally futile.

Under the title of "tropical eosinophilia" Weingarten[1] in 1943 described a group of cases of unknown etiology from Southern India. A case of tropical eosinophilia was reported by Emerson early in 1944.[2] In some respect these cases resembled those seen here but differed in that they had a marked leukocytosis and striking eosinophilia (from 50 to 80 percent of the total white blood cells). Weingarten found neoarsphenamine remarkably efficacious in his patients but its use was abandoned in this series.

All the patients with asthma-like manifestations were discharged to duty after from 2 to 4 weeks of hospitalization; they were symptom free and there were no positive physical findings. Likewise all the patients who had frank asthma with negative histories were returned to duty, similarly free from symptoms and positive findings. The several patients with frank asthma who have been evacuated all had positive histories of asthma, with or without slight pulmonary emphysema.

One important consideration in both the asthma and asthma-like patients who were returned to duty is the matter of recurrence and eventual chronicity. The limited period of observation has afforded no information on this important matter. In a period of

[1] WEINGARTEN, R. J.: Tropical eosinophilia. Lancet 1: 103-105, January 23, 1943.

[2] EMERSON, K., JR.: Tropical eosinophilia. U. S. Nav. M. Bull. 42: 118-123, January 1944.

4 months, however, only one of these patients has been readmitted with the same complaint.

It is of interest that similar observations have been reported from Panama[3] on the increased incidence of what we have elected to call asthma-like symptoms.

No data are available which might explain the special incidence of these manifestations in this area. Allergy suggests itself immediately but other factors, such as dampness of climate, need to be considered. Another factor is the relation between these symptoms and paranasal sinus changes. This is difficult to evaluate. In many of the patients seen here the laryngologist has reported evidences of sinusitis, but allergic response of the nasal and sinus mucosa could account for these. Certainly outstanding local symptoms of paranasal sinusitis have not been evident in these patients.

One other possibility in relation to allergy is the presence of allergens in the environment originating from indigenous molds, fungi, and other vegetation. No study has been made of these factors in this area.

If similar observations are made on other South Pacific islands, the condition is likely to be significant and because of the number of man-days lost initially and also because some cases may recur and even become chronic, it is an important one.

[3] COHEN, A. G.: Early form of chronic bronchitis in Panama. War Med. 5: 105-108, February 1944.

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CARBON DIOXIDE IN CONTROLLING COUGH

The administration of a mixture of 10-percent carbon dioxide and 90-percent oxygen by inhalation is a safe and feasible procedure. Analytic studies and clinical experience of others, as well as our own personal observations during the past 13 years, show that carbon dioxide by inhalation is an efficient expectorant. Its liquefying effect upon muco-pus in the bronchial tract is greater than that of the commonly used expectorants.

Carbon dioxide by inhalation occupies a unique place among expectorants in that—besides its liquefying action—it is capable of stimulating the respiratory center. Stimulation of the respiratory center causes increased respiratory expansions of the thorax, a consequent stretching and dilatation of the bronchi, and an increase in the bronchial peristalsis. These factors contribute substantially to the effective mechanical elimination of inflammatory products from the respiratory tract.—BANYAI, A. L., and CADDEN, A. V.: Carbon dioxide by inhalation in management of cough. Brit. J. Tuberc. 38: 111-116, October 1944.

OCCLUSAL RECONSTRUCTION COMBINED WITH A PARTIAL DENTURE

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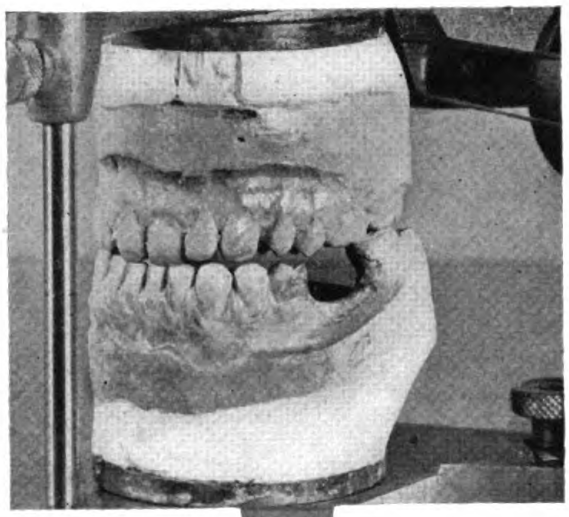
The technic and restoration to be described here were used for the case shown in figures 1 and 2. The problem was not only one of replacing missing teeth but also of restoring function by occlusal reconstruction of the posterior teeth.

Casts were made from impressions taken with alginate powder and water, and poured in hydrocal. The upper cast was mounted on the articulator by means of a face bow. The lower cast was positioned in centric occlusion by means of the usual wax bite.

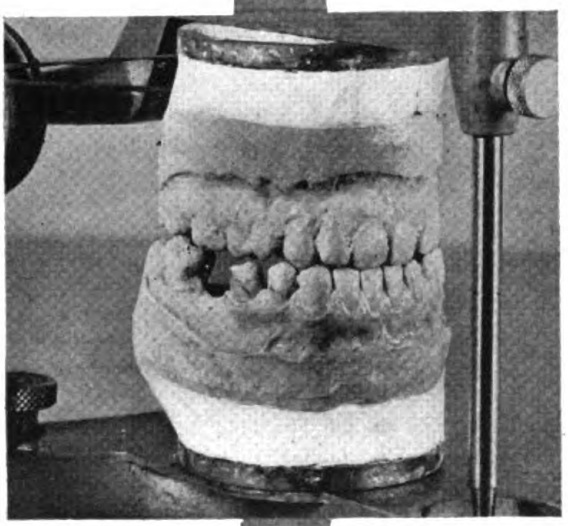
The oral and x-ray examinations and a study of the articulated casts revealed a very inadequate masticatory function. In centric occlusion the only points of contact were between the upper and lower central incisors, and the lower second and the upper first and second molars. On protrusive excursions there was only point contact between the upper and the lower molars, providing no more than two-point occlusal contact in any functional position. The lower left second bicuspid was rotated a half turn to the mesial; the right lower second bicuspid was rotated mesially and had drifted distally. The two mandibular molars showed the typical mesial inclination after loss of anterior contact.

It was decided to construct a cast partial denture with attached molar onlays, thereby restoring occlusal contact and eliminating trauma by distributing the stress of mastication to the remaining lower posterior teeth.

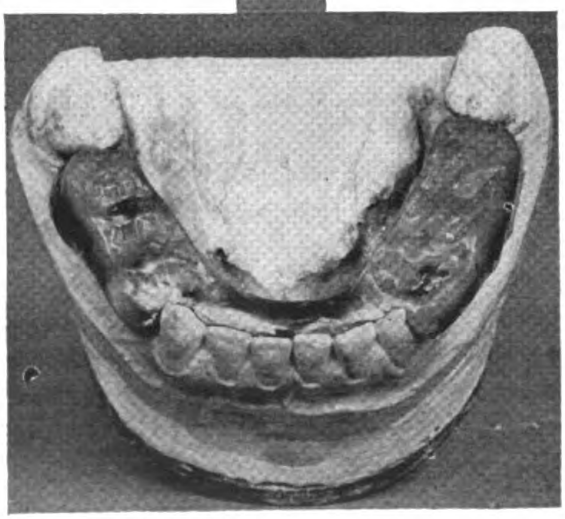
In order to effect a functionally balanced occlusion the composite bite technic was employed. The bite rim for this technic is constructed as follows: A shellac baseplate is adapted to the mandibular cast, including the occlusal surfaces of the lower bicuspids, and strengthened with a piece of wire (coat hanger) and black modeling compound. Tin foil (0.001 inch) is adapted to the cast over the area covered by the baseplate. Zinc oxide and eugenol paste is applied evenly to the tissue side of the shellac baseplate which is then firmly seated over the tin foil on the cast, thereby cementing the tin foil to the bite rim. Cast and bite rim are placed in water until the paste has set, after which they are dried with air and reset on the articulator.



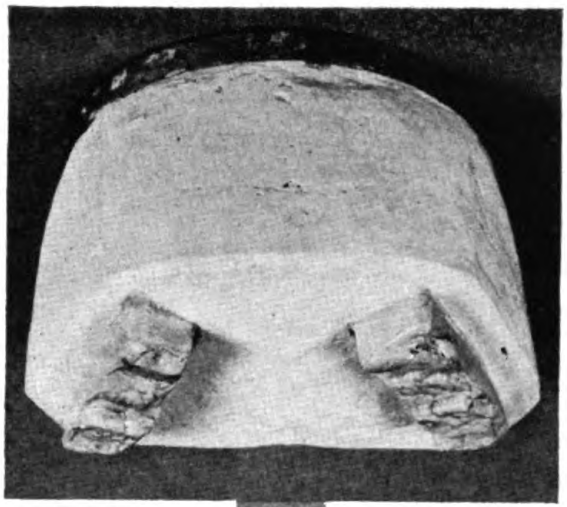
1. Study casts of the original occlusion were mounted on a Hanau articulator in centric relation by means of the usual wax bite.



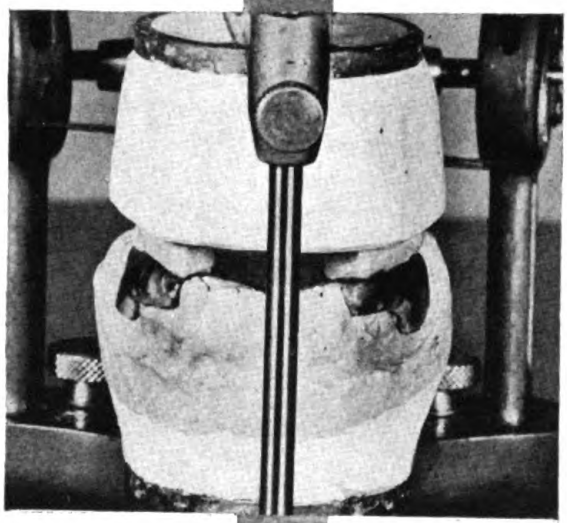
2. The only contact was between the upper and lower central incisors, and lower second and upper first and second molars.



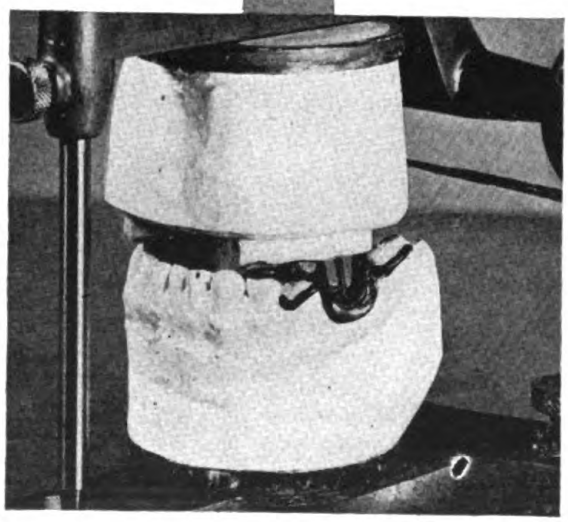
3. The wax composite bite in position on the lower cast. This wax bite is boxed and poured in stone.



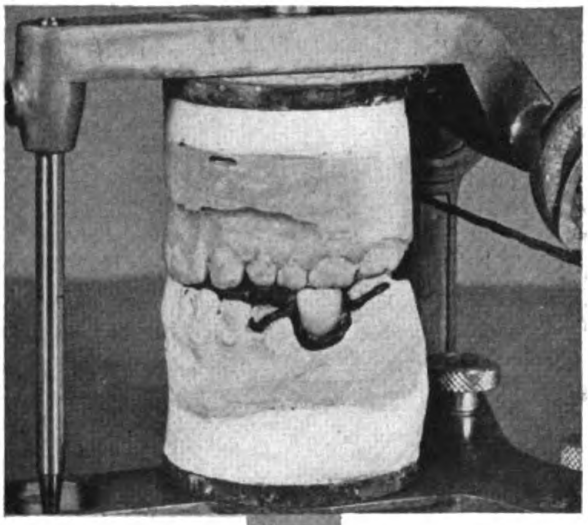
4. The mounted stone index made from the wax bite shown in figure 3 after trimming and with articulator ring in place.



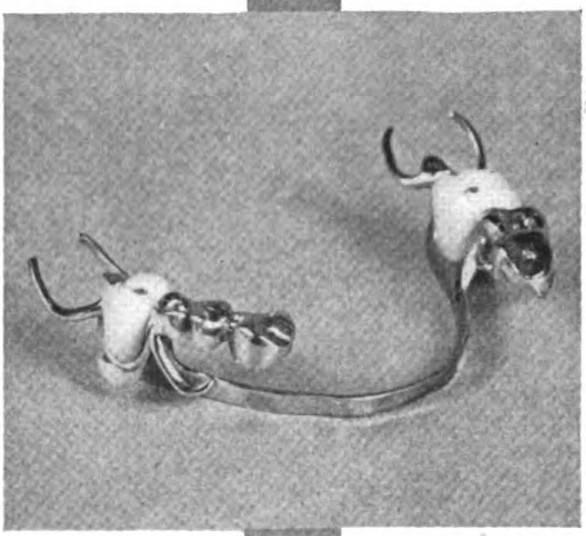
5. The mandibular cast and the stone index will next be removed from the articulator.



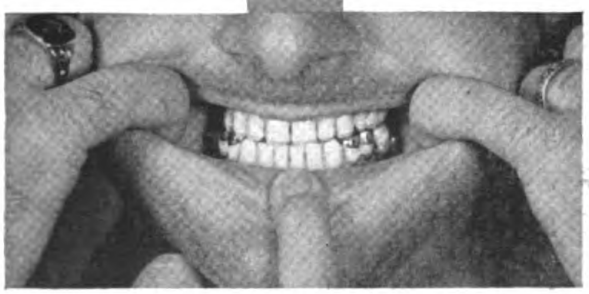
6. The waxed-up case without the tube teeth on the mandibular refractory cast.



7. Waxed case with tube teeth in place mounted in relation with original stone maxillary cast.



8. The completed all-cast partial denture with onlays.



9. The completed denture in the mouth

Black modeling compound is added until the bite rim has been built up to occlusal contact with the upper teeth. The articulator is opened 3 mm. and a soft wax added until occlusal contact with the upper teeth is again restored. The bite rim is then removed from the cast and inserted in the mouth.

The patient is instructed to chew on the soft wax in all eccentric movements within the masticatory range. This should be done by alternately chewing and sliding into various mandibular positions. Figure 3 shows the wax composite bite in position on the lower cast after the patient has registered all movements. This wax bite is boxed and poured in stone, creating a stone index of the position of the maxillary teeth during any mandibular movement.

The upper cast is removed from the articulator and replaced by a new ring to which the poured stone index is attached with plaster. Both the mounted stone index (fig. 4) and the stone mandibular cast are then unscrewed and removed from the articulator (fig. 5).

A duplicate mandibular cast, poured in a refractory material, is mounted on the articulator by means of a new ring in proper relation to the original maxillary cast, using the *original* wax bite for correct centric relation. When this has been done the maxillary cast is replaced by the stone index and the case is ready to be waxed for casting.

The tube teeth are ground to occlusion and waxed in place. Wax is carried up and over the occlusal surfaces to form onlays in contact with the opposing stone index. Figure 6 shows the waxed-up case without the tube teeth in place.

The stone index is removed and the stone cast of the upper teeth is placed in position on the articulator. The waxed onlays are trimmed buccally and lingually to conform to the anatomy of the upper posterior teeth (fig. 7). The completed partial denture (fig. 8) is inserted in the mouth (fig. 9).

By using the composite bite technic, the usual grinding-in and balancing of a denture is reduced to a minimum. Except for a few minor spots, the case was in balanced occlusion in all normal mandibular movements. The patient was asked to return after wearing the denture for two days. At that time the occlusion was checked, and any fine high spots not otherwise discernible were eliminated by chewing a fine carborundum paste.

The patient has worn the removable denture for over 4 months and states that he has not known before what it was like really to masticate his food.

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HR INCOMPATIBILITY

Hr incompatibility is incompatibility with respect to the Hr factor.—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

THE PALATAL FLAP

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Space limitation and inability to see the operative field add to the difficulties of many oral surgical procedures. This is particularly true of palatal operations where inaccessibility is increased because of the maxillary incisors. The palatal flap, then, must be made with great care so as to prevent injury to the soft tissues and yet achieve maximum exposure of bone. Any flap which requires perforation of the mucoperiosteum of the palate, or which cuts across it, causes needless postoperative pain and death of some tissue.

A flap which is made by detaching the palatal tissue at the gingival margin and pushing it back to the midline or farther, and which extends from the central incisors to the first or second molars, is quickly and easily lifted and creates a dry operative field of any size desired.

No tissue is destroyed, and by dropping the flap occasionally the blood supply is restored. A broad retractor used to hold the flap is supported on the bony surface rather than against the fold of the lifted tissue. When the operation is completed the flap is simply dropped back into position. Finger pressure is used to expel blood which may have collected under it and to push it tightly and accurately into place; sutures are not used. Within a very short time the tissue has reattached itself and all evidence of separation has disappeared.

If the wound is infected, or if there is any other reason to expect drainage, a small gauze drain is placed so as to extend from the bone defect down past the border of the flap. If retained in place for 48 hours a small fistula is created, and if edema develops, the passage of a small probe through this opening generally empties the area of fluid.

The following are three cases in which this type of palatal flap has been used.

CASE REPORTS

Case 1.—Removal of unerupted and impacted maxillary left cuspid: The palatal tissue was reflected from the second molar anteriorly to the left central incisor (fig. 1). With a No. 703 crosscut fissure bur, the bone overlying the cuspid crown was removed (fig. 2). The crown was exposed and cut from the root at the cementoenamel junction. The root portion was then lifted out with a sharp-pointed elevator, equal parts of powdered sulfanilamide and sulfathiazole were placed in the socket (fig. 3) and the flap was dropped into position (fig. 4). No sutures were used and healing was without interruption.

Case 2.—Exposure of palatal socket for curettage: Eight months after removal of a maxillary right impacted cuspid, the patient complained of pain and swelling in this area. Exposure had been made by an angular incision toward the midline, and the impacted tooth was removed through this opening. Postoperative pain and soreness still persisted.

There was some swelling overlying the socket and a slight amount of purulent discharge was obtained from light pressure. Radiographs did not show evidence of healing.

A flap was detached and lifted from the left lateral incisor posteriorly to the right molar region (fig. 5). The unhealthy granulation tissue and tiny sequestra were removed by curettage (fig. 6), the borders of the socket were smoothed, sulfonamide powder and a gauze drain were placed in the socket, and the flap was dropped into position (fig. 7). After 48 hours the drain was removed and replaced. This procedure was repeated twice at 48-hour intervals, after which no further treatment was necessary. The flap became reattached quickly and healing was rapid.

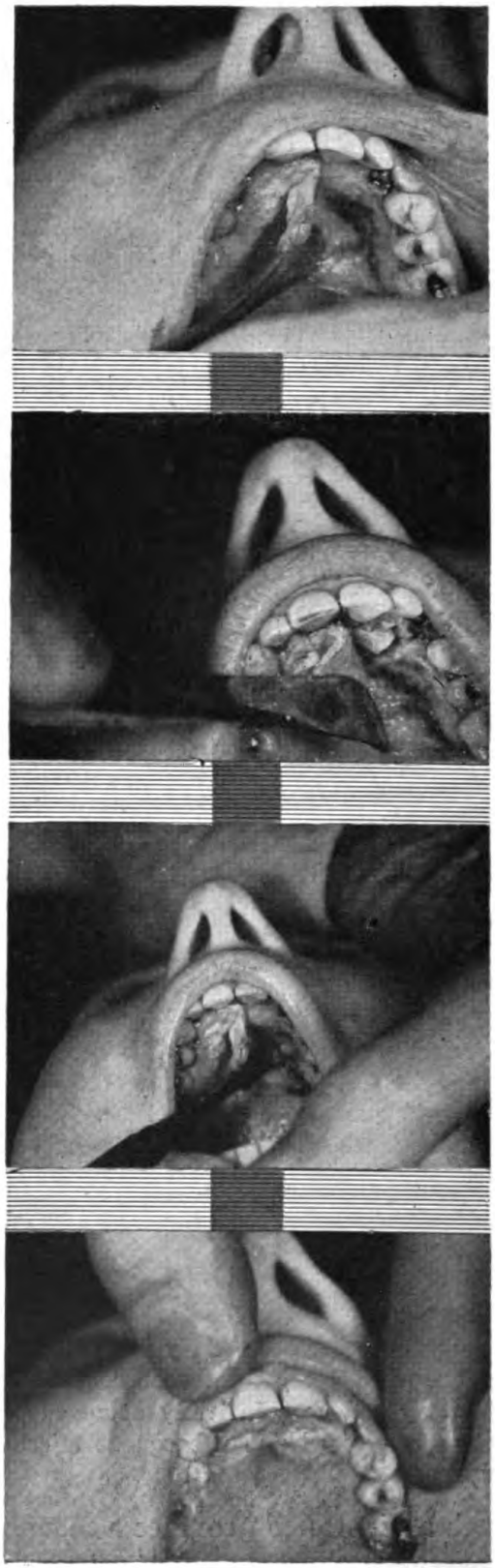
It is probable that insufficient exposure of the operative field prevented proper completion of the original operation. Bone fragments remained, the borders of the bony process were sharp and irregular, and the unhealthy, cystic soft tissue was not enucleated after tooth removal. The exposure of a flap as illustrated eliminates much of the possibility of such undesirable sequelae.

Case 3.—Fibroma of the palate: A man, 21 years of age, complained of a lump in the right palate opposite the molar teeth. The lump had persisted for 6 months and was increasing in size.

From the midline of the palate to the gingival attachment of the molar teeth, there was a lump approximately 2 cm. in width (fig. 8). A puncture biopsy brought forth no pus or serous drainage. The tentative diagnosis was soft tissue tumor of the palate.

A flap was lifted from the right central incisor posteriorly to the first molar. Under the flap, in the region of the posterior palatine canal, a thick fibrous mass 2 cm. in length and 1 cm. deep was found, firmly attached to the palatal tissue and to the bone. This was excised and subsequent microscopic examination showed it to be a fibroma.

The use of this type of flap in such an instance provides a means of complete exposure of the field. Where the growth is attached to the overlying soft tissues, dissection is possible, yet the flap remains in satisfactory condition to cover and protect the site of



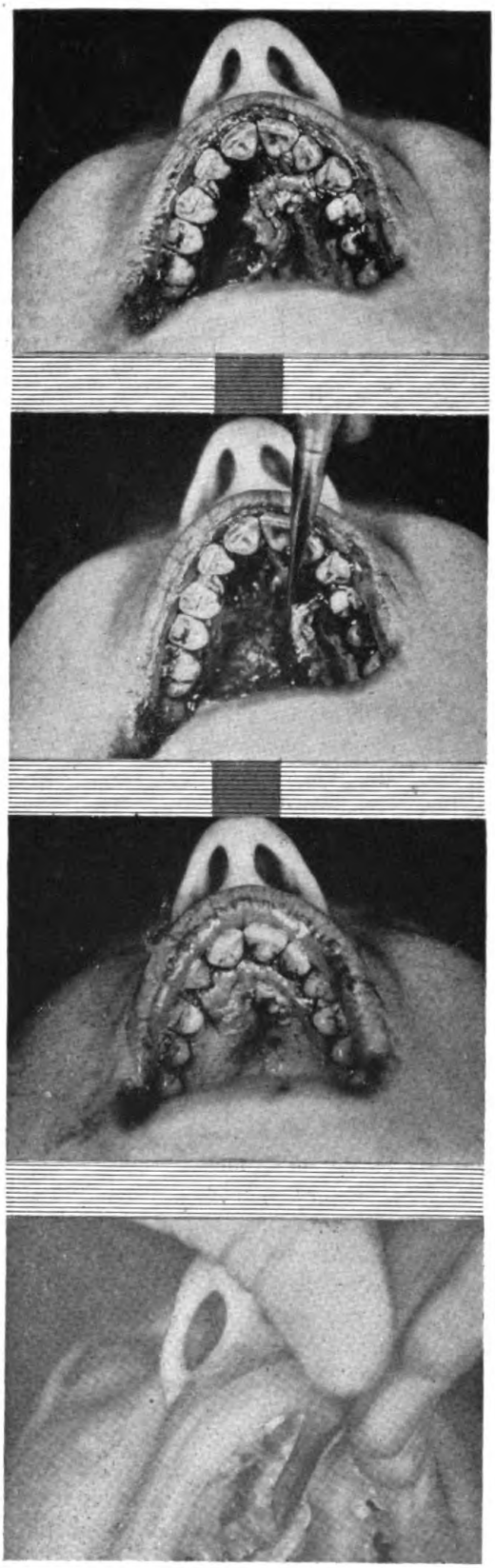
CASE 1

1. The palatal tissue reflected, exposing bone.

2. The cuspid crown exposed.

3. Appearance of tooth socket after removal of the cuspid.

4. Gingival flap back in position.



CASE 2

5. Flap tissue partially retracted.

6. Flap retracted to show bone defect near right maxillary incisor roots.

7. Flap partially returned to position.

CASE 3

8. Palatal flap reflected, exposing a fibroma.

excision. If a flap were made in this case by incision across the palatal mucoperiosteum, postoperative pain would be great, there would be less exposure of the field, and certainly considerable soft tissue would die from unnecessary manipulation, resulting in a defect in that region of the palate.

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RH AGGLUTINOGENS AND RH ANTIGENS

Rh agglutinogens and Rh antigens are five in number: Rh_1 (or Rh_o'), Rh_2 (or Rh_o''), Rh′, Rh″ and Rh_o.—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

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DENTIFRICES

The only usefulness of a toothpaste or powder lies in its cleansing action, supplementary to that of the toothbrush. Any one brand of dentifrice may serve as well as any other in this respect, provided it is not gritty and does not contain an acid.

The important thing to remember is that the brush must be properly used because, if it does not reach a particular area, neither does the dentifrice, and cleansing is practically nil, no matter what dentifrice is used. Since powder and paste have about the same cleansing value, one's preference is a matter of taste or convenience.—Bureau of Public Relations: Why and how of toothbrushing. J. Am. Dent. A. 32: 80-85, January 1, 1945.

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TOPICAL PENICILLIN IN SKIN DISEASES

Penicillin is effective in the local treatment of certain skin diseases caused by cocci. The most satisfactory method of treatment of sycosis barbae and impetigo is to spray the lesions with an aqueous solution containing 200 units of penicillin per cubic centimeter. An adequate dose of penicillin from the start, however, is essential to prevent the development of penicillin-fast organisms. A strength of 200 units of penicillin per cc. or 400 units per gm. of lanette base seems to be sufficient.

The pain in deep-seated lesions (furuncles) is much relieved after application of penicillin.

An underlying seborrheic state in cases of sycosis and impetigo is liable to cause relapse soon after cessation of treatment and necessitates further courses of treatment, but the appearance of penicillin-insensitive organisms indicates that further treatment with penicillin is of little value.—TAYLOR, R. H., and HUGHES, K. E. A.: Infective dermatoses; treated with penicillin. Lancet 2: 780-784, December, 16, 1944.

PSYCHIATRIC EXAMINATION OF NONSWIMMERS

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The experiences of this war have demonstrated that the ability to swim is responsible for saving many lives in the Naval service. Instruction in swimming is an important part of the program at all Naval training stations and each recruit is required to take a swimming test before he completes his training. The discovery of some psychiatric problems among the nonswimming group at the U. S. Naval Training Station, Newport, Rhode Island, led the commanding officer to order an individual psychiatric examination upon an unselected trial group of 60 persistent nonswimmers to ascertain the possible value of such an examination as routine for all persistent nonswimmers.

The examination of this group showed that although the majority of the nonswimmers were not psychiatric problems there were some men who would benefit from psychiatric attention. Most of these were cases of mild personality difficulties (relatively normal people with some nondisqualifying neuropathic traits) who were aided by superficial brief therapy. Others were well-adjusted except for their overly strong fear of the water, a fear directly attributable to some traumatic experience connected with swimming. Since the fear was specific to the swimming situation and existed by itself rather than as one member of a general constellation of neurotic traits, these cases must be considered merely cases of strong negative conditioning rather than cases of psychoneurosis. These men can be helped by some therapeutic advice and by specific suggestions for individual training in swimming. Brend[1] has noticed a like condition among air-raid victims in Britain and designated it "hyperphobosis" in order to avoid any confusion between it and the true neuroses. There remained a few

[1] BREND, W. A.: Differential diagnosis of contusion of the brain and psychoneurosis. Brit. M. J. 1: 885-887, June 14, 1941.

cases falling into the obviously psychoneurotic category, in which the psychiatric difficulties were sufficiently strong to render the recruit unfit for military service. Such men were discharged through the Aptitude Board.

The preliminary sampling indicated the value of a routine examination of all persistent nonswimmers and such a program was accordingly instituted under a directive from the commanding officer. The present paper is a report of the results of such an examination on the first 381 cases referred following the adoption of the program. These men were all referred to the Psychiatric Unit for examination because they were still unable to swim after three weeks of special instruction in swimming. Each man was given an individual psychiatric examination, the time consumed being adjusted to the needs of each case.

Table 1 analyzes the data upon these 381 nonswimmers. The majority of these men (279 or 73 percent) showed no fear of water and attributed their difficulties to some nonemotional factor. Among such factors, poor muscular coordination with an ensuing difficulty in participating in all sports was advanced as a reason by 18 men, or 5 percent of the group. Parental influence, usually through direct prohibition, was blamed by 15 or 4 percent. The remaining 246, or 64 percent, attributed their inability to lack of either interest or opportunity. None of these men presented any problem to the psychiatrist.

Of the 102, or 27 percent, who showed evidence of some fear of water underlying their inability to swim, 14 (4 percent) were adjudged to be neuropsychiatrically unfit for Naval service. In all these men the fear was but one manifestation of a basic, underlying instability. They were psychoneurotics whose difficulty in learning to swim echoed their difficulty in adjusting to other situations. While most of them had had some traumatic experience connected with water, the traumatic experience was a relatively minor one in explaining the dynamics of their present difficulties.

A literal quotation from one of these men who had been hit by a wave while swimming at a beach illustrates this point nicely: "I never went swimming after that. Also, Doctor, I am awfully nervous. I have varicose veins. I was treated for a blood disease for three years. I get dizzy and sick every time I get into the water. I can't help it. I try hard but I just can't. I have pains in my stomach too. Sometimes my back aches." Here it seems obvious that the fear of water is not the primary motivating factor in the individual's maladjustment but is merely being used to channelize the emotion released by his basic difficulties.

A careful examination of these 14 cases revealed that their

fundamental symptoms were of long standing, that their adjustment in civil life had been unsatisfactory, and that they were not adjusting to Naval service. They were discharged from the service through the Aptitude Board. The diagnosis of constitutional psychopathic state, emotional instability, was given 4 of them, and the other 10 were diagnosed as psychoneuroses of the anxiety, neurasthenic, and mixed types. They represented men who had been missed during the original screening examination, and whose unfitness was finally brought to attention by their difficulty with swimming.

The remaining 23 percent of the nonswimmers were men who showed evidence of some fear of water as a basis for the difficulty but who were not considered unfit for Naval service. Some of these men were borderline psychoneurotics whose symptoms were not sufficiently well developed to be considered disabling. This group included some men who were using their inability to swim for secondary gain, as well as some psychopaths in whom the resistance to swimming was but one aspect of a generalized asocial attitude. While these men do not represent the best type of Naval material and while the prognosis in many of their cases must be considered questionable, it was not possible to separate them from the service under the present standards of fitness.

Many others represented cases in which there was a strong fear of water directly attributable to some traumatic experience but who otherwise exhibited normal personality structures. These men are the hyperphobotics mentioned above. They are cases of an extreme fear reaction which does not reflect a general personality maladjustment. The past history of these individuals shows a good personality integration and their current adjustment to life is satisfactory in every regard except for the swimming situation. They show only a specific, well channelized fear of water. As Brend says, "These symptoms are really in the nature of conditioned reflexes." This can be illustrated by literal quotations from two men. The first man had had the unpleasant experience of diving off a board at a swimming hole and plunging his head into the mud. "I didn't judge the depth of the water and landed head first with my head getting stuck in the mud. From that day on, I never went swimming again, until I was sent to the Navy. I'm getting over being afraid of the water." The second one had also dived into a swimming hole but had struck the body of a child who had drowned shortly before: "I never went swimming since that time. But since I have to learn to swim, I must. I'm not afraid of water, but bumping into that dead body was a terrible thing."

In every case there is a traumatic incident resulting in an

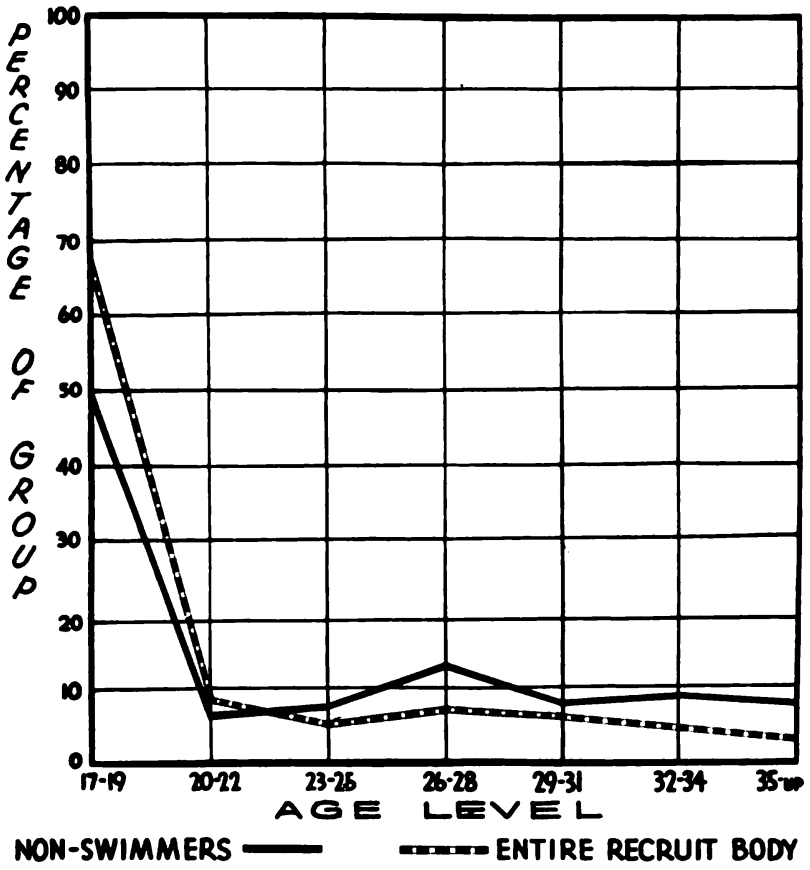
TABLE 1.—*Reason for inability to swim*

Age level	Fear of water		No fear of water		Poor muscular coordination	Total
	Fit	Unfit	Parental influence	Interest and opportunity lacking		
17–19	36	4	5	138	5	188
20–22	6	0	0	15	0	21
23–25	3	1	3	18	0	25
26–28	15	5	3	27	1	51
29–31	12	3	0	15	1	31
32–34	7	1	1	23	4	36
35 and up	9	0	3	10	7	29
Total	88	14	15	246	18	381

extremely strong negative reaction to a very definite and specific situation. It is the particular traumatic incident itself which seems to furnish the motivating power for this conditioning and it is not reinforced by other associated situations in the individual's experience or by any difficulties within the personality structure. Moreover the fear or phobia which arises is specific to the situation and shows little spread to other situations. For instance most of these cases of hyperphobosis do not mind being on the water in either a large ship or a small boat. It is *swimming* that they avoid. While such fear responses are very strong and frequently cannot be overcome without individual treatment, the subjects, nevertheless, are more amenable to treatment than are true psychoneurotics, since they show none of the psychoneurotic's defense reaction against losing his symptoms. As a rule while it is difficult to teach these men to swim, they usually do learn after intensive treatment. Moreover in those cases in which a man is recalcitrant in learning to swim, the otherwise stable personality structure would indicate that this one isolated difficulty is not sufficient reason to disqualify him for the Naval service.

We have noticed hyperphobotic reactions in some individuals returning from combat. Here again there is a strong avoidance reaction to some specific fear-inspiring situation. One man who was below deck asleep in his bunk when his ship was torpedoed now finds that he is unable to sleep below deck although he is able to work below deck, and sleeps perfectly well if he is able to rig a berth topside. In these hyperphoboses due to combat experience it is sometimes difficult to make a clear distinction between hyperphobosis and neurosis, but the differentiation is an important one for understanding the case and successfully treating it.

In order to reveal any possible age factors in the nonswimming group an age distribution was prepared for the 381 nonswimmers. In the graph this age distribution of the nonswimmers is plotted



Distribution by age of nonswimmers and entire recruit body.

against the age distribution for 2,321 recruits who represent a random sampling of the total population. As the graph demonstrates, there is a definite trend for nonswimmers to be more prevalent in the older age groups. There are two obvious explanations for this. In the first place the earliest age group on our distribution (17 to 19 years) includes the large majority of volunteers and a man is less apt to volunteer for the Navy if he is unable to swim or has any fear of the water. A second reason is that the older men seem more resistant to training and show a greater difficulty in passing their swimming test because of their relatively slower learning.

The nonswimmers at the Training Station received special training at three separate hours of the day, i. e., from 1830 to 1930, 1930 to 2030, and 2030 to 2130. There were many complaints from men in the last group because of the lateness of the hour interfering with their liberty and recreational activities. This was given as a reason for their slowness in learning to swim. Our figures, however, showed that in reality the men instructed during the later hour did just as well as those in the earlier hours, indicating that the time of instruction had no effect upon the speed

of learning despite the subjective reports of the subjects.

This investigation has shown the desirability of the psychiatric examination of all nonswimmers. In this way it is possible to detect some cases of neuropsychiatric unfitness which may be overlooked during the original psychiatric screening examination. Many borderline neurotics as well as hyperphobotics are revealed. Such men can benefit both from superficial therapy and from the opportunity offered for making specific individual recommendations concerning their instruction in the swimming pool.

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PENICILLIN IN STOMATITIS

Severe cases of Vincent's angina are not uncommon; even coma and death have occurred. In large military groups, where there is a surprising amount of oral uncleanliness, there is usually an embarrassing incidence of Vincent's stomatitis. Primarily because of the oral uncleanliness, this infection is rather difficult to clear up expeditiously. Its treatment with intramuscular injections of penicillin is noteworthy.

One hundred thousand units of penicillin were given intramuscularly (20,000 units every three hours) to a young male complaining of a throat infection. On inspection the nasal mucosa was infected; there was a postnasal drip; the mucous membrane of mouth and soft palate was involved; the throat was completely covered with patches; the gingiva was ulcerative, and there were numerous small ulcers on the sides and tip of the tongue.

A dramatic improvement occurred after 80,000 units of the penicillin had been administered, and 24 hours after the first injection the patient felt normal. His gums were not as tender, and he was able to eat solid food. Forty-eight hours after the first injection, the patches on the throat and the postnasal drip had disappeared. By the fourth day the ulcers on the tongue had almost gone, and but for the repair of the sloughed gingiva, the patient's oral condition appeared almost normal and he was discharged on the fifth day. A complete prophylactic treatment and other dental needs were taken care of five days later.—BETHELL, R. H., Lieutenant Commander (DC) U.S.N.R.

THE NAVAL OFFENDER

MOTIVATING FACTORS

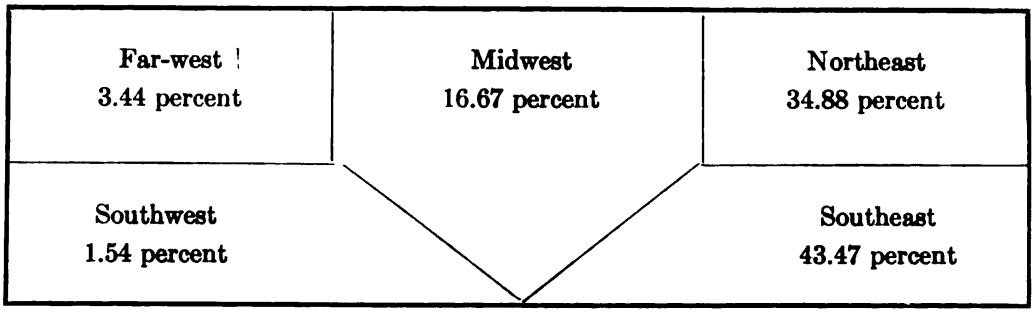
H. ROBERT OTNESS
Lieutenant H(S) U.S.N.R.
and
GEORGE A. W. STOUFFER, JR.
Lieutenant H(S) U.S.N.R.

The thousands of men, awaiting or undergoing discipline, idle or only partially employed while in confinement, present a challenge during our manpower shortage. In a peacetime Navy the problem of the offender was not so pressing. If a man by repeated offenses indicated that he was incorrigible, he was discharged from the service. Many whose patterns of delinquent behavior were not too well established were taken in hand by officers and petty officers long experienced in the handling of men and gradually molded into useful, well trained and disciplined seamen. New men, homesick and confused, tempted to desert, would be helped by a veteran crew. The training was more leisurely and the demands not as great. To the young lad the Navy became a father substitute. The married man with the strong family attachment was not the problem he is today, because those men did not often join the Navy.

With the greatly expanded Navy and the relaxing of its former rigid standards for acceptance, the multiplication of behavior problems was inevitable. The methods of the peacetime Navy were found not entirely suitable or expedient for both the increased number of offenders and the new problems which they brought with them.

The widespread induction of men at rapid speed into the service has introduced many psychopaths, mental defectives, illiterates, physically handicapped, and emotionally unstable, as well as delinquents, in spite of the fact that an effort to screen them has been made. Practically every variety of offender, including the sexually perverse, has been detected and when indicated eliminated. These supply many of the disciplinary problems in the Navy. They eventually become part of some "brig" population.

These men represent nearly every State in the Union. The chart on the following page presents the geographic distribution of 582 cases selected at random.



The offenders from whom the data for this study has been collected were admitted to the Disciplinary Barracks of the U. S. Naval Receiving Station, Norfolk, Virginia, over a period of approximately one month. These men are admitted for disciplinary action following findings at captain's mast or sentence of summary court-martial, or while being held pending transfer to a Naval prison in pursuance of sentence of general court-martial.

All men when admitted fill out an interview questionnaire prepared by the psychiatric unit. This questionnaire supplies pertinent information regarding the man's status in the Navy, a brief review of his duty history, the nature of the present offense and previous offenses, family and home backgrounds, marital status, educational and delinquency histories prior to entrance into the Navy, nature of his physical complaints, and the man's own personal opinion regarding the Navy, his duty, and his own evaluation of his adjustment to the Naval service. In addition to this he indicates whether he desires to discuss any personal problems in private.

The questionnaire is used as a supplement to an interview by a psychologist experienced in clinical procedures as well as in delinquency problems and the field of correction. The psychologist is on the alert for emotional and psychiatric problems that may be the motivating factors back of the offenses. In such cases the men are referred to a psychiatrist for evaluation and proper disposition. Hospitalization rather than discipline has often been indicated.

One thousand such questionnaires have been selected at random from the files of the psychiatric unit. These form the background for the data of this study. They furnish facts relative to the sociologic and psychologic make-up of the offenders and supply interpretations of their motivations.

All the motives of human behavior are not known. Much, however, has been discovered regarding man's intellectual status, his emotional strivings and thwartings, the influence of body on mind and vice versa, the relative influences of nature and nurture, the importance of happiness on one's job and the effects of failure and success, the value of adequate childhood training and guidance,

the value of avoiding placing square pegs into round holes, and many other facts pertaining to the adjustment of man to society.

Although man comes into existence through a fairly uniform pattern he is subjected to a great variation in the factors of his heredity and the type of home and social culture in which he must develop. The importance of a happy childhood, well directed, planned and encouraged, in the preparation for adult living, need not be elaborated upon here.

Although these facts are not readily observed in man's personality, they nonetheless explain some of his reactions to life as a whole and are frequently basically responsible for his attitudes.

The data obtained in this investigation have been grouped or classified under various headings to facilitate presentation to the reader. The information expressed in terms of percentages is based on 1,000 Naval offenders unless otherwise stated. The percentages of these same factors for the Navy as a whole are not available.

General Considerations

			Percent
1.	Proportion of Naval offenders as to Regular and Reserve status	Regular	15.3
		Reserve	84.7
2.	Enlisted or drafted	Enlisted	60.9
		Drafted	39.1
3.	Percentage having had sea duty		53.1
4.	Percentage having had combat duty		21.65
5.	Percentage having survived disaster at sea		1.7
6.	Average length of service in the Navy	12.15 mo. (range 2 to 55)	
7.	Average age	20.45 yrs. (range 15 to 37)	
8.	Percentage as to rating	Rated	13.0
		Non-rated	87.0
9.	Offender from ship or shore	Shore	56.3
		Ship	43.7
10.	First offender or recidivist	First	45.0
		Recidivist	55.0
11.	Average number of offenses per offender	2.52 (range 1 to 8)	

Family Background

1.	Father living	73.5
2.	Mother living	84.1
3.	Parents divorced or separated	18.43
4.	Stepfather	11.1
5.	Stepmother	7.5
6.	Has brothers or sisters	91.98
7.	Has half-brothers or half-sisters	9.4
8.	Reared in a foster home or orphanage	4.6
9.	Thinks he had a happy home while growing up	86.3

MARITAL STATUS

	Percent
1. Single	66.99
2. Percentage of those married, having children	51.8
3. Happily married	82.7

EDUCATIONAL BACKGROUND

1. Range of schooling	None to 3rd-year college (average 9.43 grades)
2. Did well in school	72.3

DELINQUENCY BACKGROUND

1. Played "hookey" in school	47.7
2. Has been in juvenile courts	11.0
3. Has been arrested in civilian life	27.1
4. Has been in jail (detention)	22.1
5. Has been in reform school	3.1
6. Has been in prison (sentence)	3.0

ATTITUDE TOWARD NAVY

1. How well does he like the Navy	Fine	44.8
	Fair	42.6
	Not at all	12.5
2. How well does he like his duty	Fine	36.7
	Fair	35.8
	Not at all	27.5
3. How well does he think he is getting along in the Navy	Fine	25.3
	Fair	48.1
	Not at all	26.6

FACTORS OF INSTABILITY

1. Complains of trouble in sleeping	34.5
2. Considers himself to be a nervous person	47.3

"NP" REFERRAL

1. Referred to the psychiatrist for further study	11.1

PERSONAL PROBLEMS

1. States that he has personal problems he wishes to discuss	38.2

Personal problems (not tabulated) center chiefly around domestic difficulties (financial, health, marital), concern about personal health, need for legal advice or Red Cross aid, dissatisfaction with duty in Navy, and worries about the outcome of present offense or in connection with allotment or pay account irregularities.

General considerations.—The high proportion of Reserve offenders is to be expected in view of the present great preponderance of Reserve personnel. The pre-Pearl Harbor men are the seasoned

sailors and have become adjusted to the demands of sea duty, to being away from home and to Navy life in general, but the introduction of the hazards of war has been new for both groups. The adjustment of men to sea duty is important. More consideration could be given by the seasoned crew to the new sailor coming aboard his first ship. His training in boot camp has been rapid and none too thorough. Early discouragement on first assignment, combined with fear and the anticipation of danger have had their share in producing "AOL" offenders.

The length of time in service does not seem to be as important as does the amount of responsibility and incentive the man has had in making a nonoffender. The correlation between length of service and number of offenses is not too significant. Age alone is not a good guide. The problems of the adolescents and the older men vary. The younger have the difficulty of submission to authority, while the older men have physical and domestic hurdles.

Frequently men with very little or no ability are sent to Service Schools, while others with good high school and some college education are held back—both misfits becoming disgusted with the service, and potential offenders. With the increased temptation on shore, more men become offenders than when on board ship. Dissatisfaction with duty, lack of consideration on the part of superiors, fear, seasickness, poor ship morale, callow officers and seasoned sailors, are all important factors.

The first four to seven months in the Navy produce many first offenders. Often the return of the offender to his ship at the end of his confinement results in a recidivist, his reputation being already established. Duty reclassification would save many men and would constitute all the rehabilitation needed in certain cases. Court-martial involving fines aggravates the home economic problems and results in a repeated offense, the home obligation seeming greater than the sense of patriotic duty. Recidivists are to be expected among the mental defectives, illiterates and the psychopaths.

Family background.—The potency of the childhood and family backgrounds in shaping the personality must not be overlooked. The solidarity of a good home reflects itself in the stability of its members. The insecurities of childhood produce instabilities in adult life. Broken homes, divorced parents and mistreatment place an indelible mark on children, and are common background findings among delinquents. A recent study of civilian delinquents[1] showed 78 percent with fathers living, 83 percent with mothers

[1] MIDDLETON, W. C., and FAY, P. S.: Comparison of delinquent and non-delinquent boys with respect to certain attitudes. J. Social Psychol. 18: 155-158, August 1943.

living, and 22 percent with parents divorced, in contrast to a nondelinquent group having 93 percent fathers living, 90 percent mothers and 4 percent divorced. The problems of the large indigent family, the farm boy needed at home, the subtle implications of the "only child," the over-protected home, the child from orphanage or foster-home, all create potent attitudes in the individuals and give them life-long frustrations.

Marital status.—The married man finds it difficult to be away from home, often for the first time. Because of the unwillingness or inability of the wife to carry on the battle on the home-front he is tormented with economic problems. The tragedy of unfaithfulness and divorce enters. He may have fixed obligations of payments on home or on insurance; he may have business interests with outstanding obligations, as well as many other emotionally frustrating situations.

Educational background.—This has a very important bearing on the production of Naval offenders and is closely tied up with the selection and classification of men. The mental defectives, the illiterates, the defective-illiterates, and the educationally retarded groups that are coming into the service in large numbers are constantly overwhelmed by the demands made on them by the Navy. To escape the unpleasant they go AWOL, or become offenders through their lack of comprehension of tasks to be done or through being misunderstood. Their psychologic make-up is difficult to understand by the untrained. The men with good schooling who are placed in inferior duty assignments are also dissatisfied, unhappy men. A school background of "playing hookey" and of difficulty with teachers is a forerunner of delinquency.

Delinquency background.—A recent report[2] stated that about 2 percent of all school children are problem cases, and that 4 out of 5 of these become overt delinquents, and 3 out of 4 overt delinquents become criminals. As compared with these civilian figures, it can be readily seen that the Naval offenders show a high rate of delinquency potentiality. About half of them had "hookey" records. There are also relatively high percentages of civil arrests and jail detentions. Although the percentage of reform school and prison cases is small, it is significant in considering insubordination. The influence of former inmates of reform schools and prisons upon the potentially nondelinquent must not be treated lightly; the younger men often select such a figure for hero worship and think that that is part of being a "salty sailor."

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[2] BARNES, H. E., and TEETERS, N. K.: New Horizons in Criminology. Prentice-Hall Inc., New York, 1943. p. 945.

Health complaints.—Forty-three and seven-tenths percent of the 1,000 men registered some physical complaint on admission to the brig. Many of these complaints were psychosomatic in type, precipitated by the struggling within oneself to rationalize the offense and to gain attention and pity. It is interesting to note how old complaints and old injuries, that existed many years prior to enlistment, become "alive" again on confinement in the brig.

Attitudes toward Navy.—About 87 percent of the Naval offenders indicated that they liked the Navy, leaving 13 percent who disliked it. This latter group may be a serious one in influencing the attitudes of others. That 27.5 percent did not like their duty indicates the need for some effort at more appropriate reassignment. The 26.6 percent of offenders who feel that they are not getting along in the Navy, are those unhappy in their work, inefficient, and on the way to becoming chronic offenders through discouragement.

Factors of instability.—The large percentages who had sleep disturbances and nervous feelings may suggest a prevalent psychoneurotic make-up. Emotional problems of fear, the aftermath of combat, the tension that accompanies confinement, plus the perseverative nature of a neurotic childhood all are factors in the behavioral instabilities observed.

"NP" referrals.—The relatively small percent of "NP" referrals (neuropsychiatric), in comparison to the other percentages cited, should not be misconstrued as unimportant. Within this group there have been several psychotics who were potential menaces to shipmates and civil society. Hospitalization rather than confinement was the need. All "NP" cases are not hospital cases; some are less serious mental hygiene problems. This 11.1 percent does not include the psychopathic personality group (constitutional psychopathic states).

CONCLUSIONS

This study has been a survey of some of the important psychologic and sociologic factors among Naval offenders, and offers some explanations for their poor adjustment in the Navy. The 1,500 offenders considered represent about 3,750 offenses, and 7,500 weeks (conservative minimum estimate of 2 weeks per offense away from duty), or about 1,260,000 man-hours, spent in confinement.

Each ship and station should seek out the important factors within its organization that may be contributing unknowingly to the offender problem in the Navy.

FUNCTIONS OF A PSYCHIATRIST IN A NAVY YARD

HAROLD J. HARRIS
Lieutenant Commander (MC) U.S.N.R.

There has been a steadily increasing number of requests at this station for psychiatric consultations for the Navy and Marine Corps personnel, and the need for psychiatry among the more than 75,000 civilian workers also has become increasingly obvious, both in the selection of those men during pre-employment physical examinations and in the adjustment of their problems after employment. The strain of their work results in a large number of neurotic manifestations as well as in some malingering. Close liaison between the medical officer in charge and the psychiatrist is vital.

The influx of discharged veterans seeking employment has made the work of the psychiatrist increasingly important. Because of the high percentage of discharges for neuropsychiatric reasons, these men become the special problem of the psychiatrist. Careful consideration of their individual problems is essential.

The types of cases seen are suggested by listing the activities for a representative month:

[1]Total number of neuropsychiatric examinations made	752
Daily average	29
These were divided as follows:	
New applicants (veterans)	238
New applicants (4F)	129
New applicants (others)	208
Civilian workers (rechecks)	125
Navy, Marine Corps, and Coast Guard personnel	52
Total number of physical examinations for employment (including psychiatric examinations)	3,237
(Only those whose physical condition is questionable are seen by the medical officer of the Labor Board.)	
Total number of physical examinations for recheck (including psychiatric examinations)	1,537
All these cases are reviewed by the medical officer of the Labor Board.	

[1] Since the above was written there has been a further increase in psychiatric examinations made. During the month of January 1945, 818 such examinations were made.

Employees of the yard, regardless of veteran status, are re-examined to determine fitness at the request of their personnel supervisors or at their own request, whenever indicated. Psychiatric examination is made whenever there is a possible psychiatric basis for a physical complaint. A special effort is made to re-screen veterans for more suitable jobs whenever legitimate reasons for doing so are found.

Psychiatric examinations are given only to those veterans applying for jobs who were discharged from the services for neuropsychiatric reasons. Selection is extremely important, both for the good of the veteran and that of the yard. The man who had a nervous breakdown after a few weeks or months of boot camp or basic Army training is unlikely to adjust to the noise and bustle and discipline of a Navy yard. However some have already demonstrated by previous satisfactory civilian employment that their unadaptability applies only to the armed services. These men can be accepted with fair assurance of satisfactory work. The veteran discharged after combat duty with war neurosis of the anxiety type may adjust to Navy yard work if assigned to work which he likes in surroundings where the noise and confusion is not too great. He is unlikely to adjust to noisy surroundings if startle reaction, irritability and anxiety still continue. Only a small percentage is considered unfit for any duty in the yard.

No veteran who is honorably discharged is rejected for employment. A job is found for him. Even those with bad conduct and undesirable discharges are usually given a job in the hope that they can be rehabilitated. Few of these give serious trouble. They are, however, subject to a preliminary investigation by the Civil Service Commission. They are unacceptable to the Commission only if convicted of desertion. Lesser offenses are penalized only by the loss of veteran's preference.

New applicants in the 4F category are given psychiatric examinations if they have been so classified for neuropsychiatric or for unknown reasons. A large percentage of these are acceptable on the practical theory that although they may be questionable or poor material for the armed services they may be satisfactory for the type of civilian work for which they have already shown adaptability. Many of these, however, fail to live up to expectations and must later be released. Rarely is the overt homosexual or definite psychopath acceptable.

Other civilian applicants receive psychiatric examinations if there is any obvious indication for it, such as history of a neuropsychiatric condition, obvious peculiarities of behavior noted dur-

ing physical examination, or evidence of defective mentality. Jobs can be found for the majority of those with limited intelligence, above the level of moron, but not for the psychopaths, severe psychoneurotics or psychotics. Those recovered, or in remission following psychotic episodes, are employable under the regulations if they have had at least 6 months of satisfactory employment following discharge from the mental hospital. Those accepted are frequently subject to recurrence and must be reexamined and found unfit, temporarily or permanently.

Sixteen-year-old boys, applying as apprentices, are seen for a rapid psychiatric check-up and estimation of mental capacity, if they have failed to complete 2½ years of high school. Most of those in the limited intelligence group, with little mathematical or general knowledge, have worked out well. Those found weak in mathematics are employed in painting, shipfitting, blacksmithing or foundry work, rather than as machinists, electricians or sheet-metal workers.

Civilian workers are given psychiatric examinations (rechecks) either at the request of their superiors because of obvious behavior abnormalities, or because routine physical examination has revealed the necessity for such evaluation. They are then classified as "unfit permanently," "unfit temporarily" (pending treatment), "unfit for assigned duties" (with a view to rescreening for other work or placing them in limited duty status), or "fit."

As medical officer of the Labor Board the psychiatrist at this station reviews the findings and recommendations after physical examination of each of the 1,200 or more persons sent in for recheck examinations each month. The need for further evaluation from the psychiatric viewpoint is often seen.

Navy, Marine Corps and Coast Guard personnel are seen by the psychiatrist at the request of the medical officers in the sickbays of the yard, or of the medical officers or pharmacist's mates on ships tied up at the docks. Many Marines on limited duty in the yard are seen and an opportunity is afforded to recommend change of duty when indicated, or return to hospital with a view to discharge from the service when it is obvious after adequate observation that they cannot adapt to the service. The line officers of the Marine Corps directly refer men who come to their attention, including the stragglers who turn themselves in at Navy yards. The decongestion of Marine barracks' brigs is made possible by prompt psychiatric examination of prisoners.

Evaluation of industrial injuries involving (or purporting to involve) the central nervous system is one of the major problems on which the psychiatrist is consulted. There are many head in-

juries, the vast majority of which are trivial or at least mild, with no intracranial complications. The train of symptoms induced in emotional individuals as well as in psychoneurotics is too well known to require discussion. Malingering is not rare. Many instances are found in which the working conditions or trauma have been precipitating factors in the appearance of the more serious neuroses or psychoses. The importance of recognizing them promptly is obvious.

USE OF CORNELL SELECTEE INDEX

Use of the Cornell Selectee Index[2] as a starting point for virtually all of the psychiatric examinations has effected so much saving of time as to make possible the examination of large numbers of persons, occasionally as many as 60 in a day. Over 9,000 such forms were executed in the 12-month period ending 15 February 1945. The Index has the additional advantage of serving as a permanent record.

A notable fact is that greater truthfulness in answering such questions as "Have you ever had a fit or convulsion?" or "Have you ever had a nervous breakdown?" is found in the written answer than in the verbal one. Using the significant answers on the Index as a starting point, information which leads to accurate conclusions can be rapidly obtained. Previously denied epilepsy, for example, is frequently diagnosed by following up the questions on the Index.

The Index contains virtually all the necessary questions that the psychiatrist would ask. The examinee fills out his form while waiting for examination. The form is then quickly rated, significant answers and totals are noted and are followed up by oral questioning. The number of psychiatric examinations made in the yard each month has steadily increased from 202 in April 1943 to 818 in January 1945. Even with the use of the Cornell Selectee Index this number has taxed the ability of one psychiatrist. Without use of the Index much of the work would have been done less accurately or neglected.

The cover page of the Index, form C, has space for the examinee's name, age, date, occupation, grade reached in school, address, month and year of birth, and very simple questions such as: "What is the capital of the U. S. A.?" and "Put a line under the countries fighting on *our* side: RUSSIA, JAPAN, ENGLAND, GERMANY."

The first inside page lists 44 jobs or occupations with directions

[2] Information concerning the Index and the forms themselves are obtainable from the authors, Weider, A., Mittlemann, B., Wechsler, D., and Wolff, H. G., New York Hospital, 525 East 68th St., New York, N. Y.

to encircle the "L" or "D" after those which the examinee might like or dislike. A stencil is furnished the examiner quickly to evaluate the job preferences, which are then noted in the scoring box. The distribution and number of likes and dislikes gives a ready idea of the feminine trend and of the degree of withdrawal of the subject. Those showing 9 or more significant answers or 3 or fewer likes are given special psychiatric attention.

The second inside page has 52 questions to be answered by encircling the "G" "P" or "?" to indicate "good," "poor" or "questionable" in an attempt to evaluate the examinee's self-esteem. These are recorded as the number of significant "poors" and the total number of "questionables" in the scoring box by means of another stencil. Those showing 12 or more significant "poors" or 30 or more "questionable" answers receive psychiatric appraisal.

The last page of the form is devoted to symptoms indicating psychogenic or psychosomatic complaints, as indicated by significant answers which are quickly scored as before. Persons showing a score of 15 or more receive special psychiatric appraisal. The stencil is marked to pick up various "stop-questions," affirmative answer to any one of which would also call for special psychiatric appraisal.

A simplified form (N) may be used instead of form C. It consists of a copy of the last page of Form C. It gives less information but has been found useful, especially for evaluation of boys such as the 16-year-old apprentices. This list of questions is adequate for estimation of the psychoneuroses but throws less light on their cause than does use of the more complete form. The simplified form scores the total number of psychoneurotic determinants and the stop questions only.

The Index affords a qualitative means of obtaining necessary psychiatric information, regardless of use of the stencils. Page 3 of form C (or form N) is in essence a standardized psychiatric interview which is self-administered and gives a quick, reliable screening method for detection of neuropsychiatric and psychosomatic disorders.

SUMMARY

The functions of a psychiatrist in the Navy yard are manifold. Psychiatric examinations are done for a steadily increasing percentage of new applicants for employment. Those most likely to be inept are immediately detected and either rejected or referred to other agencies.

Similar examinations are done as a part of re-examination (rechecks) of a steadily increasing percentage of those requiring

re-evaluation after employment. Personnel of the Navy, Marine Corps and Coast Guard are afforded prompt psychiatric examination on the station. An over-all picture of all physical examinations for new employees is obtained. All re-examinations of civilian employees are reviewed, from both a physical and a psychiatric viewpoint.

This system results in better selection of applicants for the various jobs and of jobs for the physically or psychiatrically handicapped applicants. Increased efficiency and saving of time is effected in examination and disposition of Navy, Marine Corps and Coast Guard personnel.

The rehabilitation program of the Government is facilitated by classification of psychiatric cases and cooperation in job-selection between the psychiatrist, the civilian personnel of the Labor Board and the Civil Service Commission.

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RH FACTORS

Rh factors are three in number, designated as Rh_o, Rh′ and Rh″ respectively.—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

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CLINICAL ASPECT OF GRAMICIDIN S

Gramicidin is a biologic antiseptic which is highly bactericidal, yet it is not injurious in concentrations of 0.4-0.8 mg. per cc. of aqueous solution and does not prevent leukocytosis. It is effective against streptococci, and less so against staphylococci. It does not lose its potency in the presence of pus, does not irritate tissue, and acts favorably on regeneration and epithelization, and the longer the cultures are under the influence of gramicidin, the better its action. For pyocyaneus, Escherichia coli, and especially proteus, gramicidin is more bacteriostatic than bactericidal.

The concentration of the solution must be higher, the more serious the wound infection, and best results are obtained with irrigations for 3 or 4 days or with daily wet dressings. In later stages of wound healing, gramicidin emulsion or ointment may be used, changing the dressing every other day. Powdered gramicidin and alcohol solutions are stable for a long time; the water solution must be prepared on the day of use. Gramicidin produces hemolysis and cannot be used intravenously or locally when bleeding granulations are present, but it quickly prepares infected wounds or ulcers for plastic surgery.—MANEVICH, A. A., and PITSKHELAURI, G. Z.: Treatment of wounds and ulcers with gramicidin. Am. Rev. Soviet Med. 2: 147-148, December 1944.

MEDICAL HOLDOVERS AT A U. S. NAVAL TRAINING CENTER

ALLEN G. BRAILEY
Lieutenant Commander (MC) U.S.N.R.

Civilians entering military service during this war are subjected to the most careful scrutiny. The great demand for manpower has put draft boards under severe pressure to fill their quotas and at times only men with gross disabilities have been rejected by these agencies. At the Induction Centers, however, each candidate has stripped and been examined with care by a series of medical and surgical specialists. If he passed this screen successfully, he has taken the oath and formally entered the armed forces. Next he has been ordered to report to a training station where he has been re-examined by a succession of specialists at the Receiving Unit before being sent to active duty. Here those who are suspected of disqualifying conditions are segregated in a Medical Holdover Unit for further study, treatment and disposition.

An inventory of the activities of this Holdover Unit for the year 1943 is most interesting. The staff of the unit consists of two medical officers, one chief pharmacist's mate, seven hospital corpsmen, and three civilian typists. Berthing space for 208 men is provided. No dispensary or sickbay is provided, because these facilities are available in an adjacent activity and men requiring bed treatment are readily transferred to a sickbay or to a Naval hospital. The unit provides an opportunity for taking a more detailed history and making a careful physical examination. It is, moreover, a convenient billet for the patient while consultations are being held, or laboratory studies carried out.

The only source for new admissions to the Medical Holdover Unit is the Receiving Unit. As soon as practicable, each admission is interviewed and carefully examined by one of the medical officers. In some instances the proper disposition is immediately obvious, but more often further laboratory studies or the opinions of consultants are required. Ultimately disposition is by one of five routes: The man may be discharged to duty, he may be transferred to the Naval hospital, or he may be transferred to the Neuropsychiatric Unit. He may be discharged from the service

as a result of a medical survey, or he may be discharged by special order discharge.

From January 1943 to January 1944, approximately 3 percent of all recruits examined at the Receiving Unit of this center were admitted to the Medical Holdover Unit for further study and disposition. Of the total number of holdovers, 70 percent were ultimately found qualified and returned to duty; 16 percent were transferred to the Naval hospital for correction of various surgical disabilities. These men were disposed of at the hospital. All but a few were discharged to duty. One percent was transferred to the Neuropsychiatric Unit for disposition. Four-tenths percent was discharged from the service by Special Order Discharge, chiefly because of positive serologic tests for syphilis without other evidence of the disease.

Twelve percent were discharged from the service as a result of recommendation of a Board of Medical Survey. Of this group, 76 had valvular heart disease. One of these, a man of 30 years of age, had a severe aortic regurgitation. He denied ever having had a chancre but his blood test for syphilis had been found positive five years previously. He had received weekly antiluetic treatments for 18 months. For two years he had been subject to occasional attacks of severe substernal pain brought on by effort and relieved by rest. He was considered to have luetic aortitis as the result of congenital infection.

Fifty-three men were given medical discharges because of hypertension. Such a diagnosis was not considered established until from three to six blood pressure readings, taken on separate days by a trained hospital corpsman, showed the systolic and diastolic pressures to be above acceptable limits. These readings were taken in a quiet room, with the patient as rested and relaxed as possible and sitting in a comfortable chair.

Forty-five men had perforations of one or both tympani. Twenty had chronic nephritis as evidenced by persistent albuminuria together with red blood cells, casts or both in the urinary sediment. In the case of men admitted to Medical Holdover because of albuminuria, all urine specimens were collected at reveille with the subject still recumbent.

The remainder of the men discharged after medical survey constituted a fairly large group with disqualifying defects of vision or hearing, and a few cases with multiple diseases and defects. There were seven patients with tuberculosis and two with spondylitis. Arthritis, asthma, duodenal ulcer, thyrotoxicosis, acromegaly and diabetes mellitus were other discharge diagnoses.

It is true that these men found not eligible for Naval service constitute a very small percentage of the total number of recruits

who were received at this center during the year. But when it is recalled that each of them had been carefully examined on at least one occasion within a few days of arrival here, and had been certified to be fit for all duty, it is apparent that an error had occurred. This is particularly unfortunate because the men have been put to unnecessary inconvenience, and an unnecessary expenditure of the Government funds had been incurred.

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RH TESTING

Rh testing is examination of blood for the Rh factor, using either anti-rhesus serum or anti-Rh$_o$ serum alone.—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

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TOXICITY OF TNT

The experiments performed on the toxicity of TNT in experimental animals, mainly dogs, show that TNT is readily absorbed through the respiratory tract when inhaled as dust. TNT is readily absorbed from the gastro-intestinal tract, but through the intact skin it is of a lower order. The toxic effects observed, both with insufflation and with oral administration of comparatively large doses over a period of several months, are characterized by disturbance of the central nervous system, moderate anemia of peripheral origin, and irritation of the gastro-intestinal tract and the urinary bladder. None of the animals developed distinct injury of the liver. This suggests that TNT itself is not a primary hepatotoxic agent. The anemiagenic action of TNT in animals is of peripheral origin and of a temporary nature. This may suggest that only some cells in the circulating blood are affected and that after these have been eliminated, peripheral destruction and hemopoiesis balance each other. Spasms of the sphincter of the urinary bladder, urinary incontinence, and irritation of the mucosa of the urinary bladder, are seldom reported in TNT workers. They resemble strikingly similar effects seen following exposure to aniline, and it appears not unlikely that they may be caused by the excretion of amino derivatives of TNT. So far, only 2,6-dinitro-4-aminotoluene has been identified in the urine of dogs.—VON OETTINGEN, W. F.: Experimental studies on toxicity and potential dangers of trinitrotoluene (TNT). Pub. Health Bull. No. 285, 1944. p. 78.

SYMPTOMATIC WEAK FEET IN NAVAL PERSONNEL

CLARENCE A. SPLITHOFF, M.D.

Foot complaints are very frequent in military service, and too often treatment consists simply of foot soaks or the suggestion is made to "forget it." However the person with flat feet who is having symptoms has a real problem. It may be assumed that all persons with disabling types of flat feet have been eliminated before entering service. This leaves those who, under the ordinary circumstances of civilian life, might have little or no difficulty but under the added stresses of military duty develop symptomatic feet.

The most frequent complaints are of tiredness and sensations of aching and burning of the feet, occasionally extending into the calves and to the thighs. There may be pain in the region of the long arch, localized usually in and about the navicular bone and its articulation with the cuneiform anteriorly and the talus posteriorly. There may be complaints of cramps and sensations of tightness in the calf muscles, especially after extended walking.

The patient may complain of a large tender callus, located usually under the second and third metatarsal head. This results from an abnormal position of the foot, with a shift of the weight-bearing portion from the head of the first to the head of the second metatarsal bone. Most patients with symptomatic weak feet report relief following rest in bed, or any change in program whereby they can be off their feet for a time.

The diagnosis is usually made with little difficulty; however a certain routine should be established by the examiner in order not to miss other concurrent conditions.

The patient is seated on the edge of a table a little above the examiner, who may be seated on a stool. The color and texture of the skin of the foot should be observed. Any excessive sweating should be noted, also the presence of corns, calluses and bunions. The form of the foot should be noted, together with the shape of the arch when resting. Any abnormalities of the toes, such as hallux valgus or hammertoe, should be observed, together with skin conditions which might contribute to the symptoms. The patient may then be asked to carry out actively the usual motions of the foot, i.e., plantar flexion, inversion, eversion and circumduction.

Palpation should be next carried out to determine tender or painful areas, particularly in the region of the navicular bone and the astragalus. The dorsalis pedis artery should be palpated to determine the circulatory status.

To detect shortening of the Achilles tendon the foot is passively inverted and dorsiflexed. Mobility should be determined by careful manipulation. Tenderness and spasticity should be carefully noted. The patellar, Achilles tendon and Babinski reflexes should be tested routinely, and all gross motions of the foot should be carried out by the patient against resistance, in order to determine muscle weakness.

TREATMENT

Any obvious faults disclosed in the general examination should be followed up. Circulatory disturbances, muscular weaknesses or neurologic changes call for further examination. However for the ordinary weak foot the following plan of treatment will usually give relief.

Footgear.—The patient should obtain, if possible, semi-orthopedic shoes. These shoes should be fitted long enough so that the ball of the foot comes just at the break of the inner border of the sole, and should be wide enough so that the leather can be pinched in a small fold with the thumb and forefinger when the patient is standing. In the event that the os calcis is in valgus position, it may be necessary to add ⅛-inch to $\frac{3}{16}$-inch inner heel wedge. More than this is usually unnecessary and uncomfortable. It is wise when possible to balance the heel wedge with a ⅛-inch outer sole wedge. In addition, support may be added to the arch by a rubber or wool felt pad, the highest point of which is placed under the scaphoid bone. This may be glued to the inner sole of the shoe.

Exercises.—The patient is then instructed in a series of exercises which should be performed for from 15 to 20 minutes twice daily. It is true that exercises done for such a short period of time daily will in themselves have no profound effect. Together with other factors, however, the cumulative result will be beneficial.

1. While standing, both feet are repeatedly forcibly inverted and the toes flexed. The patient walks back and forth across the floor several times, holding this position.

Calf stretching is done by having the patient stand about 2 feet from a wall, facing the wall and with the feet together. Keeping the body rigid and placing the hands on the wall, he then leans forward toward the wall ten times, keeping the feet in position and heels on the floor.

2. With the patient seated, both feet are actively flexed, inverted, everted and circumducted.

With the ankles crossed, the foot is forcibly plantar flexed and inverted. This exercise may also be done by having the patient attempt to pick up marbles from the medial side of the foot and place them on the lateral side of the same foot. There are any number of exercises which can be added to vary the program; however these will suffice for the average case.

Following exercise, the patient bathes the feet for 15 minutes in contrast baths. This is done by using one bucket of water as hot as can be tolerated and another of ice water, plunging the feet alternately in the hot and cold water for ½-minute intervals and finishing in the warm water. Massage is also beneficial and relaxing.

CONCLUSIONS

1. Symptomatic weak feet are seen frequently among Naval personnel in dispensary and sickbay practice.

2. The condition can be relieved by intelligent analysis of the problem and the application of simple treatment.

3. Treatment consists essentially of proper footgear with added correction when indicated, exercises, massage, and contrast baths.

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COLLOIDAL ALUMINUM HYDROXIDE GEL IN TROPICAL SKIN DISEASES

Almost all skin conditions in the tropics are made worse by continuous perspiration. Many times the usual preparations used in non-tropical climates actually adversely affect the patient. Colloidal aluminum hydroxide in the form of the ordinary commercial gel offers an excellent, finely dispersed, tenaciously adherent, astringent, acid neutralizing, moisture protective preparation which helps in quieting the acute manifestations of certain skin diseases.

These include miliaria rubra, tinea cruris, tinea circinata, weeping eczematous lesions, impetigo and epidermophytosis.

There is almost immediate relief of the distressing symptoms of miliaria on first application of the gel. Its action is quick and prolonged. Patients who worked in the hot part of the ship and who perspired freely would suffer recurrence of symptoms but after a shower at the end of the day and reapplication of the gel, relief would be experienced, the rash meanwhile becoming progressively better as the applications were continued. Colloidal alluminum hydroxide gel is the most useful and helpful of any drug or preparation employed in the management of this almost universal affliction of military personnel in the tropics.—HOWARD, C. K., Lieutenant (MC) U.S.N.R.

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THE "HOW" OF TOOTHBRUSHING

A practical sequence in brushing one's teeth is always to brush the chewing surfaces of the back teeth (molars and bicuspids). The reason is evident: These surfaces have natural grooves, crevices, pits and other irregularities into which food becomes tightly packed during mastication owing to the tremendous pressure (about 150 pounds) between the jaws. Obviously this wedged-in food can be dislodged more readily at the beginning of brushing, when the bristles are stiff, than after they have become softened. Then brush the outer side of the teeth and gums. The bristles, somewhat softened after their use on the chewing surfaces, are now less apt to injure the gum tissue. Lastly brush the inner side of the teeth and gum. The gum in this area is liable to injury by stiff bristles owing to the fact that we cannot see exactly what we are doing and that the action of the brush here is not always easily controlled. Therefore we are less likely to inflict injury at the end of brushing, when the bristles become additionally softened through use on the outer side.—Why and how of toothbrushing. J. Am. Dent. A. 32: 80-85, January 1, 1945.

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SULFATHIAZOLE IN EXPOSED PULPS

Comfortable pulps have been obtained in approximately 75 cases of exposed pulps using the same treatment in every case regardless of the size of the exposure. The experiment was based on 30 days elapsing between capping the pulp and placing the permanent restoration. Sufficient follow-up studies indicated that the treatment was effective. No extraction was done by using the sulfathiazole method. Every patient treated had exposure from caries, and hemorrhage.

The treatment consisted of a 50-percent sulfathiazole and 50-percent zinc oxide in eugenol paste spread evenly over the exposure, avoiding pressure in applying the medication. The remainder of the cavity is filled with cement, using 1 drop of eugenol with 2 of ordinary oxyphosphate cement liquid until a mix is secured which can be poured into the cavity.

At the end of 30 days a permanent restoration was placed, cutting out a portion of the cement and leaving the rest as a base. From the results obtained in this case, sulfathiazole seems to have value as a bacteriostatic in the treatment of pulps exposed by dental caries.—RUSSELL, R. G., Lieutenant (DC) U.S.N.R.

CLINICAL NOTES

CINEMA THERAPY IN AMNESIA

REPORT OF A CASE

E. LYLE GAGE
Lieutenant Commander (MC) U.S.N.R.

The cinema by reason of its sound effects, color photography and animated stories has become one of the best mediums of instruction. Motion pictures have been taken of athetoses, tremors, grimaces and incoordination and by this means intricate movements which otherwise might have gone unobserved have been demonstrated. Patients have been shown these pictures in attempts to correct posture, movements, and attitude, and hospitalized mental patients in groups have been shown motion pictures for divertissement. However the "movie" as an agent for specific treatment of psychiatric patients has been somewhat neglected. It had a rather remarkable effect in a difficult amnesia case which is reported here.

Case report.—One day in June 1944, a tall, dark, well built young man was found wandering about a town in Sicily. He was wearing American military clothing but his actions were sufficiently unusual to cause him to be picked up for investigation by the British authorities. He claimed that he "woke up" in a trench in Anzio on or about 15 May and made his way southward, hitchhiking until he was arrested. He had a patchy distribution of forgetfulness for events prior to the happenings before his arrest, but recent events and retention were well preserved. There were no trends and no hallucinations, but he could not remember whether his name, which he gave as C.... F...., was his correct one, or anything definite about his past life. General physical examination and skull x-ray study failed to disclose any significant abnormality and results of a blood Kahn test were negative.

General psychologic examination disclosed that there was a definite decrease in memory, with anxiety, confusion, restlessness, emotional instability and slight startle reaction, but no noise sensitivity, panic reaction, depression, nightmares or insomnia. He had no psychosomatic symptoms. There were agitated movements, some emotional lability, and slight retardation and belligerency. The pupils were dilated and showed hippus, but the man was thoroughly cooperative.

Because of irregularities in his uniform, his inability or unwillingness to reveal details of his past, and his speech (which was not characteristic of any language group), a thorough study of the case was undertaken by both

medical and intelligence authorities. Association tests, with and without the use of amytal, were essentially nonproductive except to show the patient more familiar with British terms than American. He claimed to be an American soldier but was unfamiliar with some of the commonest terms in the vocabulary of the average soldier, and used British phrases and terms freely.

On 30 June he was given 3¾ grains of sodium amytal intravenously without productive results. He was seen by members of six organizations having missing men but could not be identified. On 3 July he was given intravenous sodium pentothal and he spoke of the river Forth, the RAF, and said his name was David. Two days later he was again questioned under pentothal sodium without any helpful results, and the following day he was transferred to this dispensary with the notation that: "It would seem from observations and findings that the patient (1) does not know German; (2) has close ties to Scotland; and (3) has amnesia.

Examination on admission confirmed the previous findings. The patient was fully cooperative and eager to help, but showed evidence of some anxiety. He was placed in the neuropsychiatric lock ward in care of a specially trained corpsman, and careful notes were kept on his actions and conversation. He was given a full meal and ate well but was not given any medication. He spent nearly 2 hours with the intelligence officers, showing no sign of nervous instability or undue worry. He recalled no additional information, and no new knowledge concerning him was obtained by the interview.

After lunch the patient rested for an hour and a half and then he was led in conversation by the corpsman and taught to play cribbage. He then read for a while but did not seem to understand fully what he was reading. His personal habits were clean and he welcomed companionship. When given some American beer he didn't seem to know what it was. In the evening at the suggestion of the corpsman he was taken to see a motion picture. This proved to be an exciting cinema dealing with the exploits of Jack the Ripper, and home life in the British Isles. During the show the patient seemed to be concentrating intensely and immediately afterward he said he remembered some of the music and thought he had heard it in church. His brow was wrinkled and his attitude was more pensive than at any time since admission. When asked if he could sing he said he could but would not demonstrate, acting hesitant and somewhat confused. There was no change in his manner or accent.

He was returned to the lock ward and prepared for bed. At 0050 the next morning he began talking and tossing in bed. The guard stated that it seemed as though the patient was arguing with a "Master H....." He cried "don't" in a pleading voice, and said something which the guard thought was "Turn the lights out" in German. He continued to thrash about in bed calling for Master H...., and in his moving about fell out of his bunk to the deck about 16 inches below, landing on his buttocks.

He awakened, asked the guard where he was, and talked sensibly but with a decided Scotch accent which was entirely different from his previous conversation. He at once told his full name, David P...., number, place of birth in Scotland and all details of his family and his early life, enlistment and service. He stated that on awakening and seeing the light coming through the bars of the door he thought he must have been drunk and was in the guardhouse. He said that he remembered nothing since being in the trench at Anzio with German shells falling all around him, and denied all knowledge of the German language.

When told of the guard's comment about his speaking German he asked if it could have been Scotch dialect, which he demonstrated and then related that Master H...., was his close friend and number two man on the gun which the patient had fired in action. He did not remember the hospital guard of the previous day, nor anything about the game of cribbage which he had learned.

A check with the proper authorities showed this "new" man's answers to be correct in every detail, but he remembered none of his amnesic life, even when it was told him. He was discharged on 12 July.

In reviewing this case it seems that while the passage of time, earlier therapy, and the shock of the slight fall from his bunk may have played a part in breaking down the amnesia, the moving picture with its excitement, its familiar scenes, sounds and music, and the patient's concentration thereon played the major role in precipitating his recovery. It is believed that cinema therapy may merit a more prominent place in psychotherapy.

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SLEEP AND DREAMS

Investigations into the length and depth of sleep and incidence of dreaming among normal people have been surprisingly few. The only thorough work on the subject is that of Heerwagen (1889). He interrogated 406 people, who were classified in three groups, one hundred thirteen men, 151 students and 142 women. He confined his method to questioning the subjects. Among his many conclusions are the following:

The lighter the sleep the more frequent the dreams.

There is a well-marked difference in the frequency of dreams between the sexes; women dream much more often.

Women are lighter sleepers than men.

The incidence of dreams is small in childhood, increases to a maximum between the ages of 20 and 25 and then decreases progressively.

Sleep becomes lighter with increasing age.

In men the frequency of dreams and the depth of sleep have no effect on the length of sleep.

Women who dream more often sleep longer.

Women who sleep lightly sleep a shorter time than those who sleep deeply.

Women sleep longer than men, but this is because circumstances allow them so to do.—HEERWAGEN, F.: Phil. Stud. (Wundt) 5: 301, 1889. Cited by COHEN, E. L.: Length and depth of sleep. Lancet 2: 830-831, December 23, 1944.

VARICOSE VEINS OF THE UPPER EXTREMITY

REPORT OF TWO CASES

SAMUEL CANDEL
Lieutenant Commander (MC) U.S.N.R.

Varicose veins rarely occur in the upper extremity. Barker (*1*) stated in 1935 that such varicosities are almost never seen and that chronic venous insufficiency rarely develops. In 1912 Bircher (*2*) reported one case. In 1928 Sonntag (*3*) collected eight cases from the literature and added one of his own. In a case of axillary vein thrombosis reported in 1934, Matas (*4*) mentioned the appearance of varicose veins of the arm 4 years after the original thrombosis.

CASE REPORTS

Case 1.—A seaman, first class, age 19, was admitted to the medical service with the chief complaint of swelling of the left forearm of 4 months' duration. His family history was noncontributory. He stated that when he was 2 years old a birthmark had been surgically removed from his left forearm. A communication from the hospital stated that on 18 October 1927 he had been treated for cellulitis of the forearm by incision and drainage and had been discharged on 30 October. He was readmitted 4 months later with a diagnosis of cellulitis of the left arm. Twenty-three days later he was discharged without operation.

He had been well and had had no difficulty with his upper extremities until about 4 months before admission. At that time he fell on his left forearm while boxing at boot camp. The next morning the forearm was swollen. The swelling subsided after 2 days but reappeared a few days later. However as it did not interfere with his activities he sought no medical advice until 4 months later when the swelling became most pronounced.

On admission his weight was 148 pounds, temperature 98.6° F., pulse rate 72, respirations 16, and blood pressure 118/88. No abnormalities were found except those associated with the left upper extremity. There was a large varicose vein on the inner aspect of the lower third of the left arm, and a marked cyanotic pitting edema, beginning sharply at the left antecubital fossa and extending to and including the fingers. Numerous fine intracutaneous venules could be seen. There was a scar ⅛ inch wide and approximately 6 inches long on the anterior and ulnar aspect of the forearm.

The following pertinent negative physical findings were noted: The radial pulse was palpable and equal in both forearms, the varicose vein of the left arm emptied easily on elevating the limb, there was no evidence of thrombosed veins on palpating the left arm and axilla, no evidence of abnormal masses in the left axilla, no swelling of the left arm, and no evidence of

increased collateral circulation around the left shoulder or anterior wall of the chest.

A complete blood count, urinalysis, erythrocyte sedimentation rate, platelet count, and prothrombin time, were all within normal limits. The blood Kahn test was negative. An x-ray of the chest showed it to be normal, and x-ray examination of the left forearm, arm, and shoulder showed no evidence of bone disease or other pathologic change.

The patient was put to bed and the left upper extremity was elevated. Within 4 days there was a considerable decrease in the amount of edema present. However 2 weeks later, when he was permitted to get out of bed and keep his extremity in the dependent position, there was an increase of swelling of the forearm.

Eight weeks after admission the circulation time (calcium method) was 10 seconds in the right arm and 14 seconds in the left, both within normal limits.

Venous pressure determinations were done at veins in the antecubital fossa, and the exercise test of Veal and Hussey (*5*) was given. The following is a summary of the findings:

Venous pressure in antecubital fossa

		At rest*	Exercise test**
Dorsal decubitus	Right arm	100 mm.	120 mm.
	Left arm	30 mm.	30 mm.

* ***Rest:*** Venous pressure in terms of mm. of water measured at the level of the vein, 5 cm. below the fourth costochondral junction.

** ***Exercise:*** Test of Veal and Hussey. In venous obstruction the venous pressure rises to levels much higher than 10 mm. more than the venous pressure at rest. Veal and Hussey reported a rise in pressure that was never less than 50 mm. of saline in cases of local venous obstruction.

Venograms of both upper extremities were made, using diodrast as the contrast medium. The method employed was Mark's (*6*) modification of the method of Dos Santos which was used by both workers for the purpose of studying veins of the lower extremities. In the present case, 15 cc. of diodrast was injected for each film. Each extremity was roentgenographed on a separate day.

Figure 1 is a venogram of the left forearm done with a tourniquet placed above the elbow to prevent too rapid dissipation of the contrast medium. Diodrast was injected at the origin of the cephalic vein at the wrist. The basilic and the communicating veins of the forearm are not visualized. No competent valve is seen in the branches of the brachiocephalic vein.

To make certain that the basilic vein of the forearm could not be visualized, another venogram (fig. 2) was made by injecting a small vein on the anterior ulnar aspect of the forearm. Again the basilic vein was not seen. The diodrast was shunted over to the cephalic vein and was also carried by very small venules on the ulnar aspect toward the elbow. At the elbow, just under the tourniquet, part of the tortuous varicose basilic vein can be seen.

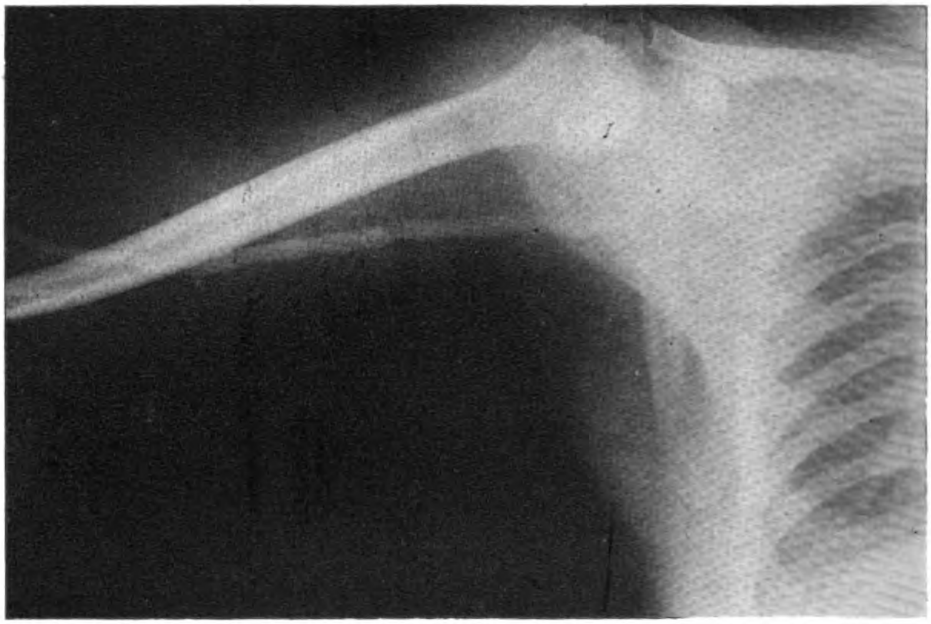
A venogram of the right upper extremity (normal) was done with the tourniquet placed higher on the forearm and with the diodrast injected in

1. Injection at radial aspect in branch of brachiocephalic vein. Tourniquet above elbow. No visualization of basilic or communicating veins.

2. Injection at ulnar aspect in branch of basilic vein. Again no visualization of basilic vein. Some of contrast medium is seen infiltrated at wrist. Note varicosity medial to humerus.

3. Right upper extremity (normal). Injection at radial aspect in branch of brachiocephalic vein. Tourniquet high on arm. Visualization of entire venous system, particularly basilic branches in forearm and communicating veins. Note competent valves.

4. Left upper extremity. Injection into varicose vein on medial aspect of elbow. Observe dilated basilic and axillary veins.



5. This venogram of the normal right upper extremity was made by injecting a branch of the basilic vein in the antecubital fossa. The basilic vein of the right arm is approximately one-half the diameter of the corresponding vein of the left arm.

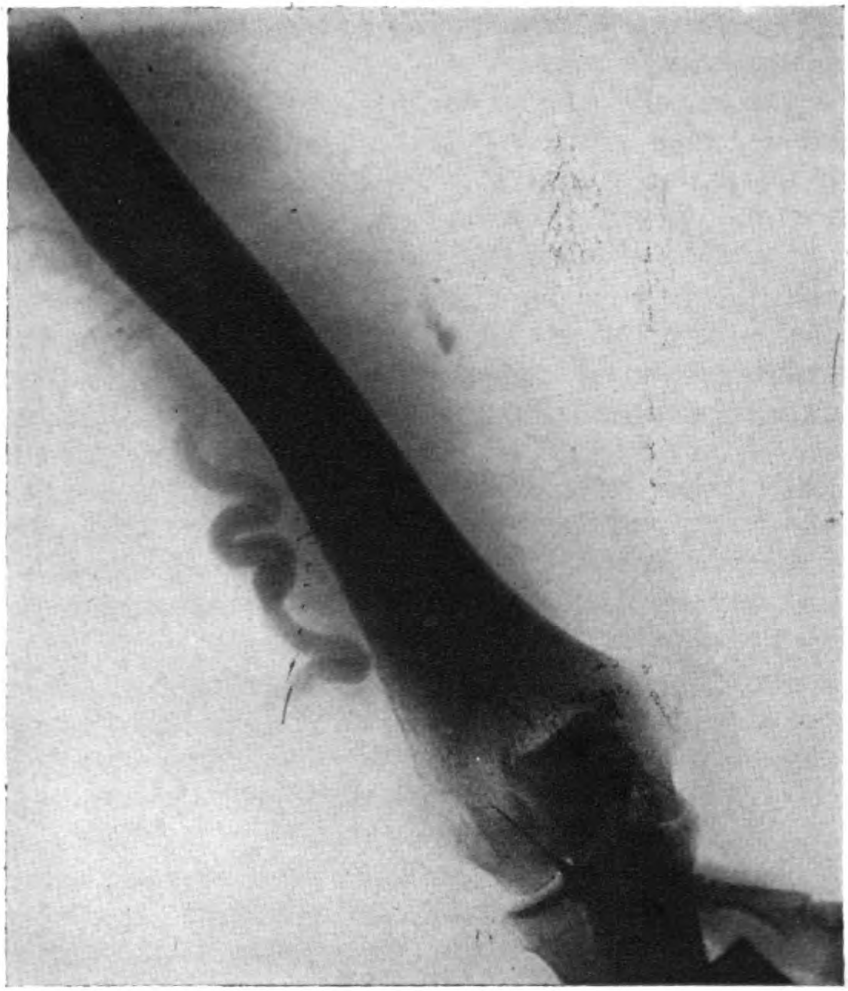
the wrist vein analogous to the one used in figure 1. Comparison with the two previous films shows a striking difference. In figure 3 the cephalic and basilic vein origins stand out clearly, communicating branches are in evidence, and good competent valves are well visualized.

The venographic study shown in figure 4 was made by injecting directly into the varicose dilated superficial vein on the medial aspect of the left elbow. The caliber of the basilic vein should be noted and compared with its fellow on the opposite (normal) arm. Its dilatation is apparent. There was no evidence of obstruction of the basilic or axillary veins which could be traced on the original roentgenogram into the subclavian vein.

Case 2.—A seaman, second class, age 26, was brought to the sickbay from an LST. The patient stated that a vein in his right arm had been enlarged for 4 years. He recalled no injury to or swelling of the arm. His only complaint was a little more rapid fatigue of the right arm after doing very heavy work. As his ship was to leave within a few hours and the condition was far from incapacitating, he was returned to duty. Physical examination disclosed no essential abnormalities except a large serpentine varicosity on the outer aspect of the lower third of the right arm. X-ray examination of the chest did not show any evidence of disease. A diodrast venogram demonstrated the varicose vein very clearly.

COMMENT

In Case 1, it was evident when the patient was first seen that the swelling of the left forearm was due to a vascular disturbance. His forearm was cyanosed, and minute venules were visible, there was a pitting edema, and a large varicose vein on the medial aspect of the elbow extended up the arm for a distance of 2 inches.



6. Injection into varicose vein of right upper extremity.

The problem in diagnosis was to differentiate between the following: (1) Mediastinal obstruction of the venous system, affecting particularly the venous channels of the left upper extremity; (2) thrombosis of the axillary or brachial vein; (3) neoplasm of the forearm with local invasion of the veins (history of removal of a nevus many years before); (4) obstruction of the veins of the forearm due to postoperative scar tissue; (5) thrombosis of the veins of the forearm following an injury incurred while boxing; and (6) varicose veins of the upper extremity with a decompensated venous system.

Mediastinal obstruction could be excluded by the normal findings of a chest x-ray and the normal venous pressure in the arm veins. Thrombosis of the axillary vein could be ruled out because there was (1) no swelling of the arm; (2) no evidence of increased collateral circulation of the shoulder or anterior chest wall; (3) normal venous pressure in the veins of the antecubital fossa (7); (4) normal response to the exercise test of Veal and

Hussey; and (5) venograms showed no evidence of obstruction of the basilic or axillary veins. There was no evidence of a neoplasm; no mass was palpable and no metastases were found. There was no regional lymph node enlargement. Roentgenograms of the bones of the upper extremity showed them to be normal. Local obstruction due to postoperative fibrosis was excluded because no vein was observed which ended abruptly at the area of scarring.

The problem then resolved itself into determining whether the edema of the forearm was caused by local phlebothrombosis or by a decompensated venous system. Varicose veins of the upper extremity are rare. Insufficiency of such varicosities must be even more rare. No proved case was found in a survey of the literature. Veal (*8*) has referred to insufficiency of the venous system of the upper extremity as the post-thrombotic syndrome when it followed thrombosis of the axillary and subclavian vein. He found that this occurred when there was a permanent occlusion of these vessels by the organization of the thrombus.

In the case presented here there was no occlusion of the basilic, axillary or subclavian veins. The basilic and axillary veins were patent and dilated, and there was positive evidence of the absence of any obstruction proximal to these vessels. It was inferred, then, that this dilatation was of long standing. However although there was a possibility of the lesion being a venous insufficiency secondary to varicose veins, it seemed more probable that it was a phlebothrombosis of the veins of the forearm following injury, and that this phlebothrombosis occurred more readily because of impaired circulation due to the varicose veins. In favor of the diagnosis of local phlebothrombosis was the history of injury to the forearm followed by swelling. Venograms failed to visualize the ulnar vessels. Unfortunately no venous pressure determinations were made at the wrist. There was much technical difficulty in entering the veins at that site in the diseased extremity.

It is interesting to speculate as to the possible origin of the varicose veins. In childhood this man had had an incision and drainage of his left forearm for cellulitis. He was told by his parents that there was a birthmark on his left forearm. He may have had an infected nevus which was excised and drained. Four months after this procedure, he was readmitted to the hospital with a diagnosis of cellulitis of the arm. No operation was done and he was sent home after 23 days. This latter admission could have been due to an axillary vein thrombosis with swelling of the arm. The thrombosis could have recanalized. Weakened walls of the axillary and basilic veins could have been a residue of this process. Recanalization of the axillary and brachial vein does

occur. Perlow and Barth (*9*) demonstrated the process by serial study of venograms on two patients with thrombosis of these veins. Matas reported varicose veins in the arm which appeared 4 years after a thrombosis of the axillary vein.

Studies of the venous pressure of the varicosed vein in this patient were consistent with findings noted in venous pressure studies on varicose veins of the lower extremity. The venous pressure of a varicose vein of the lower extremity was shown by Villaret and his associates (*10*) as often to be even lower than the corresponding normal vein. In this case the venous pressure of the varicosed vein was 3 cu. mm. of water and that of the corresponding vein of the normal arm was 10 cu. mm. of water. Venous pressure determinations of each arm in the erect position showed a very slight difference in the height of the pressures. This was observed in varicosities of the lower extremities by Mayerson, Long and Giles (*11*).

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PLASTIC REPAIR FOLLOWING SCROTAL GANGRENE

REPORT OF A CASE

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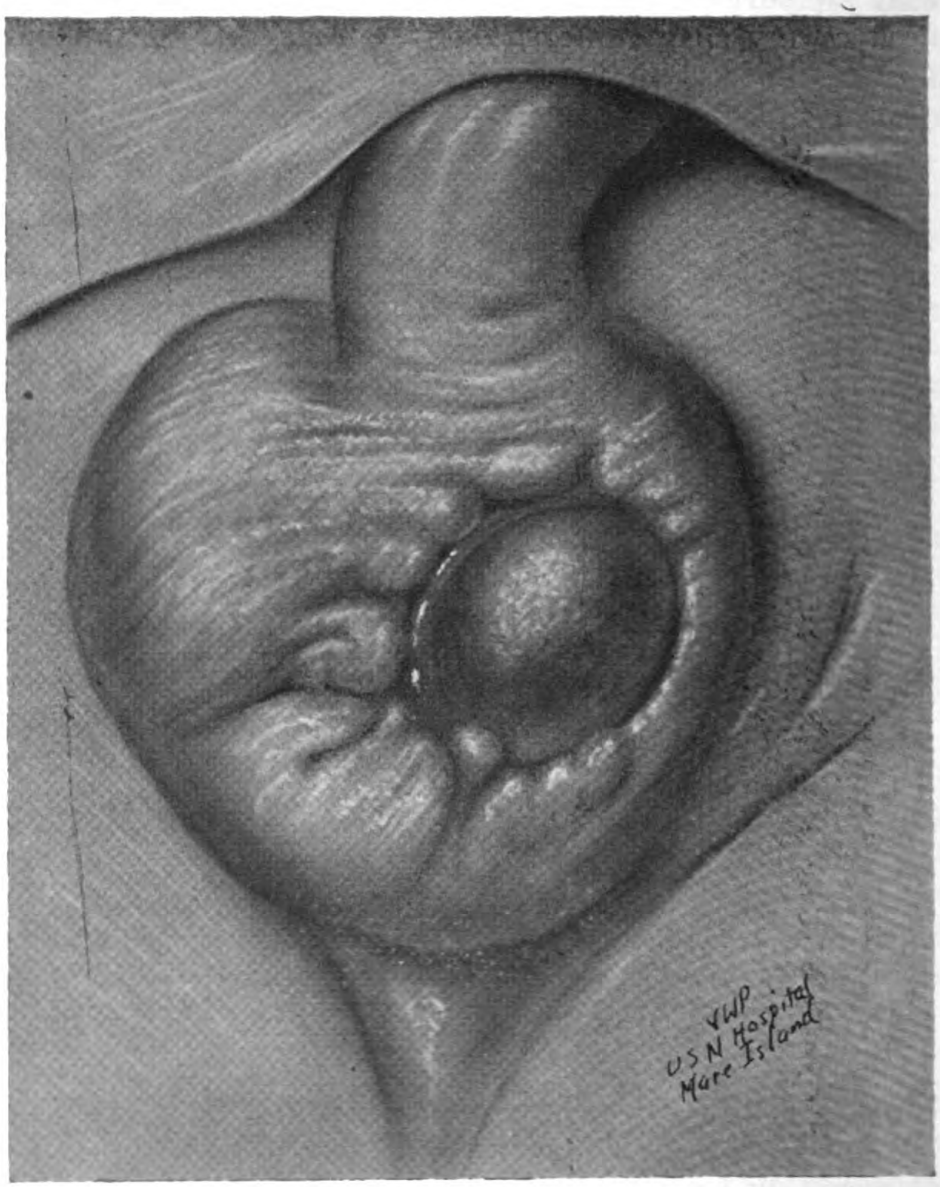
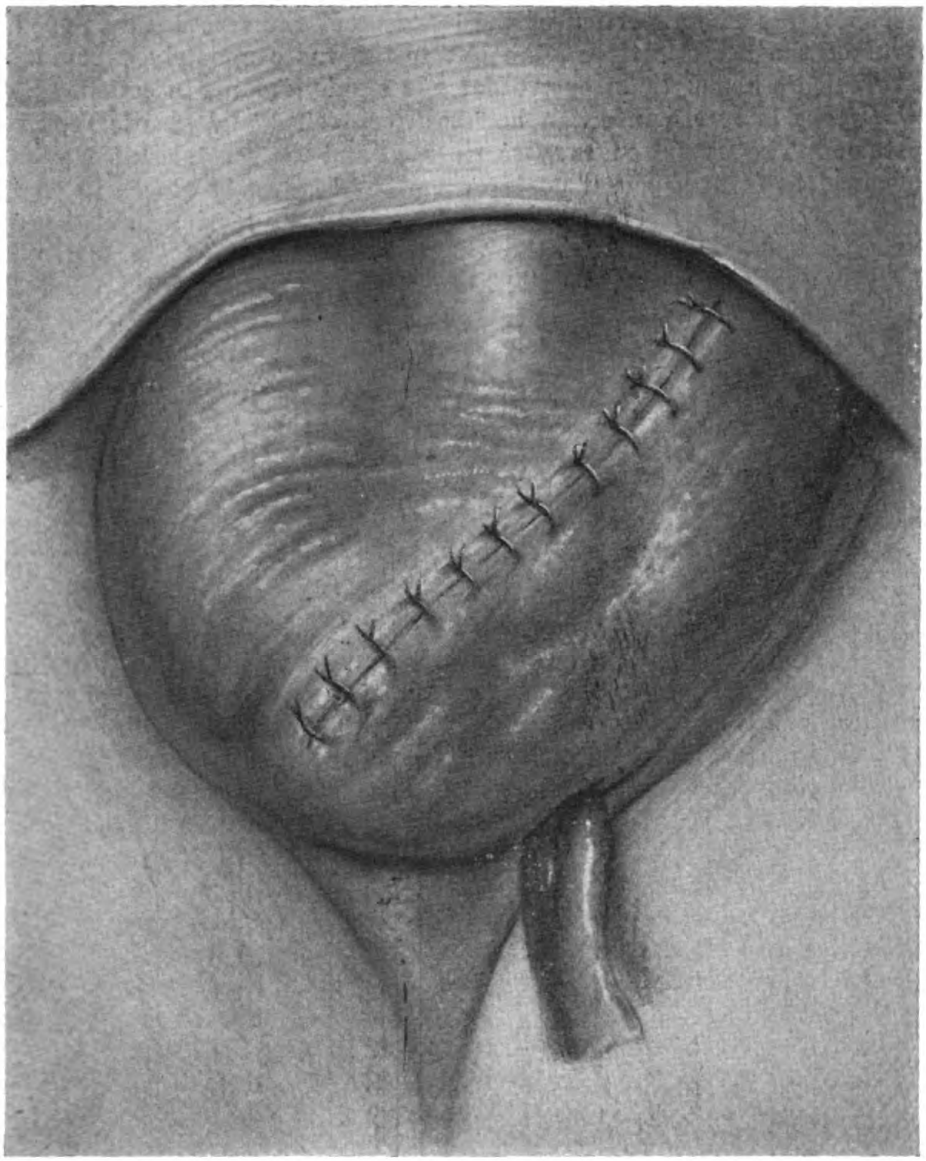
Following destruction of the scrotal skin, whether from infection or trauma, when the testes are exposed it is necessary to effect very early closure to preserve testicular viability.



1. Necrosis of skin of left side of the scrotum with testis exposed.



2. Reconstruction of left scrotum forming posterior pocket with dependent drainage.

After the loss of scrotal tissue by trauma, the testis should be covered immediately. If the loss was due to infection, coverage should be delayed until the wound is surgically clean. The material of choice to use for this covering and repair is the remaining scrotal tissue. If there is insufficient scrotal skin remaining for repair, tissue in the immediate vicinity should be utilized.

Case report.—The patient had been operated upon for left direct inguinal hernia. Nothing unusual was noted at the time of surgery and a modified Bassini repair, using an autogenous fascial strip, was done. Two days later an area on the left side of the scrotum became reddened and tender. The hernia incision was not involved. The patient's temperature rose to 102.5° F., and the leukocyte count to 15,000. The area of involvement increased and

gangrene of the major portion of the left side of the scrotum developed. On removal of the necrotic tissue, the left testis was completely exposed. Culture revealed a hemolytic streptococcus and staphylococcus infection.

Two weeks later the infection had been controlled and plastic repair was undertaken. The wound edges were elevated and the scrotal skin was widely undermined to form a pocket posteriorly. The testis was placed in this surgically formed pocket. The skin was closed without tension, and dependent drainage was employed. Penicillin therapy was employed for 3 days preoperatively and 7 days postoperatively in dosage of 100,000 units daily. Healing by primary union was complete in 14 days.

Four months after surgery the scrotal skin has stretched until it has reached normal proportions, and the testis has retained its normal size and is viable.

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THYROID HYPERPLASIA AFTER THIOURACIL

It seems to be the general experience that thiouracil in therapeutic doses does not as a rule affect the size of the goiter significantly, but there are reported three cases in which the goiter increased considerably in size as the result of treatment with thiouracil—an effect which is attributed to overdosage.

These are practical proofs of the theoretic assumption that if the pituitary is stimulated to produce excess thyrotrophic hormone by overdosage with thiouracil, an increase in the size of the goiter will occur similar to the hyperplasia of the thyroid produced in experimental animals by thiourea and its derivatives and by sulfaguanidine. A rapid and significant enlargement of the goiter in a patient under treatment with thiouracil may thus be evidence of overdosage.—DONALD, J. B., and DUNLOP, D. M.: Thyroid hyperplasia after prolonged excessive dosage with thiouracil. Brit. M. J. 1: 117-118, January 27, 1945.

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CHAETOMIN

Chaetomin, an antibiotic derived from the fungus, Chaetomium cochliodes, has promised to be of importance to medical practice and research in the future. It resembles penicillin in its value in antibacterial spectra, equalling that material in activity against gram-positive organisms and being also effective, but to only a limited extent, against gram-negative bacteria. Chaetomin contains nitrogen and sulfur in the molecule. It differs in biologic activity from gliotoxin, and while resembling tyrothricin in some respects, it differs considerably from other factors.—Editorial: Chaetomin. Am. Prof. Pharmacist 11: 54, January 1945.

SUPERIMPOSED UPPER DENTURE USED IN TREATMENT OF EXTREME PROGNATHISM

REPORT OF A CASE

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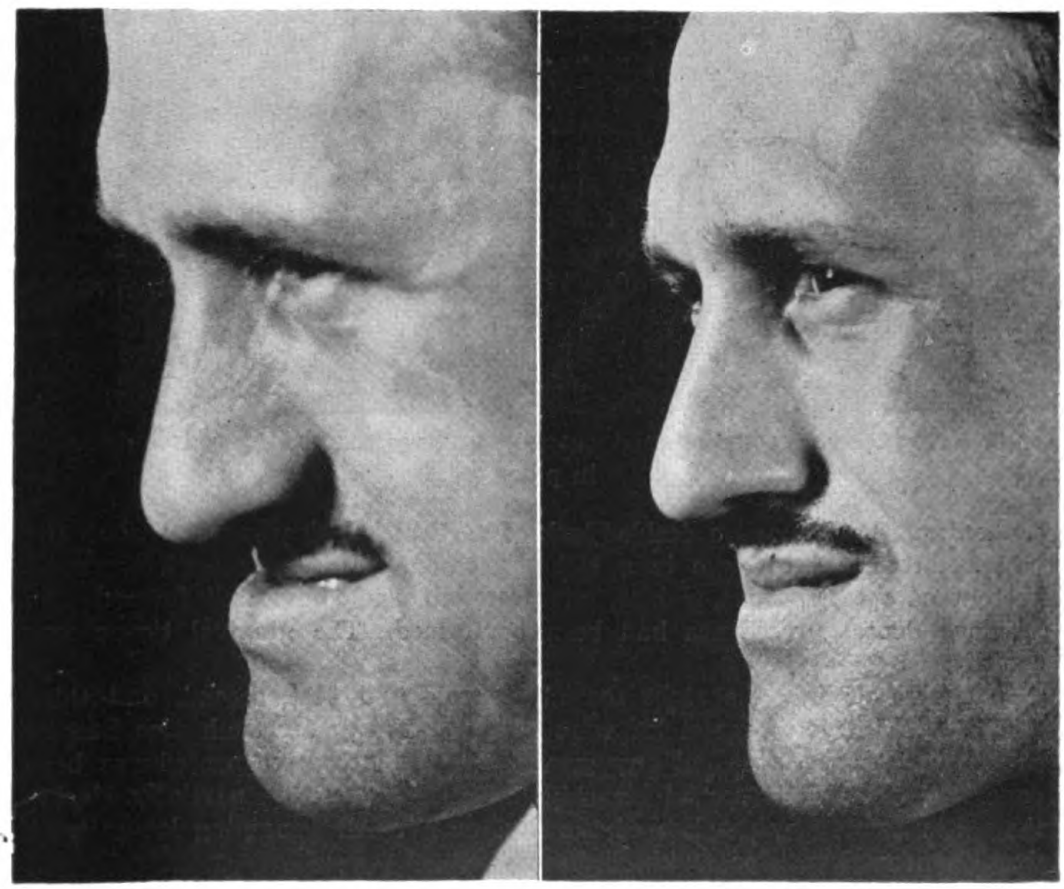
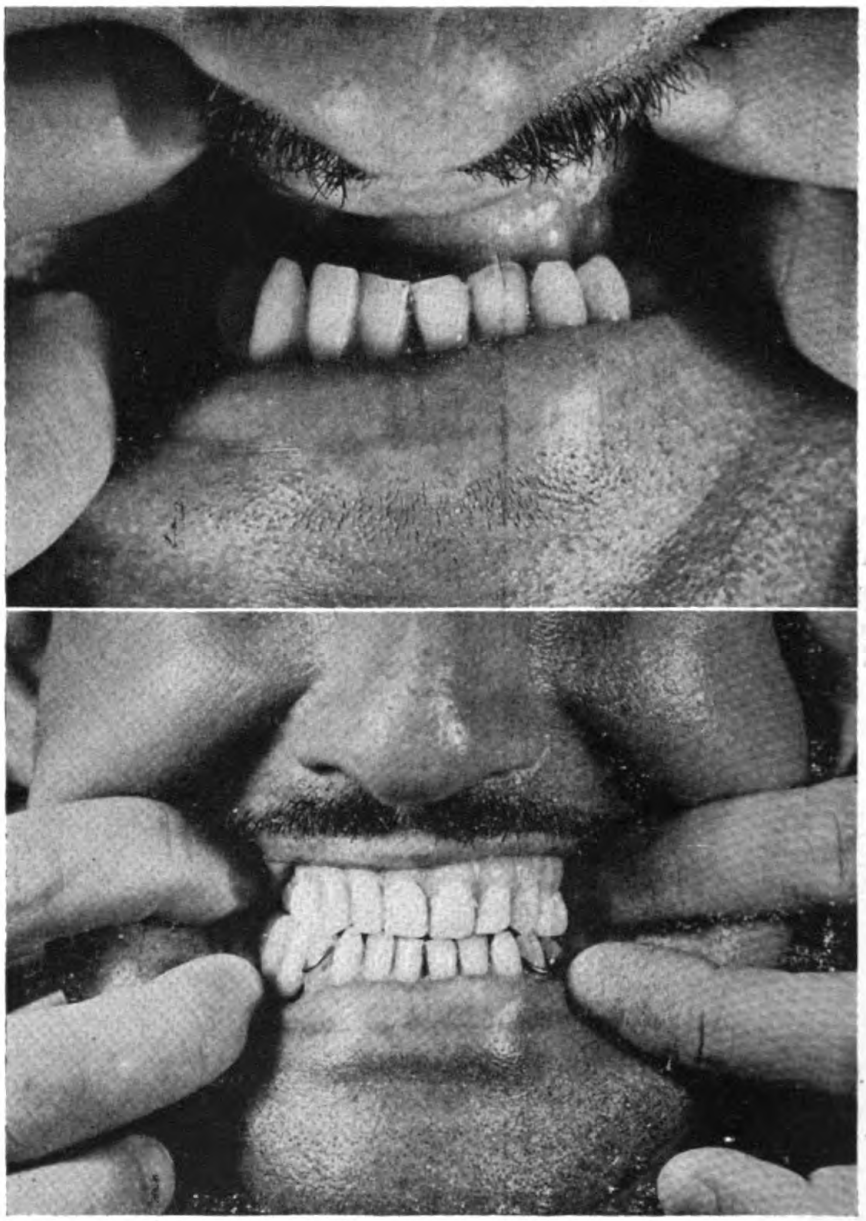
A case of extreme prognathism seen at this activity was treated by an unusual method with very satisfactory results. Because the upper teeth were sound, and the degree of mandibular protrusion so great, the practical expedient of superimposing an upper denture was tried, with the result that both appearance and function were greatly improved.

Case report.—The patient, 32 years of age, had such extreme prognathism that he had never been able to masticate efficiently. The upper lip had a



1. Profile of patient before and after treatment.



2. Front view of case before treatment and with superimposed denture in place.

sunken appearance, and a decided lack of vertical length was noted when the patient attempted to close in a biting position. The upper teeth were all present except the third molars, and were all sound and well formed. No previous dental procedures had been performed. The gingival tissue was healthy.

In the lower jaw the right second bicuspid and first, second, and third molars and the left first molar were missing. The lower teeth also had no evidence of caries, nor had any previous dental operative procedures been done. The lower left second bicuspid had drifted distally, partially closing the space created by the loss of the first molar. All remaining lower teeth were in normal position and well formed.

When the mouth was closed the lower anterior teeth completely covered the upper anterior teeth, and were approximately one-half inch in front of

them. The buccal cusps of the upper left second molar made contact with the lingual cusps of the lower left second molar which was in slight linguoversion. No other teeth were in contact when the mouth was closed; all the remaining upper teeth were lingual to the lowers in this position.

After a thorough study of the case, both clinically and from study casts, it was decided that the only practical solution was a superimposed upper denture. The complete extraction of the remaining upper teeth was contraindicated because the artificial teeth used on the full upper denture would of necessity be placed so far off the upper ridges that it would be impossible for the patient to exert any pressure or to attain any degree of masticatory efficiency. Likewise a full denture or a partial onlay appliance on the mandible would be far outside the line of force. Furthermore this patient apparently had a high rate of immunity to dental caries, his oral hygiene was exceptionally good, and he was very cooperative.

A combination compound and hydrocolloid impression was taken of the lower jaw and a lower partial denture was constructed replacing the lower right second bicuspid and first and second molars. The artificial teeth were placed directly over the ridge, disregarding the upper teeth at this time.

A hydrocolloid impression of the upper jaw was then made, the bite was taken, and the resulting study cast was mounted on an articulator in its correct relationship to the lower with the completed lower partial denture in position. The desired vertical dimension was established at the time the bite was taken; this vertical height was in turn established on the articulator, and the incisal guide pin was locked in this desired position.

The teeth selected for the upper case approximated as closely as was possible the natural upper teeth in shade, shape, and general characteristics. Acrylic teeth were used both anteriorly and posteriorly, because of the ease with which they can be conformed to any desired position and because they may be ground to a thin veneer if necessary.

The setup of the upper teeth was completed, and the upper case waxed in preparation for try-in. During the try-in the case was checked for correct vertical length, proper articulation and occlusion, and esthetic requirements, after which the case was processed by the usual technic for processing acrylic dentures. At the time of insertion, any undercut areas in the finished denture about the teeth were removed. The denture was seated, the occlusion given a final correction, and the patient fully instructed in all necessary hygienic measures.

The patient was seen at intervals subsequently and the denture was found to be functioning well. He has been able to masticate his food properly and his general appearance is greatly improved.

RH REACTION

Rh reaction is the result of the Rh test, namely either Rh positive or Rh negative. When the terms Rh negative and Rh positive are used as adjectives, they should be hyphenated; e. g., Rh-positive blood; Rh-negative individuals; but "the blood is Rh positive."—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

TREATMENT OF DEPRESSED FRACTURE OF THE ZYGOMATIC ARCH

BY THE GILLIES METHOD

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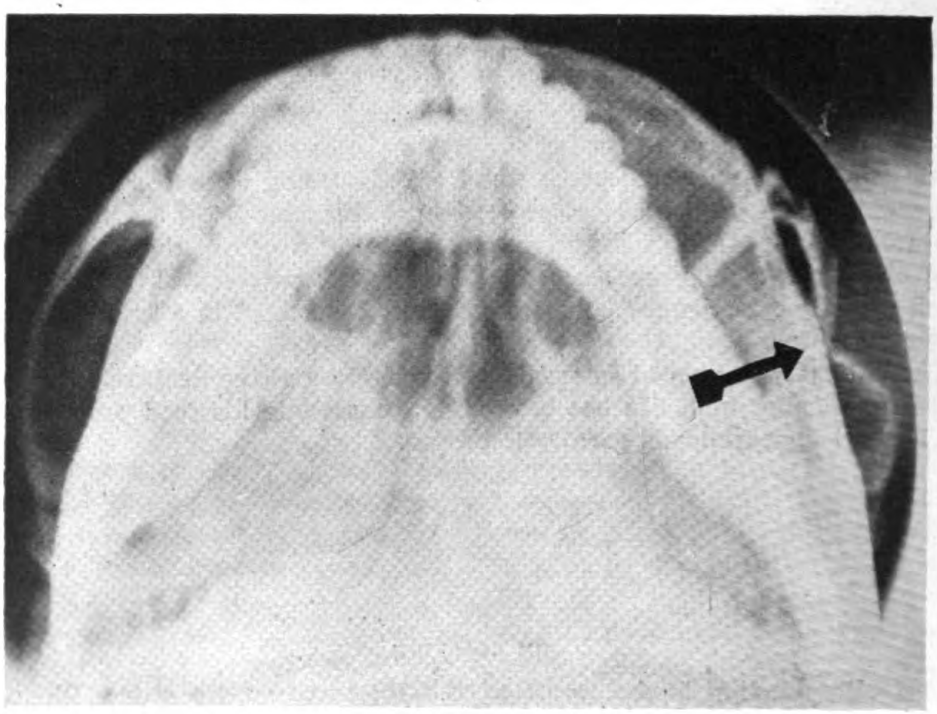
and
JAMES L. BRADLEY
Lieutenant Commander (DC) U.S.N.

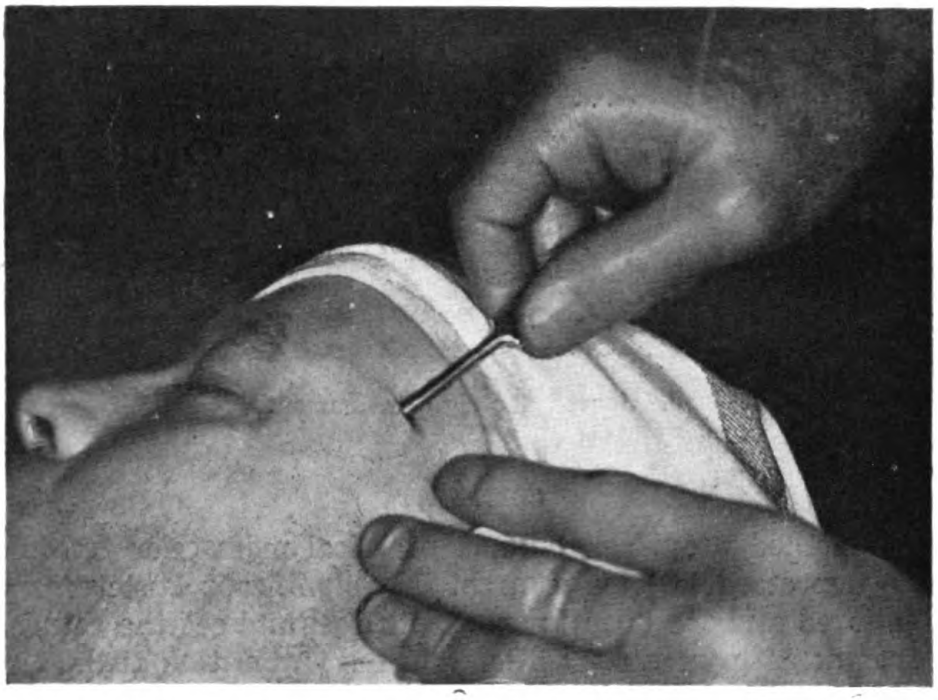
Characteristic of depressed fracture of the zygoma is complete or partial inability to open the mouth. Pressure from the broken bone causes restricted movement of the coronoid process of the mandible; restoration of function immediately follows elevation of the arch to its normal position. The following case illustrates these features of zygomatic fractures.

Case report.—The patient was struck in the left temporal region, following which difficulty in opening the mouth was experienced.

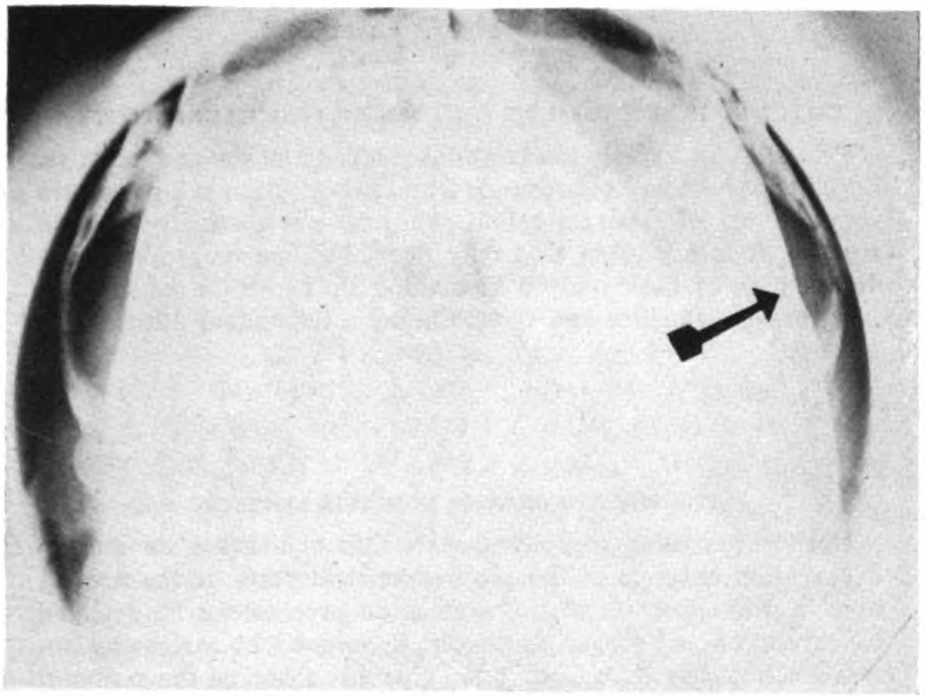
Treatment consisted in an incision made at the hairline with dull dissection through the overlying skin and superficial temporal fascia (fig. 1), to immediately below the fractured bone. A slightly curved, flat, rigid instru-



1. Depressed fracture of left zygoma.

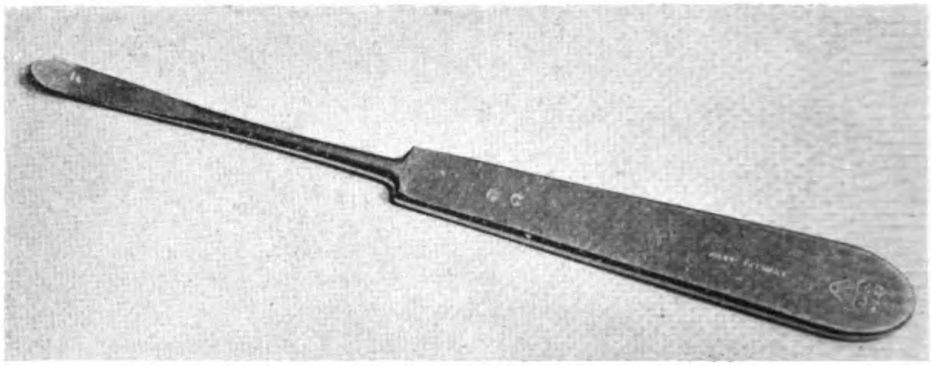


2. Incision at the hairline showing the instrument introduced under the zygomatic arch.



3. Postoperative roentgenogram of the reduced fracture.

ment (fig. 2) was introduced into position of the fracture and by medial pressure on the handle the fracture was reduced (figs. 3 and 4). Two sutures approximated the incisional margins. From the roentgenograms the bilateral symmetry of the zygomatic arches can be observed.



4. Curved flat rigid instrument.

COMMENT

This method provides a simple practical means for treatment of the depressed zygomatic arch. No significant structures are encountered and the operator can both feel and see the return of the fragments to normal position and the restoration of the facial contour. One incision provides an approach to correction of the displacement of the malar process.

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EFFECT OF DEXTROSE-SALINE SOLUTION ON PENICILLIN ACTIVITY

Penicillin is rapidly destroyed by strong acids and alkalies. Stability is best had between pH 5 and pH 7. Inasmuch as certain preparations of dextrose-saline solutions are distinctly acid in reaction it is advisable that only normal saline or pyrogen-free distilled water be employed in making up penicillin solutions.—Adviser on Penicillin and Chemotherapy, September 1944.

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ATROPHY AND CHANGES IN MUSCLE PROTEINS

During muscular atrophy due to immobilization or due to denervation changes in the physicochemical state of the protein myosin, the substrate of the contractile process can be detected by extraction and reprecipitation of the myosin at various hydrogen ion concentrations. The main changes observed are a diminished solubility of the myosin, a loss of its uniform isoelectric point and tendency to form much denser precipitates. These changes can be retarded in denervation atrophy and their recovery can be speeded up after immobilization atrophy by appropriate electrical treatment or by massage.—FISCHER, E., and RAMSEY, V. W.: Changes in muscle proteins during muscular atrophy. Arch. Phys. Therapy 25: 709-716, December 1944.

GAS GANGRENE INFECTION IN COMBAT AREA

REPORT OF THIRTEEN CASES

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During a recent island invasion in the Pacific combat area 13 patients were brought aboard this ship exhibiting symptoms of gas gangrene infection. All casualties were the result of enemy combat action and had received some form of emergency treatment on the beach within 24 hours after injury. Because of heavy cross fire, frequent counterattacks, and enemy air raids the casualties could not be evacuated to facilities aboard ship for a period of from 48 to 72 hours.

The terrain on which the casualties fell was fertilized with human feces and clinically the patients exhibited signs and symptoms of a true gas gangrene infection. On laboratory examinations of specimens from the wounds, the predominating organism found morphologically resembled Clostridium welchii. These organisms showed no motility, but there were also present gram-positive bacilli resembling Clostridium septique which were motile.

The 13 patients were given early supportive treatment of 5-percent dextrose in normal saline and of plasma intravenously before going to the operating room. After operation daily transfusions of citrated whole blood were done until the red blood cell count and hemoglobin approached normal level. Penicillin therapy was not used because the drug was unobtainable. Five grams of sodium sulfadiazine intravenously was administered followed by 3 gm. intravenously twice daily and 1 gm. orally every 4 hours. Ten thousand units of gas gangrene antitoxin were injected intramuscularly two or three times daily for 2 days and once or twice daily until the infection appeared to have subsided. Gas gangrene antitoxin was then discontinued. In 3 cases the initial dose of antitoxin was 20,000 units—10,000 units intravenously and 10,000 units intramuscularly.

The table on the following page gives a brief summary of each case.

TABLE 1.—*Summary of case histories*

Case	Age	Admission temperature ° F.	Pulse	Injury	Treatment
1	21	108	115	Gaping wound left thigh. Saphenous vein and part of sartorius and rectus femoris muscles destroyed.	Debridement, potassium permanganate (1:5,000) irrigations. Sulfanilamide crystals.
2	22	103	120	Comminuted fracture of lower third right humerus. Destruction of muscles and soft tissues to elbow.	Guillotine amputation upper middle third.
3	20	101	100	Extension blast injury to the left leg. Fracture of tibia and fibula.	Guillotine amputation after 6 days' conservative treatment, fruitless debridement.
4	20	101	110	Comminuted fracture upper third left femur. Large soft tissue destruction.	Debridement, traction and immobilization.
5	25	102	118	Penetrating wound of plantar surface, left foot.	Debridement, potassium permanganate (1:5,000) irrigations.
6	20	103	132	Blast injury to left arm and shoulder. All soft tissue, clavicle and scapula shot away with partial amputation of arm and shoulder.	Debridement, boric acid irrigations.
7	19	102	120	Wound of inner right thigh.	Debridement, sulfanilamide crystals.
8	20	102	130	Deep wound of right leg lower part. Compound fracture of tibia and fibula above ankle.	Debridement, sulfanilamide crystals, and immobilization.
9	26	104	120	Through penetrating wound right foot; fracture of 3d and 4th metatarsal bones.	Debridement, sulfanilamide crystals, and immobilization.
10	23	103	118	Left shoulder and left leg wound. Fracture of tibia and fibula.	Debridement, sulfanilamide crystals, and immobilization.
11	18	101.8	120	Extensive blast injury to right arm and hand. Complete destruction of soft tissues.	Guillotine amputation.
12	36	102	110	Deep wounds right thigh. Fracture upper third right femur.	Debridement, potassium permanganate (1:5,000) irrigations for 3 days. Dry dressing thereafter, immobilization splint.
13	21	102	112	Large wound posterior surface left leg below knee.	Debridement, rubber drains, boric acid irrigations, and immobilization.

SUMMARY

Thirteen cases of gas bacillus infection were treated with large doses of sulfadiazine and gas bacillus antitoxin, together with repeated transfusions and supportive treatment. All survived. Amputations were done on 3 cases.

Apparently the combination of sulfadiazine and gas antitoxin together with adequate surgery was responsible for the remarkable absence of deaths. Another large factor in these good results was that all patients were young, robust, healthy males.

MEDICAL AND SURGICAL DEVICES

THE CARGO CARRIER M–29

USE IN CASUALTY EVACUATION

JUSTIN J. STEIN
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The Cargo Carriers M-29 and M-29C are ideal for conditions existing in the Pacific theater of operations as conveyances for casualties on the field. The jeep ambulance in use by the Marine Corps is of great value but it will not operate in swamps, over rugged terrain, and in deep snow, sand, or mud.

The M-29 will operate with ease in mud, in snow, in the loose sand of beaches, and over very rough terrain. It is easy to operate, has a low silhouette, is powerful, and has a variety of uses. It is difficult to overturn. However it is not recommended as a replacement of the jeep ambulance, but to be used on or near the beach and under conditions where the jeep is not practical.

The LVT (landing vehicle, tracked) is of a similar nature, but weighs 18,000 pounds, requires a crew of three, and is far more expensive to manufacture and to operate. The M-29C is navigable in water which is not too rough, in swamps, and over most difficult terrain.

M-29C has a track which is twenty inches wide as compared with the M-29 with fifteen inches. Some of the features of the M-29 are as follows:

(1) Speed of 35.4 miles per hour under normal conditions with standard load.

(2) Standard gear shift with a high and low range. Thus with the 4 transmission speeds, there are available 6 gear ratios forward and 2 in reverse.

(3) Weight empty is 3,725 pounds; loaded 4,925 pounds, giving a pay load of 1,200 pounds, which is more than that of the present jeep.

(4) Over-all length is 10 feet, 5¼ inches; width 5 feet; over-all height with top on is 5 feet, 10⅝ inches.

(5) Track size width is 15 inches.

(6) Has 12-feet turning radius.

1. M-29 with six ambulatory casualties going ashore from an LCVP.
—Official U. S. Army Signal Corps Photo.

2. M-29C loaded with medical supplies debarking from an LCVP.
—Official U. S. Navy Photo.

(7) It will make seven miles per gallon under average conditions while loaded; at five miles per hour it will go 175 miles on a full tank of gasoline (35 gallons).

(8) It uses 75-octane gasoline under sea level conditions and 70-octane gasoline at 3,000 or more feet above sea level.

(9) The angle of approach going uphill is 90 degrees; angle of departure is 60 degrees.

(10) Ground pressure per square inch:

0 inch immersion.....2.10 pounds
5 inch immersion.....1.70 pounds

3. M-29C transporting two casualties over hilly terrain.
—Official U. S. Navy Photo.

(11) The vehicle is fully suppressed for radio installation, and it can be easily camouflaged.

Although it has been used to pull artillery pieces off the beach and trucks, if it is used to the extent only for which it is mechanically constructed it will perform usefully and efficiently.

It will carry two litter cases or three ambulatory wounded without requiring any changes (fig. 1). It will also carry six ambulatory wounded if no litters are used (fig. 2). With slight alterations more could be carried, but since its pay load is 1,200 pounds, more weight should not be added to the load. It rides comfortably even over very rough terrain where ordinary vehicles cannot travel (fig. 3). In heavy deep mud or sand, conditions which are found often in the Pacific area, it will function most efficiently.

Battalion aid stations or other medical units could combat load this vehicle with medical supplies and take it ashore early in the landing operation. It could be used to move water, food, and ammunition off the beach area and return with casualties. It will save many long litter hauls and will greatly aid the shore party in its beach functions.

This article is written with the hope that these vehicles will be investigated more thoroughly by all concerned and that they will be made available quickly in the Pacific area to all branches of the service. It will mark another step forward in the speedy evacuation of casualties in amphibious warfare and in amphibious combined operations in general.

MEDICAL UTILIZATION OF AMPHIBIOUS TRACTORS

JOSEPH W. KIMBROUGH
Captain (MC) U.S.N.

Various problems have arisen in the field regarding protection and accessibility of operating rooms, dressings stations, and personnel and patients in these locations. The construction of dugouts takes time, material and personnel. Falling dirt from the overhead endangers technic, and by the time the dugout is completed the location is probably not so desirable. This is especially true where military operations will be over much larger land areas than in the past. Tents obviously give no protection from gunfire and not too much from the elements. The prefabricated blackout operating room can be assembled only with difficulty on any other than a perfectly flat area. These defects are obvious.

The design and details of the new amphibious tractor (type LVT-3) could scarcely be improved upon for its conversion to an emergency operating room or dressing station. No change in standard design or equipment is necessary. The normal functioning of the tractor is not hampered. The equipment used is that which would normally be placed in a tent or in the prefabricated operating room. This equipment can be installed or removed in less than 15 minutes.

The following are some of the advantages of this new setup:

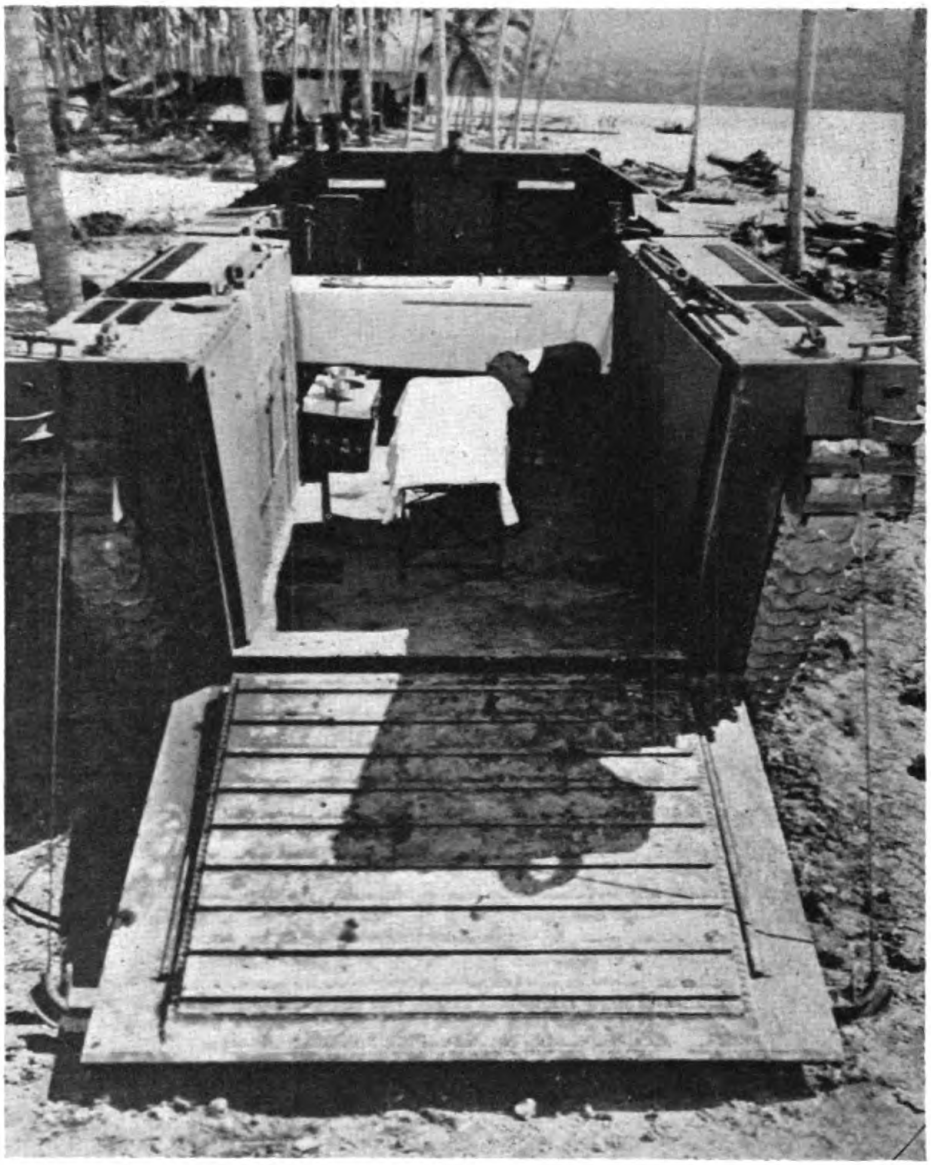
Its mobility is a basic asset. Either under its own power, or by towing if disabled, the tractor's position can be easily changed. For camouflage and coolness it can be placed in the shade and headed into the wind for ventilation.

Two water tanks of 5-gallon capacity each are built into the machine. There is ample room for such additional cans as may be needed.

A catwalk grating immediately behind the driver, extending all the way athwartship and adjustable to two positions, is ideal for a sterile setup.

Bilge drains in the deck take care of any accumulation of water.

A tarpaulin is standard equipment and with lashings, ridge pole and boat hooks can be adjusted to various positions. This gives excellent protection from inclement weather and makes an excellent blackout. With the tarpaulin rigged and ramp down,



1. The amphibious tractor (LVT-3) prepared for emergency surgery.

the port in front of the driver can be opened for through ventilation, as the tractor can be turned into the wind.

Mounts for three machine-guns are present and could be used for protection, which is not infrequently needed. The tractor is protected by ½-inch armor plate. This would be invaluable for protection against small-arm and light machine-gun fire.

By placing the tractor in a bomb crater, next to a cliff, or by sandbagging it, maximum protection from air attack could be obtained.

After the ramp is lowered for access it can be raised to give protection on four sides.

The storage batteries can be utilized for electric light when desired.

2. The tractor with tarpaulin rigged.

The tractor can easily reach locations impossible of access to any type of transportation.

It is possible to operate upon a seriously wounded man and take him immediately to a boat, having him under observation and treatment all the while.

If desired, the amphibious tractor can lie off-shore in quiet water or a lagoon and function perfectly as an operating room. Here it presents a very low silhouette. Patients could be received by boat or tractor.

When utilized as a dressing station only, there is room for two portable tables.

When utilized as an operating room, as much space is available, or more, than in the average operating room aboard ship.

There is less chance for contamination from dust and dirt than in a tent.

Radio equipment makes it easy to receive or transmit information regarding movement, location, or casualties.

The above are what appear to be obvious points of advantage in the surgical utilization of amphibious tractors. Any tractor, but preferably model LVT-3, can be thus utilized. Absolutely nothing is done to the tractor which might interfere with its full military utilization. This medical use of the tractor is merely in addition to the standard medical procedure and equipment.

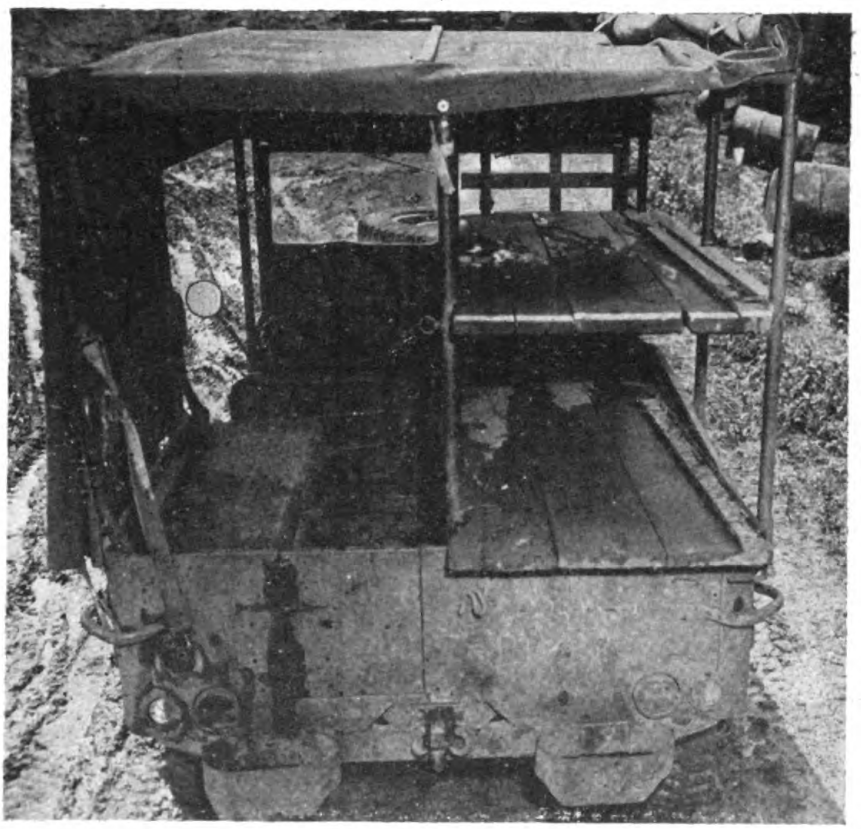
CONVERSION OF JEEP AMBULANCE FOR ALL TYPES OF LITTERS

CLAUDE R. BRUNER
Lieutenant Commander (MC) U.S.N.R.

Even at this late date there appears much misunderstanding regarding the use of the jeep ambulance as a conveyance of various types of litters which are employed in combat.

The Stokes litter for some time has been discarded for Marine field use in the jeep ambulance and is not employed otherwise except in a few unusual situations. The jeep ambulances, as delivered to Marine units as of October 1943, were equipped with metal channels to receive the stirrups of the litters.

It is desired to point out that the type of channel constructed originally in these ambulances, and for that matter any type of channel or groove, is not practical and is unnecessary. It is difficult to place the stirrup of the litter in a channel or groove



under ideal conditions and much more so when done in darkness, rain, or under fire.

A simple and practical method of constructing a litter bed in the jeep ambulance for all types of litters is shown in the accompanying illustration. The device has been used in approximately seventy ambulances, all of which have been employed repeatedly under all conditions of combat. It is simple, universal and may be constructed from common materials and by workmen of average skill.

The adaptation consists in removing any previous structures or carriers and constructing a solid platform of wood bolted to the metal cross members of the litter compartments. Five-eighths-inch plywood is preferable but any lumber from 5/8 to 1 inch thickness may be used. If desired a channel or groove may be added on one side to receive the stirrup of the litter, but such a channel is not necessary, because the weight of a patient with the litter in place prevents any tendency for the litter to move or slide from side to side.

This type of litter bed will accommodate any type litter; it is practical and simple to construct and has proved to be entirely adequate and satisfactory in several of the most difficult evacuations of the Central and South Pacific.

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DEATH IN THE BATHROOM

When Queen Elizabeth took a bath, no common event, she ordered several doctors to attend in the anteroom. The bathroom is the most dangerous room in the house. There the grandmother hides the weed killer from the children, and takes it herself in mistake for an aperient; there the shortsighted man mistakes strong carbolic for his eye lotion; there, too, the boy with a taste for gadgets uses an electric immersion heater and dies in the water; or the woman drying her hair at an electric radiator is killed as the wet strands touch the wires. Fits, falls, and scalds, all take their toll; suicides, anxious not to give unnecessary trouble, often choose the bathroom for their purpose; others accidentally drown themselves in the bath; and even natural deaths in the bathroom are not rare, a fact Queen Elizabeth probably had in mind.—Annotations: Death in the bathroom. Lancet 2: 758-761, December 9, 1944.

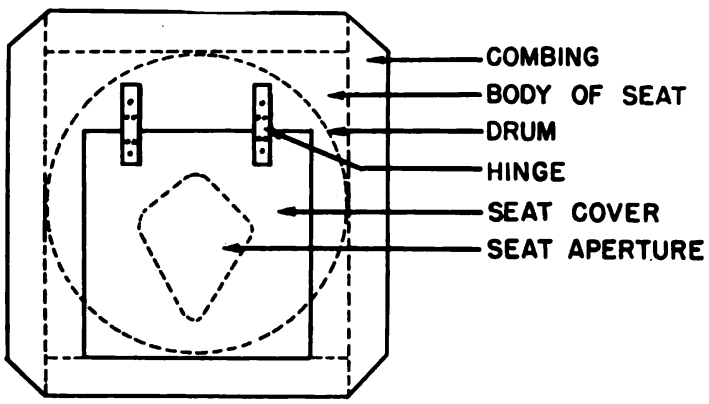
FLYPROOF HEAD FOR FIELD USE

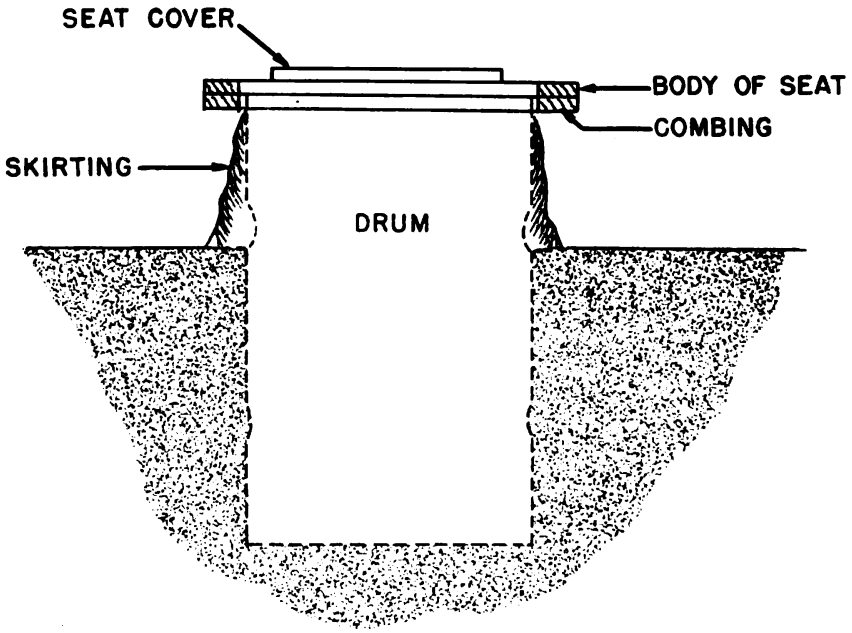
ALLEN S. JOHNSON
Lieutenant Commander (MC) U.S.N.R.

The importance of flyproof heads is evident to anyone who has wrestled with problems of field sanitation. The box latrine recommended in standard texts requires more lumber than can usually be carried on an amphibious operation, and if prefabricated it occupies space needed for more important cargo. Various experiments to solve this problem have resulted in the following device which makes use of empty oil or gasoline drums that are always available.

The top is removed from the drum and the bottom perforated in several places with a cutting torch; a cold chisel, hatchet, or corpsman's knife may also be used for the purpose. The drum is set in the ground so that it protrudes to a comfortable sitting height. On it is placed a portable prefabricated seat and a skirting of burlap or target cloth is secured about the outside of the drum to exclude flies.

The seat may be made from any lumber available. Ours were made from plywood which insures maximum strength with minimum weight and warping. Painting is not necessary. Two months' use (half of which was during the rainy season) caused no more warping of the unpainted than of the painted seats. The 4- by 8-foot plywood panel used for the flooring of 16- by 16-foot pyramidal tents will furnish sufficient material for three such seats and covers to fit the standard 55-gallon drum.





On the underside of the seat is fixed a combing about an inch deep to prevent dislocation of the seat on the drum. The cloth skirt on the outside of the drum is tacked inside this combing. The cover is secured to the seat by improvised hinges of belting or strips of hose. Various types of stops may be applied after the device is set up to prevent the seat being left open. If applied before shipment they may interfere with compact packing. Ten such seats may be crated together conveniently, weighing about 100 pounds and occupying about 5 cubic feet.

The proper care of this apparatus is essential to its successful functioning. In a tropical climate this head should be burned out at least every other day. One-half to one quart of crankcase oil or Diesel oil is poured or sprayed over the contents of the drum and ignited with burning toilet paper. Two cupfuls of low-test gasoline may be added as a primer before ignition. High-test gas burns too rapidly to ignite the less inflammable oil.

The flyproof skirting should not encase the drum too snugly as the heat of the drum may ignite it during the burning-out process. The purpose of the burning-out is two-fold: (1) It significantly decreases the volume of the drum contents on which the digging of new pits depends, and (2) it destroys fly eggs and larvae if the fire burns for at least an hour, as when fairly heavy oil is used.

Too many or too large holes in the bottom of the drum allow too much oil to escape. Four pencil-size holes permit adequate drainage of fluid into the surrounding earth without wasting the fuel oil that is introduced for burning.

This device represents an aggregation of units for no one of

which any claim of originality can be made. But the apparatus as a whole, which was given an extensive trial by a Marine division on a prolonged combat operation, solved some of the problems of field sanitation so satisfactorily that it has seemed worth while to offer it for wider use by fleet units engaged in shore operations.

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MECHANISMS OF INTRACRANIAL HEADACHE

Six basic mechanisms of headache from intracranial sources have been formulated. Headache may result from: (1) Traction on the veins that pass to the venous sinuses from the surface of the brain and displacement of the great venous sinuses; (2) traction on the middle meningeal arteries; (3) traction on the large arteries at the base of the brain and their main branches; (4) distention and dilatation of intracranial arteries; (5) inflammation in or about any of the pain-sensitive structures of the head, and (6) direct pressure by tumors on the cranial and cervical nerves containing many pain-afferent fibers from the head.—BOIES, L. R.: The symptom of headache. Journal-Lancet **64**: 400-404, December 1944.

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STREPTOTHRICIN AND STREPTOMYCIN

The production of the antibiotic substances streptothricin and streptomycin by certain species of actinomycetes is greatly influenced by the composition of the medium and by conditions of growth. The two substances are similar in their chemical behavior and in many of their biologic properties. Streptothricin and streptomycin act on various gram-positive and gram-negative bacteria. They differ, however, in the fact that streptomycin is more active against certain bacteria within each group, such as Bacillus mycoides and Mycobacterium tuberculosis among the first, and Proteus vulgaris and Pseudomonas aeruginosa in the second. Streptothricin and streptomycin are characterized by limited toxicity to animals and by high activity in vivo against various gram-positive and gram-negative bacteria.—WAKSMAN, S. A.; BUGIE, E.; and SCHATZ, A.: Isolation of antibiotic substances from soil micro-organisms, with special reference to streptothricin and streptomycin. Proc. Staff Meet., Mayo Clin. **19**: 537-548, November 15, 1944.

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ZEPHIRAN CHLORIDE AS A RUST PREVENTIVE

Zephiran chloride is an inexpensive effective germicide in which sterile instruments may be stored without rusting. In small ships and activities where sterile instruments may be difficult to keep, their storage in zephiran chloride solution will facilitate their use when they are wanted in emergencies. The solution is in the Supply Catalog (S1-4790) and makes an effective nonrust germicide.—FORREST, E., Pharmacist's Mate, first class, U.S.N.R.

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PENICILLIN-FASTNESS NOT PERMANENT

Two strains of coagulase-positive staphylococci were made penicillin-"fast" by cultivation in increasing quantities of penicillin. They were then subcultured daily in broth without penicillin and, contrary to expectations, a rapid fall in resistance to penicillin was noted. It therefore appears that "fastness" of staphylococci to penicillin is not a permanent characteristic.—TODD, E. W., and TURNER, G. S.: The temporary character of "fastness" of staphylococci to penicillin. Brit. M. J. 1: 111-113, January 27, 1945.

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DIASONE IN TUBERCULOSIS

Diasone is the disodium formaldehyde sulfoxylate derivative of 4-4′ diamino-diphenylsulfone. It is related to promin, which is of value in the treatment of tuberculosis in guinea pigs.

Diasone was given for at least 120 days to 44 tuberculosis patients. There appear to have been no serious reactions.

Signs of improvement were seen as follows: Between 45 and 125 days 60 percent of the group became sputum-negative. This occurred in all the lighter cases and in two-thirds of the moderately advanced group. Even one-third of the far-advanced group became negative. In 34 of the 44 patients the sedimentation rate fell from a mean value of 45 mm. per hour to a mean value of 11 mm. per hour in 25 weeks. X-ray examination showed that some resolution of infiltration occurred in 90 percent. Of the cavities present before therapy 43 percent disappeared.—Annotations. Diasone in tuberculosis. Brit. M. J. 1: No. 20, January 6, 1945.

EDITORIALS

PENICILLIN FAILURES

That penicillin is not a panacea is well established. Until the exact chemistry of the agent is known, what the drug will or will not do is dependent upon bio-assay measures which are as empiric as the original chance discovery of the substance. That it is not a single pure chemical is apparent from recent extraction and fractionation methods employed in its production.

The partitioning into several components was brought about by crystallization of each product of the various methods of culturing Penicillium notatum; that grown in flasks and spoken of as superficial culture produces an active substance designated as penicillin F and identified by British workers as penicillin I, that grown in tanks, the submerged culture, is penicillin G (penicillin II), and that which is grown superficially but extracted by chloroform is penicillin X (penicillin III or allopenicillin). Two other fractions have been identified, penicillin IV and penicillin V. The possibility of others in the remaining fluid is not excluded. Furthermore there is evidence which suggests that each fraction has therapeutic specificity. It is certain that as far as activity against the gonococcus is concerned, the G fraction is less active than crude penicillin, whereas penicillin X is more active than either.

How much any one factor is present in the marketed ampule is not indicated on the label nor is the method of production stated. Fractional assaying moreover has not been considered practical up to the present date.

From the method of production the tank-submerged culture gives the most abundant yield and as a consequence is the substance commonly employed therapeutically. Inasmuch as this penicillin is composed almost exclusively of factor G it is obvious that the therapeutic properties of the ordinary commercial penicillin are mostly commensurate with those of factor G, and the term "penicillin" practically connotes penicillin G.

However the proportion of the individual constituent factors is not consistent and one lot of commercial penicillin may have more

penicillin G in it than another, notwithstanding the fact that the two were grown simultaneously from the same parent mold in different tanks or successively in the same tank. Similarly proportions of penicillin F, X, IV, V and others vary in each batch. Obviously penicillin produced by different manufacturers will show further variables.

Implications of these findings are apparent and may explain the success or failure of penicillin in comparable pathologic conditions. For the same reason it is impossible to state that the effectiveness or ineffectiveness of any lot of penicillin now on the market is attributable to the presence or absence of any particular penicillin constituent.

These facts may also explain the therapeutic variations observed in the British and American products and moreover may account for the apparent contradiction regarding the efficacy of single-dose medication. Successful results in eradicating gonorrhea with a single intramuscular injection of penicillin X have been demonstrated. On the other hand, the single-dose failures recorded in the literature may be because of insufficient quantities of allopenicillin in the product administered.

The import of these findings cannot be overemphasized and indicate the need of a rechecking of all therapeutic records before any final appraisal of penicillin can be made. The uncertainty of the proportional composition of the various factors in the penicillin employed makes this task impossible but points to the course required of all evaluation studies of penicillin failure.

Purification and fractionation by crystallization is going on to a limited extent at the present time and permits accumulation of experimental data regarding the activity of the penicillin factors on different strains of microorganisms. Until each fraction, however, can be produced in commercial quantities, the crystalline crude penicillin now employed must satisfy all therapeutic demands, its complexity making its limitations intelligible.

SUMP PUMP DRAINAGE

Surgical opinion regarding the feasibility of drains in the abdominal cavity has vacillated between two extremes. There are surgeons who believe firmly in the value of drains and there are those who are as strongly convinced that once the pathologic process has been removed drains are not only unnecessary but are tantamount to borrowing further trouble. The futility of most drains in removing collections of fluid from the abdomen has led some surgeons to discard drains from their armamen-

tarium. The advent of sulfonamides and antibiotics has served only to confirm them in their conviction.

Certainly it is the experience of every surgeon, who carefully places drains in an entrapped purulent pocket within the abdominal cavity, to find the surgical dressing dry or only slightly moistened even after several days. The septic temperature, however, contradicts the absence of pus absorption.

Casual consideration of the practice of placing drains leaves the impression of vagary regarding the basic principle of inserting drains. With the patient in the recumbent position the only possible effective drainage of material under these conditions will be by capillary attraction, the inefficiency of which is shown by changing the patient's position so that a dependent flow may take place.

For several years Babcock[1,2] has been advocating an aspirating tubular drain made of stainless steel which functions on the principle of the sump pump. A perforated metal outer tube shaped not unlike that of a laboratory glass test tube is sutured into the abdominal cavity and a second perforated suction shaft is tightly sheathed into the anchored tube; rubber tubing is attached to a safety trap consisting of a parenteral fluid bottle, which in turn is connected to a motor or water gravity draw. The system is a closed vacuum mechanism and appears to be the most effective drain thus far devised.

The rationale of the procedure is sound. The perforated sheathing tube permits the drawing of dependent liquid and semiliquid accumulations, at the same time preventing bowel and other viscera from plugging the suction shaft. The supine posture of the patient facilitates rather than hampers the operation of the drain. Furthermore correlation of the effectiveness of the aspirating tubular drain before and after sulfonamide therapy favored the tube over chemotherapy.[3]

The inefficiency of drains in the past leads one to believe that they were employed more in the hope of efficacy than with conviction of their benefit to the patient. Drainage of the peritoneal cavity is helpful in proportion to the efficiency of the drain in removing noxious material from the abdomen. Gauze wicks and soft rubber tubing so commonly employed have been shown to activate tissue reaction and are walled off quickly by isolating adhesions; at the same time exudative and ulcerative formations

[1] BABCOCK, W. W.: Experiences with resection of colon and elimination of colostomy. Am. J. Surg. 46: 186-203, October 1939; correction 46: 222, November 1939.

[2] IDEM: Advantage of perineal over abdominal colostomy, with technic for transfixing abdominal opening to perineum. J.A.M.A. 113: 1933-1939, November 25, 1939.

[3] BURNETT, W. E.; ROSEMOND, G. P.; and CASWELL, H. T.: Use of "sump" drain in peritoneal infection. S. Clin. North America 24: 1316-1325, December 1944.

occur which may lead to secondary abscess after the drain is withdrawn.

Other materials have been extensively examined by Babcock[4] and for the most part found wanting. Silk, cellophane, rayon, lucite and bakelite caused fibroplastic reaction leading to production of dense fibroconnective tissue, whereas most metals and alloys have been shown to form irritant or caustic salts when placed within the body cavity, prohibiting their use. Tellurium, vitallium, certain steel alloys, and glass have successfully withstood experimental scrutiny, and qualitatively, because of their tissue inertness, have permitted their employment as drains.

It must be remembered that drains within any body wound or cavity are foreign bodies, and although inserted expressly for the purpose of providing egress for harmful material from within, they permit descending invasion of bacteria from without.

In view of these observations, consequently, reorientation of thought regarding drains is opportune.

[4] BABCOCK, W. W.: Principles and Practice of Surgery. Lea & Febiger, Philadelphia, 1944. pp. 77-80.

WHOLESALE WOOD ALCOHOL POISONING

The practical seriousness of methyl alcohol poisoning is portrayed elsewhere in this BULLETIN, pp. 1097-1109. The papers comment on the lack of proper labeling on the containers. This is to be regretted. A substance of a toxicity that exposure of the bare skin or inhalation of its fumes may produce serious poisoning should have more than optional regulations regarding label warnings of its dangers. However in the Navy, indoctrination in these matters is practiced and adequate admonition of the poisonous character of wood alcohol is given in the Handbook of the Hospital Corps and in the Medical Compend. These are further supplemented in a more special manner wherever the substance is industrially applied.

Despite these precautions it is conceivable that addiction to alcohol is great enough to lead some persons to try anything that gives off spirituous odors. This seems to be what happened in the cases reported by Kaplan and Levreault. How much of a deterrent warning labels would have been under these circumstances is questionable. The urge for imbibition and conviviality apparently transcended all ordinary caution even where enemy booty was concerned. To the alcoholic, drinking is the main function of life but the 32 percent mortality in this instance is mute evidence of the need of circumspection in what is imbibed.

The complexity of the problem of addiction is too great for discussion here but the unfortunate occurrence of 19 deaths within a year from wood alcohol poisoning justifies a review of the entire subject.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

The Editor,
UNITED STATES NAVAL MEDICAL BULLETIN,
Bureau of Medicine and Surgery, Navy Department,
Washington 25, D. C.

(For review)

DAMAGE CONTROL, A Manual for Naval Personnel, by *Thomas J. Kelly, Captain, United States Navy*; with chapters by 9 other contributors. 248 pages. D. Van Nostrand Co., Inc., New York, publishers, 1944. Price $2.50.

Damage control is a term which in its broadest sense describes every preservative feature of a vessel from its drawing-board stage to the combatant stage. Those protective features which cannot be built into a vessel must be supplied wherever possible by a vigilant and properly equipped ship's company, trained to prevent, confine and repair damage. Thus every person aboard has not only an interest but a part to play in the damage control organization of the ship.

Damage control has the same relationship to naval warfare as preventive medicine has to the practice of medicine. The ship like the patient is best prepared in advance to withstand the ravages of attack on its integrity. After the attack has begun the ship like the patient needs careful treatment. The fire like the infection must be localized to as small an area as possible and kept from the magazine similar to the effort to keep infection from the blood stream. The medical officer counterparts in the ship are the Damage Control Officer and First Lieutenant.

The restriction of movement of personnel in battle imposed upon the ship in the interest of damage control places the medical officer in a position just opposite to that which his training dictates in the care of the injured. He cannot go to the patient and no doors or hatches can be opened to bring the patient to him. This makes necessary a complete and ship-wide distribution of the medical skill and supplies aboard. Each crew member must

have a thorough knowledge of first aid and ready access to first-aid supplies in battle. After the battle has begun the medical officer is like the football coach who can only "sweat it out" on the side lines, and hope his men have learned their lessons well and his plan is well conceived.

The medical officer who wrote the four-page section of this book devoted to the medical department has endeavored to outline the general principles of damage control which apply to the medical departments of all classes of ships. The structural differences in the various classes of ships makes it a different problem in each. For example, the super-compartmentation of the battleship restricts movement of first-aid groups more than in transports. Each ship must work out its own damage control organization. In this connection the author's division of the damage control program into a precombat period, combat period, and postcombat period may be used as a framework upon which to start. In this planning the selection of battle stations for the key medical personnel is always a vexatious problem. As a guiding principle in making this important decision, it is well to remember that the medical department goes to work when the guns have ceased firing and the battle is over. Needlessly exposing key medical personnel to gunfire during the combat phase, for the questionable value they have in a first-aid capacity, and losing the services of these men for the postcombat phase, is poor planning. When it is realized what little more a medical officer can do to return a man to his battle station or even save a life out on the exposed deck than a well trained first-aid man with the same equipment, it is apparent that the medical officer's battle station should be behind as much armor as possible, regardless of accessibility during battle.

The bulk of the book is concerned with such nonmedical material as the damage control functions of the engineering, gunnery and supply departments, methods of fire fighting, the principles of stability, buoyancy, flooding and counterflooding compartments, etc. These matters are thoroughly covered and are available for ready reference. The book is primarily designed for and of interest to the Damage Control Officer and the personnel of his department.

EMERGENCY SURGERY, by *Hamilton Bailey, F.R.C.S. (Eng.), Surgeon, Royal Northern Hospital, London; Surgeon and Urologist, County Hospital, Chatham.* 5th edition. 969 pages; 1,039 illustrations, of which a large number are in color. A William Wood Book. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price $18.

The appearance of the fifth edition of this work emphasizes the utter destructiveness of modern war and at the same time the dogged determination of the British to fight back; the whole work

was completely destroyed once by bombs and again partially when nearing completion. The author's persistence in keeping in existence this book which so ably fulfills its objective to aid, "the comparatively isolated surgeon . . . not necessarily a specialist," to know, "when to operate, when not to operate, and how to operate under emergency conditions," should be especially appreciated by Naval medical officers.

Practically every conceivable surgical emergency is described by the author in a manner which adequately covers the essential features of diagnosis, treatment and errors to avoid. The great bulk of this information comes from his personal experience. The only section of the book not written by the author is the one on eye, ear, nose and throat emergencies. It therefore has one of the pleasing features of single-author books, especially with an author of the Bailey era and background, i.e., its vivid and expressive style. For example such gems of descriptive portrayal as, "The picture of an unhappy surgeon engaged in a Sisyphean task of approximating the peritoneum over a sea of distended and unruly intestinal coils has by virtue of intrathecal anesthesia passed," enlivens the text and keeps the reader on the alert for other such satisfying morsels of graceful prose.

The practical aspect of the subject is emphasized and an example of the soundness of the author's approach to the problems in emergency surgery is the fact that the opening chapter is entitled "Intravenous Infusion."

The method of clearing a flooded drip bulb of fluid, noted in a previous edition by the reviewer and of service to him many times since, is considered by itself a worth-while reason for perusing the book.

Noteworthy also is the lengthy plan of action outlined for anesthetic asphyxia.

OPERATIONS OF GENERAL SURGERY, by *Thomas G. Orr, M.D., Professor of Surgery, University of Kansas School of Medicine, Kansas City, Kansas.* 723 pages; with 1396 step-by-step illustrations on 570 figures. W. B. Saunders Co., Philadelphia, Pa., publishers, 1944. Price $10.

The author of this work, as a result of his experience as Professor of Surgery at the University of Kansas School of Medicine, came to believe there was a need for a book embracing the essentials of surgical technic in the field of general surgery. Avoiding speculation on this conjectural premise, it can be said that the author, once having established his objective, pursues it to the dreary end with courageous thoroughness and awesome determination.

The material, which covers a description of a representative

type of operative procedure for almost every known surgically amenable condition, is arranged according to systems of the body for the purpose of emphasizing the general surgical aspect of the book.

In keeping with the conformist tradition of scientific writing so zealously adhered to in medical literature, with the ever present imposing lists of references, the author had carefully gleaned from published works such treasures as could be unearthed. Among these are the time-tested favorite illustrations of the various methods of ligation of aneurysms. There is also the usual array of triangles and rectangles, and diagrams illustrating methods of closing skin defects. These are reproduced with a faithfulness which reflects a proper respect for surgical antiquity, if not an especially critical concern for practical and functional values.

A desirable feature of the book is the section on the dangers and safeguards involved in certain surgical procedures. This is worth while and could well have been expanded to include more than just the common and well-known surgical hazards.

In the section devoted to the treatment of sacrococcygeal cysts and sinuses the technic of primary closure is described. There is no mention of excision and packing, in view of which the author's statement that "recurrence is not uncommon" is most conservative.

Falling into the general class of "know how" as opposed to the "know when and if" texts of surgery, this work is subject to certain inherent criticism and prejudice at the outset. Accordingly, what has been lost, for teaching purposes, by the elimination of consideration of pathology, diagnosis, and indications for surgical treatment, must be compensated for by atlas, and reference book features. There is some of this in the book. Many of the drawings are helpful in visualizing procedures, but the accompanying descriptive text is not always inspired.

It may be that the student of surgery who is desirous of understanding a certain surgical procedure in a general way may find what he wants in this book. However, if he is seeking detailed information upon which to prepare himself for actual performance of the operation, he would best look to other sources.

ORTHOPAEDIC SURGERY, by *Walter Mercer, M.B., Ch.B., F.R.C.S. (Edin.), F.R.S. (Edin.), Assistant Surgeon, Royal Infirmary, Edinburgh;* with a foreword by *Sir John Fraser, Bart., K.C.V.O., M.C., F.R.S. Ed., F.R.C.S. Ed., M.D., Ch.M., F.R.A.C.S., F.A.C.S., Regius Professor of Clinical Surgery in the University of Edinburgh.* 3d edition 947 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1943. Price $12.

The author has obviously made every attempt to bring this third edition up to date, not an easy task in a specialty enjoying as lusty and rapid a growth as is orthopedic surgery. Fifty years ago the treatment of congenital deformities and tuberculosis of bone and joints made up the bulk of orthopedic practice, whereas today these subjects are of relatively much less importance. Despite this fact, orthopedic texts devote much more space to the detailed description of tuberculosis of the spine than to the causes of lame back and sciatica.

Unfortunately Mercer's orthopedic surgery is no exception in this regard. This edition contains 125 pages on tuberculosis, and less than two on intervertebral disc lesions. This apparent imbalance in emphasis, however, does not detract from the wholehearted recommendation of the text. There are no important omissions, the various diseases and conditions are well described, and the treatment outlined is in accord with accepted modern methods. The author exhibits a thorough knowledge of orthopedic literature and has drawn both from his own experience and that of other leaders in the specialty.

This volume on orthopedic surgery should have a place in the library of every orthopedic surgeon, and will prove valuable as a reference work alike for diagnostician, general surgeon, and medical student. It is well printed and bound, with excellent illustrations.

VITAL STATISTICS AND PUBLIC HEALTH WORK IN THE TROPICS, by *P. Granville Edge, Lecturer in the Division of Epidemiology and Vital Statistics, London School of Hygiene and Tropical Medicine (University of London)*; foreword by *Major Greenwood, D.Sc., F.R.C.P., F.R.S., Acting Dean and Professor of Epidemiology and Vital Statistics, London School of Hygiene and Tropical Medicine (University of London)*. 188 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price $5.

The appearance of this little 172-page book on the problems facing the public health worker in the collection of medical statistics in tropical countries is opportune. Although vital statistics are too much of a luxury to expect in tropical areas close behind the fighting front, they become a necessity when the task of reconstruction in liberated territories is being faced.

No one who reads this treatise for the purpose of profiting by the author's wide experience in tropical medicine and epidemiology will lay it down without a feeling of some discouragement at the apparent hopelessness of the attempt to collect reliable medical statistics in backward tropical countries. The book is certainly long on pointing out difficulties that will be faced and short on suggesting convenient ways of overcoming these difficulties. But perhaps that is inevitable. Most Americans lack the

patience that is required for a lifetime of work in some small Malayan state, for example, to build a firm foundation for the registration of births and deaths, for the reporting of communicable diseases, and for the periodic counting of the population. There is no question but that the author considers a lifetime of work to be necessary, and the evidence he presents is convincing.

He discusses the general difficulties of dealing with the inhabitants of most of the world's tropical areas. He deals with the problem of the taking of a census, a step which is essential if the medical statistics are to be interpreted. He warns of the tabus that can make the counting of births and deaths hopelessly incomplete if not taken into consideration. He draws upon his experience to show that the reporting of sickness can only be made useful after years of spade work and emphasizes again and again that if the obstacles are to be overcome, "the general environment and customs of the people must be studied with persevering determination."

The book is entertainingly written with interesting detours into related subjects, such as the tropical plants used by savage societies for medicinal purposes, and the birth customs of various parts of the tropical world. The author, a lecturer in the division of epidemiology and statistics in the London School of Hygiene and Tropical Medicine, has written a number of shorter papers concerning the demography and vital statistics of British colonial possessions, and a book, "Vital Records in the Tropics."

HEALTH AND HYGIENE, A Comprehensive Study of Disease Prevention and Health Promotion, by *Lloyd Ackerman, Western Reserve University*. 895 pages. The Jacques Cattell Press, Lancaster, Pa., publishers, 1943. Price $5.

This volume is not just "another hygiene book." It is a new departure in hygiene books in that it seeks to meet the needs not of school children or college freshmen but of upperclassmen in college and "mature, inquiring minds in all circles." To do this the author has required 862 pages but he has provided therein the material for a really comprehensive study of personal hygiene.

The author has made no effort to provide an easily readable book nor to present simple, concise statements to summarize complex or controversial problems. The evidence for both sides of each controversial question is presented and most of the conclusions are supported by ample facts and figures. So far does the author go in the pursuit of certain of the subjects that the publishers themselves suggest on the book's jacket, "If you do not happen to have the crusading spirit, you can use this book as an encyclopedia; thumbing to each subject as it comes within your sphere of interest."

In general the reviewer finds the facts presented to be accurate and well interpreted. He feels that the author has been a little "soft-boiled" in dealing with the subject of chiropractic, that he has somewhat overstressed infection, nutrition, mental hygiene, and sex hygiene at the expense of certain other subjects such as sleep, exercise and posture which receive but cursory treatment. If the adult reader can be prevailed upon to make his way through this rather extensive volume, he will gain a fund of valuable information concerning the safeguarding and improving of his health. In the reviewer's opinion, however, most readers will be inclined to use the volume more as a reference, simply reading those sections which deal with problems of special interest to the individual.

In this volume the Naval medical officer will find ready reference to many problems in personal hygiene, and many answers to questions raised by patients and students.

MANUAL OF MILITARY NEUROPSYCHIATRY, edited by *Harry C. Solomon, M.D., Professor of Psychiatry, Harvard Medical School; and Paul I. Yakovlev, M.D., Clinical Director, Walter E. Fernald State School; with the collaboration of 11 doctors.* 764 pages with 15 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1944. Price $6.

A more descriptive title for this work would have been "A Manual of Neuropsychiatry for the Medical Officer in Military Service." The book has a basic core of clinical neurology and psychiatry which has equal reference to civilian and military medicine. These chapters have been prepared by a panel of eminent specialists in a terse manner worthy of commendation. Conditions of military service have put a special premium on economy of expression. This compact volume, small enough to go into one's overcoat pocket, conforms to the existing need for discriminating condensation. The 49 chapters make rich reading for the general medical officer, covering as they do a variety of subjects under such topical headings as "Induction," "Administration and Disposition," "Clinical Entities," "Prophylaxis and Therapy," and "Special Topics."

It is thought that the volume will be widely appreciated for its orientation value and clinical expositions. It is one of the pioneer works on military neuropsychiatry to emerge from the present conflict. It is too early for a definitive treatise summing up in critical fashion the accessions and technics of applied neuropsychiatry which are in process of being established. The cloak of military secrecy has fallen over the NP problem and statistics concerning NP casualties are not now freely released for publication. Many of the most profound problems in the NP field concern the immediate and final disposition of personnel and the

postdischarge sequelae. Some of these "livest" issues are still in the crucible of controversy, hot and steaming as it were, but not yet ready to be cast into rigid molds. Military neuropsychiatry is in the making and its ramifications reach out into far corners, areas which a book such as the present one can hardly presume to explore. The young medical officer in remote places will not be disturbed by these inevitable gaps; specialists will agree that "impossibility of performance" explains the editors' failures to include what they have had to omit.

GLOBAL EPIDEMIOLOGY, A Geography of Disease and Sanitation, by *James Stevens Simmons, B.S., M.D., Ph.D., Dr.P.H., Sc.D. (Hon.), Brigadier General, United States Army; Tom F. Whayne, A.B., M.D., Lieutenant Colonel, M.C., A.U.S.; Gaylord West Anderson, A.B., M.D., Dr.P.H., Lieutenant Colonel, M.C., A.U.S.; Harold Maclachlan Horack, B.S., M.D., Major, M.C., A.U.S.; and collaborators.* Volume One—Part One: India and the Far East—Part Two: The Pacific Area. 504 pages. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1944. Price $7.

The authors' foresight in compiling this book is praiseworthy. The Medical Intelligence Division of the Army already has made available to military authorities timely pamphlets of medical importance. Great wisdom has been shown in placing much of this authoritative material in permanent book form which is suitable for general use. This is a fundamental work which contains a vast amount of information derived from the widest possible sources. With the establishment of peace, changes and additions will be required to keep the factual data up to date. The authors have pioneered in a large field; their book is a significant contribution to geo-medicine. It is hoped that they will pursue their research and publish similar volumes concerning other portions of the world. It was no happenstance that India, the Far East, and the Pacific areas were selected for the first volume. These are regions in which we are vitally involved. Many of our fighting men are located there and are moving step by step toward our ultimate goal. Their progress will be made safer by the basic knowledge of geography, sanitation, and diseases presented in this book.

Tropical diseases remained a major blind spot in American medicine until the present war. As the conflict became global, it was soon realized that large gaps existed in our scientific knowledge. Aware of this the authors acquired the necessary information to establish the groundwork upon which are built present-day control measures. Disease vectors assumed a position of great importance, and much investigation is going forward but details still exist to be filled in by the entomologists. A host of malariologists are working, both in the laboratory and in the field, to

solve the problems which confront the military surgeons. Our scientists are now in the forefront of tropical disease research. We have always excelled in the solution of health and sanitation problems. It is interesting to compare the former health facilities of the Philippine Islands with an island such as Formosa held by Japan for a similar period of time. Although steps were taken in Formosa to eradicate plague, cholera, and smallpox, and while malaria was considerably reduced, there was no attempt of comparable magnitude made to develop health and sanitary measures or to train adequate native medical personnel to care for the population.

Here is a valuable reference book containing descriptions of islands, territories and countries, systematically arranged to include discussions on geography, public health, medical facilities, health hazards and disease. A number of excellent maps show world-wide distribution of the principal communicable infections. When peace comes the accessibility of all parts of the world by rapid air transportation will keep the subject of tropical disease before the medical profession. Students of medicine will find this book most useful in preparing to cope with global medical problems of the future.

MALARIA: Its Diagnosis, Treatment and Prophylaxis, by *William N. Bispham, Colonel, U. S. Army, Retired.* 197 pages. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price $3.50.

The need for new texts on malaria is amply justified at this time. In the present volume, the author, who has been a close student of the disease, has in addition enlisted the aid of specialists in various phases of malariology in reviewing the separate chapters. Thereby errors which usually appear in a book that has wide coverage have been avoided.

The subject matter has been well organized, and for the most part controversial or inconclusive material has been omitted. The colored illustrations of the life cycle of the parasite are well done. Its chief value lies in the succinct presentation and ready availability of practically any point that the man in the hospital or field would need to know. Therefore it can be recommended as a useful text to anyone having an interest in malariology.

DISEASES OF THE DIGESTIVE SYSTEM; by 48 contributors. Edited by *Sidney A. Portis, B.S., M.D., F.A.C.P., Associate Professor of Medicine, University of Illinois Medical School (Rush).* 2d edition. 932 pages; illustrated with 182 engravings. Lea & Febiger, Philadelphia, Pa., publishers, 1944. Price $11.

This book covers the important phases of diseases of the digestive system. Each of the 47 chapters in the book has been written by one of the contributing authors. Consequently with such a

diffuse field to cover it is quite natural that little space could be given to any detailed discussion of surgical procedures.

Principal, important parts of the description and medical treatment of various gastro-intestinal diseases are covered adequately, so that the book is a very excellent reference text for one wishing to review important phases of diagnosis and treatment.

Chapters dealing with the disturbances and diseases of the colon are particularly worthy of comment; the subject of colonic infections is very thoroughly covered. The effect on the gastro-intestinal tract of lesions of the urinary tract, the cardiovascular system, and the nervous system, as well as the endocrinologic manifestations, are also covered in the text. The book should be of special interest to officers in the armed forces because of the complete coverage of the many manifestations of gastro-intestinal diseases in one volume by such an outstanding group of contributors.

The value of the book could be improved by allowing more space to the surgical treatment of gastro-intestinal diseases with more illustrations for such operative procedures.

THE GASTRO–INTESTINAL TRACT, A Handbook of Roentgen Diagnosis, by *Fred Jenner Hodges, B.S., M.D., Professor of Roentgenology, University of Michigan Medical School, Ann Arbor, Michigan.* 320 pages; illustrated. The Year Book Publishers, Inc., Chicago, Ill., publishers, 1944. Price $5.50.

This concise handbook presents the story of gastro-intestinal roentgenology in a manner which will appeal to the surgeon or internist as well as the specialist in radiology. The introduction stresses the importance of preliminary fluoroscopy and sets forth the fundamental rules which govern its use. The book is divided into sections which treat the successive regions of the gastro-intestinal tract. At the end of each section is an excellent bibliography.

There is a varied collection of good plates which are accompanied by brief comments drawn from the clinical records of the cases presented.

This work should materially assist in obtaining closer cooperation of the internist or surgeon with the radiologist in solving diagnostic problems relating to the gastro-intestinal tract.

PLASTER OF PARIS TECHNIC, by *Edwin O. Geckeler, M.D., Associate Professor of Orthopaedic Surgery, and Chief of the Fracture Service, Hahnemann Medical College and Hospital, Philadelphia.* 220 pages; illustrated. The Williams & Wilkins Co., Baltimore, Md., publishers, 1944. Price $3.

This is a well-written and generously illustrated volume devoted to the methods of using plaster of paris in surgery.

The text is clear and concise and with the aid of 255 excellent illustrations the subject has been covered so comprehensively that

the volume should prove a valuable adjunct in the instruction and training of interns and hospital corpsmen in the art of applying plaster of paris.

The making of the plaster bandages and the application of plaster by the various methods is described. Errors and difficulties are well covered.

There is a chapter on the application of the so-called pattern plaster. This method is popular in parts of Great Britain and Europe and because of its simplicity is especially useful in war surgery.

Not the least of the book's virtues is that it is practical and the chapter on follow-up care is one that is replete with helpful hints and guidance.

HYPERTENSION AND HYPERTENSIVE DISEASE, by *William Goldring, M.D., Associate Professor of Medicine, New York University College of Medicine; and Herbert Chasis, M.D., Assistant Professor of Medicine, New York University College of Medicine.* 253 pages. The Commonwealth Fund, New York, publishers, 1944. Price $3.50.

This volume exemplifies meticulous research in the theories of hypertensive disease. Chapters on Clinical Aspects of Hypertension, Renal Mechanism in Genesis of Hypertension, and Evaluation of Medical and Surgical Treatment appear as those of most practical value.

For the general physician in the Naval service, it is the reviewer's opinion that the general text is of too highly a technical nature and contributes little help to those seeking practical points for general application. However for those who might be interested in the technical and research branches of the subject of hypertension, this volume would probably be of great service in helping to direct plans of investigation, by its numerous and readily available graphs, charts, and tables of the authors' experiments.

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RH CLASSES

For convenience in analyzing genetic results, the classification of persons according to their reactions only with anti-Rh′ and anti-Rh″ is convenient. This yields four classes, W, U, V, and UV, analogous to the four common blood groups. Each class includes a pair of Rh types as follows: class W, Rh_0 and Rh–; class U, types Rh_1 and Rh′; class V, types Rh″ and Rh_2; class UV, types Rh′Rh″ and Rh_1Rh_2.—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

PREVENTIVE MEDICINE

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ACUTE METHYL ALCOHOL POISONING

REPORT OF EIGHTEEN CASES

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Acute methyl alcohol poisoning has been encountered infrequently in the Navy. During the 10 years prior to 1943, only one report of this condition appeared in the BULLETIN (*1*). During a 6-month period, 18 cases were studied at a South Pacific fleet hospital; 6 of these patients died. This high mortality rate and relatively large numbers of patients made this condition the most serious single malady encountered at the activity.

All but one patient came from three different activities on the island, five patients coming from a Marine activity, three from a construction battalion, and nine from another construction battalion. The patients within each separate activity were admitted within a period of 24 hours.

The sources of the methyl alcohol, in all cases but one, were products intended for use in testing for leaks of Freon gas in refrigerators and labeled either "alcohol" or "methyl alcohol." None of the containers carried poison labels. In all cases the poison had been mixed with water and fruit juices, in undetermined proportions, and then consumed.

The estimated amounts of methyl alcohol ingested varied from an unknown volume to 750 cc. among the 6 patients who died, and from 90 cc. to 500 cc. (?) among the 12 patients who lived. The lethal dose of methyl alcohol cited in the recent literature (*2*) is from 100 to 250 cubic centimeters.

All of the patients were admitted from 24 to 72 hours after the ingestion of the poison. The commonest symptoms were those of

mild alcoholic intoxication within a few hours after drinking; and drowsiness, headache, photophobia, blurring of vision, dyspnea, nausea, and vomiting within 24 hours. In most patients blurred vision and dyspnea persisted up to 72 hours. Of the six fatal cases, one patient died within 12 hours and five within 48 hours.

The commonest physical findings on admission included various degrees of drowsiness and confusion, an odor of methyl alcohol on the breath, flushed face, low-grade fever with proportionately rapid pulse, and Kussmaul's respiration. The ocular abnormalities were observed in 10 of the 12 surviving patients. These findings consisted of various degrees of loss of color vision, initially of green color sense; thereafter of red, yellow, and of blue color senses, successively. The reduction of vision was the same in both eyes, with loss of central vision and of central color field; the peripheral vision remained initially intact in most cases. Unilateral or bilateral supraorbital or retro-orbital pain was experienced by most patients for 1 or 2 days after admission. The objective early abnormalities included slight conjunctival injection, slightly dilated and sluggishly reactive pupils, mild hyperemia of the disc and retina, haziness of the disc margins and slight engorgement of the blood vessels, less so in the periphery, more noticeable in the macular area, with a vessel ratio of two to three. The ocular tension and refractive media were normal in all cases.

LABORATORY FINDINGS

Most urines contained traces of albumin and acetone bodies, and numerous hyaline and granular casts. All urines were acid, pH 5.5 to 6.0. The blood in every instance showed an alcohol contents of from 1 to 5 mg. per 5 cubic centimeters. In several instances during the first few days a mild secondary anemia, slightly prolonged prothrombin time (determined 72 hours after ingestion of the poison), and an elevated sedimentation rate were evident. The blood of one patient who died approximately 24 hours after ingesting the alcohol, examined at the autopsy, showed a prothrombin time of 72 seconds. Facilities for the determination of the blood alkali reserve were not available. Lumbar punctures were performed on three patients. In one patient the initial pressure was 330 mm. of water; the following day it was 110 mm. of water. The spinal fluids were not otherwise noteworthy.

PATHOLOGIC FINDINGS

Macroscopic.—The salient postmortem findings and those common to all six patients included the following:

In all instances there was moderate to severe cyanosis, lividity

was present posteriorly and there was generalized and intensified postmortem rigidity. There was no evidence of postmortem clotting of the blood, although autopsy was performed in two instances 18 and 24 hours after death.

The lungs were voluminous, covering the anterior surface of the pericardial sac. Marginal emphysema was commonly present. Many subpleural petechial hemorrhages and larger ecchymotic areas were present. The lungs on palpation showed no areas of consolidation. Section exhibited edema and congestion of the lung parenchyma. The bronchi were congested, and in one instance contained aspirated food particles.

In each instance the heart revealed subepicardial hemorrhages but was otherwise normal.

The liver was moderately enlarged, the average weight being 2,000 grams. The capsular surface was smooth and glistening. On section the cut surface swelled forward, everting the capsule. In each instance the liver pattern was obscured by a yellow-brown mottling. The cut surface appeared greasy. Small areas of necrosis could be detected in one case. The gallbladder and biliary ducts appeared normal.

The mucosa of the stomach exhibited punctate hemorrhages, and the walls appeared edematous. The duodenum in each case showed mucosal congestion and edema, and edema of the wall. The remainder of the intestinal tract revealed only mucosal congestion at various levels.

The kidneys were uniformly increased in size, averaging 175 grams. On bisection the cut surface swelled forward, everting the capsule. The kidney markings were obscured by the degree of swelling present. The pelves all showed petechial hemorrhages.

The eyes were not examined because facilities for sectioning them were lacking.

On removing the calvarium, the dura was noted to be tense in all cases. Reflection of the dura revealed marked engorgement of the vessels of the pia-arachnoid. In most cases the latter was lifted above the convolution by accumulation of clear spinal fluid. There was herniation of the cerebellum into the foramen magnum. On removing the brain there was no asymmetry between the two hemispheres. Section revealed edema, swelling and congestion throughout the brain and brain stem. The vessels lining the ventricles were especially hyperemic. Small punctate hemorrhages could be discerned in scattered areas.

Microscopic.—Various degrees of edema and hyperemia were found throughout the brain and brain stem. The vessels in the floors of the ventricles were engorged, and there was desquamation of the ependymal cells. There was a severe subpial edema

with engorgement of the small cortical vessels, associated with rather extensive perivascular edema. Nissl's granules revealed degenerative changes, many appearing indistinct and fragmented. Small focal areas of hemorrhage could be seen in a few areas. Similar changes were observed in the brain stem.

Throughout the lungs there was considerable engorgement of blood vessels, both large and small. There were many small subpleural hemorrhages, and scattered throughout the lung parenchyma were numerous small focal hemorrhages involving several alveoli and usually associated with a degree of emphysema.

The liver cells appeared swollen and filled with small fat vacuoles. These changes distorted and in some instances nearly obliterated the sinusoids. Many nuclei were pyknotic and some showed degrees of karyolysis. Areas of focal necrosis in the midzonal area were present in two cases.

There was some superficial necrosis of the mucosa of the stomach with infiltration of the submucosa by plasma cells and by polymorphonuclear leukocytes. Small mucosal hemorrhages were common and there was engorgement of the vessels of the submucosa and wall, with concomitant edema.

Most of the tubules of the kidneys revealed extensive degeneration. In many areas the nuclei stained poorly or not at all. The cytoplasm appeared filled with small fat vacuoles. The collecting tubules did not appear to be severely damaged. Many of the glomeruli appeared intact; others were the seat of focal hemorrhage, or were destroyed by hemorrhage into the surrounding parenchyma.

TREATMENT

The initial treatment, in most of the patients who lived, included gastric lavage, enemas, magnesium sulfate, repeated intravenous infusions of 5-percent dextrose in saline, and the administration of large amounts of sodium bicarbonate, both orally and intravenously. No patients were treated with ethyl alcohol, as advocated by a recent writer (*3*).

All of the last five surviving patients were given from 4 to 6 gm. sodium bicarbonate (tablets) every 2 hours until the urines, tested at intervals of 2 hours, attained a pH of 7.5 (nitrazine paper). In addition a total of seven intravenous infusions of sodium bicarbonate were administered to four of these patients. Fifteen grams of sodium bicarbonate U.S.P. (unsterilized) were dissolved in one liter of 5-percent dextrose in saline. In view of the danger of decomposition of the bicarbonate by heat, the resulting solution was not sterilized. Each infusion was given by the drip method over a period of 1 hour. In none of the patients were there observed

any febrile or other reactions to these infusions. In every instance the decrease in the degree of acidosis, as measured by the change in the urinary pH, was paralleled by clinical improvement, diminished respiratory rate, and disappearance of mental confusion. The urinary volumes were satisfactory in all cases.

The degree of acidosis in these patients is shown by the data in table 1.

TABLE 1.—*Effect of sodium bicarbonate upon the acidosis*

Case No.	Severity of poisoning	Blood alcohol in mg. per 1 cc.	Total dosage of sodium bicarbonate orally and intravenously in grams	Period for urine to attain pH 7.5 in hours
14	Moderate	1.5	46	Less than 28
15	Moderate	1.0	61	Less than 28
17	Severe	2.5	124	40
18	Severe	3.5	126	44
16	Severe	5.0	162	56
Average for 5 normal individuals			6.4	3

Of the six patients who died, four died before reaching the hospital. A fifth patient arrived semi-comatose, markedly dyspneic, and died with failing respiration 2 hours after admission. The sixth patient arrived deeply comatose, markedly dyspneic, and exhibiting generalized clonic convulsions; he died with failing respiration 1 hour after admission. None of the patients who died were treated with sodium bicarbonate.

The results of treatment were satisfactory in 11 of the 12 surviving patients. Normal visual acuity was attained by these 11 patients within 4 weeks after admission, and they were discharged to duty. The ocular findings during recovery were characterized by the following changes: Within 4 or 5 days blue color sense returned, followed successively by yellow, red, and green color sense. The hyperemia of the discs and of the retina subsided. In six of ten patients visual acuity was normal within 1 week; five, when re-examined 2 months later, were found to have normal vision. Within 72 hours after the consumption of approximately 140 cc. of methyl alcohol, one patient showed light perception and projection present, complete loss of color sense, vision limited to hand movements at 1 foot distance, moderate edema and pallor of the discs, and marked hyperemia of the maculae. Three days later the discs appeared yellow-white and the retinal vessels were diminished to one-half of their normal caliber, with no change after the inhalation of amyl nitrite. During the following 3 weeks color sense and visual acuity showed slight improvement. During the fourth week after admission the discs began to appear slate gray; hyperemia

persisted around the macular areas. By the sixth week visual acuity was decreased and the caliber of the vessels was diminished to one-third of normal. By the eighth week color vision was limited to faint perception of blue; vision consisted of fingers at 2 feet on the right and 1/20 on the left; both nerve heads showed contraction.

In one patient a bout of benign tertian malaria with fever of from 102° to 103° F. lasting 1 day, was followed, within 12 hours, by decided subjective visual improvement. This suggested the use of intravenously administered typhoid vaccine as an adjunct to the treatment of amblyopia.

Three patients developed numbness of all toes about 6 days after ingestion of the poison. No significant disturbances of tactile or pain sensation were observed. Multiple vitamins and large doses of thiamine chloride were administered to these patients. The symptoms disappeared within 4 weeks.

COMMENT

These cases illustrate the tragic consequences of inadequate labeling of supplies of methyl alcohol, and re-emphasize the necessity, as pointed out by Voegtlin and Watts (*1*), of plainly marking this material "Wood Alcohol—Poison."

In common with early reports (*4*) (*5*) and more recent descriptions of this condition (*1*) (*3*) (*6*), these cases illustrate the presence of a profound acidosis as an important cause of much of the symptomatology and probably even of the fatal outcome. The likely cause of the acidosis is an accumulation in the tissues and body fluids of formic acid, derived from the oxidation of unexpired methyl alcohol (*2*). Formic acid is a poisonous corrosive, approximately ten times as strong as acetic acid (*7*). Other oxidation products, such as formaldehyde and lactic acid, may be operative in the intoxication.

These cases also emphasize the necessity for prompt and intensive treatment of the acidosis. The serious symptoms of the acidosis, as mentioned by Voegtlin and Watts, may be treacherously masked for many hours. Two of our patients were admitted to the ward in an ambulatory state. When seen by the medical officer about 15 minutes later they were found sitting on their beds, smoking, disclaiming any great discomfort, but 30 minutes later both patients were dyspneic and confused.

During this relatively asymptomatic latent period the rapid determination of the degree of acidosis is possible only by means of an estimation of the blood alkali reserve. But the absence of facilities for such a procedure need not delay the institution of

active treatment. Furthermore by the use of urinary pH estimations as a means of regulation of dosage of the sodium bicarbonate, the danger of significant degrees of alkalosis can be avoided.

The degrees of acidosis among these patients, as depicted by the amounts of alkali necessary for treatment (table 1), are strikingly similar to the findings in cholera by Sellards (*8*).

The intravenous administration of sodium bicarbonate (or of sodium lactate, if available (*1*)) is indicated in most cases. In the more severe cases nausea and vomiting present an obstacle to the oral administration of adequate amounts of bicarbonate.

Prompt treatment of the acidosis also may be important in the prevention of optic nerve injury, for a recent writer (*3*) has observed that the degree of amblyopia appears to depend on the degree and duration of the acidosis. The value of artificial fever therapy in the treatment of amblyopia is problematic and requires further critical investigation.

The role played by a possible prothrombin deficiency in the pathogenesis of the intoxication needs further elucidation. Nevertheless the administration of vitamin K, either in medicinal form or in the form of transfusions of whole blood, is probably indicated.

MANAGEMENT

The results of study of the cases lead to the following suggestions for emergency management:

1. Enforce complete bed rest; pulse and respirations to be taken every hour, urine pH determination every hour, intake and output to be charted.
2. Give magnesium sulfate, 3 oz., orally or through stomach tube, followed by sodium bicarbonate, 6 grams.
3. Give high saline enema (1 quart).
4. Insert inlying catheter; urine to laboratory for routine analysis and pH and acetone bodies determination.
5. Begin intravenous administration of 15 gm. of sodium bicarbonate dissolved in 1,000 cc. of 5-percent dextrose in saline. Repeat every 6 hours or oftener until urine pH reaches 7.0.
6. Take blood for alcohol content, coagulation and prothrombin times, erythrocyte count and hemoglobin. Type and cross-match.
7. Procure oxygen tank and mask, to be kept at bedside, and have available a syringe with intravenous needle, containing 1 gm. caffeine sodium benzoate, and another filled with 2 cc. nikethamide.
8. Transfuse with 450 cc. whole blood.
9. Give 6 gm. sodium bicarbonate (tablets) orally every 2 hours until urine pH reaches 7; thereafter reduce dose for maintenance at that level.

Postemergency management should include protection of eyes from exposure to strong light and the administration of multivitamins, thiamine, nicotinic acid, vitamin K, and transfusions. Repeat daily erythrocyte count and hemoglobin, coagulation and prothrombin times, and complete urinalysis.

SUMMARY

1. The clinical findings in 18 cases of acute methyl alcohol poisoning are presented.

2. The pathologic findings in 6 cases are reported.

3. The role of acidosis in the symptomatology of the intoxication is described.

4. A scheme of treatment is presented in detail.

5. The hazard of inadequate labeling of products containing methyl alcohol is strongly emphasized.

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RH ANTISERUMS

Rh antiserums are antiserums reacting with one or more of the Rh factors. Among human beings, in addition to serums containing only one sort of Rh agglutinin there are some with two Rh agglutinins. Five common varieties of human Rh antiserums are anti-Rh_o, anti-Rh', anti-Rh", anti-Rh_o' (containing two agglutinins, anti-Rh_o and anti-Rh') and anti-Rh_o".—WIENER, A. S.: The Rh blood factors. J.A.M.A. 127: 294, February 3, 1945.

METHYL ALCOHOL POISONING

REPORT OF FORTY-TWO CASES[1]

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The prevention of methyl alcohol poisoning is far easier than its recognition or cure. An isolated case of methyl alcohol poisoning may readily go unrecognized until a critical and hopeless stage is reached. Often the history in such cases is obscure or misleading, and at times the patient arrives at the hospital in coma without any possible obtainable history. However the clinical appearance and the mode of death of a patient as a result of methyl alcohol poisoning is so characteristic that an immediate search for those who shared in the drinking should be instituted and the source and methods of distribution of the poisonous liquor determined.

This problem presented itself shortly after the invasion and conquest of an area previously held by the Japanese. The supply of methyl alcohol used by the enemy for fuel purposes only, was discovered in captured Japanese fuel drums. This poisonous liquor was not left by the enemy in containers which could be mistaken for beverage purposes. Despite repeated official notifications, the methyl alcohol in the fuel drums was ferreted out by enlisted personnel and natives who were attracted by the alcoholic odor but who failed to appreciate its dangerous effects or fatal consequences when consumed in even small quantities. The methyl alcohol was shared and served in a mixture of orange, pineapple, or other fruit juice, in proportion of three of fruit juice to one of alcohol. This so masked the repulsive odor of the poisonous liquor that it went unrecognized. Only an experienced and suspicious person could detect the odor of methyl alcohol in such a mixture.

Forty-two patients were admitted to the Medical Battalion because of Poisoning, acute, methyl alcohol. They arrived in two groups: The first group consisted of 13 patients, all appearing

[1] These patients were studied and treated in the "field" where laboratory facilities were few and limited. More elaborate clinical studies might have given more valuable and interesting data.

within a few days; and 2 weeks later the second group, comprising 29 admissions within 24 hours, reported for treatment. Six natives and 36 enlisted personnel were affected. Thirteen died, a mortality of 32 percent. Four autopsies were obtained and the findings were practically identical in all cases.

The first case of methyl alcohol poisoning was unrecognized clinically. The patient arrived at the hospital in deep coma, and almost moribund. No history was obtainable. The striking features of the physical examination were a deepening purplish lividity from the costal margins upward, most striking in the face and lips; cyanotic finger tips; deep and labored respirations, 5 per minute; full, bounding, 40-per-minute pulse, and widely dilated pupils which failed to react to light. There were no other abnormal physical or neurologic signs. Within an hour after admission the respirations steadily declined and finally ceased, but the pulse and heart rate continued with full volume and after 10 minutes declined in rate, after which the patient died. Spinal fluid removed shortly after death showed no increase in cells or any organisms.

Autopsy revealed congested viscera, filled with dark blue blood, most notable in the lungs. The brain was only moderately edematous, and there were extensive patchy subpial and subarachnoid hemorrhages over both cerebral hemispheres.

On the day following the death of the above-mentioned patient, a man from the same company was admitted complaining of headache, blurring vision, and epigastric pain. Upon close questioning, it was learned that this man had been drinking with the patient who died on the previous day. The source of the "liquor" was obscure. Within the next few days eleven patients who had consumed various quantities of methyl alcohol were admitted to the hospital. At the time of their admission the clinical picture varied from mild symptoms of headache and blurring vision to deep coma. Seven patients of this group died.

The experience gained clinically and at autopsy from these two patients facilitated the making of a diagnosis of methyl alcohol poisoning in the other cases and a fairly uniform regimen of symptomatic treatment was instituted promptly.

COMMENTS

The forty-two patients were males from 19 to 45 years of age, most of them in the age group between 20 and 25 years. They had gone through a rigorous military campaign shortly before. Although the exact quantity of methyl alcohol consumed could not be ascertained, it varied from 4 to 8 ounces. At least three of the patients who died were confirmed chronic alcoholics.

On the average the patients arrived at the hospital from 24 to 36 hours after the drinking bout. At first their symptoms were a sense of intoxication; but after 6 to 12 hours they began to note blurring vision, splitting headache, epigastric distress, abdominal cramps, nausea, and vomiting, the blurring of vision being the most alarming and forcing the patients to seek medical aid. Drowsiness was noted in the severe cases and often progressed to coma and death. Repeated convulsions of a decerebrate type were observed in 6 patients shortly before death.

Following a clue given by a patient who subsequently died, a large gathering at a party was interrupted in the search for methyl alcohol. Eleven admitted having taken only one drink (6 oz.) of "spiked fruit juice" which contained one-third methyl alcohol. An earthen 5-gallon jug of alcohol was discovered on the premises. Chemical analysis by the Naval Industrial Health Department showed that it contained methyl alcohol 92 percent by volume, ethyl alcohol 4 percent by volume, and residue 1.7 percent by weight. When informed of their condition they willingly came to the medical station where emesis with sodium bicarbonate was induced. Each was given magnesium sulfate, 1 oz., and put on a forced fluid regimen. They were observed for 48 hours but none of these patients suffered any ill effects.

The forty-two patients admitted may be divided into three groups according to the symptoms and findings:

1. *Mild.*—There were 19 patients classified as having mild toxicity. These complained of some blurring vision, moderate headache, nausea and vomiting. Some had no complaints. Physical examinations failed to reveal any positive finding. Treatment was symptomatic. All recovered with no sequelae.

2. *Moderate.*—There were 13 patients classified as moderately severe. These had initial complaints of blurring and failing vision, particularly for distant objects. Abdominal cramps, epigastric distress, vomiting, hiccoughing, dyspnea, and drowsiness appeared in sequence, which in some became increasingly severe. Memory defects and mental confusion were present in practically every patient.

These people all appeared acutely ill with moderate cyanosis of the face and finger tips, and dilated pupils which responded poorly to light. Respirations were elevated and labored. The fundi appeared normal and neurologic examination disclosed nothing relevant. Five patients in this group became increasingly worse, lost consciousness and died. Eight patients recovered and were observed for over a fortnight. They showed disturbances in vision with residual complaints of blurring and photophobia. Visual acuity was seriously diminished in several of these patients. Two

had impairment of vision limited to gross finger movements. The remaining six patients showed a diminution in visual acuity varying from 8/20 to 16/20. Two patients had impairment in color perception and one was able to recognize blue only. Ophthalmoscopic examination showed hyperemic fundi with slight tortuosity and spasm of the retinal arterioles. Optic pallor or atrophy was not observed.

Treatment in these cases included bed rest in a dark and quiet room, intravenous hypertonic dextrose, plasma, dextrose and insulin intravenously, phenobarbital, oxygen, ethyl alcohol by mouth in small quantities every 3 hours, aminophylline, and respiratory stimulants as indicated. The only medication that seemed to have any beneficial effect was isotonic sodium bicarbonate (1.3 percent) given intravenously. This was most effective in combating the severe acidosis. Some, however, progressed to a fatal ending and their condition was not influenced by any medication or combination of measures instituted.

3. *Severe.*—In the third group there were eight patients who were admitted with evidence of severe toxic poisoning from methyl alcohol. Four arrived in deep coma, with cyanosis of the upper portion of the chest, face, and fingertips, cold moist clammy skin, dilated fixed pupils, slow labored respiration, and rapid thready pulse. They died shortly after admission. Two of these patients had several convulsions of the decerebrate type shortly before death. The other four patients were conscious and responsive upon admission but appeared drowsy and mentally confused. They also presented lapses of memory. However they did not present the picture of cyanosis and shock, although they appeared seriously ill. The pupils were widely dilated and responded poorly to light. Respirations were rapid and deep, the pulse feeble and swift. Despite a variety of medications their course was rapidly downhill and within a few hours after admission convulsive seizures of the decerebrate type set in, followed shortly by death.

TOXICOLOGY

From the available literature it is apparent that the exact mechanism by which methyl alcohol produces its toxic effect is not well known. The consumption of from 2 to 4 ounces of methyl alcohol can be fatal. Methyl alcohol by oxidation is reduced to formaldehyde, which upon further oxidation forms formic acid.

$$\underset{\text{Methyl Alcohol}}{CH_3OH} \rightarrow \underset{\text{Formaldehyde}}{HCHO} \rightarrow \underset{\text{Formic Acid}}{HCOOH}$$

Formic acid is believed to have a specific affinity for the central nervous system, particularly the optic nerves, respiratory center,

and vagus nerve. The resulting pathosis causes visual disturbances, respiratory paralysis and acidosis. The clinical progress of the condition is dependent upon the accumulating injury to the nervous system and tolerance to the poison. Treatment is symptomatic and no method to prevent the breakdown of methyl alcohol into its deadly components is known.

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PHYSIOLOGIC PRINCIPLES OF HEAT AND COLD

The psysiologic responses to heat and cold are the same, although for opposite reasons. A hot water bottle on the abdomen shortly produces an area of hyperemia beneath it. An ice bag on the abdomen produces first an area of pallor, with constriction of the capillaries, followed shortly by an area of hyperemia which is as distinct as that produced by the hot water bottle. The surface reaction is, in both cases, the same. In one its object is to pick up heat, carry it away from the heated area, and distribute it over the body so that it cannot accumulate locally and cause damage to the tissues. In the other case the hyperemia serves to bring in heat to the chilled tissue from distant parts of the body so that no local damage will result from freezing. It has been demonstrated experimentally that temperature changes in either direction penetrate the tissues to only a small extent. The changes ½ inch beneath the surface are registered only in small fractions of a degree. The hyperemia which tends to equalize the temperature in either direction explains the failure of the temperature changes to extend deeper into the tissues.

It formerly was believed important to use ice in inflammatory conditions and heat in conditions that resulted from trauma or spasm. The reasons for these rather specific instructions lay in a misunderstanding of the depth to which the temperature changes penetrate. Ice was prescribed for infectious processes on the theory that there was less bacterial growth in the cold and that the application of heat might promote bacterial growth and aggravate the condition. In respect to heat treatment of infections in the depths of the pelvis, if we think of the affected uterus or tubes as being several inches below the surface from whatever direction they are approached, it is evident that the surface application of heat will produce no thermal changes in these areas and consequently the choice of hot or cold applications to the abdomen may be determined by the amount of comfort they give the patient.—JANNEY, J. C.: Medical Gynecology. W. B. Saunders Co., Philadelphia, 1945. Chapter 41, pp. 255-256.

NITROBENZENE POISONING

REPORT OF A FATAL CASE

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Nitrobenzene is a yellowish, intensely sweet, oily liquid having the odor of oil of bitter almond. It is produced as an intermediate product in the manufacture of aniline oil and marketed under the name of artificial oil of bitter almonds, or oil of mirbane. It is used as a perfume in soaps and pomades. The Pure Foods and Drugs Act (*1*) forbids its use as a substitute for oil of bitter almond in flavoring food. However it is used commonly as a solvent for shoe polish dyes, lacquers, indelible inks, and the like.

Nitrobenzene is readily absorbed through the skin and through the mucous membrane of the intestinal tract. A number of cases of poisoning, some fatal, caused by wearing shoes which had been colored with dye in which nitrobenzene was used as a solvent, have been reported (*2*). In factories where nitrobenzene is manufactured, headaches with sleepiness are frequently produced by inhalation of the fumes.

The first symptoms of poisoning are headache, muscular weakness, a peculiar blueness of the face, and loss of consciousness. In the fully developed poisoning the whole surface of the body is a deep bluish color, and the mucous membranes are blue-gray. The pupils are dilated, muscular relaxation is complete except that sometimes the jaw is rigidly set, consciousness is lost, respiration is rapid but shallow and irregular, and the pulse is rapid and thready or entirely imperceptible. The urine contains urobilin, indican, and acetone. Recovery may occur after many hours of unconsciousness. The blueness of the skin may remain for several hours or days after recovery (*1*).

The symptoms of nitrobenzene poisoning are due in part to the action of the poison on the nerve centers and in part to its destructive effect upon the blood, with the formation of methemoglobin.

The following case report closely parallels that reported by Wirtschaftar and Wolpaw (*3*).

Case report.—A 20-year-old white male prisoner was found unconscious on the floor of the laundry unit where he had been working. He was brought to the emergency room by ambulance.

At the time of admission, the patient's respirations were 10 per minute; pulse rate 110, irregular and somewhat thready; and the blood pressure was 112/40. There was deep cyanosis of the entire body, most noticeable beneath the fingernails and on the mucous membranes of the mouth and lips. The sclera and conjunctiva were also deep blue. At intervals of from 2 to 3 minutes there were perceptible twitchings of both arms, and once this twitching extended to the muscles of the face; the legs did not seem similarly affected. There was retching, but little vomitus was expelled. An odor about the patient, suggesting shoe polish, rapidly filled the room.

The patient was given 1 cc. of nikethamide and his stomach was lavaged with warm limewater. The solution returned from this lavage was light green. Forced oxygen inhalations were administered and the respirations increased to 24 per minute. The patient was removed to a ward, placed in an oxygen tent, and given 500 cc. of whole blood and 500 cc. of plasma. A heat cradle was placed over the patient.

During the following 4 hours, nikethamide had to be given frequently as his respiration rate kept dropping. Five hundred cubic centimeters of normal saline was administered intravenously during the interval.

The patient expired, apparently from respiratory paralysis, 4 hours and 40 minutes after admission to the hospital. The cyanosis had not changed during the interval between admission and death. No laboratory studies were done before death. From clinical symptoms and the characteristic odor, it was believed that the patient had drunk nitrobenzene; this was later confirmed by laboratory studies. Subsequent investigation revealed a partially filled bottle of commercial spot remover on the work bench where the patient had been working. Chemical analysis of this solution showed that it contained a large quantity of nitrobenzene.

Autopsy was conducted 13 hours after death. Rigor mortis was intense throughout the entire body. Postmortem lividity was of a dark purplish color. Purplish mottling was observed over the face, chest, thighs, and legs. There was intense cyanosis of the nail bed. Peripheral edema was not evident. On opening the calvarium a distinctive odor of nitrobenzene was present. The vessels of the hemispheres were dark blue in color and intensely congested. The lungs showed moderate edema and were somewhat darker in color than usual. The heart muscle also appeared to be darker than normal. The stomach contained about 200 cc. of light green fluid giving the characteristic odor of nitrobenzene. There was moderate injection of the stomach mucosa but no evidence of ulceration or necrosis. The remainder of the gastro-intestinal tract was normal. The kidneys were of a chocolate brown color. Markings were indistinct.

The blood was chocolate brown in color, fluid, and failed to coagulate after standing for several hours at room temperature. All the body cavities, as well as all the organs, gave the odor of nitrobenzene. Morpurgo's test of the stomach contents was strongly positive for nitrobenzene.

Chemical examination of the stomach contents removed at autopsy, and of the liver, brain, urine, and kidneys showed the presence of nitrobenzene.

Microscopic examination of tissues revealed widespread passive congestion, intense cloudy swelling, and intracellular and extracellular deposits of small granules of dark brown pigment. There were no other microscopic findings

of significance. The cause of death was established as Poisoning, acute, nitrobenzene.

COMMENT

It was interesting to note that the odor of shoe polish was immediately recognized by all those who entered the patient's sickroom but no one was able to name the drug or solvent. When the patient was first brought into the emergency room the chemical ingested was unknown. No one had seen him take it.

The routine treatment of gastric lavage and stimulants was followed empirically. The characteristic blue of methemoglobin was recognized. Whole blood, plasma, and oxygen were given to combat the change in the oxygen-carrying power of the blood stream. On later reviewing the literature it was noted that dextrose intravenously will not only prevent the formation of methemoglobin but that it has a tendency to reduce that which is already formed (*4*). In this case, however, a large quantity of the poison was proved to have been ingested, and a great percentage of the hemoglobin had already been converted to methemoglobin by the time the patient was admitted to the hospital. It is doubtful if dextrose would have changed the ultimate result in this case. Methylene blue was considered in treatment but none was available for intravenous use.

The muscular twitching of the arms and face were probably due to anoxemia of the brain rather than to direct injury of the centers. Throughout the 4½ hours that the patient was hospitalized his pulse remained fairly strong, never going above 110 per minute. His blood pressure, recorded at frequent intervals, showed the diastolic pressure to have been lowered proportionately more than the systolic, the pressures ranging between 112 and 108 systolic, and between 48 and 40 diastolic.

The patient died of a respiratory paralysis, probably due to the cerebral anoxemia produced by the formation of methemoglobin, as well as to some combined toxic effect of the drug directly on the center. On postmortem examination, evidence of the massive methemoglobin anemia was present, both macroscopically and microscopically, throughout the various organs. The characteristic odor of nitrobenzene was present in all the body fluids, including that of the brain.

CONCLUSIONS

1. Because of its objectionable odor and taste, products containing nitrobenzene are infrequently used in suicidal attempts.

2. From the subjective symptoms and objective findings this type of poisoning should be diagnosed readily.

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STRETCHER FOR CUTTING SKIN GRAFTS

The stretcher consists of three transverse bars and three longitudinal bars. The central and terminal bars are each furnished with eight nails, four centimeters long, the point of each nail being bent toward the exterior of the apparatus. The central bar is grooved spirally to enable the transverse bar to move backward or forward, the two lateral bars serving as a guide for these movements. The four outer nails are detachable so that it is possible to regulate the width of the cutaneous rectangle to be cut. The handle turning clockwise separates the two bars provided with nails.

To calculate the dimensions of the graft, place the two bars at a convenient distance, using the number of nails required. The distance between the two bars with nails should be five centimeters longer than the size of the cutaneous surface desired. Insert the nails of the unmovable bar. Then the nails of the movable bar by pushing the apparatus toward the nails already fixed, so that these cannot be dislodged, stretch the skin transversely and introduce the nails of the movable bar. Turning the handle extends the movable bar until desired tension of the skin is obtained. Place the knife below the bars and cut the graft.

The stretcher offers the surgeon a practically flat distended cutaneous surface. The area of the graft can be easily regulated and permits grafts from regions other than the thighs, i. e., the abdomen or the axillary region, the size of the apparatus being in accordance with the area to be cut.—PAES, A.: Presentation of a new stretcher for cutting skin grafts. Brenthurst Papers No. 6: 10-11, October 1944.

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Jacobson, Bernard M., Lieutenant Commander (MC) USNR (*Acute Methyl Alcohol Poisoning*, p. 1099). B.S., Harvard University, 1925; M.D., Harvard Medical School, 1929. Intern, Beth Israel Hospital, Boston, 1929–31; Moseley Traveling Fellow, Harvard University, 1931–32; research fellow in medicine, 1932–35, instructor in medicine, 1935–37, and associate in medicine, 1937–41, Harvard Medical School; assistant in medicine, 1932–36, and assistant physician, 1936–, Massachusetts General Hospital, Boston; junior visiting physician, Beth Israel Hospital, 1940–; private practice, Boston, Mass., 1933–41. Fellow American Medical Association; member American Society for Clinical Investigation.

Johnson, Allen S., Lieutenant Commander (MC) USNR (*Flyproof Head for Field Use*, p. 1079). A.B., Yale University, 1922; B.A., Oxford University, 1925; M.D., Harvard Medical School, 1927. Intern and assistant resident, Lakeside Hospital, Cleveland. 1927–30; private practice, internal medicine, Springfield, Mass., 1930–; assistant visiting physician, Springfield Hospital, 1932–; visiting physician, Westfield State Sanatorium, Westfield, Mass., 1937–; cardiologist, Wesson Maternity Hospital, Springfield, 1938–; consultant, Health Department Hospital, Springfield, 1935–. Fellow: American College of Physicians; American Medical Association; member: New England Heart Association; Massachusetts Medical Society.

Jones, John Paul, Lieutenant (MC) USNR (*Hyaluronic Acid—A Tissue Polysaccharide*, p. 963). M.D., Medical College of Virginia, 1937. Intern: Hospital Division, Medical College of Virginia, 1937–38; Children's Medical Service, Bellevue Hospital, New York City, July 1938–Oct. 1939; private practice, Richmond, Va., 1939–42; staff: Grace Hospital; Retreat for the Sick; Sheltering Arms Hospital, Richmond. Member: Richmond Academy of Medicine; Medical Society of Virginia; Richmond Pediatric Society; Virginia Pediatric Society.

Kaplan, Abraham, Commander (MC) USNR (*Methyl Alcohol Poisoning*, p. 1107). B.S., Harvard University, 1923; M.D., Harvard Medical School, 1927. Associate neurosurgeon: Mount Sinai Hospital, Bellevue Hospital and Hos-

pital for Joint Diseases, New York City. Fellow: American College of Surgeons; American Medical Association; member: New York State Medical Society; New York Neurological Society. Diplomate: National Board of Medical Examiners; American Board of Neurological Surgery.

Levreault, Gerald V., Lieutenant (MC) USNR (*Methyl Alcohol Poisoning*, p. 1107). B.S., Tufts College, 1938; M.D., Tufts College Medical School, 1942. Intern, Springfield Hospital, Springfield, Mass., 1942–43. Diplomate National Board of Medical Examiners.

Macgregor, Charles A., Lieutenant, junior grade (MC) USNR (*Urinary Frequency among Personnel at Sea*, p. 1007). A.B., Colby College, 1938; M.D., Harvard Medical School, 1942. Fellow in bacteriology and immunology, Harvard Medical School, July–November 1942; house officer in pathology, July–November 1942, surgical intern, November 1942–November 1943, and assistant resident in surgery, November 1943–January 1944, Peter Bent Brigham Hospital, Boston, Mass.

Martin, Kent E., Lieutenant Commander (MC) USNR (*Intravenous Salicylates in Rheumatic Fever*, p. 1000). A.B., University of Cincinnati, 1924; M.B., 1931, and M.D., 1932, University of Cincinnati College of Medicine. Intern, 1931–32, resident, 1932–33, and junior staff member, 1937–, Christ Hospital, Cincinnati, O.; assistant clinician, University of Cincinnati College of Medicine and Cincinnati General Hosptal, 1933–39; assistant attending staff, Bethesda Hospital, Cincinnati, 1935–; private practice, Cincinnati, 1933–42. Fellow American Medical Association; member: Ohio State Medical Association; Cincinnati Academy of Medicine.

Mast, William H., Lieutenant Commander (MC) USNR (*Prostatitis and Seminal Vesiculitis as Common Causes of Backache*, p. 1002). A.B., 1924, and M.A., 1925, Colorado College; M.D., University of Colorado School of Medicine, 1929. Intern, 1929–30, and surgical resident, 1930–31, Colorado General Hospital, Denver; postgraduate study, Brady Department of Urology, New York Hospital, New York City, 1937; private practice, Gunnison, Colo., 1934–42. Fellow: American College of Surgeons; American Medical Association; member: Colorado State Medical Society; International College of Surgeons.

Matros, Nathaniel H., Lieutenant Commander (MC) USNR (*Casualties During Amphibious Combat Operation*, p. 909). B.S., Marquette University, 1928; M.D., Marquette University School of Medicine, 1930. Intern, Evangelical Deaconess Hospital, Milwaukee, Wis., 1930–31; assistant in surgery, 1932–33, surgeon, 1934, and assistant chief of surgical services, 1934–35, Veterans' Administration Facility, Oteen, N. C.; chief of surgical services, Veterans' Administration Facility, Aspinwall, Pa., 1936; private practice, Asheville, N. C., 1936–; surgical staff, Aston Park Hospital, Asheville, 1938; attending surgeon and member of executive staff, St. Joseph's Hospital, Asheville, 1939–40. Fellow: American College of Surgeons; American Medical Association.

Mistachkin, Norman L., Lieutenant Commander (MC) USNR (*Medical Observations on Seabees in the Jungle*, p. 916). B.S., University of Minnesota, 1926; M.B., 1930, and M.D., 1931, University of Minnesota Medical School. Intern, City of Detroit Receiving Hospital, Detroit, Mich., 1930–31; instructor, Washington University School of Medicine, 1932–35; private practice, St. Louis, Mo., 1932–42. Fellow American Medical Association; member: Missouri State Medical Society; St. Louis County Medical Society.

Monheim, Albert I., Lieutenant (DC) USNR (*Superimposed Upper Denture Used in Treatment of Extreme Prognathism*, p. 1063). B.S., University of Pittsburgh, 1932; D.D.S., University of Pittsburgh School of Dentistry, 1932. Private practice, Elizabeth, Pa., 1932–43. Member: American Dental Association; American Society of Prosthodontists; Pennsylvania State Dental Society; Odontological Society.

O'Connor, Gerald B., Lieutenant Commander (MC) USNR (*Plastic Repair Following Scrotal Gangrene*, p. 1060). A.B., University of California, Berkeley, 1921; M.D., St. Louis University School of Medicine, 1925. Intern, Southern Pacific General Hospital, San Francisco, 1925–26; resident, St. Francis Hospital, San Francisco, 1926–27; private practice, San Francisco, 1927–28; postgraduate study, clinics in the United States and Europe, 1928–29; private practice in plastic and reconstructive surgery, San Francisco, 1929–; plastic surgeon: St. Mary's Hospital, Mary's Help Hospital, Southern Pacific General Hospital, Western Pacific Hospital Association; St. Francis Hospital; St. Joseph's Hospital, French Hospital and San Francisco Polyclinic; San Francisco Sonoma County Hospital, Santa Rosa, Calif.; Sonoma State Home, Eldridge, Calif. Fellow: American College of Surgeons; American Medical Association; member: California State Medical Association; San Francisco County Medical Association; American Society of Plastic and Oral Surgeons; Pacific Coast Railway Surgeons; Northwestern Pacific Railway Surgical Association. Diplomate American Board of Plastic Surgery.

O'Neill, Francis J., Lieutenant Commander (MC) USNR (*Nitrobenzene Poisoning*, p. 1112). B.S., University of Vermont and State Agricultural College, 1929; M.D., University of Vermont College of Medicine, 1932. Intern: station hospital, Fort Sam Houston, Texas, 1932–33, and Central Islip State Hospital, Central Islip, N. Y., 1933–35; physician, Lago Oil and Transport Company Hospital, San Nicholas, Aruba, Netherlands West Indies, 1935–36; assistant physician and senior assistant (pathologist), Central Islip State Hospital, Central Islip, 1936–39; director of clinical laboratories, Binghamton State Hospital, Binghamton, N. Y., 1939–. Fellow American Medical Association; member: Broome County Medical Society; The Medical Society of the State of New York; American Society of Clinical Pathologists. Diplomate National Board of Medical Examiners.

Otness, H. Robert, Lieutenant H(S) USNR (*The Naval Offender*, p. 1029). A.B. and M.S., University of Idaho, 1932; Ph.D., New York University, 1939. Psychologist, New York State Training School for Boys, Warwick, N. Y., 1938–39; chief clinician, Training School, Vineland, N. J., 1939–43. Member: American Psychological Association; American Association for the Advancement of Science; American Association on Mental Deficiency; New Jersey Association of Psychologists.

Ruehlman, David D., Lieutenant (MC) USNR (*Gas Gangrene Infection in Combat Area*, p. 1069). B.S., University of Wisconsin, 1927; M.D., Marquette University School of Medicine, 1929. Private practice, Monroe, Wis., 1931–43; surgical staff: Monroe Evangelical Hospital, 1931–43; St. Clare Hospital, 1940–43. Fellow American Medical Association; member: State Medical Society of Wisconsin; Green County Medical Society.

Russell, Hollis K., Commander (MC) USNR (*Acute Methyl Alcohol Poisoning*, p. 1099). A.B., Washington College, 1924; M.D., College of Medical Evangelists, 1929. Resident and assistant pathologist, 1930–35, and hema-

tologist, 1935–, Grasslands Hospital, Valhalla, N. Y.; pathologist: St. Agnes Hospital, White Plains, N. Y., 1935; Yonkers Professional Hospital, Yonkers, N. Y., 1940–. Fellow American Medical Association; member: New York State Association of Public Health Laboratories; New York State Society of Pathologists; American Association of Pathologists and Bacteriologists. Diplomate American Board of Pathology.

Schneierson, Samuel J, Lieutenant Commander (MC) USNR (*Unusual Feature of Respiratory Infections in a South Pacific Area,* p. 1010). M.D., Long Island College of Medicine, 1926. Intern, 1926–28, and adjunct attending physician, 1930–42, Lebanon Hospital, New York City; adjunct attending physician, Jewish Memorial Hospital, 1936–; associate attending physician, Lebanon Hospital, 1943–. Fellow American Medical Association; member New York State Medical Society. Diplomate American Board of Internal Medicine.

Shambaugh, Philip, Lieutenant Commander (MC) USNR (*Silk Technic in Appendectomy,* p. 932). B.A., Amherst College, 1926; M.D., Harvard Medical School, 1930. Intern and assistant resident surgeon, Peter Bent Brigham Hospital, Boston, 1930–33; Arthur Tracy Cabot Fellow in Surgical Research, 1934, and Harvey Cushing Fellow in Surgery, 1935, Harvard Medical School; resident surgeon, Presbyterian Hospital, Chicago, Ill., 1936; associate attending surgeon, Cook County Hospital; attending surgeon; Henrotin Hospital, Illinois Masonic Hospital, and Wesley Memorial Hospital, Chicago; associate in surgery, Northwestern University Medical School. Fellow American Medical Association; member: Chicago Surgical Society; Central Surgical Association. Diplomate American Board of Surgery.

Smiley, Dean F., Lieutenant Commander (MC) USNR (*Pneumonia in the U. S. Navy—1882–1942,* p. 973). A.B., Cornell University, 1916; M.D., Cornell University Medical College, 1919. Instructor in hygiene and preventive medicine and medical adviser, 1920–21, assistant professor of hygiene and preventive medicine and medical adviser, 1922–28, professor of hygiene and preventive medicine and health officer, 1929–42, Cornell University, Ithaca, N. Y.; formerly field investigator for Carnegie Foundation for the Advancement of Teaching; acting director, Division of Health and Physical Education, New York State Department of Education; president, American Student Health Association. Fellow: American Public Health Association (former councilor); American Medical Association. Author of college textbooks in field of hygiene and preventive medicine.

Spingarn, Clifford L., Lieutenant (MC) USNR (*Hyaluronic Acid—A Tissue Polysaccharide,* p. 963). A.B., Columbia College, 1933; M.D., Columbia University College of Physicians and Surgeons, 1937. Intern, Mount Sinai Hospital, New York, N. Y., 1937–40; instructor in pharmacology, Columbia University College of Physicians and Surgeons, 1940–42.

Staehle, Melvin E., Lieutenant Commander (MC) USNR (*Gas Gangrene Infection in Combat Area,* p. 1069). Ph.B., 1921, and Ph.G., 1923, St. Louis College of Pharmacy; M.D., Washington University School of Medicine, 1929. Intern, St. Luke's Hospital, St. Louis, Mo., 1929–30; house surgeon, Frisco Employes' Hospital, St. Louis, 1930–31; private practice, Normandy, Mo., 1931–43. Fellow American Medical Association; member: St. Louis County Medical Society; Missouri State Medical Association.

Stein, Justin J., Lieutenant Commander (MC) USNR (*The Cargo Carrier M-29,* p. 1071). M.D., Baylor University College of Medicine, 1933. Intern,

Cincinnati General Hospital, Cincinnati, O., 1934–35; special fellow, Mayo Clinic and Mayo Foundation, 1933–34; assistant surgeon, 1935–37, associate surgeon, 1937–38, surgeon, 1938–41, Veterans' Administration Facility, Hines, Ill.; director, department of pathology and radiology, Westlake Hospital, Melrose Park, Ill., 1938–; director, department of pathology and clinical laboratory, Elmhurst Community Hospital, Elmhurst, Ill., 1938–. Fellow: American College of Surgeons; International College of Surgeons; American Medical Association; member American College of Radiology. Diplomate American Board of Radiology.

Stewart, Wayne H., Lieutenant (MC) USNR (*Treatment of Malaria with Arsenicals*, p. 991). A.B., University of Michigan, 1937; M.D., University of Michigan Medical School, 1941. Intern in surgery, University Hospital, Ann Arbor, Mich., July 1941–July 1942.

Stouffer, George A. W., Jr., Lieutenant H(S) USNR (*The Naval Offender*, p. 1029). B.S., Shippensburg, 1937; M.E., University of Pittsburgh, 1937. Experimental engineer, personnel, U. S. Steel Corporation, Pittsburgh, Pa., 1937–39; instructor in psychology, Purdue University, 1940–41; psychologist; U. S. Penitentiary, Lewisburg, Pa.; Federal Correctional Institution, Texarkana, Texas, 1939–40; Division of Corrections, State of Indiana; State Penal Farm, Greencastle, Ind.; State Reformatory, Pendleton, Ind.; and State Prison, Michigan City, Ind., 1941–42. Member: American Sociological Society; International Council on Exceptional Children; American Psychological Association.

Van Dyke, Paul B., Lieutenant Commander (MC) USNR (*Practical Technic for Hemorrhoidectomy*, p. 930). M.D., University of Vermont College of Medicine, 1930. Intern: Mary Fletcher Hospital, Burlington, Vt., 1930–31; Presbyterian Hospital, New York City, 1931–32; resident surgeon, Fifth Avenue Hospital, New York City, 1933–34; assistant in histology, University of Vermont College of Medicine, 1929–31; assistant in pathology, Columbia University College of Physicians and Surgeons, 1931–32; clinical assistant in surgery, 1934–38, and clinical assistant in proctology, 1938–, Metropolitan Hospital (Welfare Island), and Flower and Fifth Avenue Hospitals, New York City; private practice, surgery and proctology, New York City, 1934–. Fellow American Medical Association; member: Medical Society of the State of New York; New York County Medical Society.

Wheelock, Mark C., Lieutenant Commander (MC) USNR (*Pathologic Aspects of Appendix in Military Personnel*, p. 957). M.D., State University of Iowa College of Medicine, 1930. Intern, Western Pennsylvania Hospital, Pittsburgh, 1930–31; associate professor of bacteriology and pathology, University of Alabama School of Medicine. Fellow American Medical Association; member: American Association of Pathologists and Bacteriologists; American Society of Clinical Pathologists. Diplomate American Board of Pathology.

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Wittson, Cecil L., Lieutenant Commander (MC) USNR (*Psychiatric Examination of Nonswimmers*, p. 1023). B.S., University of South Carolina, 1928; M.D., Medical College of the State of South Carolina, 1931. Instructor in biology, University of South Carolina, 1927; intern, neuropsychiatry, 1932–33, assistant physician, 1933–36, and senior assistant, 1936–40, Central Islip State Hospital, Central Islip, N. Y.; instructor in psychoanalysis, New York Psychoanalysis Institute, 1933; instructor in neuropsychiatry, Columbia University College of Physicians and Surgeons, 1935; attending psychiatrist, New York State Psychiatric Institute and Hospital, New York City, 1935–37. Fellow American Medical Association.

Wolff, Margaret H., Lieutenant (NC) USNR (*Oxygen Concentration in Oxygen Tents*, p. 988). Graduate, School of Nursing, Temple University Hospital, Philadelphia, Pa., 1930; B.S. in Education, Temple University, 1943. Science instructor and educational director, Hospital for Women, Baltimore, Md., 1937–42. Member: American Nurses Association; American Red Cross.

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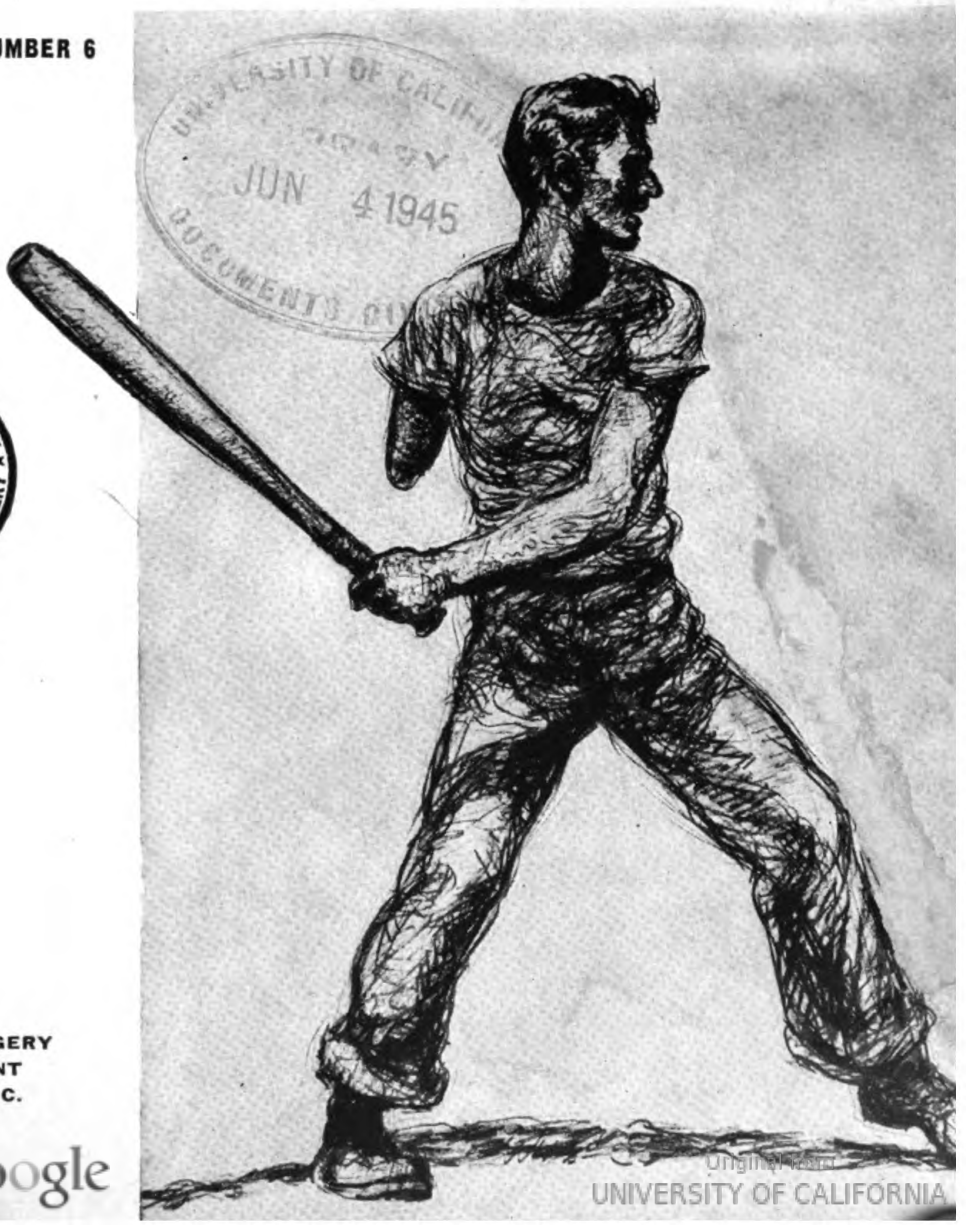

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NAVY DEPARTMENT,
Washington, March 20, 1907.

This UNITED STATES NAVAL MEDICAL BULLETIN is published by direction of the Department for the timely information of the Medical and Hospital Corps of the Navy.

TRUMAN H. NEWBERRY,
Acting Secretary.

Owing to exhaustion of certain numbers of the BULLETIN and the frequent demands from libraries, etc., for copies to complete their files, the return of any of the following issues will be greatly appreciated:

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PREFACE

THE UNITED STATES NAVAL MEDICAL BULLETIN was first issued in April 1907 as a means for supplying medical officers of the United States Navy with information regarding the advances which are continually being made in the medical sciences, and as a medium for the publication of accounts of special researches, observations, or experiences of individual medical officers.

It is the aim of the Bureau of Medicine and Surgery to furnish in each issue special articles relating to naval medicine, descriptions of suggested devices, clinical notes on interesting cases, editorial comment on current medical literature of special professional interest to Medical Department personnel, and reports from various sources, notes, and comments on topics of professional interest.

The Bureau extends an invitation to all medical and dental officers to prepare and forward, with a view to publication, contributions on subjects of professional interest.

The Bureau does not necessarily undertake to endorse views or opinions which may be expressed in the pages of this publication.

ROSS T MCINTIRE,
Surgeon General, United States Navy.

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Accuracy and fullness should be employed in all citations, as it has sometimes been necessary to decline articles otherwise desirable because it was impossible to understand or verify references and quotations.

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All original contributions are accepted on the assumption that they have not appeared previously and are not to be reprinted elsewhere and that editorial privilege is granted to this Bureau in preparing all material submitted for publication. Authors are urged to keep their papers short.

It is regretted that reprints of articles can no longer be supplied by the Government Printing Office.

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TABLE OF CONTENTS

PAGE

PREVENTIVE MEDICINE

U. S. NAVAL MEDICAL BULLETIN

VOL. 44 JUNE 1945 NO. 6

SPECIAL ARTICLES

FOREWORD TO SYMPOSIUM ON AMPUTATION

FROM THE NAVAL AMPUTATION CENTER

U. S. NAVAL HOSPITAL, MARE ISLAND, CALIFORNIA

JOHN P. OWEN
Commodore (MC) U.S.N.

The primary function of the medical department is to treat the sick and disabled, and to return them to duty. A certain group, however, such as the amputees, cannot expect to return to duty or to their former work capacity because of severe and permanent disability. Amputees, therefore, are more than a surgical problem. Treatment begins, rather than ends, with the initial amputation. Furthermore there is the problem of psychologic adjustment, but the major factor in the patient's return to normal living is that of prosthesis.

Heretofore in the Navy, an artificial limb was purchased from a private limb manufacturer. The necessity for repeated limb fitting and servicing while the patient was in the hospital made this arrangement unsatisfactory. The manufacturer and the patient were too far apart. On the other hand the patient could procure the limb from a private manufacturer through the Veterans' Administration after his discharge. The time spent in establishing eligibility for this service was time that the amputee could have employed to advantage in learning how to use his prosthesis. Furthermore the period of hospitalization was wasted, in so far as it might have been utilized in adjustment to his prosthesis.

The need, therefore, for a reconsideration of the special problems of the amputee was apparent. Besides the benefits of surgical management and psychologic adjustment through segregation

and specialization, there is the added distinct advantage of bringing patient and limb maker together. Daily supervision is made possible with immediate detection and correction of defects and with proper instruction in balance, gait, and use of the prosthesis. The detection of defects in the stump such as scars, neuromas, and contractures can be corrected early. Thus the hospitalization period may be utilized for intensive conditioning of both stump and prosthesis and the amputee prepared to meet the problems of civilian adjustment through occupational exploration and rehabilitation services.

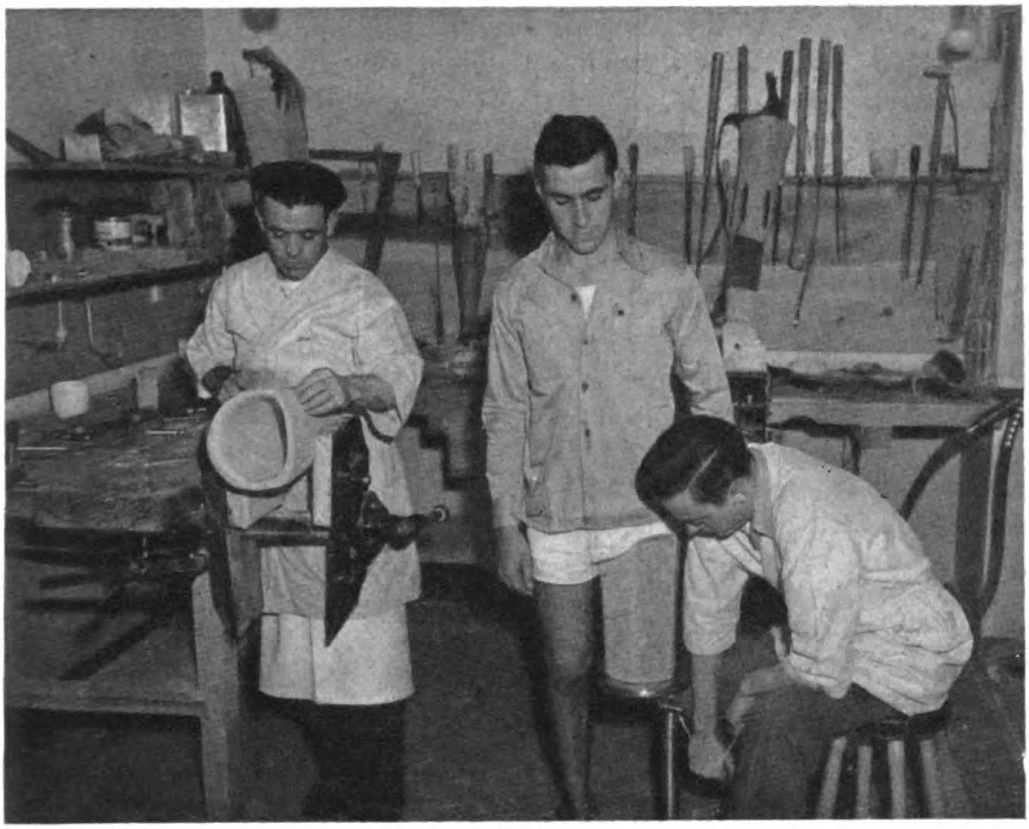
Soon after Pearl Harbor, beginnings were made at the U. S. Naval Hospital, Mare Island, with the establishment of a small shop having limited equipment. An expert leg maker, a civilian, assisted the orthopedic surgeon in the development of the shop and supervised the needs of a small group of patients, part of the number of casualties evacuated to this hospital after Pearl Harbor.

In the following months, many experiments were made, utilizing numerous types of materials. Because of the many advantages to be derived from the use of plastics, emphasis was laid on this material in the construction of a modern type of prosthesis. With the assistance of a commercial corporation and with the shops and facilities of the Navy Yard, the development of this work progressed satisfactorily.

During the spring of 1943, the Surgeon General of the Navy visited this hospital and observed the work in progress. Following his visit, the hospital was designated as an amputation center by the Bureau of Medicine and Surgery. Amputation cases treated in West Coast Naval hospitals and all coming from the South Pacific were ordered transferred to this center. The Bureau of Medicine and Surgery allocated sufficient funds for the center's maintenance.

In the meantime the department expanded from one room to an entire basement floor of the Administration Building. Additional machinery was purchased and the facilities of the shop were increased to meet the demands of increased production. The need of trained personnel to assist in the operation of the department was apparent. The Bureau of Medicine and Surgery cooperated by transferring enlisted men with previous limb making or allied trade experience. The department has now increased to four orthopedic surgeons, an expert civilian leg maker, and thirty-five enlisted mechanics.

The shop now contains a reception room, a room for fitting and training, a leather room, a plastic room, a room for the preparation of plaster-of-paris molds, a pylon room, a room for the pro-



A corner of the brace shop.

duction of prosthetic feet, a machine shop, a carpenter shop, an arm prosthesis room, a storeroom for supplies, and the orthopedic surgeon's office. Plans have been completed and approved for the construction of a new and modern artificial limb factory.

With the progress of the war has come the realization that many time-honored ideas and methods require reconsideration. Among the many problems requiring revision was the entire subject of prosthesis. The immediate demands of the patients focused a spotlight on the aims of the military services in providing war casualties with the best of surgical treatment and care. The Army, the Navy, the Veterans' Administration, the National Research Council, the artificial limb manufacturers as well as foreign governments scrutinized with meticulous care their previous practices and methods. Through joint conferences and consultation, the methods of the military services and of the private limb industries were surveyed in order that the best method of construction and best type of material would be made available. Efforts are being made toward standardization, and all the groups involved are deeply concerned in procuring for the amputee the most satisfactory prosthesis which will permit him to walk with comfort and will be adaptable to the routine pursuits of life. In

these deliberations the staff of the U. S. Naval Hospital at Mare Island has actively participated. Furthermore, by the development of the plastic leg, a distinct contribution to the field of prosthetics has been made, an achievement in which the Navy can take pride.

The reports which follow describe the activities of the Amputation Center during the first year of its operation. During this period, 758 amputees were admitted, and of this group, 300 have been completely processed by means of surgery, aftercare, prosthesis, and rehabilitation.

The complete story cannot be told here, for the real measure of the success of this program will depend on how well these patients fit themselves into civilian life. I feel assured that the hazards of social living have been mitigated for these men through the services provided at this amputation center.

A. EARLY CARE OF AMPUTATION PATIENTS

JOSEPH M. GREER
Captain (MC) U.S.N.R.

Amputation is probably the oldest operation in war surgery. For many centuries amputation was performed not only for crushed, injured, and gangrenous limbs, but for compound fractures as well. Even as late as World War I there was a tendency toward radical treatment in this respect.

In general, the twentieth century has been marked by a conservative attitude toward the need for amputation, as is shown by the following figures: Among 8,000 casualties during the last year of the Napoleonic wars, Larrey reported 365 amputations. During the Spanish civil war in Catalonia, only 342 amputations were reported among 42,000 casualties. In World War I there were 4,403 amputations among 243,897 casualties. In this war, so far, among 946,872 casualties, there have been 6,693 amputation cases.

Indications for amputation.—On the field of battle the general care and treatment of the amputation patient is not unlike the care and treatment of any severely injured man; the control of hemorrhage, first-aid dressing, splinting if necessary, the treatment of shock by morphine, blood transfusion, and infusions of plasma and penicillin are similarly required.

The extent of impairment and recoverability of the circulation will determine whether or not the limb requires immediate amputation or can be treated conservatively. This decision must be made by the surgeon at the advance base. The entire outlook of the injured man is frequently determined by the surgical care he receives at that base. Even severe gunshot and shell wounds complicated by compound fractures can be treated successfully by standard methods of wound cleansing or debridement, traction and immobilization, as long as the circulation is intact and adequate.

The second indication for amputation is that of advancing, uncontrolled gas bacillus infection or progressive infection that fails to respond to surgical drainage and chemotherapy.

A third indication is such extensive mutilation and tissue destruction as to render restoration of function impossible. In this category is found the limb hanging by a shred of tissue or the disruptive mangling wounds of hands and feet with destruction of all viable tendons, complicating fractures and extensive loss of bone substance.

Types of amputation.—Flap amputations first came into prominence in the nineteenth century, following the work of Liston who described regional technics. Prior to that time guillotine amputations were the standard method of treatment. Primary flap amputations have limited usefulness in war surgery, and then only in carefully selected cases. The procedure of choice today is the open amputation, and this at the most distal point of viable tissue. Despite the use of modern chemotherapy, flap amputations break down under field conditions and in fact under the best of hospital conditions, because the wounds are manifestly or potentially infected.

There is no disagreement concerning the desirability of leaving the wound open or flaps unsutured but there is disagreement concerning the exact type of procedure to follow. The advocates of guillotine amputations still adhere rigidly to this procedure. Unfortunately the operation has been abused principally because it has been too well standardized. From observations at this activity, it has been noted that prolonged convalescence and loss of bone length have resulted because of poorly managed traction or unwise choice of the amputation site. The amputation is frequently performed at a site of election instead of at the most distal viable point. In below-knee amputations, loss of the knee mechanism usually results.

The true guillotine amputation, however, is particularly indicated in a malignant and rapidly progressive gas bacillus infection when a complete transection of all the tissues in one plane,

as the term connotes, should be performed. In all other conditions, such as loss of blood supply, severe mutilation or chronic infection, a true guillotine operation is not indicated.

The word "guillotine" has a twofold meaning; one signifying a true transection of all the tissues in a single plane and the other a temporary amputation. In view of the afore-mentioned indications it would be wise to reserve the term to its first and true meaning.

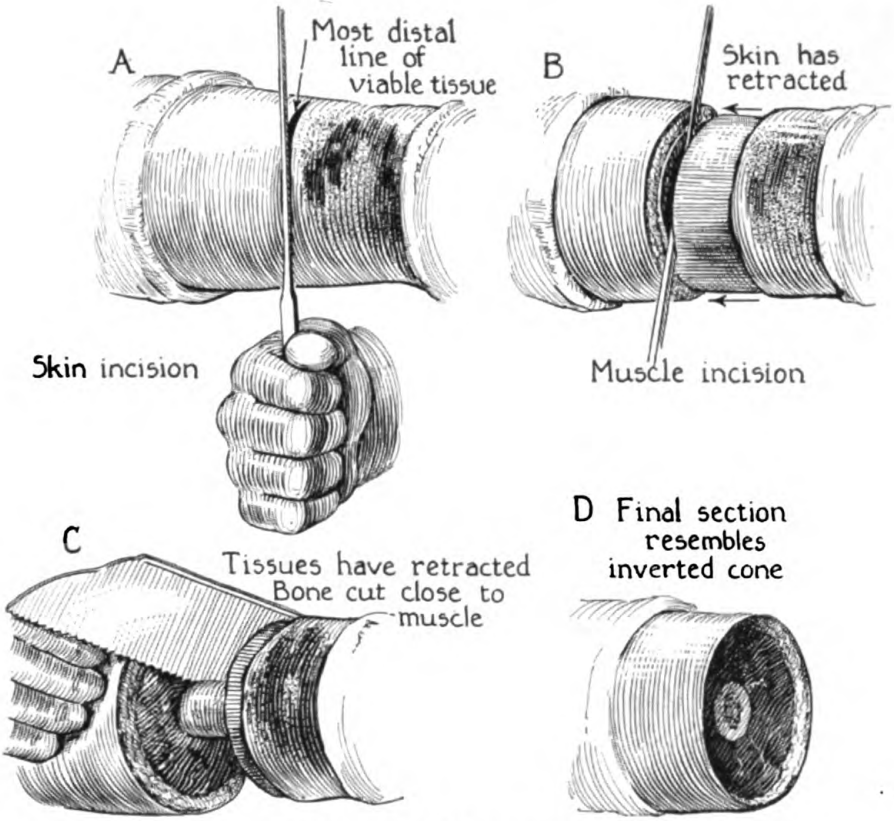
Inasmuch as all amputations done in the field are intended to be temporary or provisional in character, to be followed at a later date by a secondary or final amputation, the words temporary or provisional are more adequate in describing the procedure to be done in the field. The operation may be of the (1) modified guillotine type, or (2) a modified flap amputation, or (3) an unsutured flap amputation.

Modified guillotine amputation.—This operation consists of a circular incision through the skin and superficial fascia at the most distal point of viable tissue. The skin and superficial fascia spontaneously retract as the deep fascia and muscle are incised in one sweep of the large amputation knife, the incision being carried down to the periosteum. The muscle retracts in like manner and the periosteum is incised sharply without reflecting it. The bone is sawed with a large saw, taking great care not to strip the periosteum. The large vessels are doubly ligated with plain or chromic gut and the smaller ones with plain gut. The nerves are sharply divided without manipulation or injection with alcohol, formalin, or other solutions and lie free in the muscle tissue. In fact the vessels and nerves are usually sharply severed with the same sweep of the amputation knife as it divides the muscle tissue. Sulfanilamide crystals are sprinkled in the wound and a vaseline gauze dressing is applied.

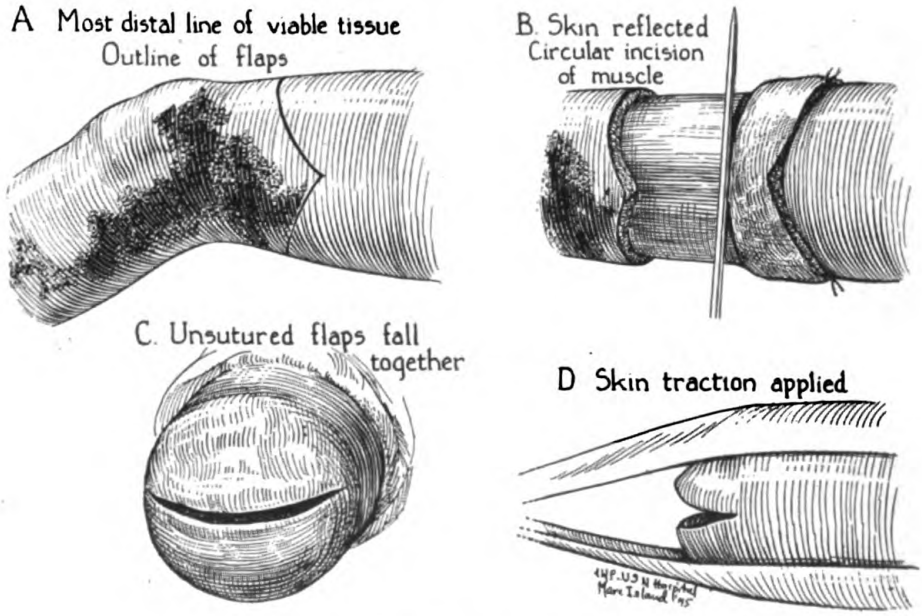
Modified flap amputation.—In this operation an anterior flap of viable tissue is reflected. The muscle, bone, and skin posteriorly are cut in one plane as in the true guillotine amputation. The anterior flap is allowed to fall over the cut surface and is approximated to the posterior flap of skin. The flaps are not sutured, although one or two central sutures may be placed to hold the flap in position.

The unsutured flap amputation.—This is designed as a true primary flap amputation through viable tissue, except that the flaps are left completely unsutured. They provide the best dressing which can be applied to the wound.

This method has reduced healing time and is now the accepted method at this amputation center.



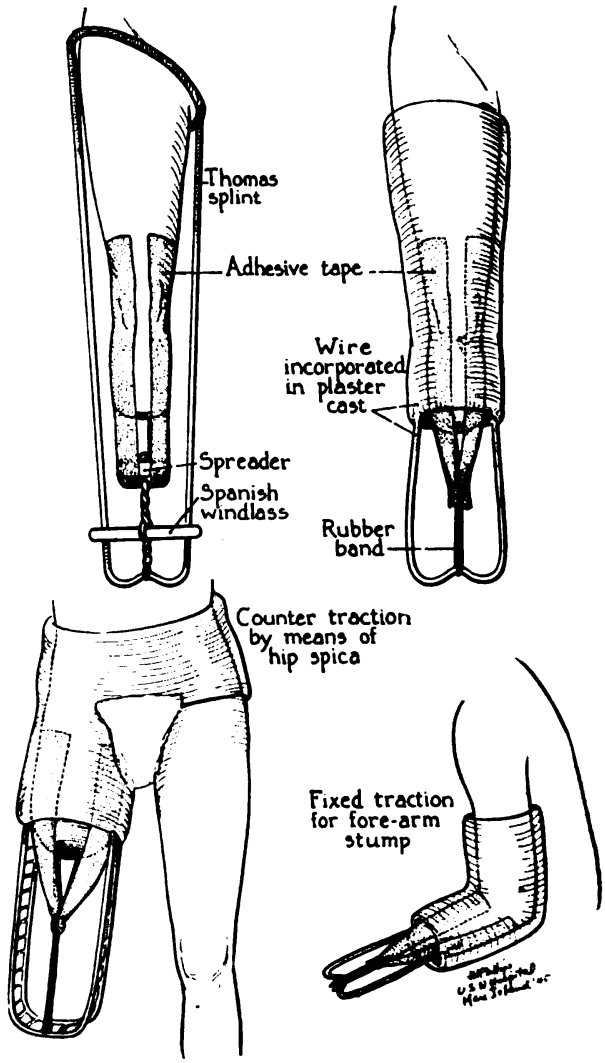
1. Modified guillotine amputation.



2. Modified flap, "provisional" amputation.

The application of traction.—Immediately after the amputation, regardless of type, skin traction is applied and maintained

continuously until wound healing is almost complete. Skin traction may be applied by means of adhesive strips, using 2, 3, or 4 strips as the case may require, or sponge-rubber strips or stockinet saturated with adherent. As the traction is maintained continuously, it may be done by means of pulleys and weights hanging from the foot of the bed. If the patient is to be evacuated, fixed traction may be applied and maintained by means of countertraction employing a Thomas splint, or by a properly fitting plaster cast (fig. 3). In this cast, the heavy wire is incorporated and extends for some distance beyond the end of the stump. The traction strips are fixed to the end of the wire at the point where it makes a hairpin curve. In this way traction is maintained during transportation.



3. Continuous skin traction to be used during evacuation.

During all this time the patient is treated generally as his condition may require, using morphine, plasma, penicillin, etc., blood as indicated. The nursing care and attention to administration of adequate nourishment are important factors; chemotherapy is given and the wound is dressed as infrequently as possible. Most important, skin traction is maintained to the stump continuously until the patient arrives at the amputation center.

SUMMARY

1. The care and management of the amputation patient from the advance base to the amputation center has been outlined.

2. Danger to life and the future uselessness of the extremity

are the indications for amputation. Questions to be decided are: (a) Is the blood supply irreparably damaged? (b) Is the infection uncontrollable? (c) Will the limb be useless?

3. Initial amputation is provisional and should be of the open type.

4. The technic of the modified guillotine procedure with slight variations in certain cases has been described.

5. The importance of traction in the early management of amputation cases has been emphasized and its maintenance during transportation has been stressed.

B. DEFINITIVE SURGICAL MANAGEMENT OF AMPUTATIONS

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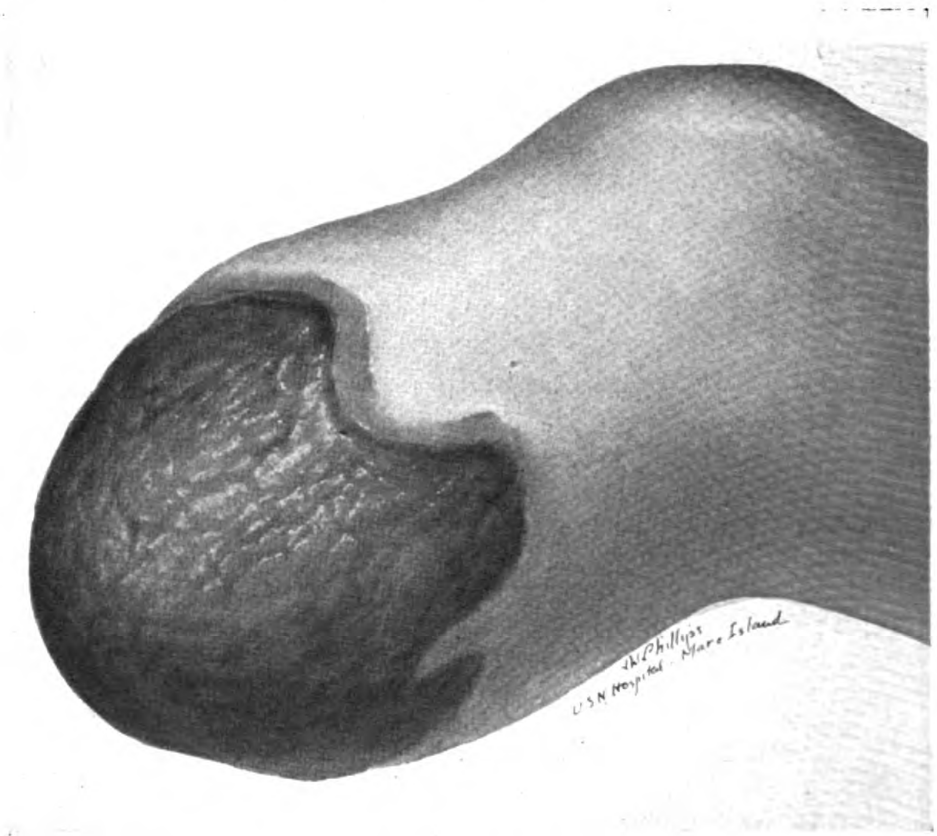
Captain (MC) U.S.N.R.

The rehabilitation of the amputee begins with the decision of the surgeon to amputate. The future of the patient will depend in large measure on the site and character of the amputation. The guillotine amputation or the modified flap amputation is only a provisional procedure; the end sought by the final amputation is a stump that will properly carry the patient's weight and permit him to wear a prosthesis with comfort and utility.

Processing.—Since the establishment of the Amputation Center at Mare Island, 758 amputees have been brought to this hospital for the completion of the surgical management of their amputations, for their preparation for artificial limbs, and for their readjustment to the demands of normal work and living after discharge from the service. Evacuated from the South Pacific by air or ship, the patient is usually admitted with a large granulating wound on the end of his stump, frequently with extruding bone, and occasionally with multiple lateral incisions following guillotine amputations. In many instances skin traction has not been applied or it has been interrupted in the course of transportation (fig. 1).

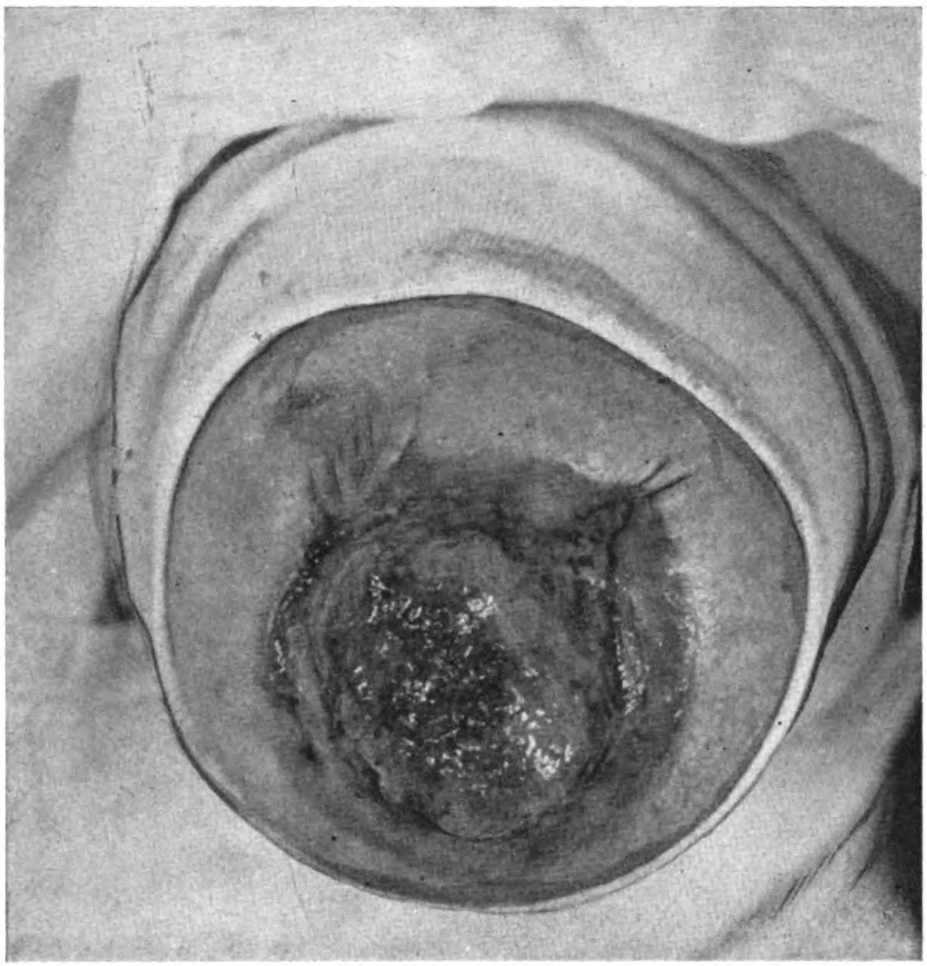
As a result wound healing requires months before secondary operations can be performed. Furthermore, when the guillotine amputation has been made at or close to the site of election instead of at a more distal viable point, skin closure is difficult or



1. Guillotine amputation stump without use of skin traction. Loss of stump below knee is necessary because of inadequate skin coverage.

impossible without further sacrifice of bone. The long period of wound healing taxes the ingenuity of the surgeon, who frequently performs revision operations in the presence of granulating wounds, and is forced to depend upon sulfonamides or penicillin for control of sequelae. In young patients this procedure may be practical, but too often complications occur which reveal the feeble character of the healed wound. The incision may break down postoperatively or upon the wearing of a prosthesis.

Evaluation of stump.—For the first ten days after admission, the patient is built up nutritionally and his general condition studied and evaluated. Anemia, hypoproteinemia, malaria and other complications are attended to by blood transfusion, high protein diet and appropriate medication. Traction is applied immediately to all stumps with open wounds and simple vaseline gauze dressings cover the wound surface (fig. 2). During this probationary period the stump is also carefully evaluated. Roentgenograms, bacteriologic studies, sketches and photographs are made showing the progress of wound healing, and the first definitive procedure is planned.



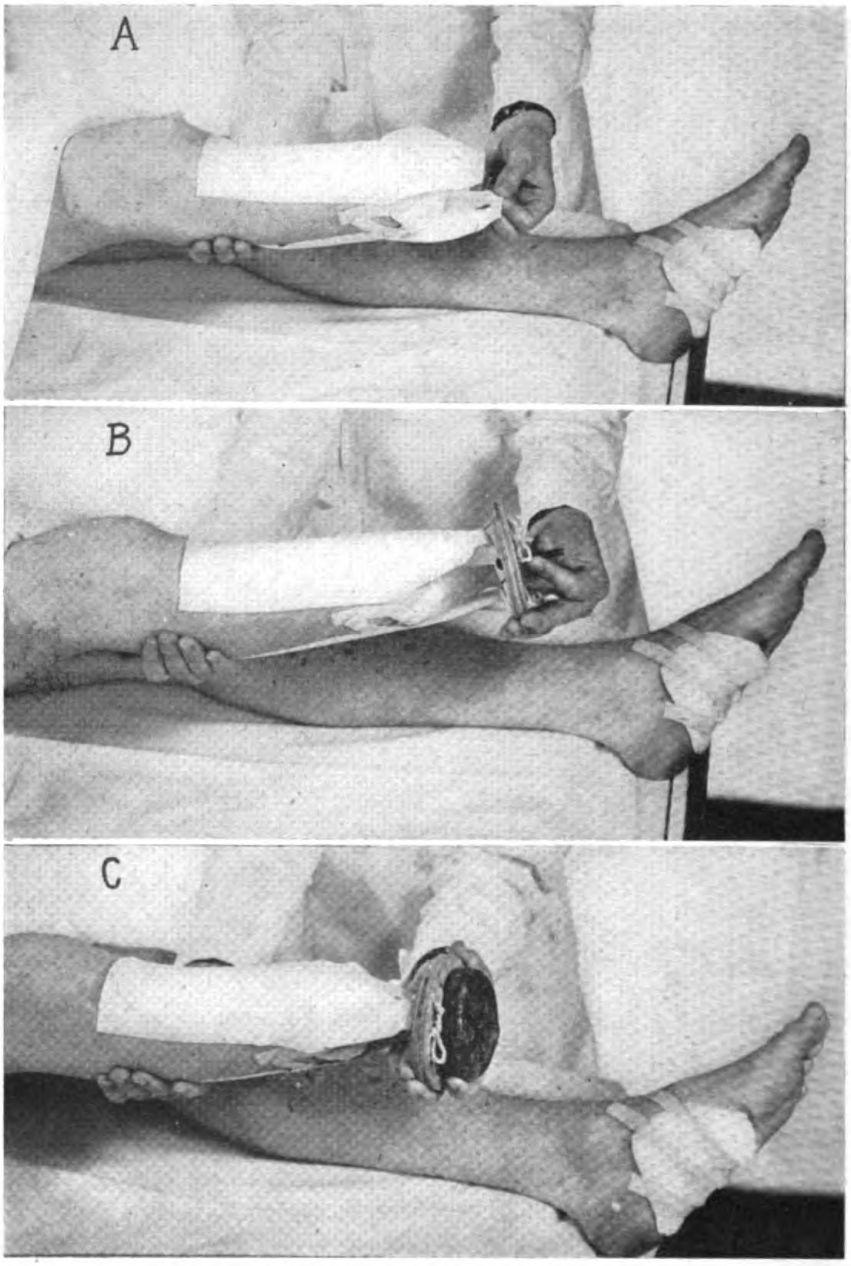
2. Guillotine amputation stump after several weeks of skin traction with Ace adherent and stockinet.

FIRST DEFINITIVE PROCEDURE

Skin traction.—In the majority of open wounds skin traction is continued (fig. 3). Stockinet impregnated with Ace adherent is the method of choice although sponge rubber and adhesive strips are also used (fig. 4). Pulley traction with from 3 to 5 pounds of weight suffices in the average case of bed traction. Overhead suspension traction is used for arm cases. When skin traction has progressed satisfactorily, ambulatory traction is permitted. A weight attached to the stockinet on arm or leg will exert continuous pull while the patient is up and around.

Skin graft.—When the stump length is adequate and a particularly large wound is present, skin-grafting expedites the healing period and advances the date of revision.

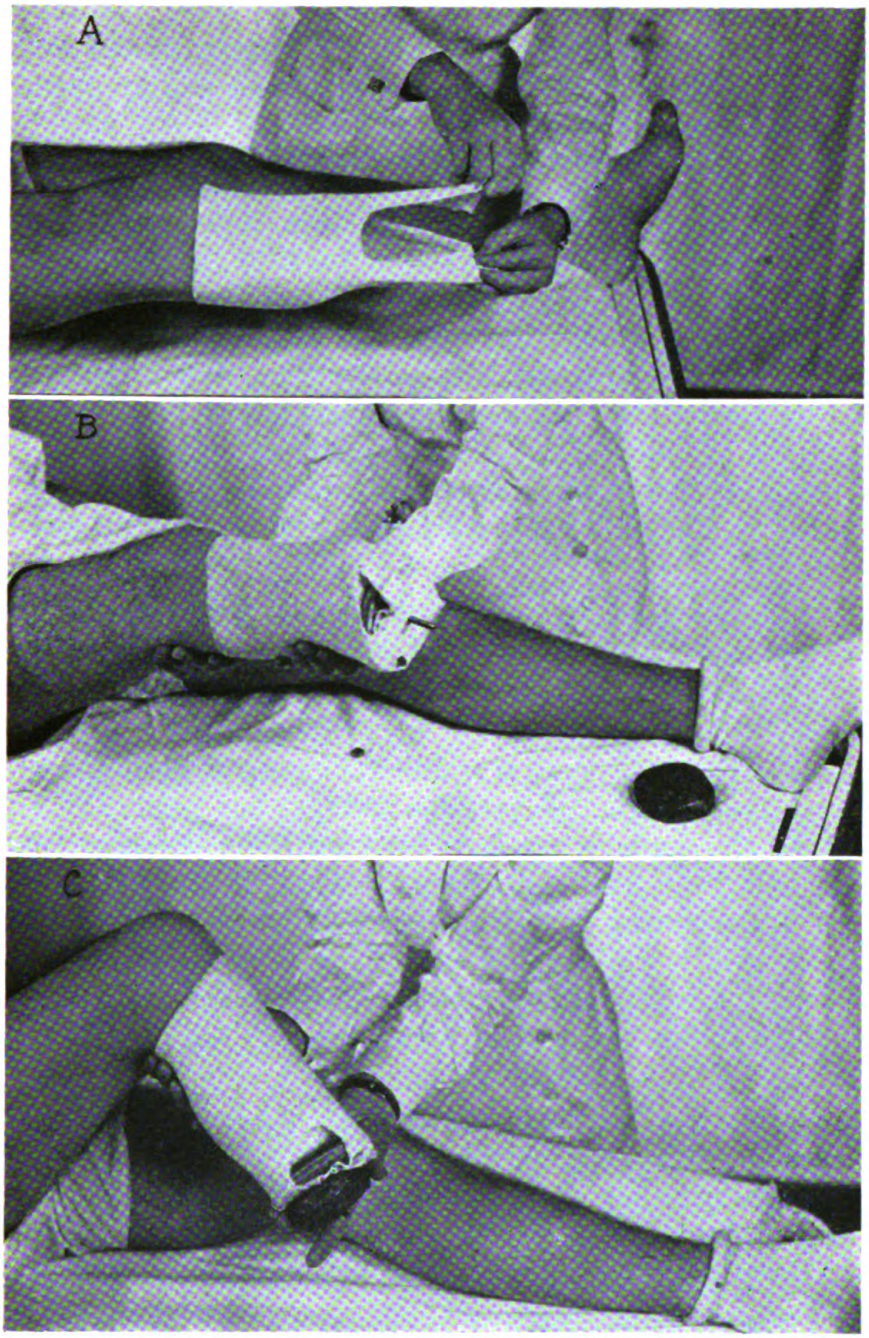
Debridement.—In the presence of a badly infected stump, a debridement is a valuable procedure. The operation generally



3. Application of skin traction with adhesive.
   A. Anterior and posterior adhesive strips applied.
   B. Attached to spreader.
   C. Weight attached directly to spreader for ambulatory traction.

consists in the removal of all slough down to healthy soft tissue, and also obviously infected bone. There is no attempt to make any flaps or to close or approximate the skin. The healthy wound that remains is treated by skin traction or skin-grafting.

Modified flap amputation.—Primary flap amputation is never indicated in the presence of a granulating infected wound. How-



4. Application of skin traction with Ace adherent.
   A. Application of stockinet.
   B. Stockinet secured to spreader.
   C. Weight added for ambulatory traction.

ever in many cases the infection is minimal and the stump length is more than adequate. Under these circumstances an anterior flap is made but the rest of the tissues are transected in the classic guillotine manner. This leaves a wound which will heal faster after traction than the typical guillotine amputation in which all

the tissues are transected in one plane. In some instances the anterior and posterior flaps are made and approximated by a few central sutures, leaving the sides of the wound widely open.

SECOND DEFINITIVE PROCEDURE

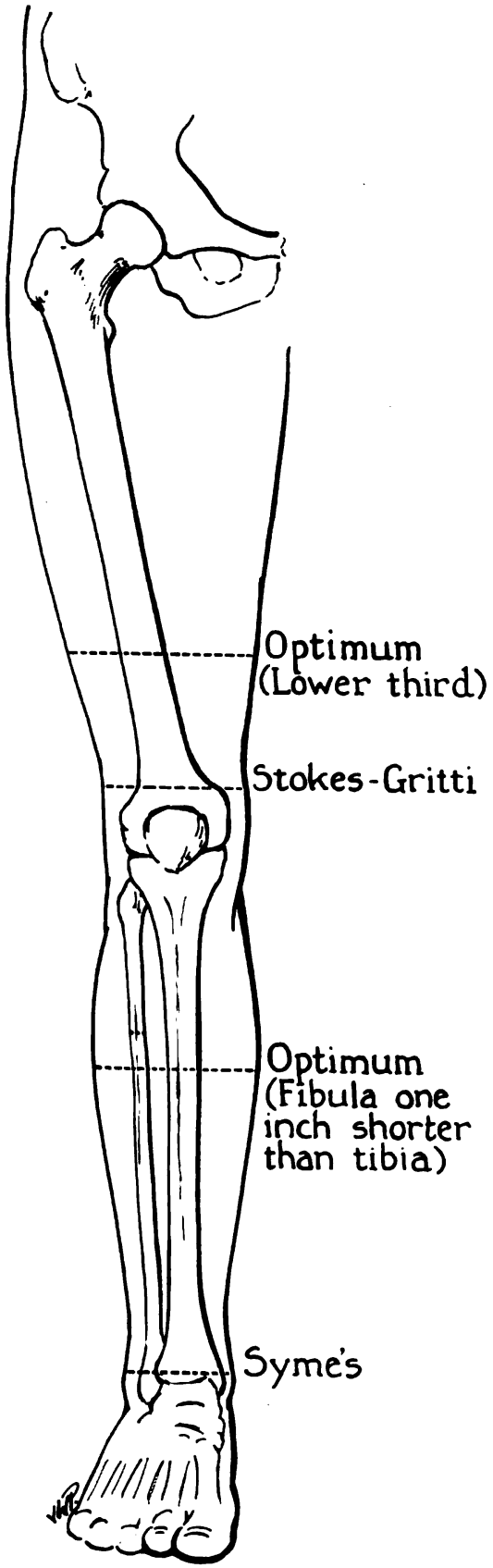
The aim of the first definitive procedure is to obtain a healed stump. As a result of prolonged skin traction, a concentric scar firmly attached to the underlying bone is obtained. Skin-grafting produces a healed wound but the scar may be too fragile and break down in the ordinary case. Modified flap amputation is followed by a scar that is generally depressed or puckered. None of these scars are adequate for the support of a prosthesis. Their fragility and position make it difficult for the amputee to wear his prosthesis. For this reason a further and final step has to be taken.

Plastic repair.—The removal of dog-ears, wrinkles, wide scars or depressed scars may be all that is required to produce a fine pliable linear transverse scar which is not adherent to the underlying structures.

Revision.—The scar that remains following a guillotine stump is generally concentric, of variable extent, but generally tightly adherent to the underlying bone and adjacent tissues. The removal of this scar and the approximation of the skin requires extensive undermining, particularly in short below-knee stumps. Technically this is called a revision, but it is far from a minor procedure. Not infrequently closure of the flaps cannot be performed without the removal of some bone, in which case the revision is in reality a reamputation.

Reamputation.—This term, as employed here, is reserved for those cases in which not only bone is removed but regular flaps are cut as in primary flap amputation. This can be done only where adequate length is present, as in a 10-inch below-knee stump, a long thigh stump, or a disarticulation of the knee or elbow.

The aim following plastic repair, revision, or reamputation is to leave the best possible stump and one of the greatest length obtainable. It should be of the shape that allows it to be fitted properly with an artificial limb. The tissues at its end should fit snugly, neither loosely nor too tightly. It should consist of nothing but skin and subcutaneous tissue. There should be a minimum of scar tissue in the stump both superficially and in its deeper portion. The scar should be so placed that it is away from the pressure of the artificial limb. It should not be adherent to the end of the bone.



5. Sites of election, lower extremity.

Sites of election.—Attention thus far has been directed to the character of the stump. The length of the stump is also of primary consideration. The optimum levels of amputation as they pertain to stump length are referred to as sites of election (fig. 5).

These sites have been determined by experience and represent the best location for bone length and muscular attachment which will provide satisfactory leverage and support in the operation of an artificial limb. They are to be regarded as guide posts rather than arbitrary limits of amputation. Too often, variation in actual practice from these prescribed levels is desirable in order to obtain an adequate stump. The sites of election have not only been established by surgeons but by artificial limb manufacturers as well.

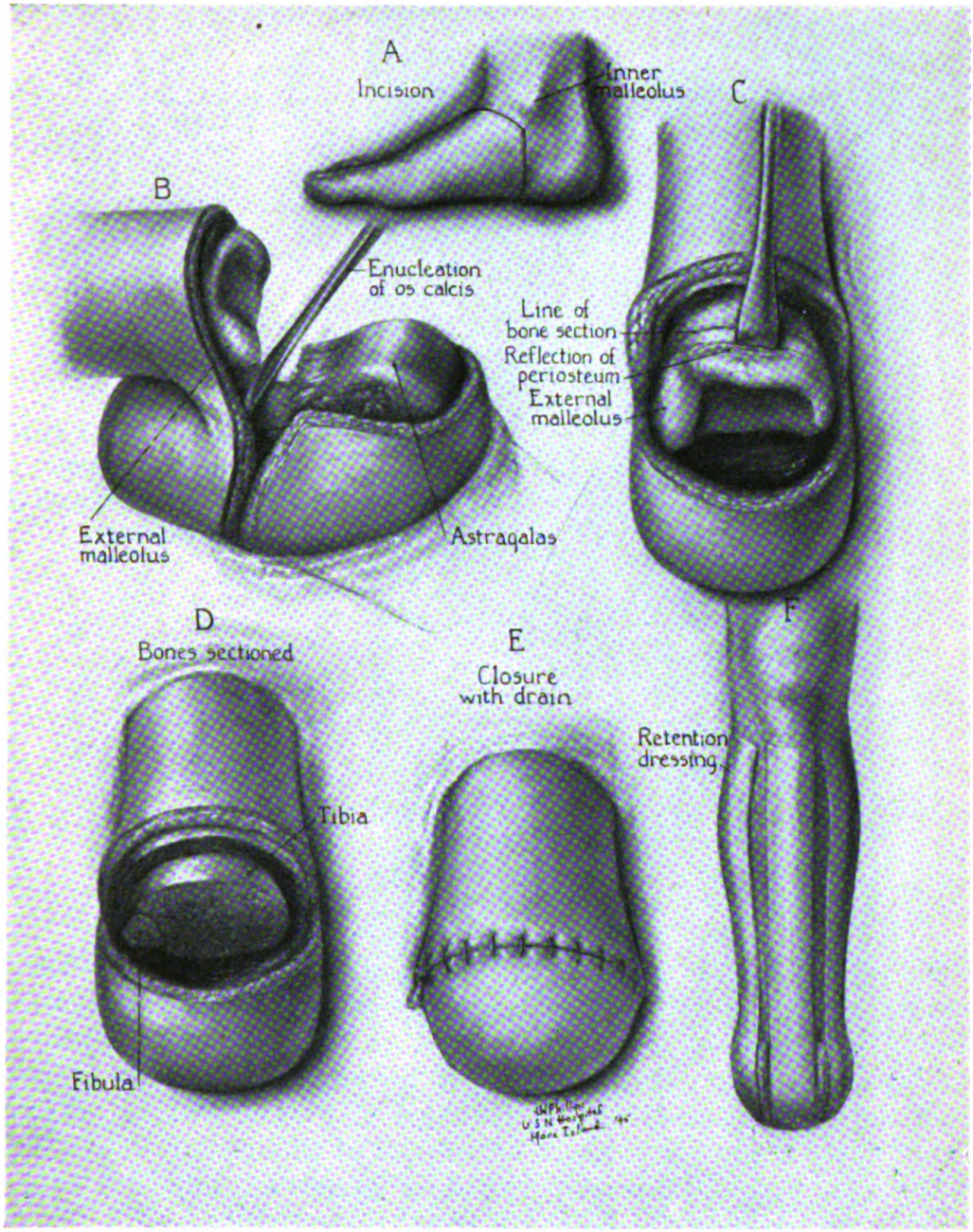
Limb makers have influenced the whole field of amputation surgery. Difficulty in the manufacture of certain types of prostheses has frequently caused condemnation of certain types and sites of amputation. Traditional methods, for example, demanded stumps that could withstand the weight

6. Syme's amputation.

borne on the end of the stump as in the old peg leg. This meant that the stump had to be thoroughly cushioned by muscle flaps against this trauma. Terminal scars had to be avoided and unequal skin flaps had to be prepared.

With the advance of modern prosthesis, the weight shifted from the end of the stump to side-bearing and ischial-bearing, and the surgery therefore was also modified. It was found that muscle flaps were no longer necessary and that short skin flaps were adequate, thus avoiding the danger of skin necrosis.

Out of the welter of controversy concerning the objectives of final amputation there has been general agreement on the desirability of obtaining as a final result one of four types of amputation. These four types are the Syme's amputation, the below-knee amputation, the Stokes-Gritti amputation, and the midthigh amputation. While a modification of these four types may be indicated under special conditions, these standard amputations have met the demand of the average case at this amputation center.

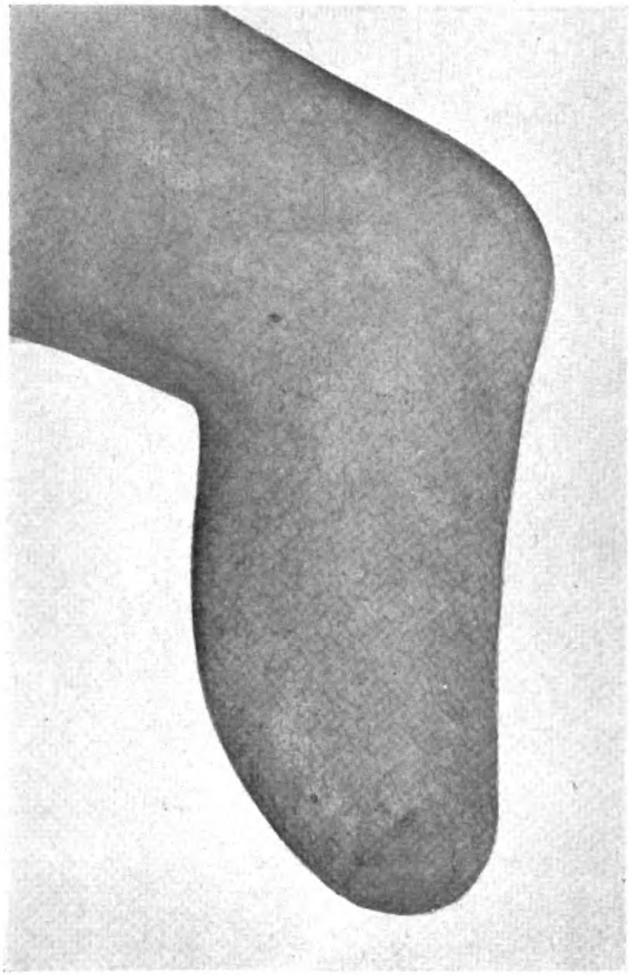


7. Technic of Syme's amputation.

LOWER EXTREMITY

The optimum site of election in the foot is any point distal to the joint between the cuneiform and metatarsal bones. Any point proximal is unsatisfactory because of the loss of leverage due to the removal of the metatarsals.

Syme's amputation.—This amputation (fig. 6) is used for any injury to the foot in which loss of tissue is proximal to the metatarso-tarsal joints. Intermediate amputations attempting to save

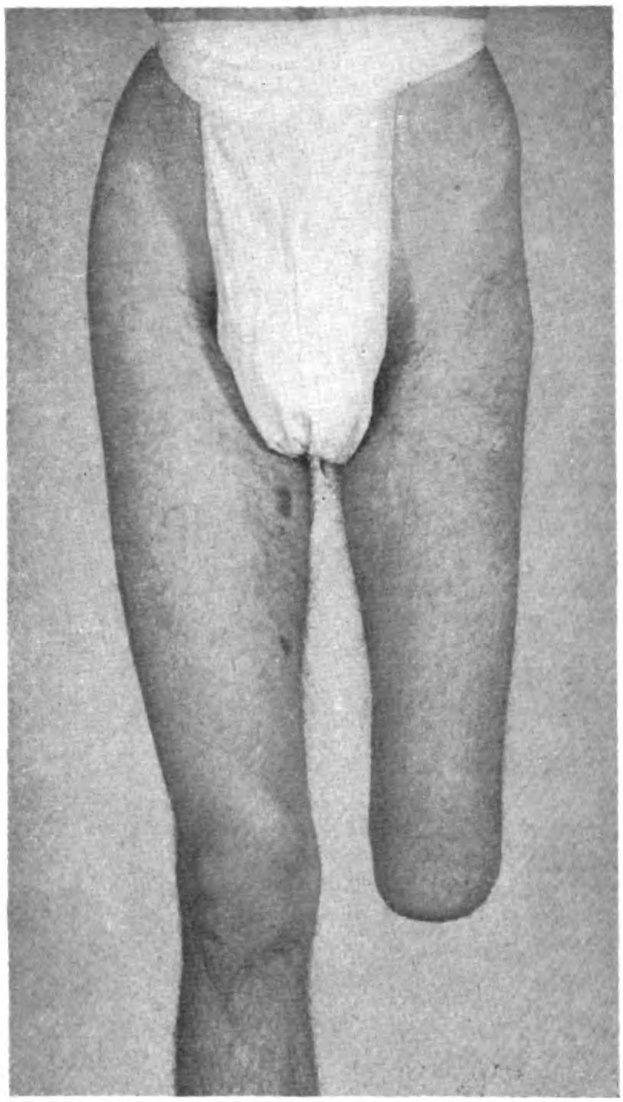


8. Optimum level for below-knee stump.

tissue of the foot prove unsatisfactory, disabling, and time-consuming, requiring repeated amputations with resulting economic disability. Syme's amputation provides an adequate and desirable end-bearing stump. Direct weight is borne on a skin flap made from the original heel, long accustomed to weight-bearing. Only two of these amputations were performed at this center. Too few of the foot amputations admitted here presented sufficient skin to serve as an adequate heel flap for this procedure.

The operation consists in a transmalleolar section (fig. 7) about one-quarter inch above the articular surface of the tibia at the ankle joint. The os calcis is enucleated and the skin of the heel is used as a skin flap to cover the tibia and fibula. The amputation should not be performed in the presence of infection, because unless the wound heals by primary intention the amputee cannot be properly fitted.

Leg amputation.—The classic site of amputation below the knee is 5½ inches below the knee joint line (fig. 8). At this level, optimum conditions of leverage and support are available. Considerable latitude however is permitted. Even 8-inch or 10-inch

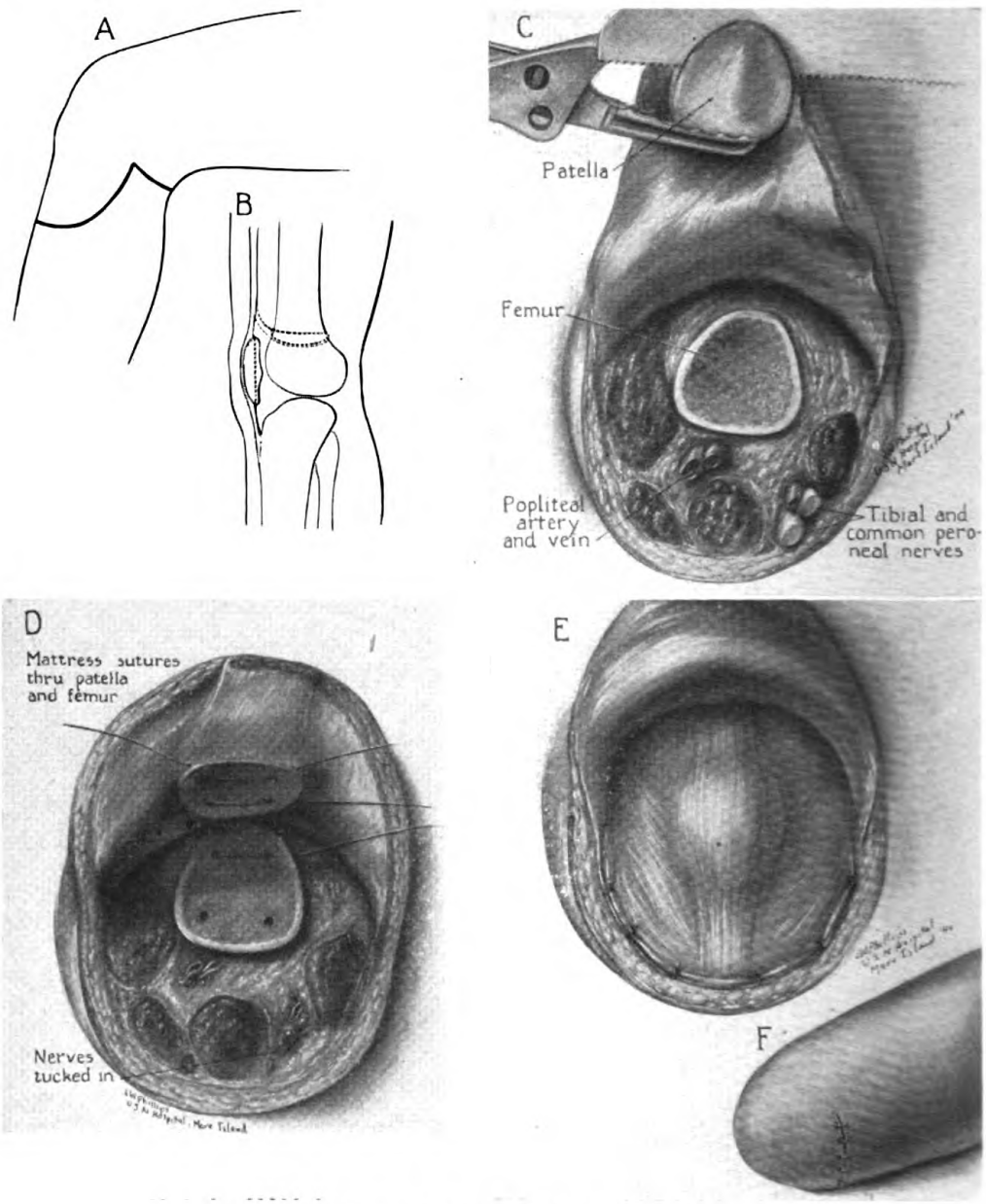


9. Stokes-Gritti amputation stump.

stumps can be fitted satisfactorily with a boot or "Muley" type of prosthesis.

Ideal conditions in the below-knee stump are present for a side-bearing artificial leg. The three pressure bearing areas are the internal condyle of the tibia, the tibial tubercle and the head of the fibula. Stumps of 2 to 3 inches can also be effectively utilized, especially if most of the muscles clothing the tibia and fibula are removed or thoroughly shrunk, leaving a stump essentially of skin and bones. The knee mechanism is so valuable that every attempt should be made to preserve it.

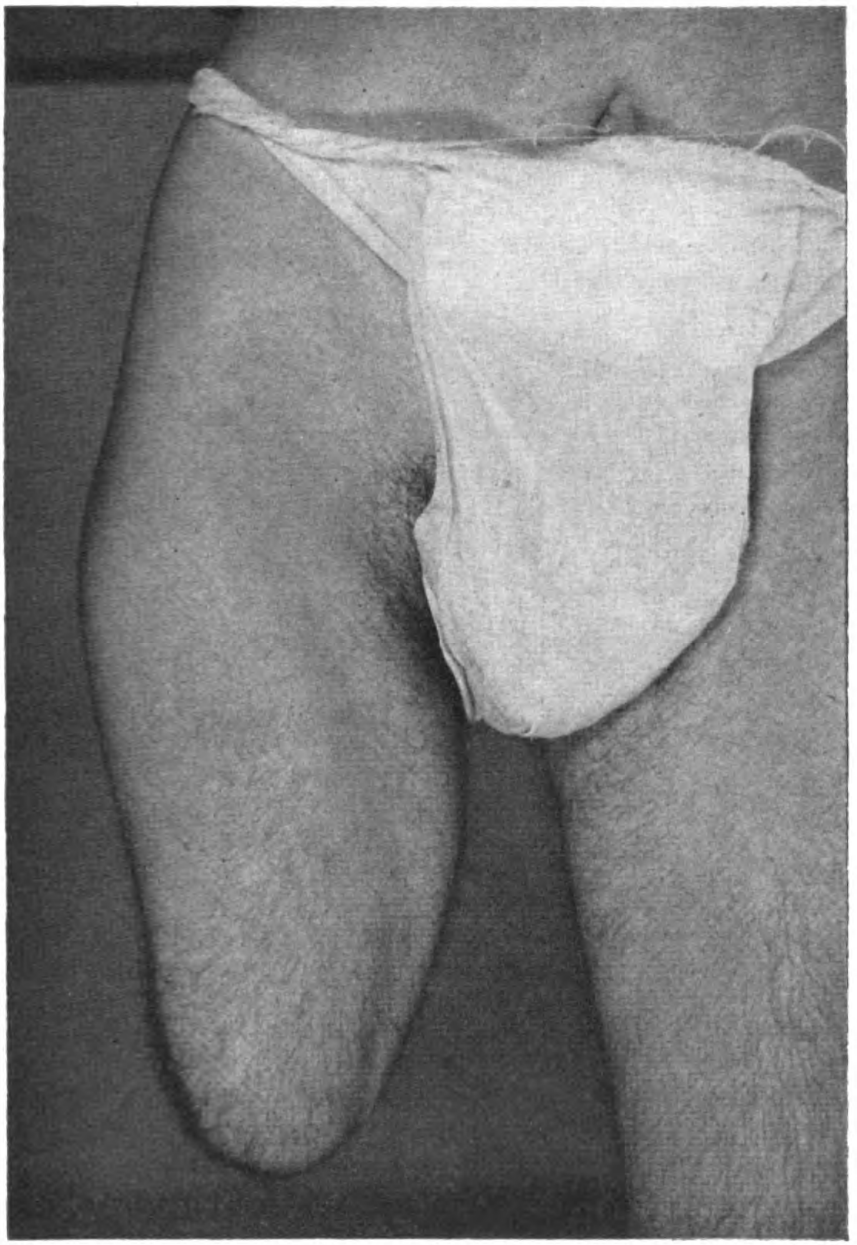
Stokes-Gritti amputation.—This amputation, similar to the Syme's, provides a weight-bearing stump which can withstand excessive strain. Because of its ability to endure prolonged and excessive weight-bearing, the Canadians value it more than the below-knee amputation (fig. 9). The operation aims to utilize the



10. Technic of Stokes-Gritti amputation.

sectioned patella fused to the femur at or about the level of the adductor tubercle. In making flaps in this operation, the skin and muscle flaps anteriorly should be made as one, providing adequate circulation and avoiding skin necrosis (fig. 10).

Thigh amputation.—The classic site of amputation in the thigh for a side-bearing or ischial-bearing stump is at the junction of the lower and middle third of the thigh (fig. 11). Here again some latitude is permitted. The stump must be long enough to utilize all the power of the adductor muscles which are inserted for the entire extent of the femur. The loss of every inch of femur renders muscle control of the hip more difficult. On the



11. Classic site for amputation of thigh at junction of lower and middle third.

other hand longer side-bearing stumps may be unsatisfactory because of altered conditions of leverage.

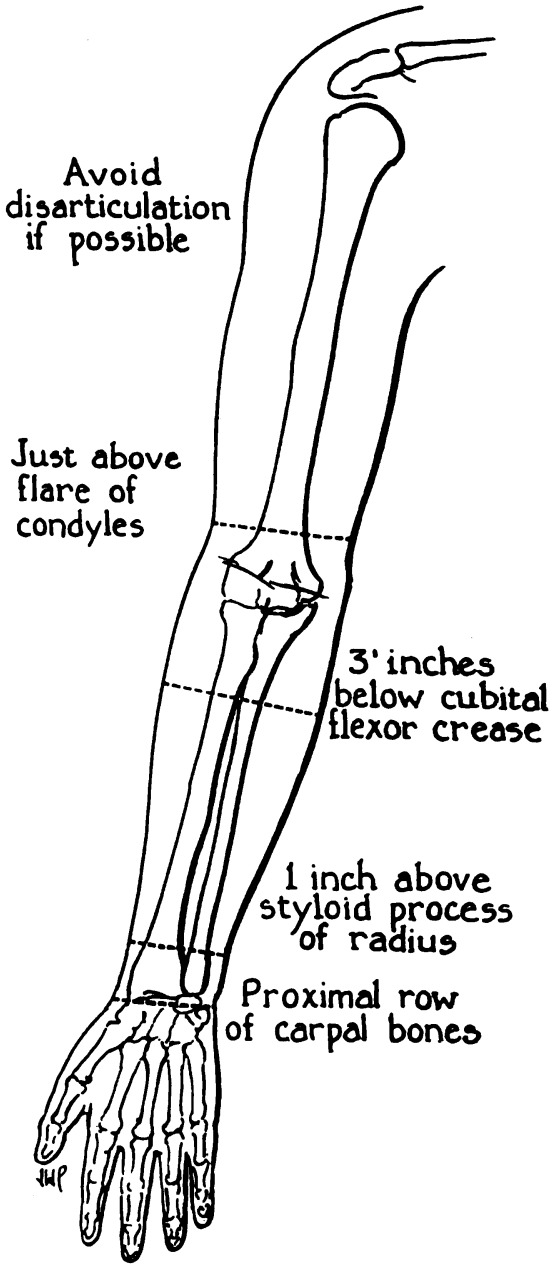
The shortest practical stump is 3 inches below the greater trochanter. When the stump is too short to remain inside the socket during movement at the hip, the amputee has to wear a tilting table limb. No matter how short the stump, it is important to preserve the hip joint. For purposes of limb fitting, disarticulations should be avoided except in serious pathologic conditions such as sarcoma. When considering sites of amputation in the event of double amputation, it is vital to preserve the natural

knee action in at least one of the limbs.

UPPER EXTREMITY

Finger amputation. — In the fingers, conservative amputation is practiced at all times. Injury to the terminal phalanges with avulsion of skin is treated by immediate or subsequent skin-grafting. Crush injuries are given the opportunity of healing by infrequent dressings of vaseline gauze after light debridement.

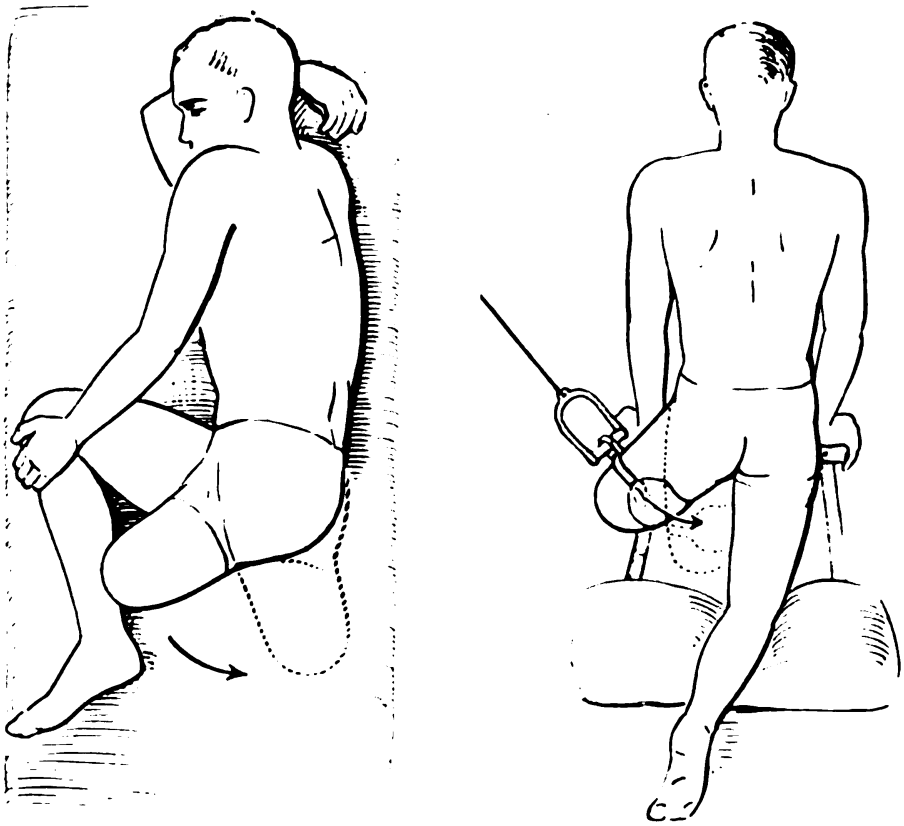
Amputation of single fingers at their proximal phalangeal joint leaves an ugly and useless stump. In these cases the entire metacarpal is resected along with the short phalangeal stump. Where more than one finger is involved, the short phalangeal joints are retained because of the additional power they provide.



12. Sites of election, upper extremity.

Wrist amputation. — If the patient does not plan to wear a prosthesis, partial hand amputation is performed leaving the proximal row of carpal bones, thus preserving full pronation and supination in the distal radio-ulnar articulation. When prosthesis is employed (fig. 12), the forearm is amputated 2 inches above the styloid process of the radius. Disarticulation at the wrist is undesirable. The irregularity of the articular surface of the radius and ulna makes limb fitting difficult. The extra length of the prosthesis necessary to house the wrist assembly provides an awkward looking artificial arm. Furthermore these stumps are painful, cold, and cyanotic.

Forearm amputation.—Amputations of the forearm are per-



13. Extension and adduction exercises of thigh stump.

formed up to a point 3 inches distal to the cubital flexor crease. Stumps shorter than this do not have sufficient leverage to operate the artificial arm efficiently. Nevertheless short stumps of less than 3 inches can be utilized by fixation canals to operate prostheses successfully.

In the final amputation in forearm amputations, short anterior and posterior flaps of the same length are made. Using the diameter of the forearm as a guide, the flaps are cut from 2 inches to 2½ inches beyond the level of the bone section. All the soft tissues and bone are sectioned in one plane. The corners of the radius are rounded off, because in the healed stump it comes in contact with the bucket of the artificial limb. The bones are then covered only with the skin flaps.

Arm amputation.—Disarticulation of the elbow is undesirable because of prosthetic reasons. Exceedingly long humerus stumps, like long femur stumps, are also undesirable. Amputation is best performed just above the flare of the condyles, whereas the shortest stump that can be utilized is 2 inches distal to the anterior axillary fold. Disarticulation of the shoulder interferes with proper construction of a prosthesis.

The operation is performed by anterior and posterior flaps of

the same length, again using the diameter of the arm as a guide to the total length to be covered. The flaps, as in the forearm, consist of skin and subcutaneous tissue only. They are dissected to the top of the incision and at this level the muscle and bone are sectioned.

AFTERCARE

The surgeon's work is not completed at the end of the operation. Two further duties remain to be performed. He must prepare the stump to receive the prosthesis and he must teach the patient to use it.

Shrinking.—Preparation of the stump means that the shape of the stump must be changed in order that it may be fitted properly with an artificial limb. The bulbous or edematous stump must be shrunk in order that it may become a narrow cone. This is done by the compression obtained from a tight elastic bandage that has been previously unwound and stretched. Shrinking is also obtained by the wearing of a pylon. Bandaging has the advantage that it can be started early, long before the stump can tolerate the pylon. The bandage is applied under great tension to the end of the stump, otherwise the stump becomes bulbous instead of conical. Bandaging is repeated several times a day, and if rigidly followed sufficient shrinking in from 4 to 6 weeks is obtained so that a permanent prosthesis may be applied. This goal is rarely reached without close scrutiny and supervision. The patient is apt to view the shrinking process with apathy, while the surgeon concentrates on the surgery and not on the aftercare.

Massage.—Massage of the stump is contraindicated. The freshly cut nerves will be too tender to withstand the trauma of manipulation and manual pressure. Physical therapy has no place in the aftercare of amputation stumps except in the management of contractures and in the employment of exercises.

Exercises.—Exercises are rarely necessary in leg amputations. They are required in thigh amputations, especially in short thigh stumps. The loss of the distal attachment of the adductor muscles causes overaction of the abductors. Development of the adductors and extensors of the hip is necessary in order to control the use of the prosthesis. The loss of the knee mechanism puts a double load on the hip extensors, that of extending the hip and the artificial limb (fig. 13).

Definitive surgical management is complete when final amputation has secured a stump of proper length and shape, adequately shrunk with good muscular control to receive and operate a prosthesis efficiently and with comfort.

C. MANUFACTURE AND FITTING OF ARTIFICIAL LIMBS

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Commander (MC) U.S.N.R.
and
MATTHEW LAURENCE

The aim of the Amputation Center of the U. S. Naval Hospital at Mare Island, California is to provide each amputee with a permanent prosthesis. In order to qualify this statement it is necessary to define more clearly what is meant by a permanent prosthesis.

No artificial limb can be considered absolutely permanent, but each amputee reaches a stage in his convalescence which can be considered relatively permanent. An artificial limb fitted to this patient will remain a usable prosthesis for at least a year. In order to prepare the stump for the permanent prosthesis, the guillotine amputation must be revised so that it results in a well-formed, cone-shaped stump with a minimum of scar tissue and a minimum of sharp protruding points of bone. It must be properly shrunk, in order that the artificial limb will continue to fit the stump over a long period of time; the weight-bearing areas of the stump, moreover, must be toughened. The patient must be taught to walk properly and the leg must be properly alined and adjusted.

In order to bring about this quasi-permanent stage, shrinking by elastic bandaging has been done in some instances and in others a temporary prosthesis or a pylon has been employed. At the present time at this activity the pylon is used as a provisional prosthesis on all below-knee amputations.

An articulated pylon for thigh amputations is a temporary or unfinished leg and hence will not be described in detail.

CONSTRUCTION AND USE OF THE ARTICULATED PYLON

A pylon is defined by Dorland as "a temporary artificial leg." A pylon that can be applied early and has all the mechanical advantages of a permanent leg is preferable to a pylon which enables the patient to get around early but in an awkward manner. The pylon to be described has been used at this hospital on approximately 200 patients, over a period of 2 years. It is simple to construct and apply, and its metal parts can be used over and

over again. Its use hastens the shrinking process and produces a stump that changes very little when the permanent leg is applied. It also helps to develop the hip and thigh muscles.

In some amputation centers the elastic bandage has been adopted as the only means of shrinking the stump before applying the prosthesis. When the elastic bandage is properly applied and kept tight by frequent changes, considerable shrinkage of the stump is noted. This type of shrinkage is less permanent however than that which is caused by the pressure of weight bearing in an articulated pylon or permanent leg and it does not provide exercise for the remaining muscles of the leg.

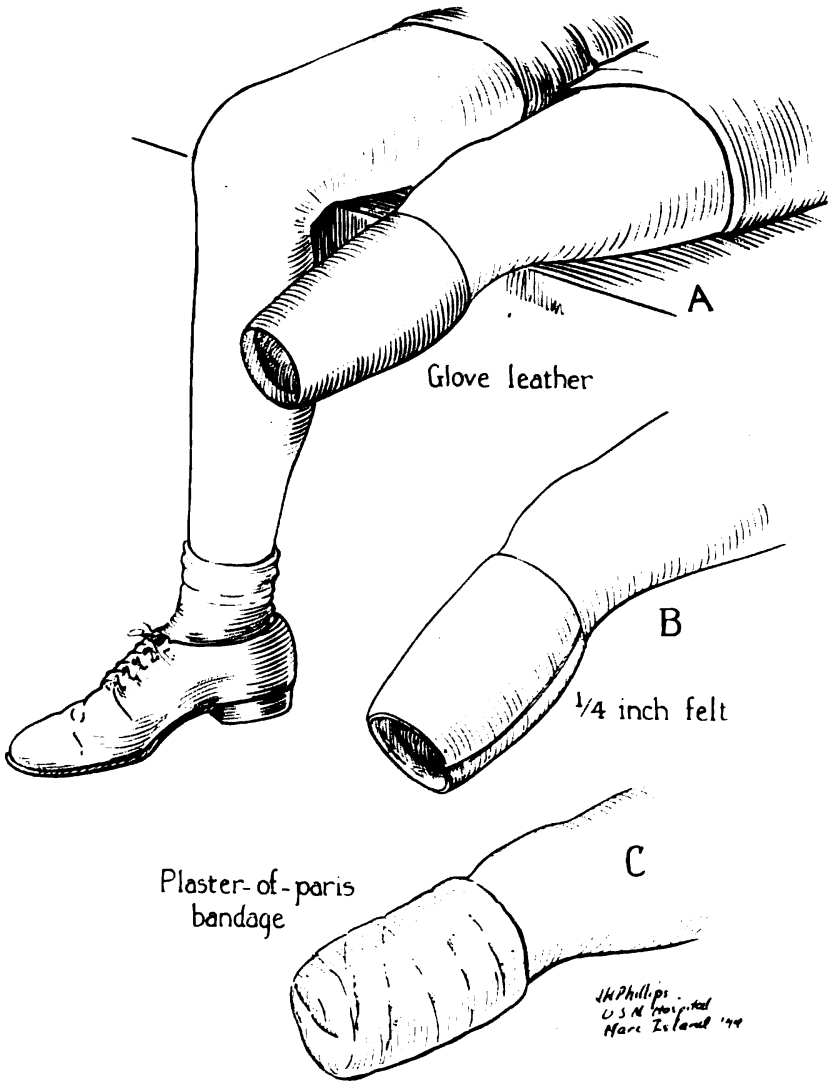
It has been observed that a stump which has been shrunk and toughened by walking on a pylon for from 4 to 6 weeks, when subsequently operated upon, has very tough skin; the weight-bearing musculature has been replaced by considerable fibrous tissue and the denuded ends of the bones have been covered by a fibrous cap ranging up to ¼ inch in thickness. This condition more nearly approaches the final shrunken state of so-called "old" stumps than those which have been shrunk by bandaging only.

The plaster-of-paris bucket of the pylon is changed as often as necessary during the shrinking process to insure generalized weight-bearing. This prevents painful pressure points. The mechanical parts are the same as those of the permanent leg and hence there is no change in the walking habit when the permanent leg is applied. Neuromas, painful scars, and circulatory disturbances are ascertained and corrected before a permanent leg is fitted to the patient.

BUCKET

The bucket is side-bearing and must conform accurately to the contour of the stump. Because it is more or less cone-shaped and extends beyond the end of the stump, one must be sure that it does not choke the stump end.

Steps in constructing the bucket.—A piece of soft glove leather is cut long enough to extend around the stump and overlap about 1 inch, and wide enough to extend from the lower end of the femoral condyles to 1 inch beyond the end of the stump. This piece of leather is wrapped snugly around the stump and glued to itself (fig. 1A). The piece of ¼-inch saddle felt, the same size as the leather, is skived along its overlapping edges and glued to the leather and to itself (fig. 1B). Finally the felt is wrapped with three rolls of 4-inch plaster and while it is setting it is molded accurately around the calf and shin, and around the bony prominences of the condyles and fibula (fig. 1C).



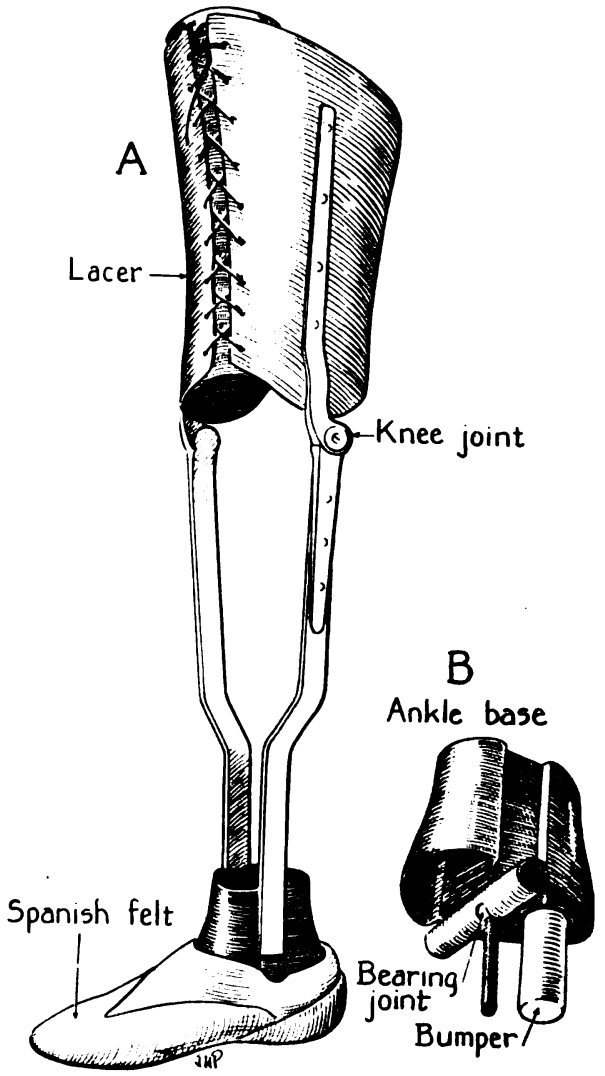
1. Application of leather, felt and plaster to stump.

Leather and metal portion of the pylon including the foot.—This portion of the pylon can be made of parts from discarded artificial legs. The foot and ankle parts can be of any standard make as long as they simulate the type of artificial foot and ankle joint the patient will eventually have in his permanent limb. This amputation center makes the parts used by its patients.

The lower arms of a pair of normal commercial knee hinges are riveted to two pieces of cold rolled steel, ¼ inch by 1 inch. The length of the patient's normal leg determines the length of these two pieces of steel that are bent to converge on the ankle joint (fig. 2).

A leather lacer is riveted to the upper arms of the knee hinges. The width of the patient's knee and thigh determines the size of the lacer. It is usually 12 to 15 inches long (fig. 2A).

The ankle joint consists of a piece of tube steel or a wooden



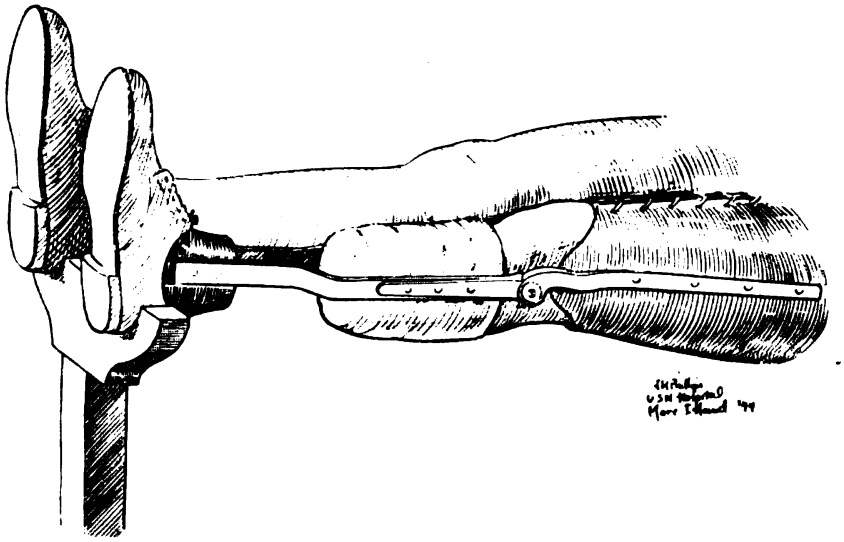
2. Parts of articulated pylon.

block with slots on each side to receive the side steel pieces. The bolt of the ankle hinge passes through the foot and the foot is thereby bolted to the ankle apparatus.

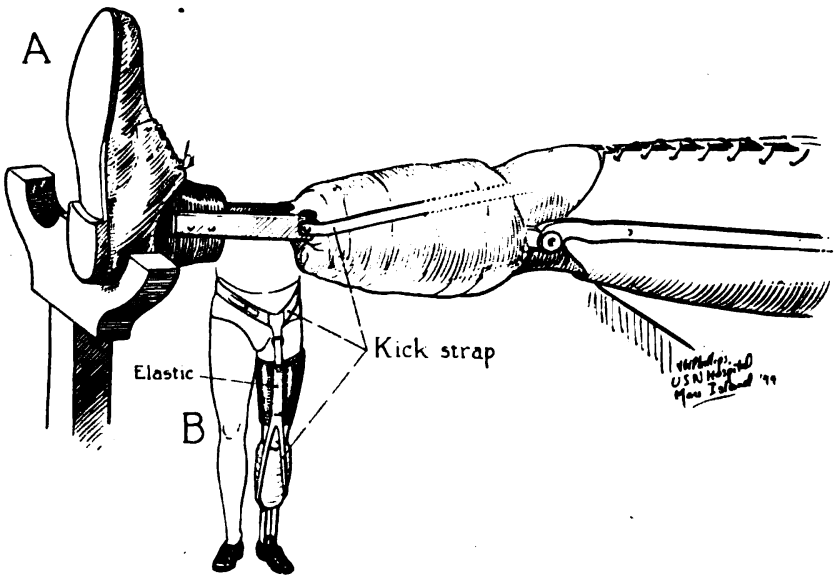
The foot can be of any standard make but its size must conform to the size of the patient's shoe. It has been the policy to make a foot for each patient, which will fit his shoe, and this same foot is eventually transferred to his permanent leg. A rubber bumper is fitted into the posterior portion of the ankle joint to give it the normal spring-like action (fig. 2B).

Fixing the metal and leather portion of the pylon to the bucket. —The leather lacer and metal parts are slipped over the bucket and thigh and lined up with the knee joint and with the opposite leg (fig. 3). The hinges of the knee joint can be within ½ inch above or below the actual knee joint without affecting the patient's walking. The pylon is purposely fitted ½ inch longer than the opposite leg to allow for the sinking of the stump into the bucket and to prevent the patient from developing a habit limp from the feeling of a short leg.

The metal bars are then attached to the plaster bucket with two or three rolls of plaster and again allowed to set (fig. 4). Walking is permitted as soon as the plaster is set and the thigh lacer tightened. Crutches or a cane are used if necessary, but almost always the patient is able to walk without aid. Caution must be exercised in the first few days to prevent the patient from walking too far, and thus bruising the stump, or causing excess ten-



3. Alinement of pylon and measurement for proper length.



4. Final fixation of stump to pylon by incorporation in plaster.

derness and swelling. The patient is usually so happy to find himself walking that by his excesses on the first day he develops painful thigh muscles and a painful stump. Actually no permanent damage results, but the pain continues for several days and impedes progress.

Kick strap.—A kick strap (fig. 4) with a pelvic band is attached to the lower end of the metal bars about 4 inches above the ankle joint; this helps the patient to extend his knee and to walk correctly. The elastic portion of the strap also aids in the development of the quadriceps group, preventing extreme fatigue during the training period.

Early weight-bearing and limpless walking is a great stimulus to morale. Within 10 days after his revision the amputee is urged to get out of bed and use crutches. A pylon is fitted to his leg as soon as it can bear weight, generally within from 4 to 5 weeks. Within 2 weeks after the application of the pylon, sufficient shrinkage has taken place to necessitate the application of a new bucket. The patient is then granted a 30-day leave. When he returns he inevitably needs a new bucket. When the stump has reached its maximum shrinkage, the patient is fitted with a permanent leg. The stump will continue to shrink over a period of a year or two but this secondary shrinking is so slow that no attempt is made to keep the patient in the hospital for that length of time.

PERMANENT PROSTHESIS

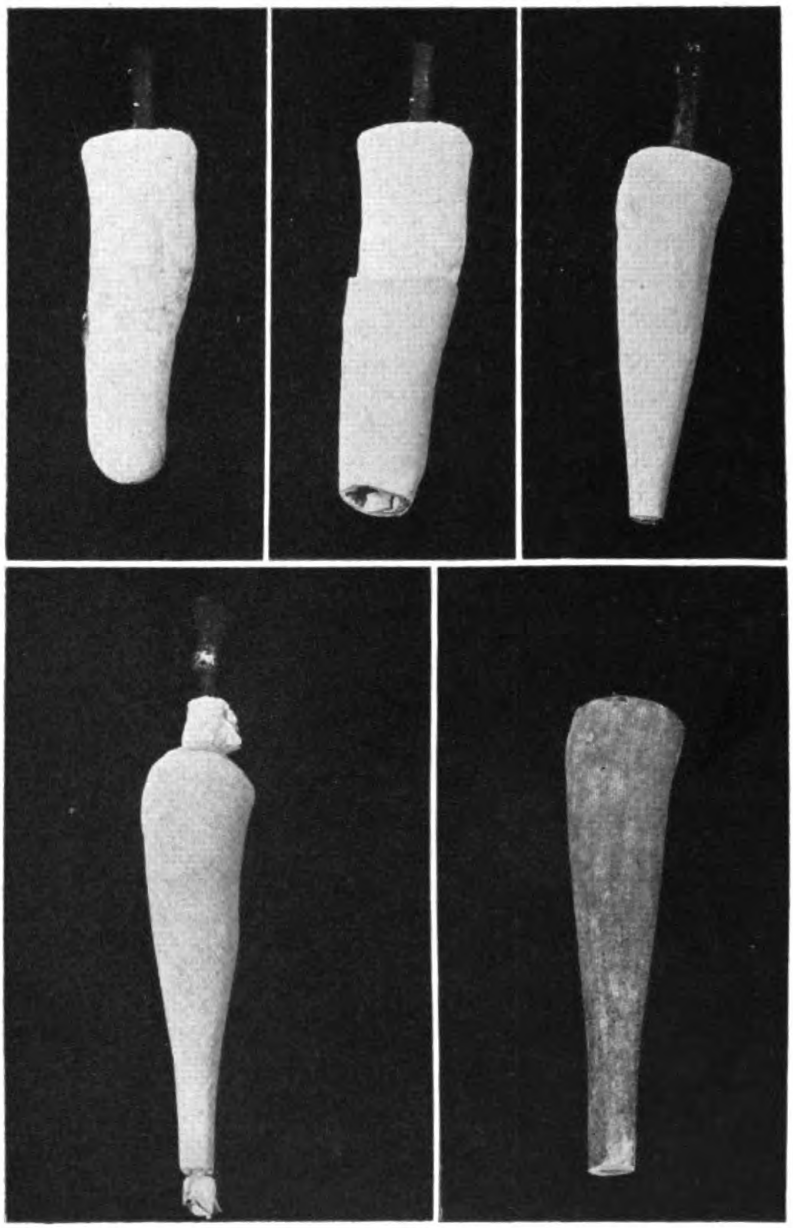
The experiences with the articulated pylon were so productive that consideration was given to the similar construction of a permanent leg using more sturdy materials. It was thought that if a leg could be made from a plaster mold of the patient's stump and, therefore, one that would fit all portions of the stump, it would be a progressive achievement in the manufacture of artificial limbs.

The material that lent itself most readily to this type of limb manufacture was a common commercial phenolic resin material which was easy to obtain and equally easy to use. A plastic material used in the manufacture of artificial legs or arms should not require technical machinery and should be thermal setting rather than thermal plastic. The finished product should be tough and sturdy enough to maintain the weight of the patient and withstand the stress and strains of the hinges, ankle joints, and other parts. In some instances it has been necessary to combine plastic parts with wood and leather, but generally the legs and arms manufactured at this center are of plastic material only.

BELOW-KNEE PROSTHESIS

The routine method of constructing an artificial leg for a below-knee amputation is as follows:

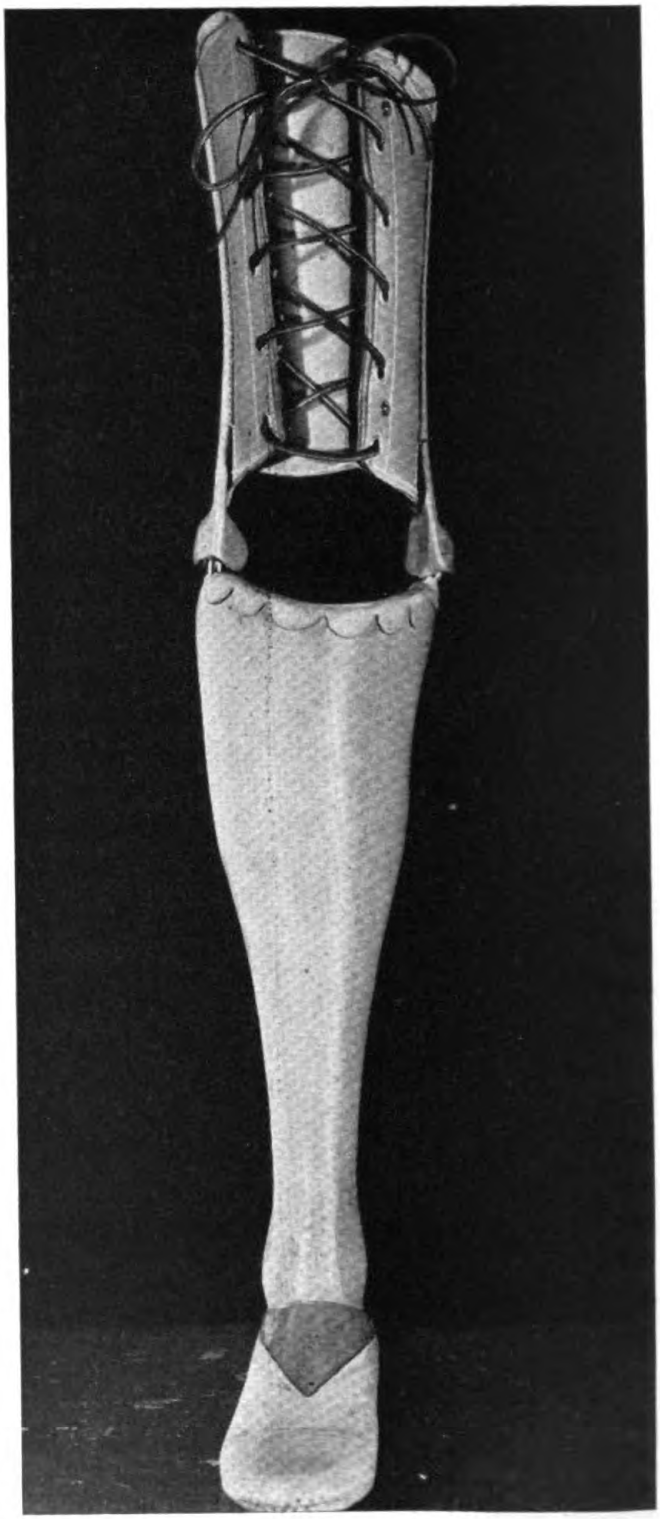
A plaster mold is made of the preconditioned stump and the high points are covered with a small patch of leather to give a small amount of relief to this area. A layer of one-quarter inch white felt is sewed around the plaster mold and treated with a coating of Stayflex (fig. 5). The felt, therefore, becomes a non-absorbent type of rubber-like material that does not disintegrate readily or absorb moisture. A second plaster cast is made of the



5. Steps in construction of below-knee plastic leg.

stump mold plus the felt liner. The male portion of this cast serves as the mold for the permanent plastic shell. After an ankle block has been attached to the lower end of the mold, five layers of stockinet are drawn over the mold and tied at each end. These layers of stockinet become the filament or the laminate of the plastic shell through which the plastic material permeates.

The stockinet mold is dipped into the phenolic resin material and allowed to soak for one-half hour. Then it is placed in an oven and baked at 250° F. until it is cured. The plaster mold is now broken out of the shell and the surface is sanded. The knee hinges, thigh lacer, and foot are attached to this shell and the



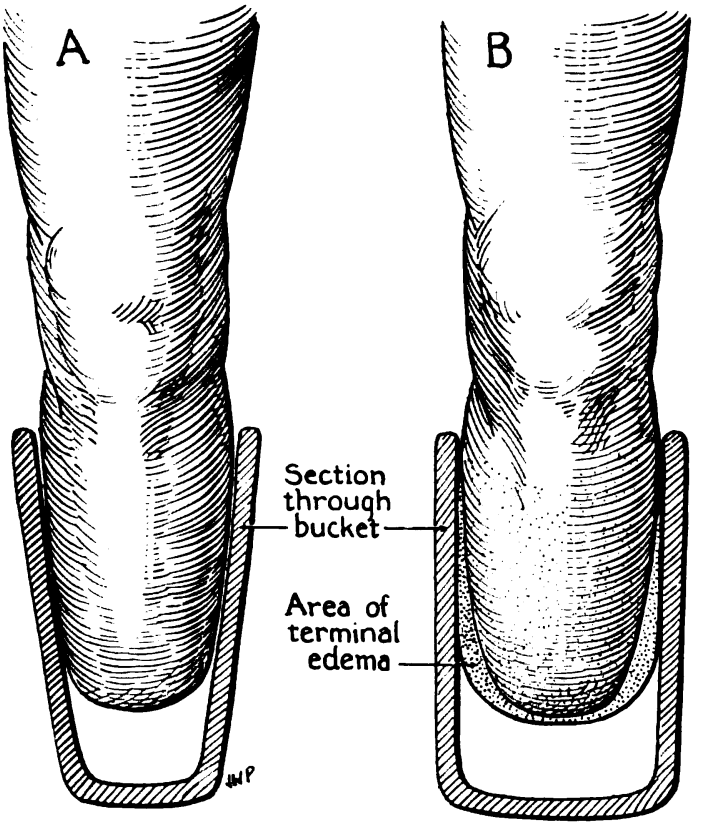
6. Finished plastic leg.

patient is allowed to walk on the partially finished leg for several days to ascertain any minor misalinements. When the patient has decided that his leg fits well and when the mechanic is satisfied that no more minor adjustments are to be made, the leg is put through a finishing process which consists of covering it with rawhide and paint (fig. 6).

The stump invariably shrinks a small amount after the patient has used his permanent leg for a few weeks. At this time a thin glove leather liner is fitted into the socket. This overlaps the edges in such a way that the upper rim of the socket is made smooth and comfortable.

Very short stumps or those stumps in which the fibula has been removed frequently require a hard bucket in order to make them comfortable. In these instances after the patient has become accustomed to his leg the felt liner is removed and a hard leather liner which has been stretched over a plaster cast of the stump is inserted into the shell.

A properly fitted below-knee prosthesis will last a long time



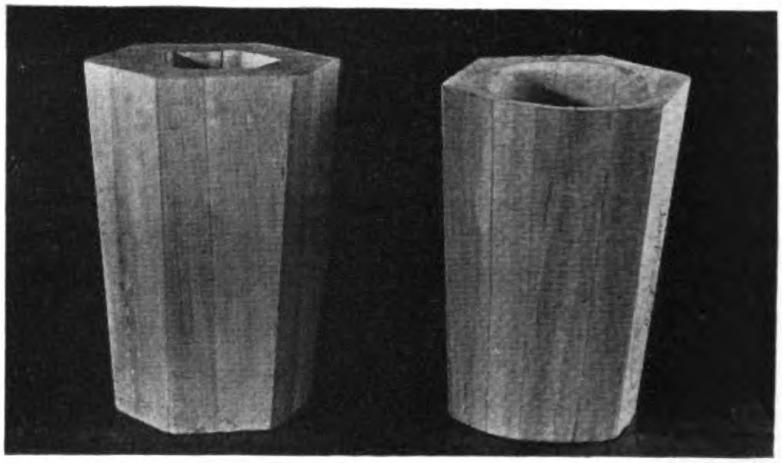
7. **A.** Well-fitted bucket distributes weight over major portion of stump.

B. Poorly-fitted bucket constricts knee and produces terminal edema.

and will permit the patient to stand on his feet more than 8 hours a day. If the stump has been classically amputated and revised and if the artificial leg has been properly fitted, the side-bearing prosthesis will allow the patient more mobility and hold up as well as the average end-bearing or ischial-bearing stump.

Furunculosis, terminal edema, recurrent cellulitis and ulceration about the tibial head are caused by a poorly fitted leg. An opportunity was available to refit a few elderly veterans from the last war who were complaining of a painful stump, recurrent cellulitis, and other similar conditions. In each instance of terminal edema, the patient was carrying his full weight around the top of his stump. By casting a new leg that distributed the weight over the entire stump, the complaints were eliminated.

Terminal edema is caused by the end of the stump dangling loosely in the bottom portion of the bucket. If this is allowed to persist it frequently results in discoloration of the skin, minor ulcerations, pain and eczema. When a limb maker is confronted with a patient whose stump has shrunk considerably he usually places a leather liner in the socket to correct this fault. He seldom makes the liner long enough to envelope the stump completely and there is a failure to equalize the pressure on all surfaces of the stump. The stump is choked at the top by such procedure, causing



8. Block of basswood before and after it is "pulled out."

a terminal edema or other complications. If the socket fits well over all surfaces of the stump, terminal edema and its sequelae will be eliminated (fig. 7).

ABOVE-KNEE PROSTHESIS

The manufacture and fitting of a thigh leg presents a great many problems that differ from those of lower leg amputations. The thigh stump is always much softer and larger than the below-knee stump and, with the exception of the long end-bearing types of thigh stumps (Stokes-Gritti), the stump is almost cylindrical in shape and when short is frequently barrel-shaped. Plaster casts of this soft barrel-shaped stump are not accurate and no method has been found for constructing the ischial-bearing thigh socket by the use of plaster casts and molds.

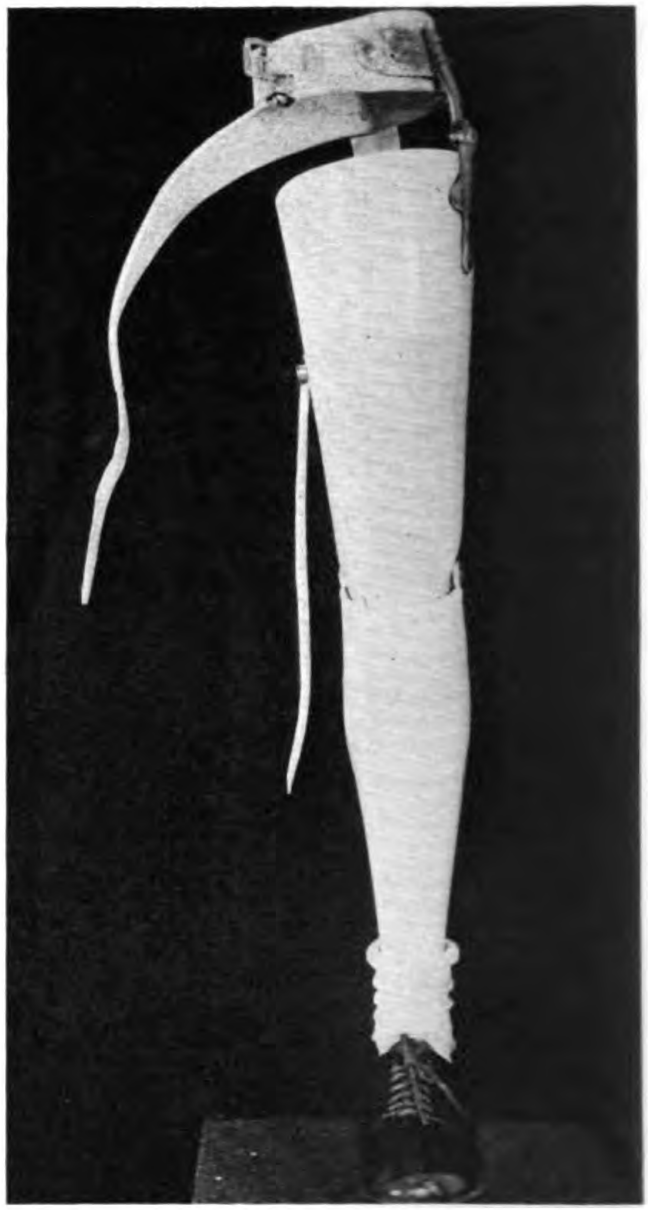
Although there are numerous types of prefabricated and plastic thigh sockets on the market, all of them have been made over a universal mold and an attempt is made to make them fit the patient by inserting leather liners. It has been the experience here that prefabricated thigh sockets, no matter how well constructed, do not allow for the individual adjustments necessary between the weight-bearing ischial tuberosity and the central axis of the knee joint. All artificial limbs for thigh amputations are constructed with a moderate amount of valgus deformity at the knee to simulate the natural alinement of the femur, and hence additional difficulties arise.

The thigh socket is constructed from wood, using a plastic shin and a wood and felt foot. A fine grain basswood which has been especially kiln-dried and contains no checks or knots is used instead of a solid block of willow (fig. 8). Six to eight pieces of this type of wood, 2 inches thick, are mitered and glued to form

9. Foot, shin, knee, and thigh socket assembled for preliminary fitting.

a hollow, tapered hexagon. The approximate shape of the socket is determined by bending a lead tape around the upper portion of the thigh which serves as a rough pattern on the top of the wooden block. The block is "pulled out" in the usual method used by the artificial limb trade.

Previous to the carving of the thigh socket the patient has been measured for a foot, shin, and knee joint (fig. 9). The shin is made of the same plastic material as described for the below-knee leg. The knee joint has already been fitted onto the shin, and the knee lock has been inserted over the knee bolt. The thigh socket is now attached to the knee and shin by three metal straps and the patient is allowed to walk on the unfinished leg. As he walks before a mirror and is watched closely by the leg fitter, the adjustment of the thigh socket is made and the alinement is corrected. The patient should walk without a "swing" or a "whip." The hip joint, which is normally placed 1½ or 2 inches in front of the trochanter, frequently needs adjustment notwithstanding limb manufacturers' convictions of where the hip joint should be placed. Each patient walks best with a hip joint either in front of or opposite to the trochanter, and the ab-

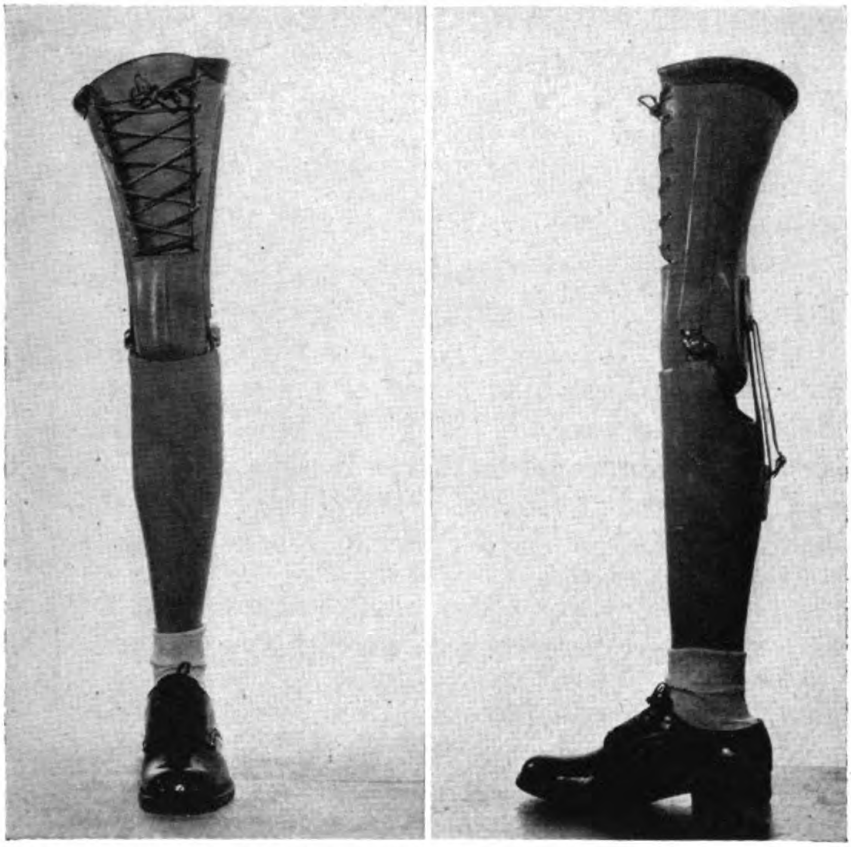


10. Finished thigh leg.

solute position of the hip joint is not so important as the fact that the patient can walk without a "whip" in his leg.

The scope of this article does not allow a full discussion of problems of the hip joint or problems of the shape of the thigh socket. After trying numerous standard shapes of thigh sockets and positions of hip joints, however, it was found that each thigh requires a slight alteration in both of these aspects. The type of knee lock, ankle joint and foot can be of any standard make, the less complicated the better. The material of which the shin is made is of no importance except that it should be easy to construct, strong and light, as shown in the figure above.

Before a thigh leg is fitted, the stump itself should be thoroughly examined in order to ascertain the possibility of contractures, paralysis, muscle atrophy, painful scars, and other conditions. All contractures and deformities of the thigh stump must be removed by exercise, physiotherapy, and stretching before an attempt is made to evaluate the gait. Patients with even five degrees of flexion-contracture of the hip joint will have a noticeably bad gait. Patients with internal or external rotation deformities will also have a peculiar gait, and unless these facts are known the limb fitter may frequently try to re-aline the leg and still not be able to improve the gait of the patient.



11. Stokes-Gritti prosthesis.

END-BEARING STUMPS

The long thigh stump with the patella on the end of the femur (Stokes-Gritti) is especially constructed for end-bearing, and, naturally, when this operation has been performed on the thigh an end-bearing type of prosthesis is given to the patient (fig. 11).

There are other types of long thigh stumps, however, which also lend themselves to an end-bearing type of prosthesis. A stump revised (with the removal of the patella, and the tendon, bursa, and fascia placed over the bone end) or a long thigh stump (amputated just above the femoral condyles) which has a good healthy skin flap and considerable fat over the end of the bone lends itself readily to an end-bearing prosthesis. Long thin stumps or stumps with scars or bony irregularities will not stand end-bearing weight. In all stumps which are not the true Stokes-Gritti type, the thigh lacer of the prosthesis is run up to the ischial tuberosity and thereby the prosthesis becomes partially ischial-bearing (25 percent to 30 percent) and partially end-bearing. The patients who have been fitted with an end-bearing leg walk very well because they do not have to depend on the knee-locking device to help extend the knee. There has been no occasion here to fit a

prosthesis to a stump which has been disarticulated through the knee. These cases have either been converted into a Stokes-Gritti type of amputation or into a classic midthigh amputation.

END-BEARING PROSTHESIS

A plaster cast is taken of the stump and a mold is made, over which a heavy piece of leather is stretched and sewed. This serves as a thigh socket. A plastic shin and foot are assembled to correspond to the measurements of the opposite leg and the thigh socket is attached to the knee hinges. After the patient has walked for several days in this skeleton leg, a knee block is added and the leg is finished with additional leather, rawhide, straps, and other accessories. This type of prosthesis is slightly heavier than a normal thigh leg but when applied to a good end-bearing stump it becomes a comfortable, usable leg.

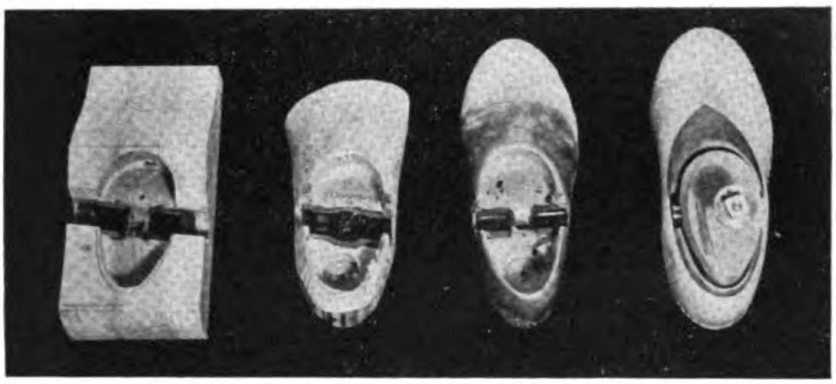
THE FOOT AND ANKLE JOINT

A good serviceable foot must be light and strong and must fit the shoe perfectly. It should have a soft toe and sole, in order to absorb the shock of pavement and floors and to allow the patient to walk quietly. There are numerous types of feet and ankle joints on the market but many of them have unnecessarily complicated parts which do not add to the patient's ability to walk. A foot consisting of a wooden block, a Spanish felt toe and a sponge rubber sole has proved satisfactory at this activity. A single bolt ankle joint is not heavy and the amount of excursion in the average artificial ankle joint is so slight that ball bearings, needle bearings, and lateral mobility are not necessary. The hard rubber ankle joints, allowing some mobility in all directions, often give the patient a feeling of instability which is not desirable.

A willow, poplar, or basswood foot block is fashioned on the bandsaw and duplicator and to it is glued a Spanish felt toe. A strip of leather and sponge rubber comprises the sole. The wood is covered with rawhide and the entire foot is covered with soft leather. When the ankle block and ankle bolt are properly fitted into the wooden portion of the foot, the foot can be attached to the leg, and toed out or in as the individual case demands (fig. 12).

UPPER EXTREMITY PROSTHESIS

In the manufacture of upper extremity prostheses, several extremely important factors should be considered. It should be noted that the loss of any portion of the upper extremity causes the patient to be more seriously handicapped than a similar loss



12. Steps in manufacture of artificial foot.

in the lower extremity. The shorter the arm stump the less function the patient can realize, no matter what type of artificial arm may be applied. The loss of the dominant hand requires a complete re-education of the opposite hand for all work. The loss of an elbow severely handicaps the patient and the loss of a shoulder joint makes it almost impossible for him to use an artificial prosthesis to any extent.

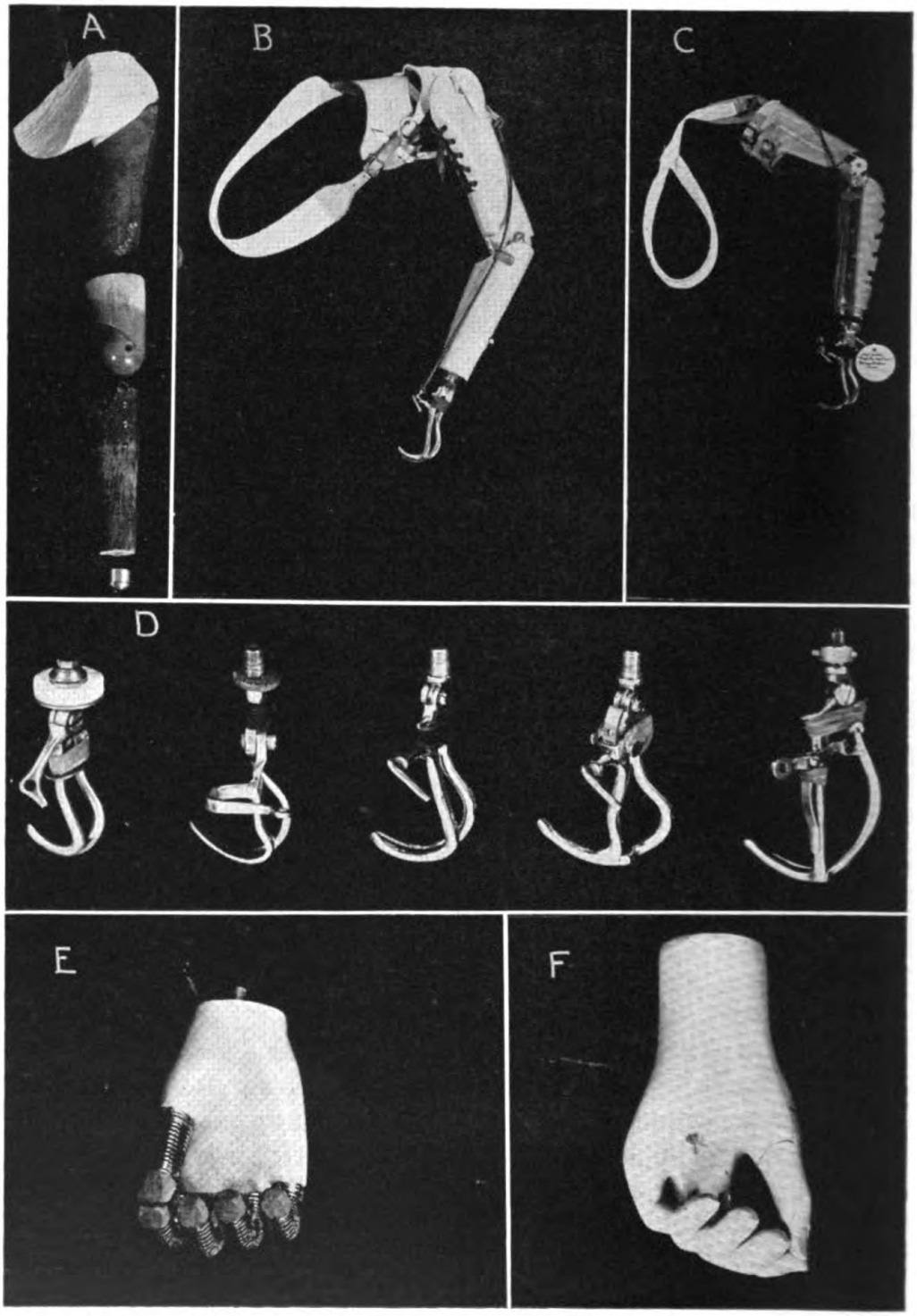
Analyzing still further the problem of the rehabilitation of the arm amputee, it should be recalled that the normal two-handed person uses one hand to hold the object and the other hand to make the finer movements of the particular operation attempted. Similarly the amputee whose arm stump is short can expect to use his prosthesis only for a certain amount of stabilizing and must train his opposite hand, if it is not the dominant hand, to do the finer work.

BELOW-ELBOW PROSTHESIS

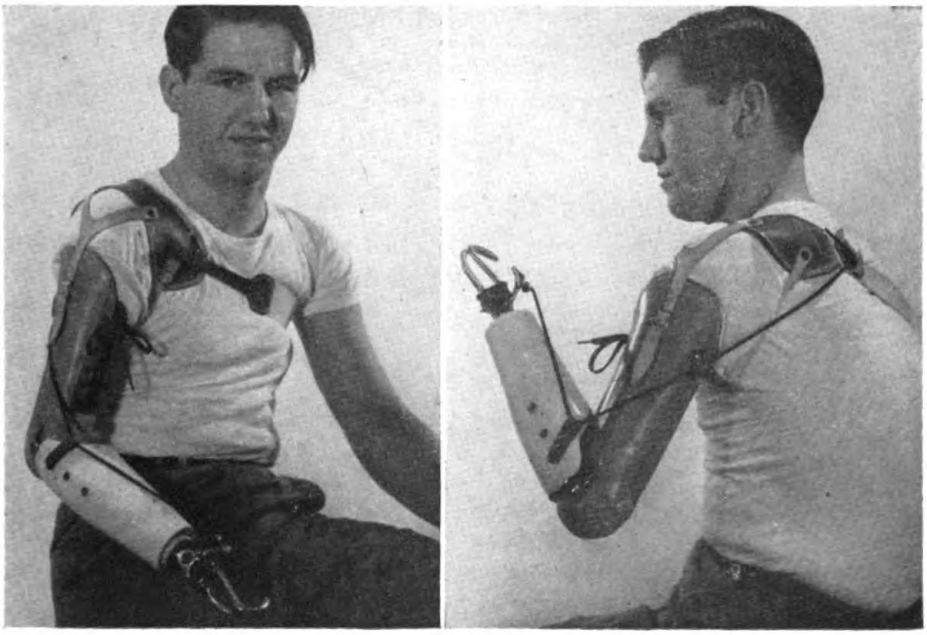
Prostheses for forearm amputations are the most easily constructed of all prostheses. The leather or plastic cuff which is fitted over a plaster cast of the forearm stump is fitted into the arms of the metal wrist attachment and a pair of light elbow hinges is attached to a leather arm band. The wrist attachment will accept either a hook or a hand which is worked by a lanyard up the arm and across the back to the opposite shoulder. Standard fittings of all the parts can be replaced easily or repaired.

ABOVE-ELBOW PROSTHESIS

Prostheses for arm amputations are considerably more complicated and require a mechanical elbow with a spring-ratchet stop and bulky harness to attach it to the body. In these cases the use of the hook is definitely limited because of the absence of a natural



13. A. Plastic, wood and leather parts for arm prosthesis.
B. Finished arm prosthesis.
C. Finished forearm prosthesis.
D. Standard hooks for utility arm.
E and **F.** Standard mechanical hands.



14. Pull on lanyard by opposite shoulder operates utility hook.

elbow. The positions in which the hook can be opened and closed are limited to those which are possible with the arm flexed. Shoulder disarticulations and short humeral stumps require a leather shoulder cap to fill out the width of the shoulder and to hold the arm in place. Naturally the higher the amputation the less function of the stump because of the loss of muscle attachments which move the arm.

The use of the split hook is preferred here to the mechanical hand and the patient is encouraged to learn to do as much with the hook as possible. Each arm amputee goes through a course of training in the use of his hook and every opportunity is taken to help the patient overcome the feeling of its unsightliness and the embarrassment he feels when using a hook in public (figs. 13 and 14).

Obviously the best mechanical hand on the market at the present time is only a poor substitute for the normal hand, both from the cosmetic and the functional standpoint. The patient, therefore, is presented with the type of hook which will be the most useful to him in his special kind of work.

SERVICING AND REPLACING

The artificial limb is a mechanical apparatus which requires constant supervision and servicing. Because patients here are always close to the artificial limb shop, they are permitted to observe the construction of their own leg or arm. They are in-

TABLE 1.—*Statistical analysis of prostheses*

Types	Number
Pylons	208
Below-knee legs	89
Above-knee legs	97
Symes legs	1
End-bearing legs (Stokes-Gritti)	11
End-bearing legs	34
Above-elbow arms	52
Below-elbow arms	47
Practice arms	11
Cineplastic arms	11
Special prosthesis for fingers	24
Special prosthesis for feet	12

TABLE 2.—*Personnel*

Corps	Number
Naval	117
Marine Corps	164
Veterans	8

structed in the proper care of stump sock and stump as well as their own prosthesis.

During the first year in which the patient wears an artificial limb his stump will change shape to some extent. Certain areas will become tough, the muscles of his thigh and hip will become strong and he may even change his gait somewhat. He is warned therefore about the possibilities of injuring the stump in a poorly fitted socket and is instructed in the proper use of leather liners. Any amputee who has been discharged from this hospital can feel free to return for adjustments and repairs on his leg or arm as they are needed. If he lives at a great distance, he can have the necessary work done through the Veterans' Administration.

TRAINING

In order to prevent the patient from becoming weak and flabby and to prevent muscle imbalance or contractures, a system of exercise, early walking on crutches and early weight bearing is instituted. In addition to the prevention and correction of contractures and the use of exercises during the period of surgical convalescence, the amputee is carefully supervised in his adjustment to his prosthesis. The below-knee amputee requires only a minimum of supervision in order to improve posture and gait. The above-knee amputee requires assistance in learning to transfer body weight from the sound to the artificial leg without buckling at the knee. At the same time transfer of weight to the sound leg must be accomplished with a free pendulum motion at the hip

joint, thus maintaining the rhythm of normal gait. Bad habits of swinging the prosthesis sideways are corrected.

STATISTICS

Although follow-up statistics are as yet sketchy (tables 1 and 2), patients at this center are followed for as long as 3 months in the hospital after they have been fitted with an artificial prosthesis. Discharged patients are further contacted by correspondence concerning their condition.

SUMMARY

A patient who walks well on an artificial limb or who uses an upper arm prosthesis with facility, has a well-revised, painless stump, a well-fitted prosthesis, and an absolute minimum of muscle atrophy or joint contractures. By a good gait the amputee testifies that everyone who has had a part in his convalescence has succeeded by various means in preventing such conditions as painful stumps, contractures, and misalined limbs. Equipped with a well-fitting permanent prosthesis, this person is prepared to take his place in industry, on the farm, or in the commercial world, fit to meet the competition of those who are free from disabling defects.

D. PLASTIC SURGERY OF AMPUTATION STUMPS

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and
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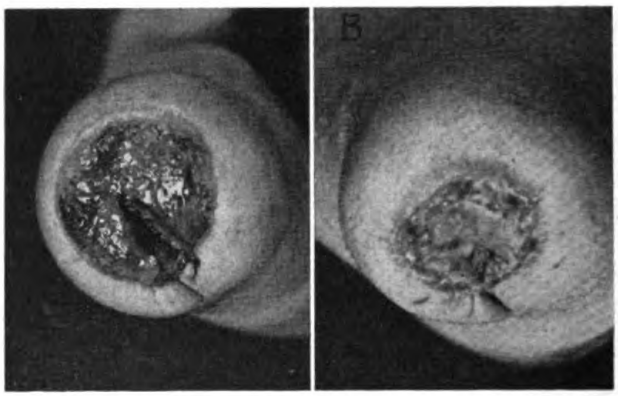
Most of the patients admitted to this amputation center present open stumps in various stages of healing. The larger number have had true guillotine amputations with complete transection of the tissues in one plane. These open amputation stumps are in fact surgical ulcers and should be covered at the earliest possible moment when the stump bed will accept a graft. The application of skin traction will help to draw the skin gradually over the end of the stump until the wound heals with a deep concentric scar. This procedure, however, requires considerable time. Skin-graft-



1. **A.** Guillotine amputation of thigh showing typical large granlating wound. **B.** After application of skin graft there is marked reduction of final scar due to contraction of adjacent skin.

ing, on the other hand, reduces the period of treatment, and many other advantages result from its early use.

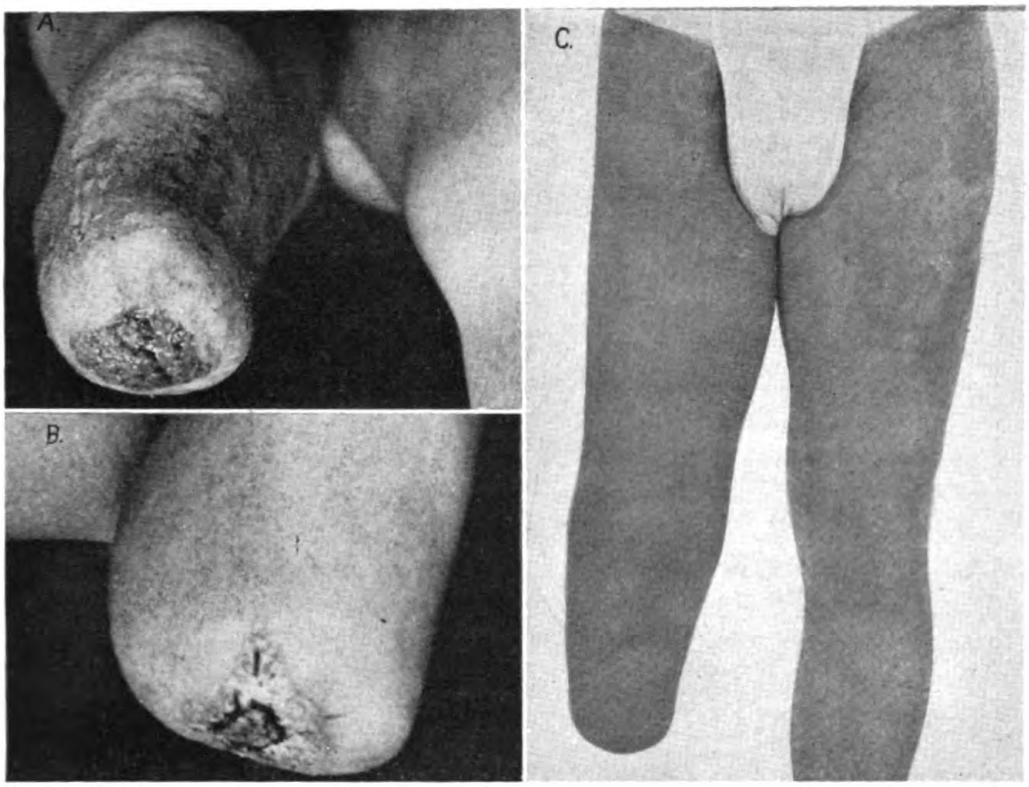
SKIN-GRAFTING

Indications for skin-grafting.—The indications for early skin-grafting on open amputation stumps are based on the sound surgical principles of: (1) Improvement in the general health of the patient; (2) diminution of infection; (3) reduction of scar tissue formation; (4) reduction or elimination of pain; (5) decrease in the frequency of dressings; (6) simplification of patient care and nursing; and (7) earlier stump revision or reamputation.

Reduction in the eventual bone loss is also obtained by the gradual contraction of the grafted area. Skin traction applied to the stump after skin-grafting, even in the presence of a ring of scar, will increase the amount of skin available for later revision. This is especially valuable in the short amputation stump where every effort should be made to preserve bone length and the proximal joint (fig. 1).

The success or failure of skin-grafting amputation stumps will depend in large measure on the preliminary care of the open stump, the methods of application of the skin graft and the after-care of the grafted stump.

Preliminary care.—Prior to the application of the skin graft, edema must be eliminated, vasomotor tone and local circulation improved and infection diminished. Postural treatment aids in these objectives and can best be accomplished by keeping the patient strictly in bed and elevating the part. Pressure dressings and local compresses stimulate the ulcer bed to develop firm, flat granulations. The control of local infection is best obtained by the



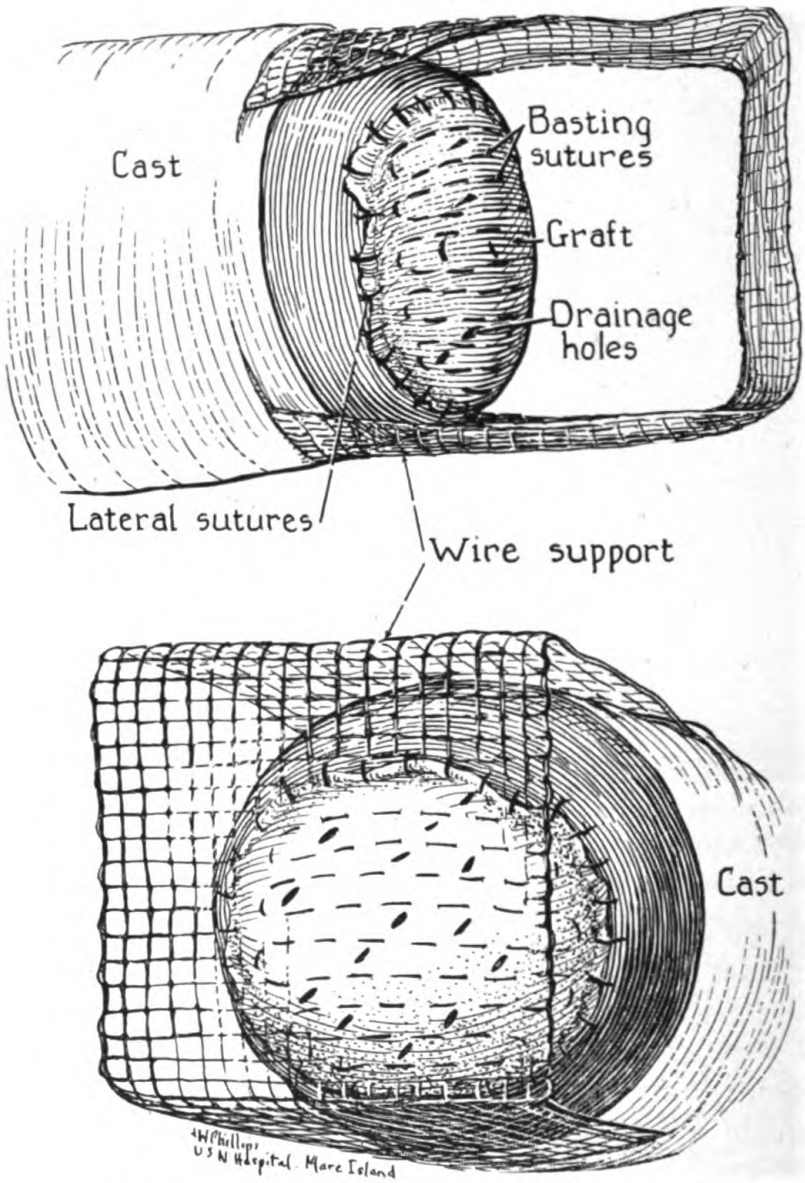
2. A. Guillotine amputation below the knee with short stump. **B.** After skin-grafting and contraction of the scar area. **C.** Revision of stump without bone loss, preserving knee.

use of 100,000 units of penicillin 2 days previous to skin-grafting and for at least 7 days after operation. Sulfadiazine as an adjunct is of value, particularly where staphylococcus infection is present.

Method of application.—The one-piece, thin, split-thickness skin graft is easier to handle, has a better chance of survival and provides adequate skin coverage. Through the continuous contraction of the skin-grafted bed, more of the adjacent skin is mobilized, facilitating later revision of the stump. The split-thickness graft is perforated throughout to permit drainage and is then sutured to the margin of the wound under normal skin tension. The graft is further secured to the wound by many basting sutures (fig. 2).

Aftercare of graft.—The final dressing may be open or closed. The relative percentage of "takes" with both types of dressing has been the same. If the ulcer is relatively clean and the bed regular, the closed method is preferred. When the base is irregular and exudation more active, the open method is employed.

Closed method.—The closed method consists in applying several layers of 3-percent xeroform gauze to cover the graft after it has been sutured to the new bed. Flat gauze sponges and a large flat gauze pad are placed in position and held firmly in place by elastoplast. Anterior and posterior skin traction strips are now



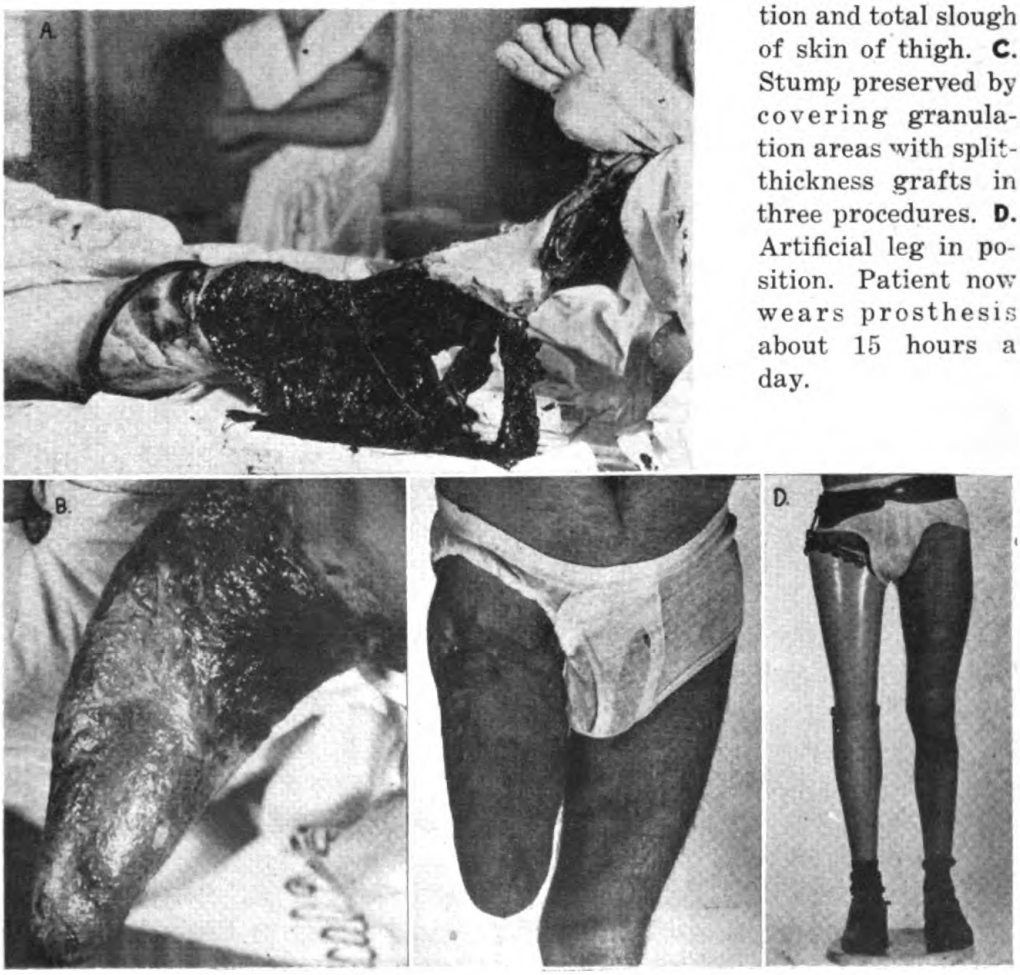
3. Management of skin grafts by open method.

placed in position and a firm elastic bandage is applied. The grafted area and its proximal joint are immobilized by splinting. The entire area is elevated and not disturbed for 5 days. On the fifth day, all of the dressings are removed. Secretions are evacuated and a similar dressing and splint reapplied. This dressing is changed on the tenth postoperative day. All the sutures are removed, secretions wiped away, a dry pressure dressing reapplied and traction is continued.

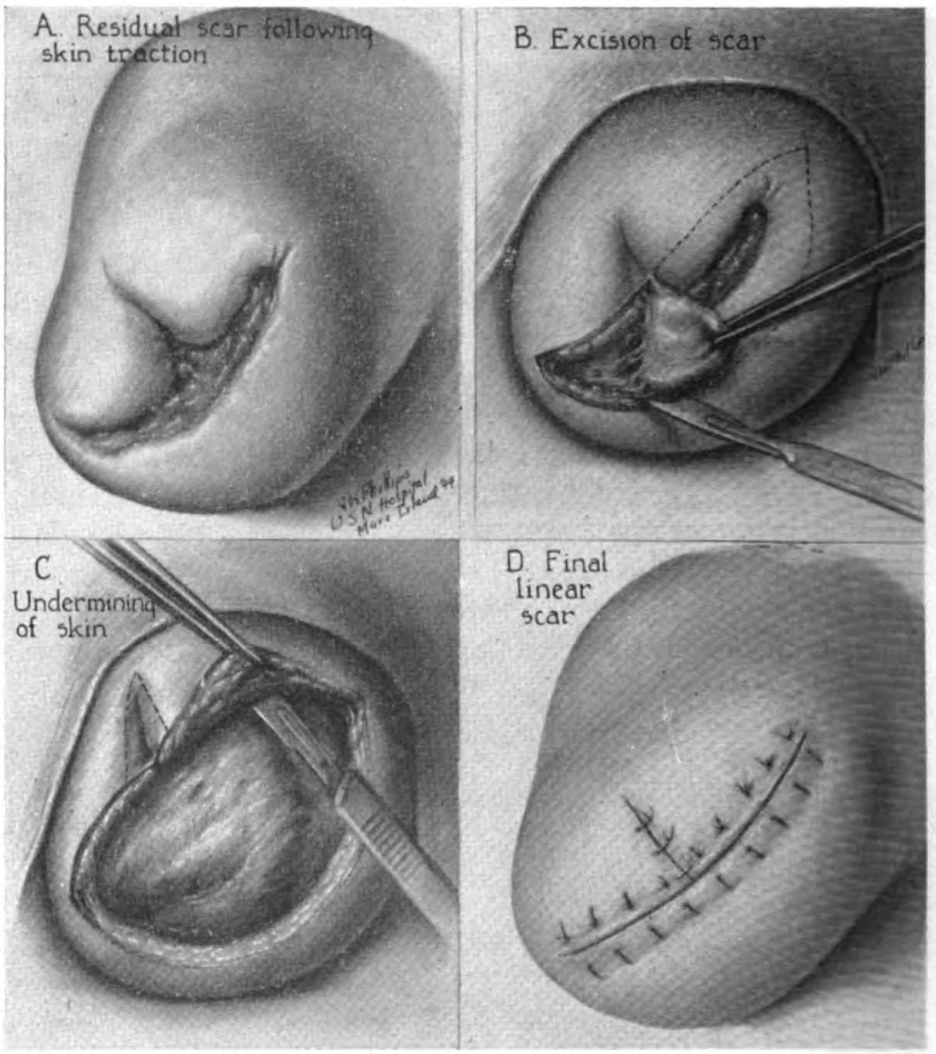
Open method.—In the open method, it is necessary to use many more basting sutures, as these are the main points of graft immobilization (fig. 3). Skin traction with a 3-pound weight is applied and a plaster cast is added to immobilize the proximal

joint and to protect the grafted area. The cast is so constructed that the grafted area is open but protected by plaster strips. The part is elevated and by using sterile applicators and massage from four to eight times a day, the secretions that collect are removed. The massage is done from the center to the periphery, forcing the secretions from under the graft. The sutures are taken out on the tenth day. On the fourteenth day all splints are discarded and a mild pressure dressing is applied and traction employed for another week. All dressings are then removed but the traction is continued.

More than 130 amputation stumps were treated by skin-grafting. Five bilateral amputation stumps were treated in the same manner. Secondary skin grafts were required in 14 patients, 7 of whom had fallen on their stumps and reopened their wounds after a complete take of the original skin grafts. In one patient it was necessary to do 5 different grafts. This patient originally had a 90-percent take of the graft but knocked it off. The 3 intervening



4. A. Extensive mutilation following crush injury by crane. **B.** Following guillotine amputation and total slough of skin of thigh. **C.** Stump preserved by covering granulation areas with split-thickness grafts in three procedures. **D.** Artificial leg in position. Patient now wears prosthesis about 15 hours a day.



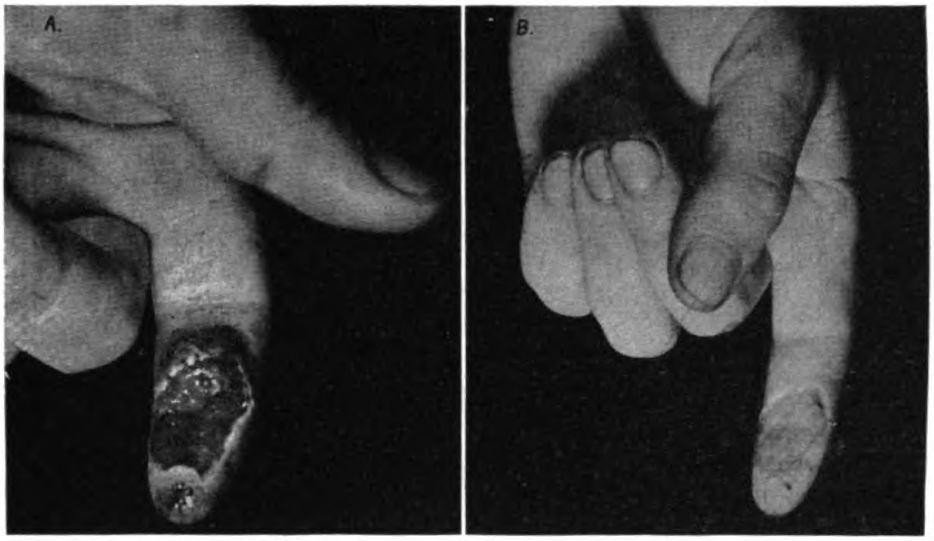
5. Plastic repair of arm stump.

grafts were digested by the wound secretion. The open method was employed on the final graft and a complete take was obtained.

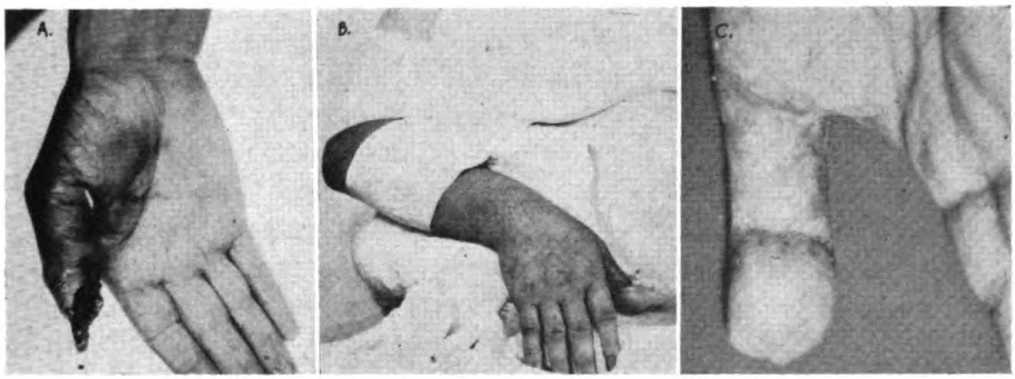
Of the skin grafts which were employed to cover the amputation stumps, 15 required the open type of dressing and the remainder the closed method. Originally all of the skin grafts were treated by the closed method but poor takes on many of the wounds prompted the use of the open method. Despite poor circulation, fibrosis, infection, exposed bone in the wound, and some general debility, there was a 75-percent take of the skin grafts (fig. 4).

SURGICAL RESTORATION

There are several plastic procedures which have been successfully employed on amputation stumps to preserve their length and



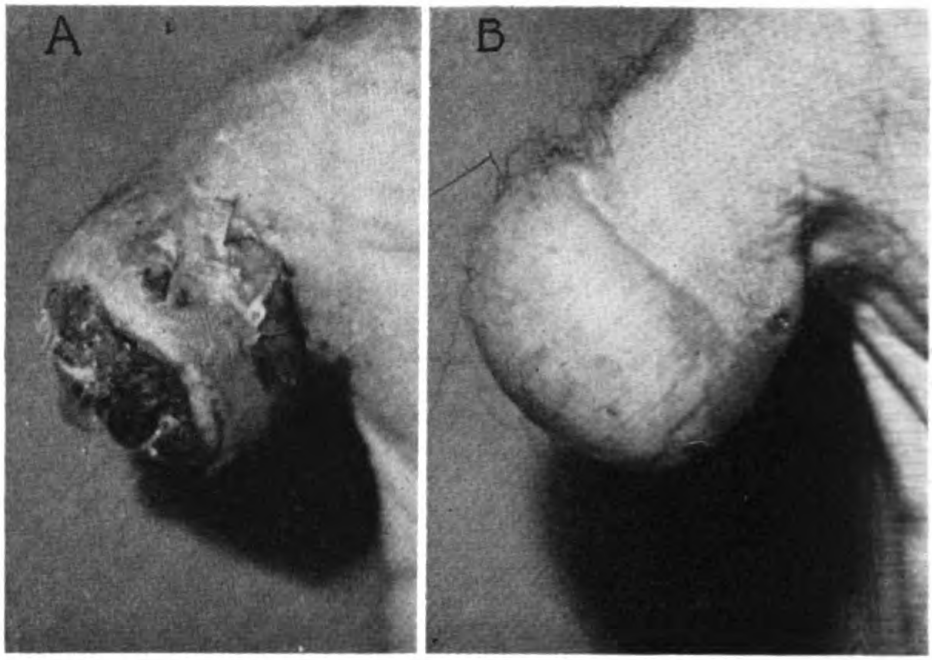
6. **A.** Partial amputation of the index finger. Soft tissue only involved. **B.** Two weeks after immediate application of split-thickness graft.



7. **A.** Avulsion of thumb with exposure of distal phalanx, flexor tendon, and digital nerves. **B.** After debridement immediate suture of thumb to a tailored abdominal flap. **C.** Reconstruction of thumb pad after severance of abdominal pedicle.

materially improve the function of the part. These are used in selected cases and can be divided into those procedures which are employed immediately after amputation and those used at a later date (fig. 5).

Early cases.—In amputations of the thumb and fingers, it is imperative to preserve length. If the soft tissue alone is involved, the defect is closed by applying a thick split-thickness graft. When the bone and tendons are exposed, a full-thickness flap of skin and fat must be used to cover the defect (fig. 6, A and B). This is usually done by suturing the injured digit into a tailored flap from the abdomen. A single or multiple flap may be employed, depending on the particular lesion. The amputated member is cut free from the abdominal flap in from 2 to 3 weeks and the



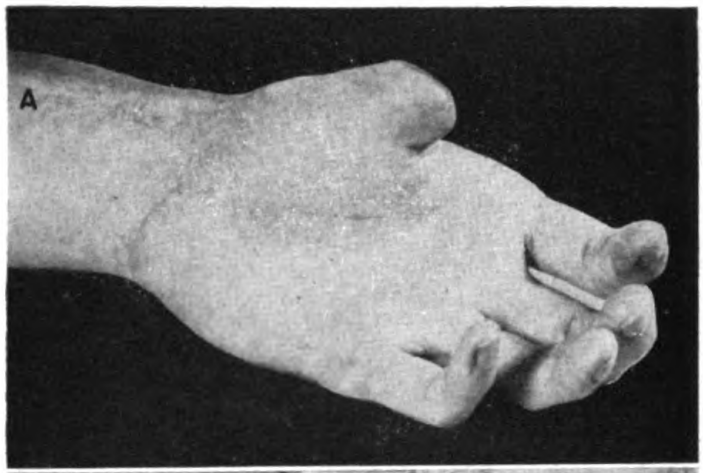
8. A. Avulsion of distal phalanx of thumb. **B.** Abdominal pedicle flap applied 4 days after injury.

free end of the flap is fitted into its proper place (fig. 7). Arm or forearm amputation can be similarly managed by utilizing the abdomen or the lateral chest wall for the covering material (fig. 8).

Late cases.—The same procedures can be employed where a short arm or leg stump is present, and a proximal joint is to be saved. The choice of the donor area depends on the problem at hand. When a flap is used to cover an amputation stump in a weight-bearing area, full return of sensation to the skin flap should take place before any type of weight bearing is permitted. If this is not adhered to, flap necrosis with ulcer formation will result.

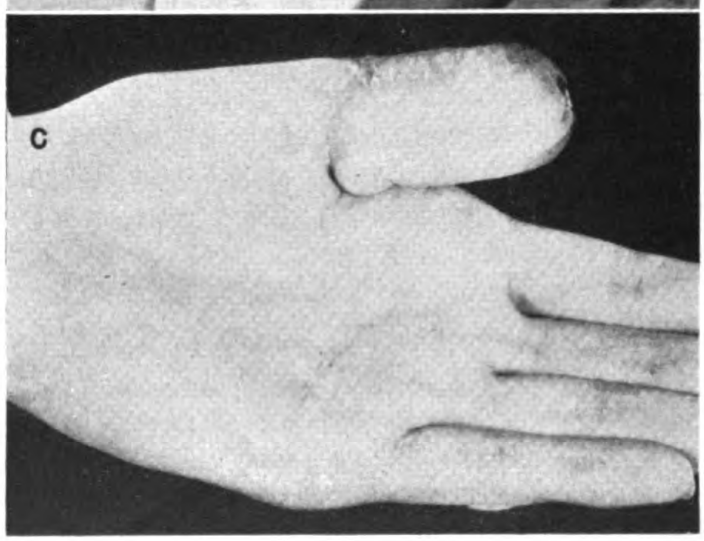
There were 52 patients requiring plastic repair of finger stumps. The majority of these repairs were confined to the fingers and thumb and were done to relieve pain, and to improve function and appearance. Of these patients, 20 required removal of painful neuromas and 18 required abdominal tube pedicle or flap grafts for the covering material.

Phalangization.—The most important function of the hand is that of prehension. This is obtained by the opposition between the thumb and any of the fingers. The loss of the thumb, therefore, is followed by a serious disability. While grasping power for small objects is maintained between the folds of the fingers, and that for large objects between the fingers and the palm of the hand, the resulting member is no better than an ape's hand. The distinguishing characteristic of the hand with all its variations is



9. A. Amputation of thumb proximal to metacarpophalangeal joint.

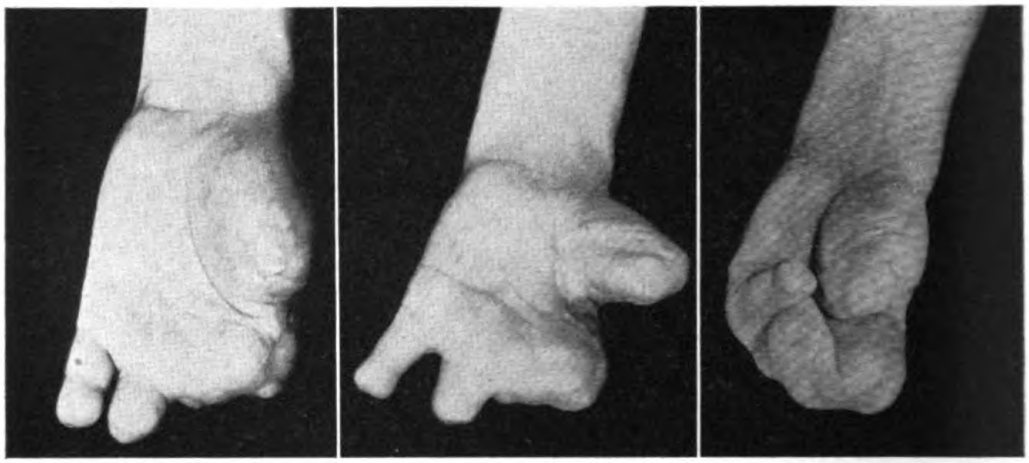
B. Abdominal tube pedicle sutured to thumb stump to reconstruct soft tissue for new thumb.



C. Thumb reconstructed with a tibial bone graft for support. Pedicle scar placed in dorsolateral position, a silent area.

achieved by the forceps-like action of the thumb opposed to the fingers.

The restoration of a new thumb by means of a tubed pedicle flap and bone graft is a long drawn out procedure with uncertain



10. **A.** Loss of prehension due to absence of all fingers and thumb. **B.** Phalangization of thumb by Nicoladoni procedure. **C.** Prehension obtained by adduction of reconstructed thumb.

results (fig. 9). Rotation of the index finger and its associated metacarpal has not been performed at this center. Phalangization of the metacarpal of the thumb is a practical and valuable procedure.

Technic.—A transverse incision is made across the skin of the thenar web and by blunt dissection the lumbrical and interosseous muscles are dissected to deepen the defect in the web as far as possible. It may be necessary to sever portions of these through one-half of their thickness. A flap is then designed with its base toward the wrist on the dorsum of the index metacarpal. This is rotated and sutured into the depths of the sulcus created between the thumb and index finger. The remaining denuded areas are covered with either a split-thickness or Wolfe graft. This simple procedure gives a good functioning, serviceable thumb stump (fig. 10).

ARM AND FOREARM

Because amputation of the upper extremity cannot be standardized as in the lower extremity, one must be prepared to offer the arm amputee a wide variety of surgical and prosthetic services. The selection of the prosthesis or the surgical procedure will be influenced not only by the patient's choice but also by his background, hopes, aims and aspirations as well as by his physical and mental capacities. A utility arm with a split hook device, controlled by a lanyard attached to the opposite shoulder, will meet the requirements of the man who returns to the farm. The welder will be in the same category. To these men the prosthesis is essentially a tool to be used for specific mechanical purposes, in one

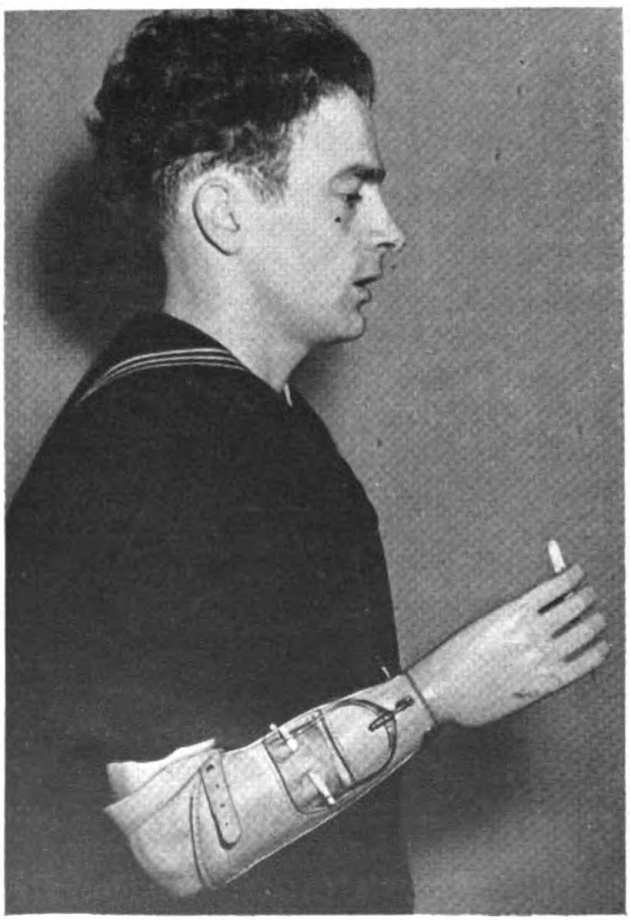
11. Cineplastic motors in forearm stump with pegs in canals.

particular vocation, as well as for the routine pursuits of life.

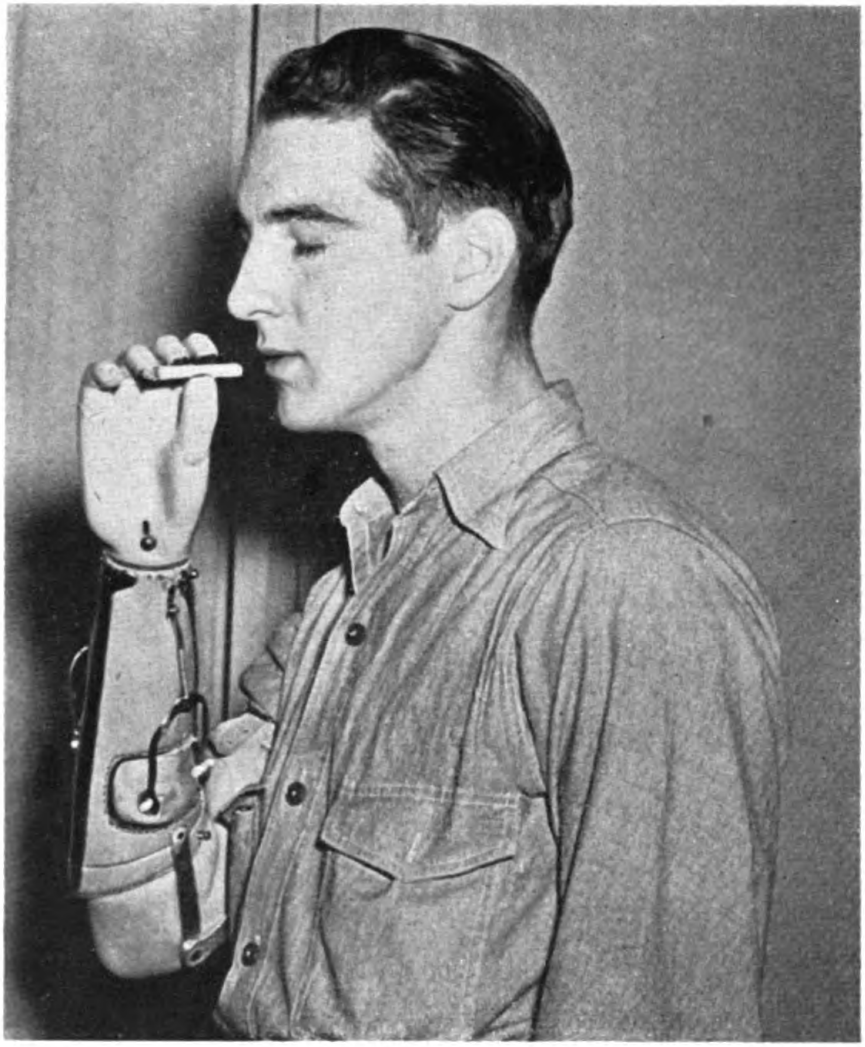
The sensitive person, or the one who in his normal work relationships will meet the general public, is reluctant to accept this tool to meet the demands of day-to-day living. He must have a device which will provide social acceptance as well as some measure of usefulness. His social recovery depends not only on his ability to use his appliance but also upon social approval by neighbors, friends, and those he will contact in his many personal relationships. Special artificial hands with competitive claims of utility and efficiency must be weighed in providing him with one most suited to his needs and personality.

Cineplasty.—Among the artificial hands, the cineplastic hand will come up for consideration. The use of the cineplastic hand is attended by some of the handicaps inherent in all appliances, such as weight, unnaturalness, and lack of normal tactile sensation. The great contribution of cineplasty is that it provides direct

12. Pegs in canals for activating dorsal and volar motors of cineplastic arm.



13. Cineplastic arm applied.



14. Cineplastic arm in use.

muscular control of the artificial hand by the same muscles or muscle groups which performed the functions of prehension in the normal hand. Not only are the same muscular functions duplicated but the same cortical psychomotor patterns are retained. The preservation of these patterns provides a natural function to the hand which cannot be duplicated by any other mechanism. The muscles are always in gear because of muscle tone, thereby providing quick and automatic movement (figs. 11, 12, 13, and 14).

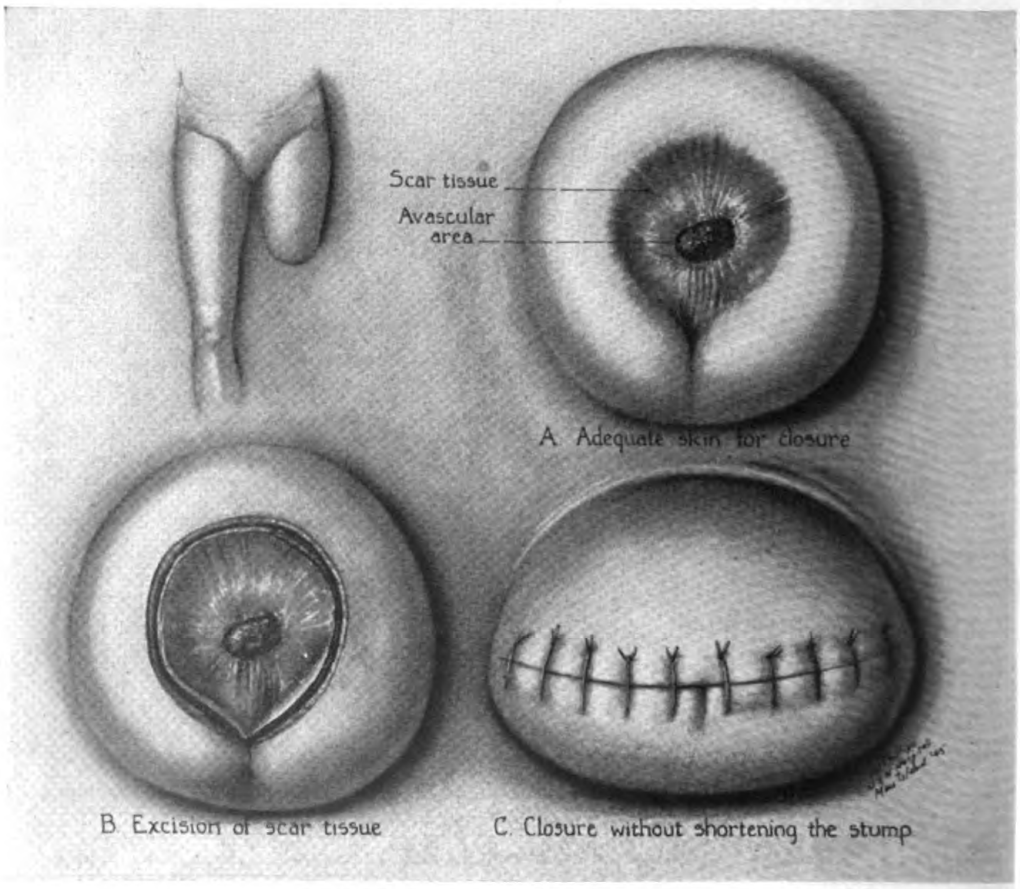
Krukenberg's arm.—There will be those who cannot or will not accept prosthesis. Many single-arm and even double-arm amputees get along without a prosthesis. For the blind, double-arm amputee, inability to use the tactile sensation at the end of his stump frequently makes the use of prosthesis difficult if not impossible. In this case, splitting one of the forearm stumps into a prehensile unit, as in the Krukenberg operation, provides grasping power

while at the same time retaining the valuable tactile sensation at the end of the stump. Braille can be learned rapidly and the blind amputee is soon restored to a familiar world. Though the Krukenberg amputation is unsightly, it has the additional advantage of being fitted with a prosthesis that operates by means of the approximation of the two finger elements.

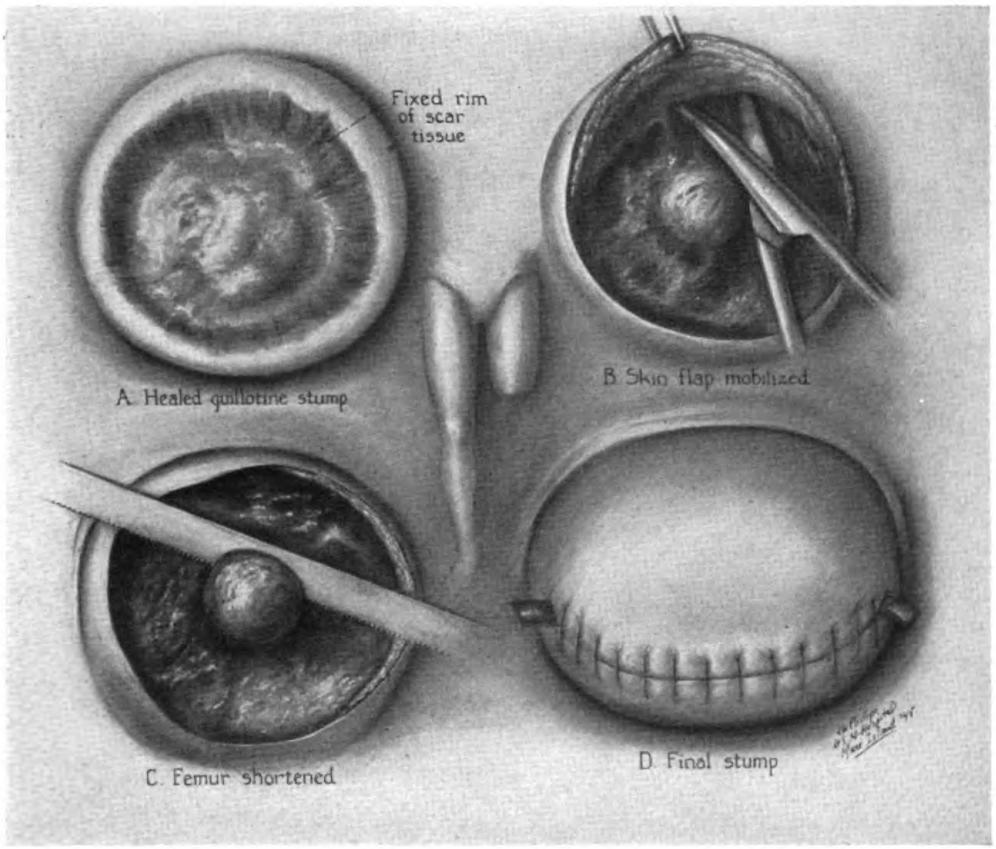
E. REVISION OF THIGH AMPUTATION

PAUL F. OLSON
Lieutenant Commander (MC) U.S.N.R.

The aim of the final thigh amputation is to provide full end-bearing, partial end-bearing, or ischial-bearing stumps. After preliminary treatment of the open stump following provisional amputation, the patient is prepared for this final stage by means of plastic repair, revision, or reamputation.



1. Plastic repair of thigh stump.



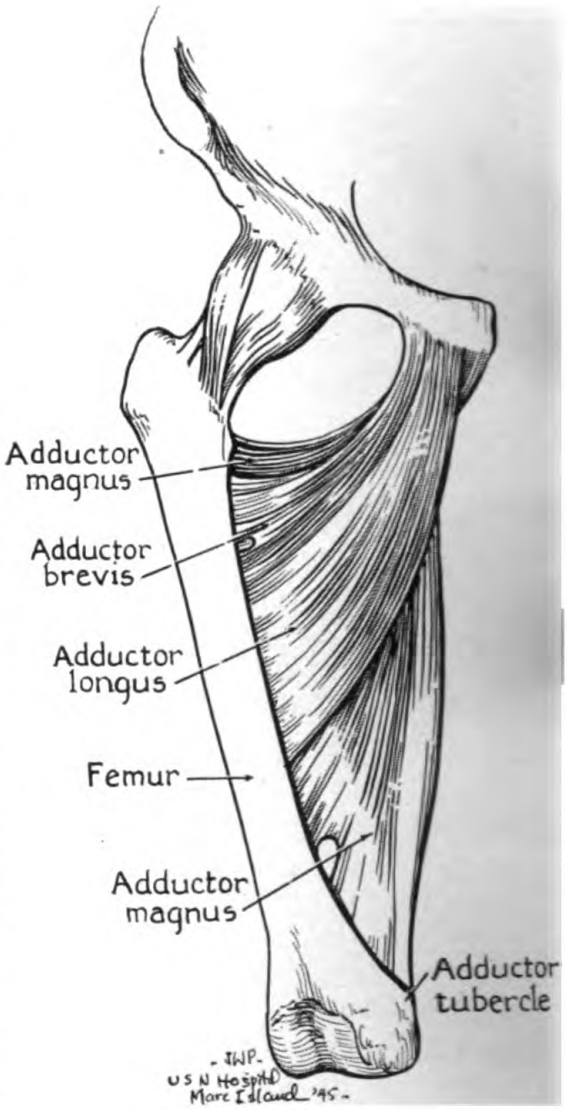
2. Revision of thigh stump.

Plastic repair.—In performing surgery subsequent to a guillotine amputation, a simple plastic operation suffices in those cases in which the skin edges can be brought together over the end of the stump. In the lower extremity it is essential that the skin be approximated, as a broad thin scar will not withstand continued weight bearing. After the open end of the provisional amputation stump has healed, the resulting disk of scar tissue is excised and the skin margins mobilized. The incisions are carried proximally only far enough to eliminate lateral prominences (fig. 1).

Revision.—In revision, the first step is to excise the disk of scar tissue on the end of the stump. The skin flaps are then mobilized. The bone and muscle are shortened sufficiently to permit the skin to be closed over the end. A tourniquet may be employed, but only briefly. The bleeding points are secured with absorbable sutures and the nerve is severed and permitted to retract. The periosteum is cut cleanly and the femur is severed. If undue lateral prominences of skin exist, they are trimmed before closure. However the objective is to get a rather square stump, and not to jeopardize the blood supply of the skin flaps by carrying the incisions too far proximally (fig. 2).

REAMPUTATION

Anatomic considerations.—In any amputation stump there are two basic considerations, the lever and the musculature which manipulates that lever. Below the knee the stump is manipulated by the quadriceps and hamstring muscles, both of which insert within the proximal two inches of the tibia. The stump distal to this point acts merely as a lever, and the muscles which are severed at the operation are not functional muscles (fig. 3).

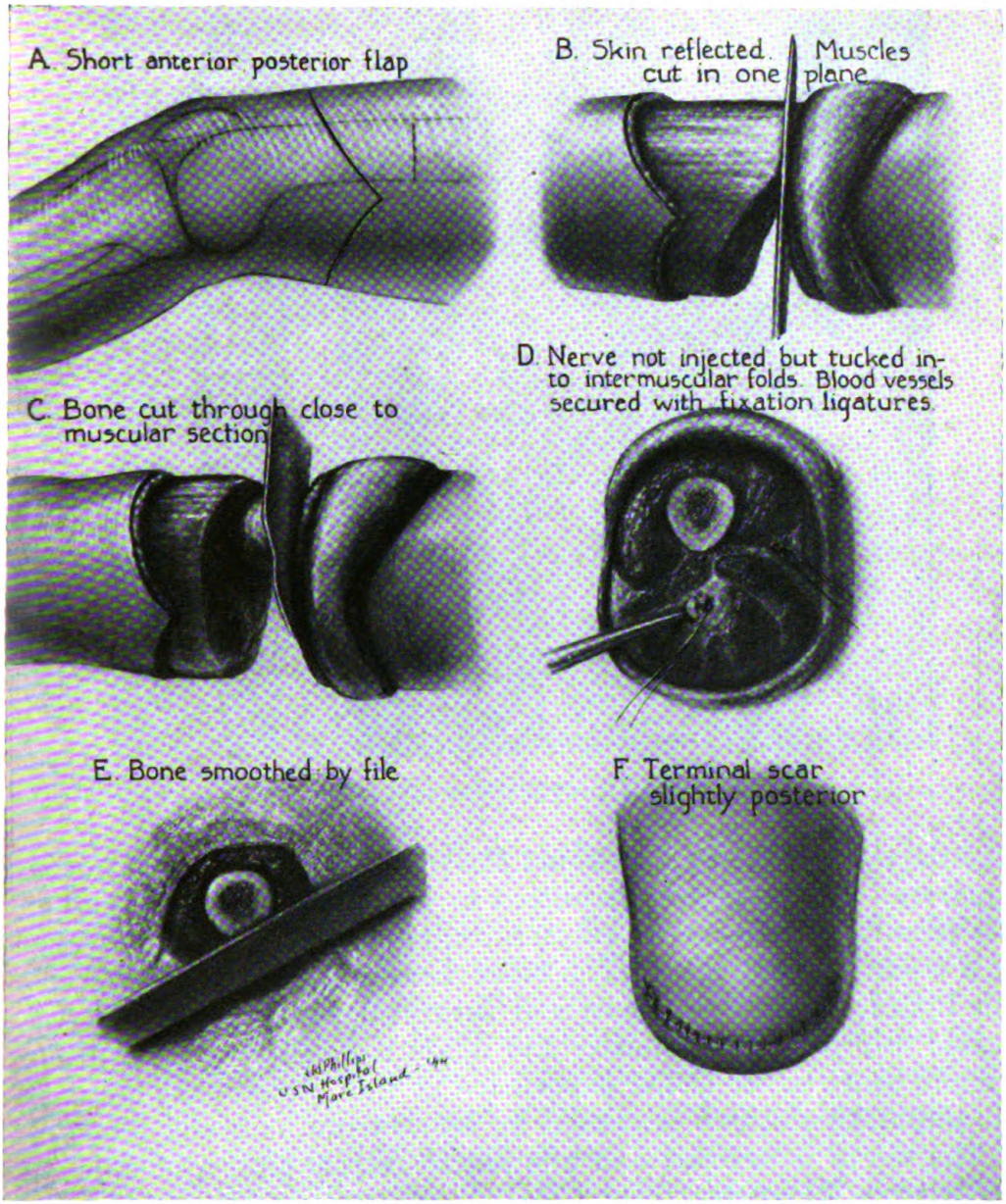


3. The adductor muscles.

Amputations through the thigh present an entirely different problem. The muscles which manipulate the lever are attached to that lever throughout its entire length. A Stokes-Gritti amputation severs a minimum of functional muscles, because the quadriceps tendon is reattached and only the hamstrings are sacrificed. Any amputation proximal to the adductor tubercle of the femur severs muscles which manipulate the femur, and the higher the level of the amputation, the greater is the loss of functioning muscles.

The adductor muscles attach throughout almost the entire length of the femur, and the more proximal the level of the amputation, the greater is the loss of the power of adduction. Muscle imbalance results, with a tendency toward abduction of the thigh which produces an unsatisfactory gait. In short thigh stumps there is also some tendency toward external rotation of the femur.

Although the classic site of election for a thigh amputation is at the junction of the middle and lower third of the thigh, some deviations from this rule are permitted, especially when it is de-

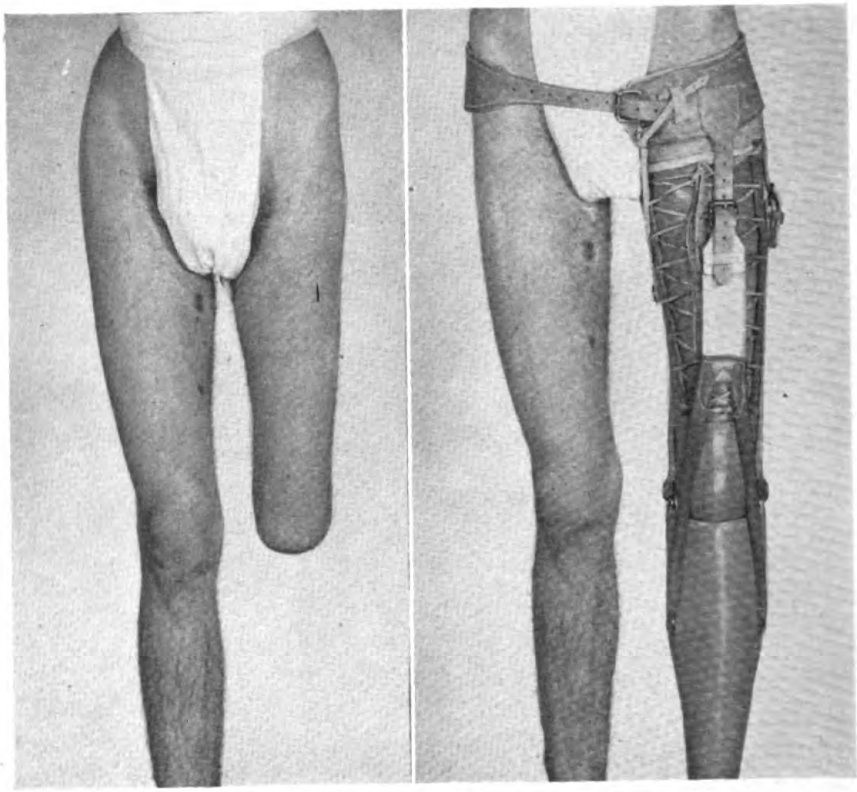


4. Reamputation of thigh.

sired to provide partial end bearing on the stump. In this event an amputation is performed at the most distal point, which leaves sufficient room for the housing of the mechanical knee.

Technic.—The principles of a reamputation are the same as those for a primary flap amputation (fig. 4). The anterior skin flap is laid out a little longer than the posterior flap so that the resulting scar will lie posterior to and not directly over the end of the femur. Laterally the incisions do not extend proximal to the level at which the bone is to be severed, the purpose being to insure a good blood supply to the central portion of the flap.

The incision is carried deep, including the fascia with the skin.



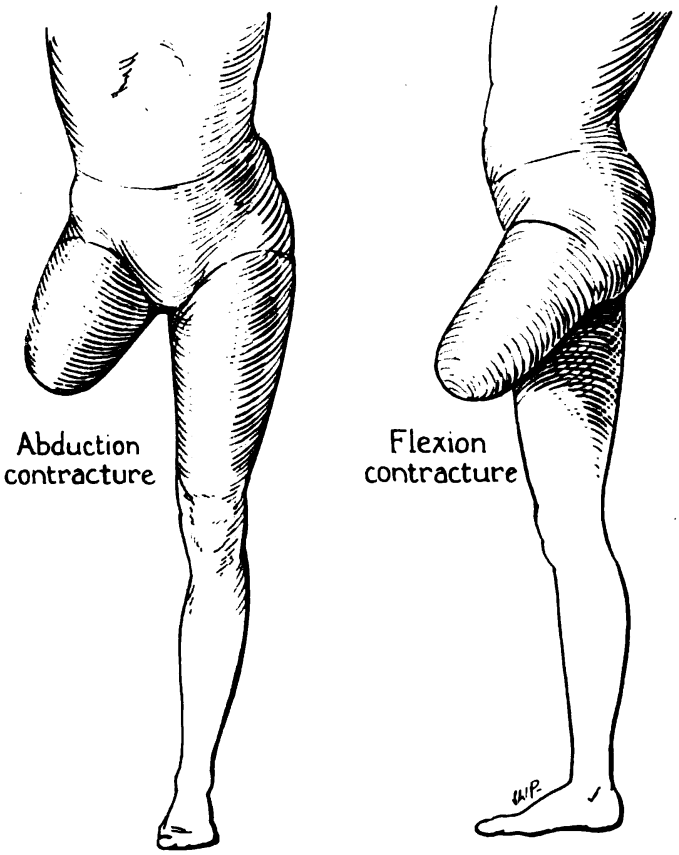
5. Stokes-Gritti amputation and prosthesis.

The flaps are dissected back and the muscles and bone cut across squarely. Muscle is not permitted to extend distal to the end of the femur. Because of its retractility, however, it may be severed at a slightly distal point. The blood vessels are secured with catgut ligatures, since nonabsorbent suture material is not well tolerated in proximity to muscle and is apt to cause irritation under weight bearing. It is the experience at this center that sinus in an amputation stump is caused by sequestrum or a silk ligature.

The nerve is severed and allowed to retract into a cushion of soft tissue. Ligatures around the nerve are to be avoided even at the expense of a little bleeding. The flap is closed over the end of the femur and a drain is placed in each corner of the wound. Should sulfonamides be desired locally, the drug of choice is sulfanilamide as it is absorbed with sufficient rapidity so as not to interfere with wound healing. Sulfathiazole and sulfadiazine are better given by mouth.

End-bearing stumps.—The Stokes-Gritti is the best of the thigh amputations. It provides a complete end-bearing stump, and does not disturb the muscle mechanism of the thigh (fig. 5).

Sixteen Stokes-Gritti amputations have been performed at this center. Many short below-knee stumps which might be suitable for Stokes-Gritti amputation are given a trial of weight bearing.



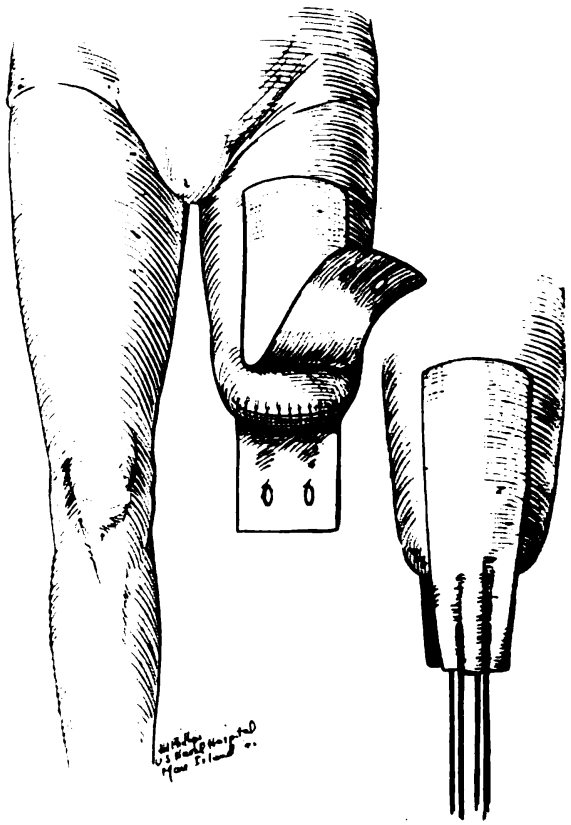
6. Common contractures of hip joint to be avoided.

Every effort is made to preserve the knee. The most modern mechanical knee does not approach the functional perfection of the human knee. It is only when the knee has been irreparably damaged, or where the below-knee stump is too short to be of any value, that the amputation is converted into a Stokes-Gritti. One patient on admission had a disarticulation at the knee with the patella preserved. The pull of the quadriceps had caused retraction of the patella but it was possible to convert the stump into a Stokes-Gritti at a slightly higher level than usual.

In performing the Stokes-Gritti operation, there are several details which contribute to success. The anterior flap is formed so that it crosses the midline over the insertion of the patellar ligament into the tibial tubercle. The incision is carried deep into the knee joint and the patella and skin are dissected back as one flap. The posterior incision crosses the midline just distal to the popliteal fold and is carried deep through the hamstrings. The blood vessels are secured and the tourniquet removed. The femur is severed through the cancellous bone, preserving the flare of the condyles. The posterior surface of the patella is removed with a saw so as to expose raw bone. The patella is secured to the end

of the femur by ligatures passed through drill holes, and it is important to prevent side slipping of the patella during healing. The patellar ligament is secured to the fascia posteriorly and the fascial layers are closed, with a drain in each corner.

Postoperative care.—If left to himself, the patient will seek the most comfortable position and will soon have the thigh stump propped up in acute flexion (fig. 6). The raw muscle ends reattach themselves to the surrounding tissue, and if the stump heals in a flexed position, a contracture in that position will result. It is therefore imperative to keep the stump in a neutral position. Perhaps the best way to accomplish this is to apply skin traction while the patient is still anesthetized and to continue the traction until the wound is healed (fig. 7).



7. Application of skin traction at operation.

As soon as the stump is healed, physical therapy is instituted for the purpose of developing mobility and strength of the thigh stump in the directions of adduction and extension. The amputees who walk least well are those who have abducted and flexed thigh stumps. Such patients will walk with a waddle gait because of the abduction, and with a sway back because of the flexion of the thigh. They will be unable to take a full stride because of their inability to get the leg underneath and behind them. These defects can be guarded against by leaving the thigh stump long, by preventing flexion contracture during convalescence and by instituting early and vigorous exercises.

STATISTICS

This report is based on the 241 amputations through the thigh which have been cared for at this amputation center. Only two of the patients have had bilateral thigh amputations. Of the 241

stumps, 2 were disarticulated at the hip, 223 were amputations through the shaft of the femur at various levels, and 16 were end-bearing stumps of the Stokes-Gritti type.

F. REVISION OF BELOW-KNEE AMPUTATION STUMPS

ORLANDO S. NESTING
Lieutenant Commander (MC) U.S.N.R.

The majority of below-knee amputations seen at this center have been provisional guillotine operations. This type of amputation has been performed with the aim of saving as much bone as possible and of leaving the stump wound open in order to avoid complications.

At the time of admission, the majority of stumps show a granulating wound covered with an oil-base type of dressing. Prior to entry, few have had traction. Cultures taken from wounds have revealed a wide variety of organisms, with no particular bacteria predominating, or appearing to be of unusual importance (fig. 1).

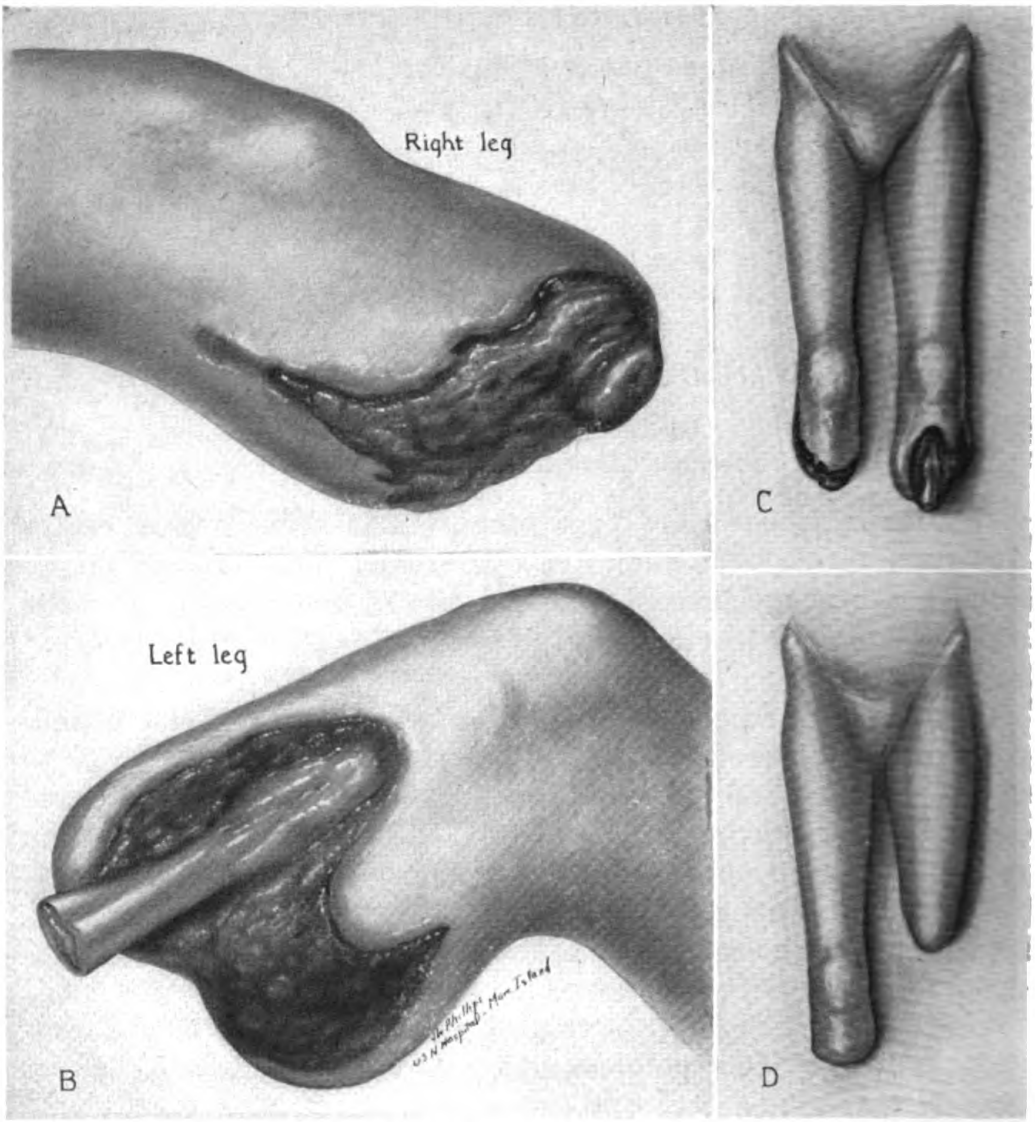
The stumps vary greatly in length. The primary objective has been to save bone length and not to select an ideal site for amputation.

The ideal is to obtain a stump of such shape, length, and condition as to provide a painless and comfortable adjustment to an artificial leg.

Length.—A below-knee stump, ideally, measures from 5½ inches to 6½ inches in length, taken from the joint level. Two inches has proved to be the minimum length to which a prosthesis may be satisfactorily fitted. With a 2-inch stump, it is advisable to remove the entire fibula. If the stump is less than 2 inches in length, it will usually not remain in the socket of the prosthesis when the knee is flexed.

Shape.—A conically shaped stump is the ideal. However local complications such as impaired circulation, scars, repeated infections, and similar conditions frequently force the surgeon to be satisfied with less desirable shapes.

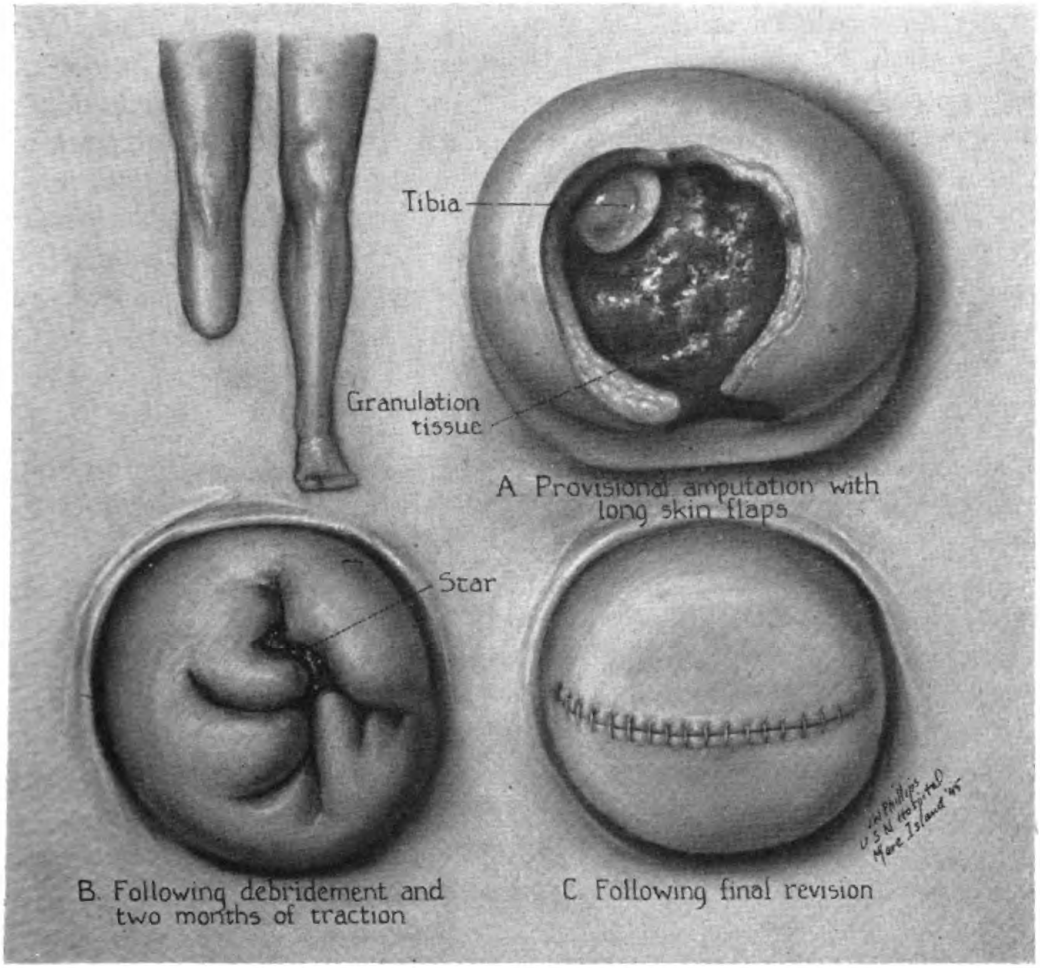
Scars.—A terminal or slightly posterior transverse scar has proved ideal. Anteroposterior scars tend to retract and form sulci with resulting intertrigo and unsatisfactory adaptation to a socket. However the surgeon is occasionally forced to accept a bizarre scar as the end result because of local complications. The scar



1. A, B, C. Condition on admission. **D.** Lack of skin traction during evacuation resulted in loss of left knee because of inadequate skin for revision.

should not be in a position where it will be exposed to pressure. There should be few if any sulci. The scar may be adherent to bone but should not be adherent to soft tissue, because the milking action of the stump in the socket pulls at soft tissue with resulting nerve irritation and a painful stump. Since the skin is elastic and moves freely, adherent scars are best avoided by a row of sutures in the subcutaneous tissue. The deep fascia may then adhere to soft tissue beneath, but the skin moves freely over it, thereby producing a minimum of irritation to nerve ends.

Skin and bone.—Inadequate skin is usually a far greater problem than inadequate bone in the preparation of a stump for prosthesis. The surgeon in the active theater saves as much bone as possible. This is especially important in above-knee amputa-



2. Steps in the management of a below-knee stump where sufficient skin was available to avoid the loss of bone length.

tions. However in the revision of below-knee amputations the surgeon is far more concerned over the lack of skin than bone length (fig. 2). The value of the guillotine amputation with its unnecessary sacrifice of skin is therefore questioned. The principle of the guillotine is good in that it leaves an open, adequately draining wound. The same results, however, can be obtained with the modified flap amputation.

Procedures.—When a patient is admitted, the stump and wound are carefully studied and measured. Photographs, sketches, and roentgenograms are made. Routine laboratory and dietetic measures are instituted, and a general evaluation of the patient's condition is made. A program of dressings, traction, and general care is outlined and followed.

All preliminary treatment aims at wound closure. Before final revision is performed, the stump should be closed and dry. The percentage of failure to obtain an ideal stump is increased by

hurrying into a revision before proper closure of the wound. Occasionally all attempts to close the wound will fail and a revision will be performed in the presence of an open wound. This is done only when inflammation and edema are reduced to a minimum. Closure of the wound may usually be obtained by traction and split-thickness skin flaps for closure. When the wound is closed, dry, and all scabs and debris have had time to be removed, the stump is prepared 48 hours preoperatively and the patient is brought to surgery for his final revision.

OPERATION

Position.—Below-knee operations are facilitated by placing the patient on his abdomen with a small triangular block or folded sheet elevating the leg.

Anesthetic.—Spinal, intravenous, or general anesthesia may be used as preferred.

Marking.—Methylene blue or a similar dye is used to mark the lines of skin incision.

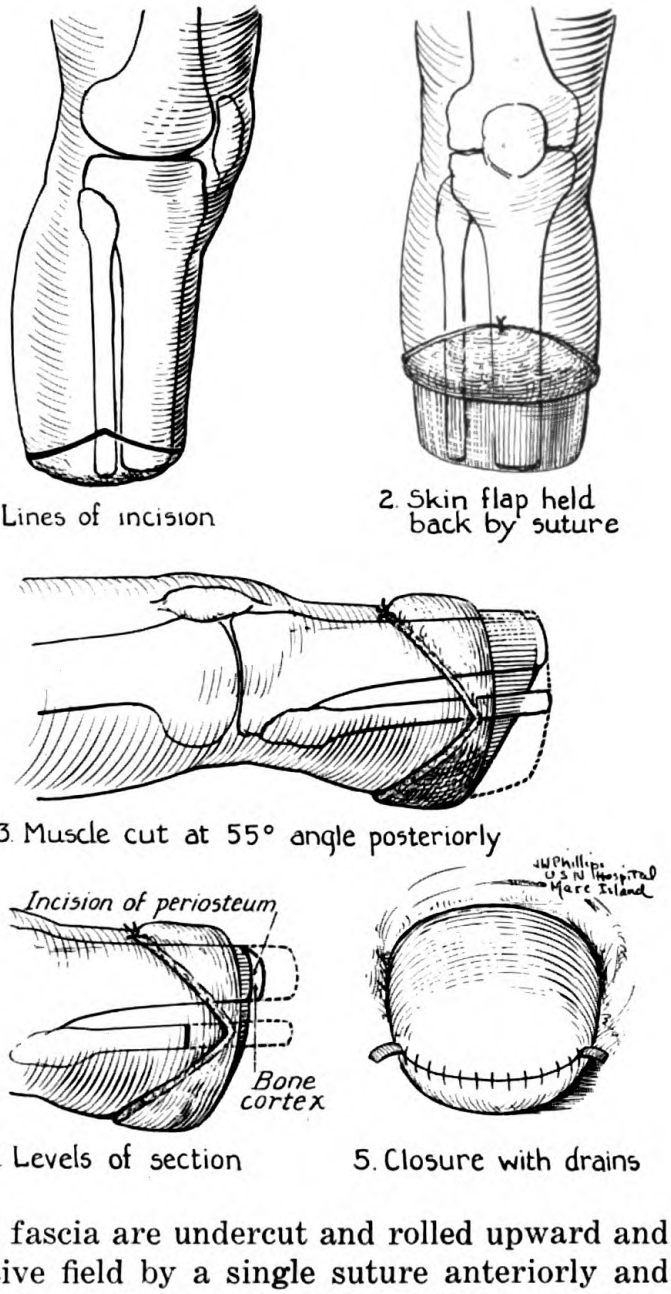
Tourniquets.—Though the use of tourniquets is optional, they are rarely used in amputation, revision, and plastic work on stumps at this center because of resulting circulatory damage to an already devitalized area. Manual pressure on the femoral artery has proved satisfactory for control of hemorrhage.

Flaps.—The anteroposterior diameter of legs varies. The surgeon, therefore, must estimate the length of skin flaps to cover the bones at the level of amputation.

The flaps should be semicircular rather than oblong. The perimeter of the anterior and posterior flaps should be as nearly equal as possible in order to prevent dimpling. The flaps should be equal in length since the stump will not be an end-bearing one. However a slightly longer anterior flap resulting in a slightly posterior scar is satisfactory. Short flaps should be made with enough bone resected to allow loose coverage of the bone anteroposteriorly. The short flap destroys less circulation, with less marginal necrosis and slough. The resulting medial and lateral prominences, dog-ears, may be removed after healing, by wrapping or plastic operation. The center of the wound is the area where necrosis and sloughing ulcers are most frequently seen. Once this area is healed, dog-ears are easily removed.

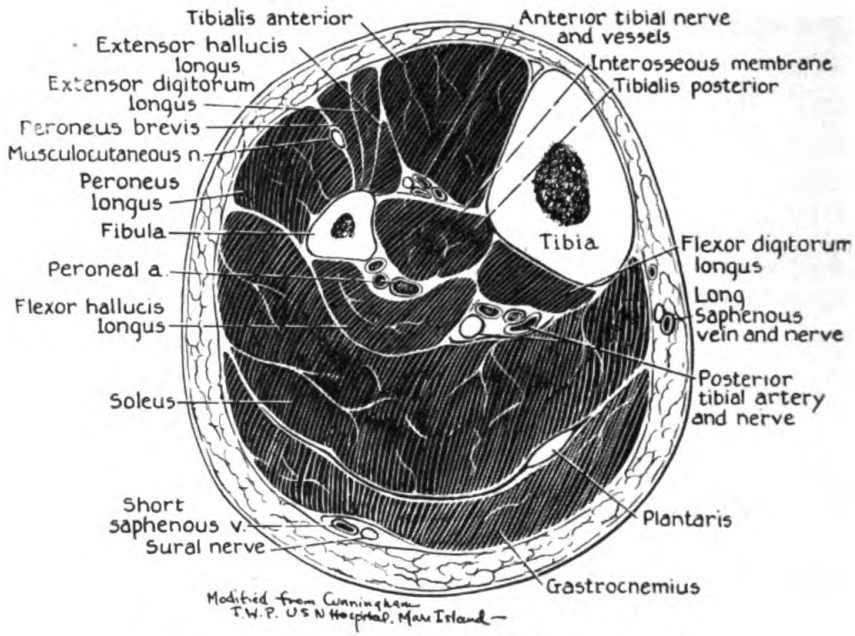
Procedure in extensive revision and reamputations.—With the proper preparation and markings completed, incisions are made through the skin and deep fascia, down to the muscle (fig. 3). These flaps are made in healthy skin, allowing for excision of the existing scar. The skin and deep fascia are cut down to the mus-

3. Reamputation below the knee.



cle. The skin and deep fascia are undercut and rolled upward and held out of the operative field by a single suture anteriorly and one posteriorly through the skin. Anteriorly the fascia and tibial periosteum fuse and the subcutaneous tissue is more sparse than posteriorly. However there is enough tissue to allow for a row of sutures in the subcutaneous tissue at closure.

Anteriorly, the muscle is cut with an amputation knife at right angles to the bone at a point about ½ inch from the rolled cutaneous flap. Posteriorly the muscle is cut at an angle of about 55 degrees with the bone from outside inward and distally to the point ½ inch distal to the level at which the bone is to be sectioned. This oblique posterior incision of the muscle aids in the attainment of the conical shape desired.



4. Cross-section at level of middle third of leg.

A circular incision of the periosteum is made ¼ inch above the level at which the bone is to be sectioned, and the periosteum is scraped distally with a periosteal elevator. The tibia is then sawed through at a point ¼ inch distal to the point of circular incision of the periosteum, thereby leaving about ¼ inch of bare cortex. This decreases periosteal trauma in the beveling process and lessens the tendency for formation of exostoses. The fibula is sectioned at a level 1 inch to 1½ inches above the level at which the tibia was sectioned, by means of a Gigli saw (fig. 4).

The vessels are now ligated with suture ligatures. Nerves are best left alone or gently pulled out a short distance and severed with a very sharp scalpel or razor.

The tibia is beveled and the sharp points smoothed down with a coarse file. Relative hemostasis is assured. Deep drains are placed at both ends of the wound. The subcutaneous tissue is carefully sutured with chromic catgut. The skin is closed with a dermal type suture, and the wound is dressed.

Skin traction with adhesive strips is applied at once. This removes tension from the suture lines, and aids in prevention of flexion contractures of the knee. The patient is given as a routine procedure 1 day of sulfadiazine and penicillin therapy preoperatively, and 7 days of each postoperatively.

Minor revisions and plastic operations.—The same preoperative procedures are used as in the more extensive operation previously described.

In the plastic repair, the scar is excised and the skin and deep

fascia are mobilized by undercutting for a sufficient distance to allow wound closure. Muscle may be excised to facilitate closure. Relative hemostasis is assured, deep drains are inserted at each end of the wound, and the subcutaneous tissue and skin are carefully separated and sutured.

Foot and ankle amputations.—The Syme, Chopart, Lisfranc and Pirogoff operations have been performed infrequently, primarily because the cases admitted have had such extensive destruction of tissue in the area of the foot and ankle as to prevent application of these technics.

Statistical summary

Operative procedure	Number
Below-knee amputations exclusive of foot and toe amputations	230
Prostheses fitted without revision	9
Minor plastic procedures	36
Multiple revisions	18
Single revisions	157

Aftercare.—The wounds are not dressed until at least 5 days have elapsed postoperatively, unless the postoperative course warrants dressing earlier. The drains are removed at the first dressing. Sutures are removed on the tenth or eleventh day postoperatively and traction is maintained continuously for 14 days postoperatively. Sulfadiazine and penicillin are both given for 7 days postoperatively and the patient is placed at absolute bed rest for 14 days postoperatively.

When the wound is healed, the stump is wrapped with an elastic bandage for shrinkage. When the stump has reached a satisfactory state of shrinkage, the patient is fitted with a temporary pylon. After complete shrinkage and conditioning the stump, a permanent prosthesis is fitted, and the patient is ready for discharge, having had a complete course in proper walking and rehabilitation.

Complications.—Hematomas are rare because of the careful hemostasis performed at operation and routine drainage of the wound. Postoperative infection has been minimized by performing revisions only after wound closure, by use of sulfadiazine and penicillin therapy, by infrequent late dressings postoperatively, and by insistence that all personnel applying wound dressings wear masks, gloves and gowns.

Feeble healing and marginal necrosis are combated by the use of short skin flaps, loose approximation of skin flaps anteroposteriorly through resection of adequate bone length to insure that

result, and 14 days' elevation of the stump by keeping the patient in bed.

Postoperative pain is rarely a serious complication with adequate drainage, reasonable use of narcotics, elevation of the stump, and care in not applying too tight a dressing.

Flexion contractures of the knee are rare, if constant traction is maintained, with early physical therapy.

Neuromas and painful stumps are infrequent because of minimum traumatization of the nerve-ends at surgery, drainage of the wound, careful suture of the subcutaneous tissue, thereby decreasing adhesions between skin and underlying soft tissue, and careful fitting of the stump to a prosthesis.

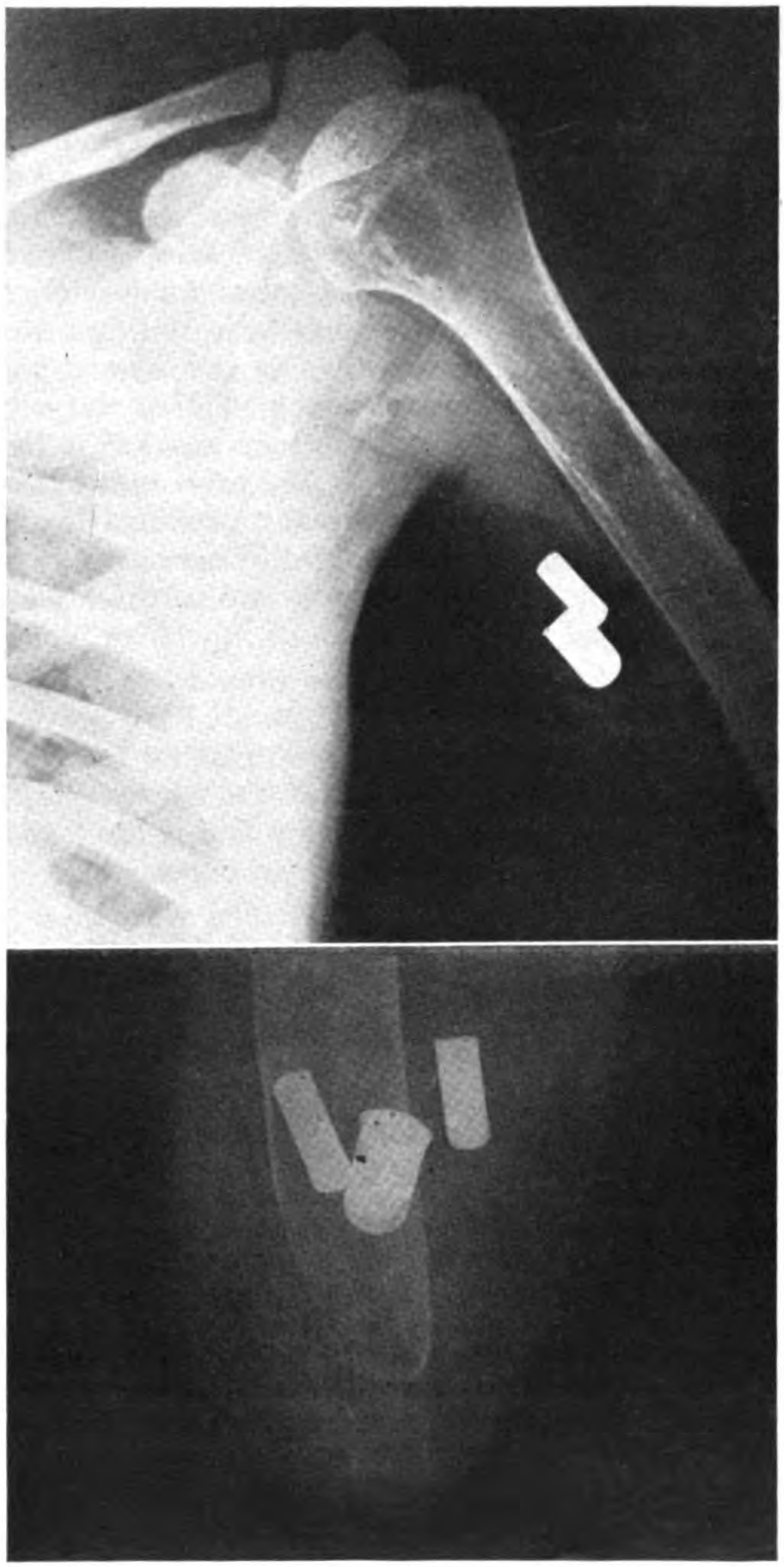
G. PAINFUL STUMPS AND THEIR TREATMENT

DONALD F. COBURN
Lieutenant Commander (MC) U.S.N.R.

The apparent causes of pain in amputation stump neuromas are (1) scar formation about the regenerating fibers with impairment of circulation, (2) infiltration of the nerve trunk proximal to its severed end with scar, and (3) occasional infection in the nerve trunk. The neuroma of an amputation stump is quite similar to the neuroma of a severed nerve in an otherwise intact limb. However patients with a neuroma of a severed nerve complain much less than those with an amputation neuroma.

In view of the similar histologic picture in the nerves of the two types of patients, one is forced to conclude that the circulatory impairment in the amputation stump with its attendant atrophy, and the absence of viable tissue distal to the amputation neuroma are the basic factors contributing to the syndrome of the painful phantom limb, notwithstanding the fact that viable tissue is found distal to the neuroma of the severed nerve in an otherwise intact limb.

The incidence of painful stumps has been very low in this hospital and, although several neuromas have been excised at revisions of stumps, the neurosurgical service has had occasion to operate upon only three patients who have had intractable pain. The most common site for a painful stump has been in the amputated finger, and the treatment of the commonly found medial and lateral neuromas has been one of incision, usually performed by the plastic surgeon.



Tantalum cups applied to nerves in arm stump.

It is apparent that the minimal number of painful stumps which are seen in this hospital is in direct relationship to the technic employed in handling the nerve trunks at the time of the

initial or secondary operation. It seems fairly well established that the following steps are advantageous in lessening painful neuromas: (1) Only slight traction on the nerve trunk during the operation; (2) severance of the trunk as high as is practicable, with little traction, with a sharp scalpel; (3) no injections of the trunk with alcohol or other chemical agents; and (4) covering the end of the nerve trunk with muscle whenever possible, without appreciably altering the course of the nerve.

Excision of the neuroma has been the first step in the treatment of a painful stump. Burying the severed nerve in bone has not been practiced here, although Boldrey states that the technic has continued to give satisfactory results in the hands of his colleagues. On three patients the procedure has been utilized of dividing the involved nerve trunk proximal to the neuroma and covering the proximal end of the nerve with a tantalum cup, holding the latter in place with two or three fine tantalum wire sutures passed through the sheath.

The purposes of this procedure have been (1) to minimize the amount of scar formation in the end of the nerve, (2) to prevent scar from adjacent tissues from invading the nerves, and (3) to protect the future bulbous end of the nerve from the irritation of external stimuli. The cup is rigid and is large enough to prevent constriction of the blood supply in the nerve.

To date the results of this method with these very few cases have been encouraging, and it is planned to handle additional cases in the same manner.

H. REHABILITATION OF THE AMPUTEE

HENRY H. KESSLER
Captain (MC) U.S.N.R.

The aim of medical and surgical treatment is the relief of symptoms and the restoration of working capacity. In the military service, return to duty is expedited by programs of physical conditioning, convalescent training and occupational therapy.

For the amputee, use of all the resources of treatment and the development of the physical powers of the patient cannot achieve return to duty or to full working capacity. A small number of amputees can carry on limited service activities, but for the majority amputation is the open door for discharge from the

service. The plan of treatment for this group, therefore, must be designed for their return to civil life. Both the process and the methods of this adjustment are what is meant in this article by the term "rehabilitation."

Rehabilitation has many meanings. The accepted interpretation is the restoration of the patient to his pre-illness or pre-accident status. If he had been a machinist or a farmer before entering the service, successful rehabilitation would be achieved if he were restored to those former occupations.

If this idea is applied to the background, qualifications, and needs of the patients at this amputation center, it would be found that the majority of these men did not go beyond the eleventh grade in school. Many were in unskilled occupations. More important still is the fact that these men are older and their personalities have been changed by their service experience. To restore these amputees to illiteracy or blind alley jobs or to their previous personalities is unwise and frequently impossible. The conception of the term rehabilitation must be modified, therefore, to mean the utilization of the physical and mental powers of the amputee to achieve optimum social and civil adjustment.

The problems which face these men after discharge must be taken into consideration. Some of these problems are expressed in the anxieties of the patients when they arrive here from overseas. They want to know, first of all, how their wives and sweethearts will be affected by their disability. They want to know how their communities will receive them. They want to know whether they will be able to work in remunerative employment.

It is a responsibility of the Rehabilitation Service to resolve these anxieties. Psychologic adjustment takes place rapidly through the segregation of large numbers of amputees in a center of this type. It is uncommon to find a man depressed because of his disability. Discipline by his group and automatic evaluation of his disability by comparing himself to his buddies and shipmates reduces the sense of loss of the arm or leg. As one patient described it, "I did not lose it, I gave it."

Communication with his family and his loved ones soon overcomes his fears and qualms as to how they will react to his disability. As he observes his buddies and shipmates being fitted with prostheses and walking satisfactorily, the problem of walking is also resolved. By participating in the rehabilitation program in the hospital he soon answers his own questions about his capacity to work and his ability to become a civilian again. There are other problems that disturb him which cannot be resolved in the hospital, but these are of minor importance. The returning amputee is also disturbed about G.I. wisecracks after he ex-

changes his uniform for a civilian suit. He is disturbed about rationing and about a host of other actually insignificant problems he has heard bandied about in "bull" sessions overseas and even on the wards of the hospital. All these problems cannot be solved in the hospital environment, but the important adjustments to the requirements of social living after discharge can be met.

There are four major objectives, the foundations of which will be laid in the hospital. They are (1) social living (the routine pursuits of life), (2) the ability to take care of himself (personal hygiene), (3) the problem of transportation, and (4) the problem of employment with all its ramifications. Rehabilitation is the provision of those principles, technics and ideas which will help the amputee to solve these problems. Occasionally, full realization of these objectives may be achieved before the patient leaves the hospital. In general, the active application of the principles learned takes place on the larger stage of civilian life.

There will be those who will make a rapid and satisfactory adjustment because of strongly integrated personalities. They know exactly what they want to do and where they want to go. On the other hand, for a small number the outlook and attitude is thoroughly hopeless, either because of the severity of their disability (high double thigh amputation, for example) or because of severe emotional problems too deep to be affected by routine psychiatric or hospital treatment.

The majority will make more or less satisfactory adjustments depending upon their individual equipment mentally and physically and the individual life situations which they face after discharge. Among these life situations is always the usual prejudice of the man in the street toward a person with a physical defect. This attitude is an atavistic one, an instinct which has grown out of the primitive fear of the unknown. Persons with physical defects have too frequently been associated in the minds of men with the devil, malignancy, sin, and evil spirits. Despite centuries of enlightenment, this idea still prevails. Because of this important barrier to adjustment it must be fought constantly. Its malevolent influence can be modified by reducing the physical defect and improving the physical and mental powers of the individual

PHYSICAL RESTORATION

The first step in the rehabilitation process is that of physical restoration. This is accomplished by means of prosthesis. In the lower extremity the artificial leg serves two functions. It conceals the defect and it replaces the function that is lost. Psychosocial prejudice is thereby minimized while the ability of the amputee

to discharge his work responsibilities approaches the normal.

In the case of the upper extremity, concealment of the defect is less adequate. Furthermore the function of the natural hand cannot be reproduced—only imitated. Psychologic prejudice and functional capacity are less adequately met. Nevertheless by means of prosthesis the patient's powers are improved.

The amputee is directed then to the four objectives: Social living, personal hygiene, transportation, and work capacity. These ends are achieved under a program of physical conditioning, occupational therapy, and convalescent training. Before the patient is discharged from this hospital he must satisfactorily pass an achievement test which includes the major elements of the aforementioned four objectives. The hand amputee must learn to dress and undress, tie his shoes, feed himself, lock and unlock a door, handle a key, write, manage a telephone, drive a car. The leg amputee must also pass an achievement test. He must learn how to drive a car, ride a horse, dance, bowl, swim, engage in other sports activities, climb a platform, and descend a ladder or stairs. These are not isolated activities but are carried along with other features of the rehabilitation program.

Though the objectives of personal care, transportation and social living are important, the major factor in the patient's successful rehabilitation will be his economic adjustment on his return to civil life. This phase of his adjustment is, therefore, emphasized in our program.

VOCATIONAL GUIDANCE

In the last war, the patient's plans for his future adjustment in civil life began after he left the hospital. These adjustments were frequently unsatisfactory because of frozen habits, wasted time and opportunity, and the administrative difficulties that had to be solved before he was accepted by the rehabilitation agency. The valuable period of hospitalization can now be utilized to assist the amputee in planning for the future life he is to live upon his return home.

The best technics of vocational guidance, orientation and training are made available while he is in the hospital. They can be undertaken only after an evaluation of the patient's mental as well as his physical equipment. An appraisal of the patient's capacities and abilities, his interests and aspirations can be obtained by observation, by interviews and by aptitude testing. In this connection, a staff of Educational Services officers are available to counsel and guide the patients in a choice of future occupations. More than a thousand interviews are given each month.

When a patient has made his decision concerning postservice educational or employment plans, he embarks on a program of training or vocational exploration during the period of his hospitalization. This program has the purpose of facilitating or supplementing his training and experience, thereby making his adjustment easier. To that end, arrangements can be made for educational programs on the grade school, high school, and college levels. Credits on the high school or college level can be completed, thus helping patients to qualify for jobs having educational requirements. Commercial and trade training likewise is made available. Trade training raises many physically handicapped amputees from the unskilled to the semiskilled or skilled class, thus ensuring greater economic returns and personal satisfaction.

For the amputee who has sloughed off many of the controls and influences of home, church, family, and workplace during his military service, a supervised program of actual employment provides an opportunity to regain the homely yet important industrial virtues. In this program which is termed here "work-training," he again learns the importance of punctuality, responsibility for property, and the value of a dollar. Work-training provides him also with a laboratory where he can test out his vocational interests. He learns to transfer the loyalties toward his buddies and chiefs of his combat unit to the employer, foremen, and fellow workers of the industrial unit of which he becomes a part.

When he is discharged from the hospital, he has been physically restored by prosthesis, he has been vocationally guided and trained, and is prepared to resume his life work interrupted by the war, equipped by additional training and by an orientation and comprehension of the problems he has to face.

PROCESSING

The processing of an amputee from admission to discharge takes the following course. Evacuated from the South Pacific by air or ship, he is brought to the hospital for the completion of the surgical management of his amputation stump, where it is brought to that final state which will make it fit an artificial leg with a maximum of comfort and utility.

As soon as possible, even before the final steps of wound healing, the patient is urged to get out of bed. Long bed care only intensifies depression and anxiety. His general physical condition is improved by systematic exercises in general body conditioning. As soon as the stump is sufficiently conditioned, a temporary prosthesis is applied. The patient learns to walk and balance

1. Various handicrafts are available for training the arm amputee. Fly-tying is one of the popular activities.

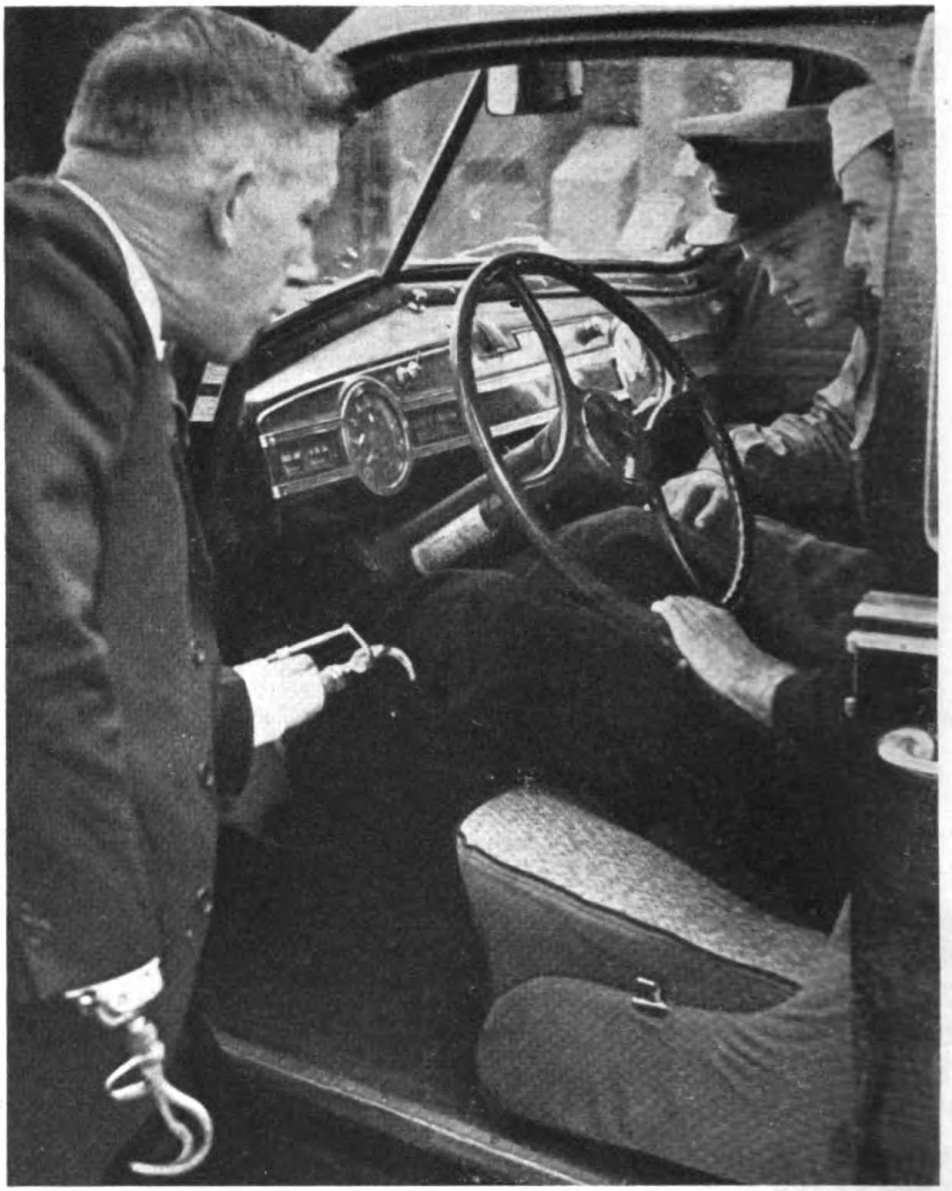
—American Red Cross Photo.

himself. He toughens the stump to meet the demands of weight bearing. When the stump has shrunk and a permanent prosthesis been applied, he is conditioned to a full day's work demands as well as to social activities.

In the early days of hospitalization, a limited program of occupational therapy is made available (fig. 1). Leather work, fly-tying, knotting, the care of miniature gardens, finger painting, carving airplane models are a few of the activities in which he is encouraged to participate. For the arm amputee, training in the use of the remaining arm may be begun early. This training may take the form of writing or typing and other occupational therapy procedures such as drafting, blueprint reading, sketching, and simple electrical assembly. When he is ambulatory, he can carry on in radio and auto repair, printing, agriculture, carpentry, or watch repair work (fig. 2).

The stimulation of interest in leather work, whittling or lapidary work is a stepping stone to interest in correspondence courses or self-help courses in blueprint reading. The patient is thereby prepared for the services of the Educational Services officer who will spend considerable time discussing his plans for the future.

When the patient is ambulatory, an opportunity for more intensive counseling is available. The patient's whole background

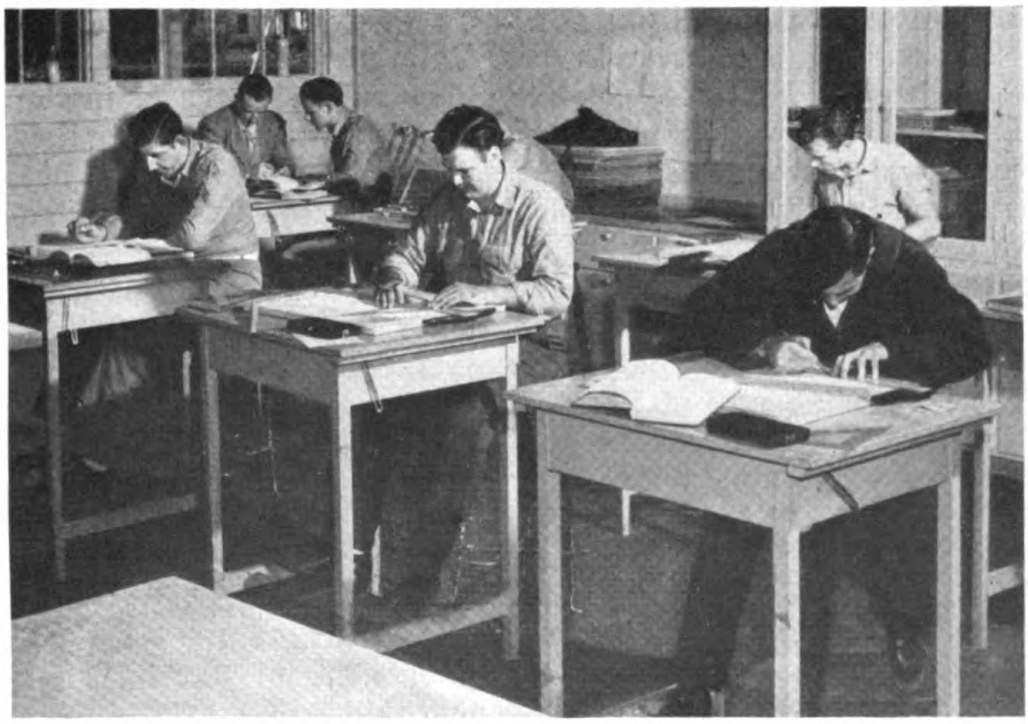


2. Amputee teaches amputee to drive.

is spotlighted and all the facets of his personality are explored. This requires not only technical competence on the part of the counselor but definite rapport with the patient. Personal magnetism will frequently compensate for even limited technical ability in this field. The patient must sense the counselor's vital interest in his welfare (fig. 3).

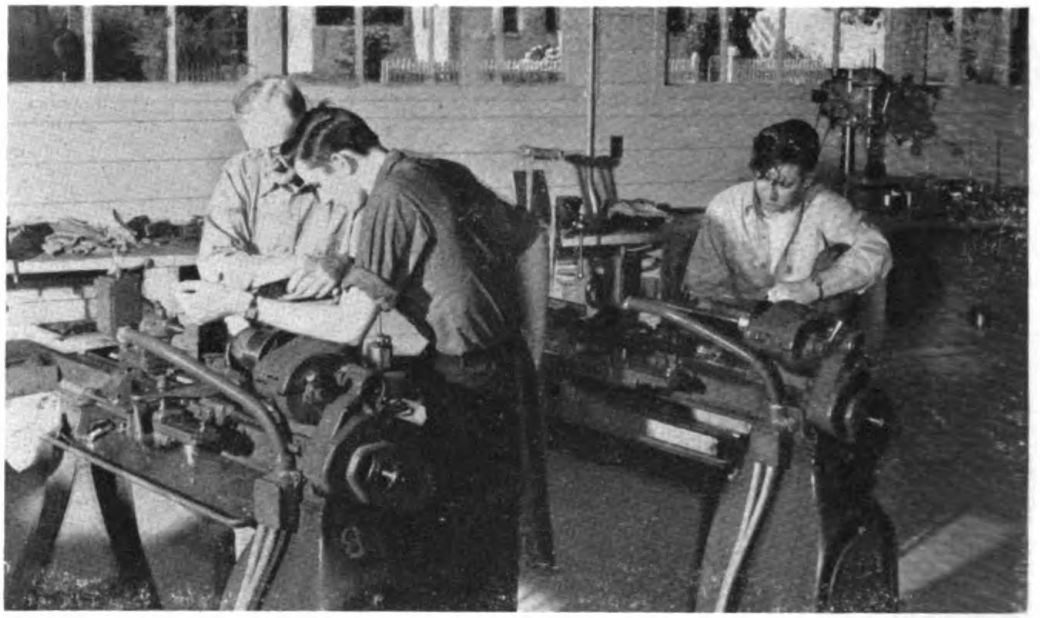
In helping patients to arrive at satisfactory vocational objectives, it may be necessary to avail ourselves of detailed psychologic analysis by interviews, observation, and special tests. Some wish to go into the fields of law, dentistry, ballistics, radio, welding, electricity, or metallurgy. Some plan to work as machinists, veterinarians, grain and feed buyers. The choice of the training

3. Vocational counseling assists the amputee in determining qualifications and vocational interests.



4. Amputees learn drafting, mathematics, and other school subjects during convalescence.

—Official U. S. Navy Photo.



5. The machine shop is a valuable laboratory for testing work capacity and aptitudes.

—Official U. S. Navy Photo.

program must, in the final analysis, be that of the patient. It is he who makes the selection with the assistance and guidance of the staff. Training must also take into consideration the period of the hospital stay and the necessity of frequent interruptions for surgery and limb fitting.

This training is of several types. Tutorial training is arranged by instructors who meet patients either on the wards or in the classroom to help them with mathematics, science, social studies, mechanical drawing, and commercial subjects (fig. 4). The five part-time instructors who implement this phase of the program are accredited to Napa Junior College.

Arrangements have been made for actual attendance of patients at a variety of schools, as Napa Junior College, Stanford University, California School of Fine Arts, Samuel Gompers Trade School, Pacific School of Radio, University of California, Vallejo High School, San Francisco Junior College, Santa Rosa Junior College, Sacramento Junior College, and San Francisco State College.

Similarly, arrangements have been made with the Apprentice School, Navy Yard, Mare Island; the Radio Material School, Treasure Island; and the Torpedo School, Navy Yard, Mare Island, to take convalescent patients on a more or less informal basis in order to aid them in developing skills (fig. 5).

Employers in this area have accepted patients for part- or full-time employment and such employment contributed, in the opin-

ion of the rehabilitation officer, to the patient's rehabilitation. Full advantage has been taken of modern technics in matching the physical capacities of the amputee to the physical demands of the job in accordance with the methods developed by the Occupational Analysis Division of the War Manpower Commission.

Prior to discharge each patient is interviewed by a full-time veterans' representative of the United States Employment Service (USES). He completes a referral card and sends it to the regional or local office of the USES nearest the home of the patient. Upon arrival at home the patient is contacted by USES which maintains constant interest and supervision until he is placed in satisfactory employment in his home community. Furthermore the hospital keeps contact with its former patients by individual card and letter. Use is made of the services of the Red Cross. The hospital thereby gains valuable information regarding the patient's adjustment to his artificial limb, his home situation, and his employment. Those who live in areas adjacent to the hospital have the opportunity of further consultation and aid regarding both their prosthetic and their occupational problems by the staff at Mare Island. Those who are far removed are referred to the Veterans' Administration, the State Rehabilitation Commission, the USES, and the Selective Service Boards in their home communities.

CASE REPORTS

Case 1.—A Marine corporal had just completed the eleventh grade when he entered the Marine Corps. He lost his right leg above the knee in action on Guam in July 1944, and returned to the States in August. He was interviewed in his bunk at the U. S. Naval Hospital, Mare Island, by the Educational Services officer 3 days after his arrival. The purpose of this preliminary interview was to gain a rough idea of his educational and occupational background in order to gage his probable future course of action.

He was bedfast for a number of months because of a series of operations. During the course of several interviews, the Educational Services found that the occupational experience which interested him the most was a job with an aquarium. Fish breeding had been his hobby for 6 years. Inasmuch as he was undecided regarding his occupational choice and further schooling, it was necessary to find him a goal in order that any work carried on during convalescence would be a meaningful experience for him. An occupational interest inventory test was given to him at this time and it verified his interest in the field of nature. He also had high scores in science and art.

The next step taken by Educational Services officers was to write to various colleges in the St. Louis area from which this amputee came, to find out what training was needed in ichthyology, and he was urged to complete his high school education. As he was still a bed patient, he enrolled in English literature; the English course was taught by a hospital corpsman who was a former high school principal and who has been granted emergency credentials

from nearby Napa Junior College to teach patients during off-duty hours.

After his Marine Corps records and his high school credentials were received, he was interviewed by the principal of Napa Junior College. The principal evaluated his service schooling and military experience, together with his high school record, and informed him that at the completion of the English literature course, a Napa High School diploma could be awarded to him.

However while this was an important step in his future planning, he still needed information regarding ichthyology, its physical and educational requirements, and as a future career. Interested replies to questions were forwarded from the State of Missouri Conservation Commission, the St. Louis Zoological Board of Control and others, so that a general picture of the field in that area was drawn.

In the meantime he completed his English course and went home on leave over the Christmas holidays. While he was at home his mother did a great deal toward helping him to make up his mind to go on to college—a plan which he had been urged to follow almost from the beginning, but in which he needed the added weight of his mother's wishes to convince him of its value. He is now planning on entering the second semester of Napa Junior College as a full-time student until he is finally surveyed to civil life, at which time he expects to continue his college career, majoring in ichthyology.

Case 2.—This officer, a lieutenant, junior grade, was wounded in the battle of Peleliu, losing his right arm at the shoulder. Before the war he had taught social studies and coached for 4 years. Arriving at the U. S. Naval Hospital, Mare Island, he expressed an interest in further education, particularly counseling and vocational guidance. Rehabilitation counselors at the hospital pointed out that his disability would be a social handicap in his chosen field, but the lieutenant's interest and drive in the field of education was so strong that he brushed aside these objections. In an attempt to acquaint him in fields other than teaching, he was referred to a large manufacturing company in the San Francisco Bay area. They were much impressed by his personality and ability, and wanted to hire him as a veterans' personnel manager, but a call from his former superintendent of schools promising him a job as a school counselor drove any thought of business from his mind. He decided definitely to continue in the educational field. Investigation disclosed that, starting in January, he could finish work in guidance and counseling at Stanford University's School of Education, which would give him a Master's degree by August.

Armed with letters of introduction, the lieutenant enrolled at Stanford University, went to register for his courses with the guidance professor, but found that he was on leave for the purpose of organizing a counseling program at San Quentin prison. However arrangements were made for him to start his course of training at San Quentin under the supervision of the guidance professor. This will have the added advantage of giving him invaluable experience in a practical situation. He will write his thesis at San Quentin and, upon his return to the University campus later in the year, he will finish the other requirements for the degree.

In the meantime, he returns to the hospital periodically for further surgery and limb fitting. His schooling does not interfere with his convalescence and his drive and interest are such that he can take full advantage of time spent in the hospital.

Under an ordinary hospital situation, this amputee would have been forced

to "sweat out" his convalescence without organized help in furthering his educational and vocational plans. On the other hand this case is a shining example of how the system of helping a man find his goal and getting him started toward it works out in an actual rehabilitation situation.

Case 3.—This seaman, first class, with a right below-knee amputation, wished to become a watch repairman. Through the California State Rehabilitation Commission, arrangements were made for him to try his skill at this trade. He found that he had neither the basic dexterity nor the inclination to carry on this type of work. He finally found the type of work he desired with the Tennessee Eastman Corporation. This man made his mistakes in the hospital and escaped the resultant frustration and economic loss of these false steps after discharge.

Case 4.—A Marine private, first class, with an amputation of the right leg above the knee from wounds received at Cape Gloucester, was an apprentice lens grinder before entering the service, having completed one year of apprenticeship. Arrangements were made for him to continue lens grinding and to work off more apprenticeship time while convalescing.

PLACEMENT

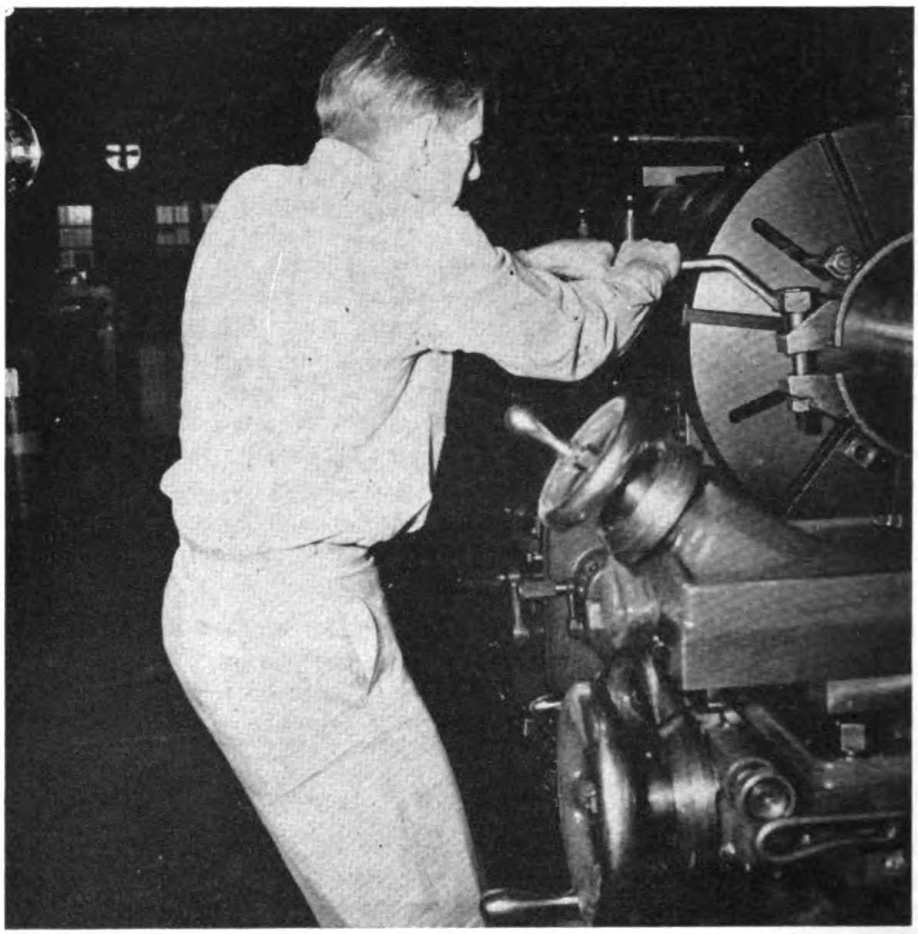
Work-training projects are designed for two purposes. In the first place, the over-all training serves as a preliminary field of exploration from which the selection of a permanent vocation may be realized. It is very important that the patient avoid frequent job changes after his discharge from the hospital. He can make these changes while he is still a patient in the hospital, without the sense of frustration that accompanies these consequences in civilian life. Work-training affords the amputee additional opportunity to determine how well he conditions himself to the physical demands of the job and demonstrates the adaptation of the amputation stump to the job requirements (fig. 6).

Case 5.—An aviation machinist's mate, second class, who lost his right leg below the knee, will find a place with his uncle who operates a large dental laboratory. Work-training was provided for him in the Navy dental clinic.

Case 6.—A Marine sergeant, who suffered a gunshot wound of his left hand, is employed at the State Game Farm, Yountville, California, breeding pheasants and partridges.

Case 7.—A seaman, first class, with an amputation of the left arm and with the loss of his left eye, is working as a glass blower at the Radiation Laboratory of the University of California.

Case 8.—Another seaman, first class, lost his left arm at the shoulder as a result of a bomb explosion. He was provided with a hook arm prosthesis but it was questionable whether he could utilize it because of the severity of his disability. He received intensive training in the occupational therapy department and work-training was deferred until he had mastered the use of his prosthesis. A job was then secured for him as a butcher's helper in the Navy Yard cafeteria. He developed a remarkable facility in cutting meat as



6. Leg amputee in work-training finds himself capable of operating a heavy lathe for a full workday.

well as carrying out the difficult mechanical chores of lifting and transporting large trays of meat. Although it is questionable whether he will continue in the butcher trade after he leaves the hospital, he has demonstrated to himself the utility and practicality of his prosthesis.

Case 9.—An aviation radioman, first class, who lost both legs below the knee in action on Bougainville, had been a farmer before he entered the service. Because of his disability a return to the farm in an active capacity was seriously questioned. He was fitted with temporary legs and allowed to go home on leave. His father wired for an extension of his leave so that he might assist in the harvesting of the crops. When he returned he was in excellent health, tanned and had gained in weight. His stumps, too, were in fine condition, ready to be fitted with his permanent legs. For more than two months he had worked on the farm operating a tractor and a binder and carrying out all the chores of farm work.

Other men are employed in aircraft assembly work as electricians and machinists, as bookkeepers, draftsmen, printers, telephone servicemen, auto repairmen, wholesale meat handlers, etc. The many industrial and commercial enterprises in the vicinity of the hospital are glad to employ these men. The employers are assured of loyal, competent and eager service. The trainees are

7. An industrial shoe store on Mare Island furnished two amputees an opportunity for developing sales ability and learning general business principles.

provided with opportunities that galvanize latent powers into action.

In operating a well-rounded rehabilitation program it is necessary to avail oneself of the assistance of all those agencies and groups that are participating in the national program geared to the adjustment of the veteran to civilian life. To this end, a full-time representative of the United States Employment Service has been assigned to the hospital for the purpose of referring the amputee to suitable employment in his home community. Registration with the USES assures the amputee of direct contact with

a veterans' representative of the USES in his home city. The type of work begun in a work-training position at the hospital can thus be continued after discharge.

A full-time representative of the Veterans' Administration is also on the premises. All Veterans' services are explained to the amputee before he is discharged and the necessary forms completed to establish his right to pension and other benefits. The California State Bureau of Vocational Rehabilitation also maintains a representative on the hospital compound. One of his important duties is to see that vocational training which has been started in the hospital is continued after discharge until such time as the veteran's pension has been adjudicated and his rehabilitation taken up by the Veterans' Administration.

The following cases illustrate how amputees have fared in returning to civilian life.

Case 10.—A Marine private, first class, who lost his right arm at the shoulder at Bougainville, has had continuous employment with an automatic music company. In addition to this satisfactory work record, his adjustment to community activities is 100 percent.

Case 11.—A liaison officer between workmen and engineers is the position enjoyed by another Marine private, first class, who lost his right arm at the shoulder at Cape Gloucester. His preference is for electrical engineering, and he plans, with the assistance of the Veterans' Administration, to take a refresher course in his chosen field in a year and eventually go into business for himself. He is a prospective father and takes great pride in his home, which he is remodeling and redecorating himself.

Case 12.—Since his discharge, a fireman, first class, of the regular Navy, who suffered an amputation below the right knee at Guadalcanal, has been continuously employed as a machinist in a welding shop. He enjoys a full social life and uses his artificial leg so skillfully that many persons have no idea he lost a leg.

Other wars with their quota of disabled veterans have left many with the disillusionment of broken promises. It is the aim of the rehabilitation program at Mare Island to fulfill these promises not *after* demobilization but *before* discharge, thus realizing the ideal that "the object of all help is to make help superfluous."

COMPRESSION DRESSING OF AMPUTATION STUMPS

DUNCAN C. McKEEVER
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Observation of patients who have had amputations from 2 days to 2 weeks prior to their arrival at this base hospital leads to the conclusion that the treatment of the stumps by means of skin traction is entirely inadequate and ineffective and, in some cases, may be harmful. This is particularly true of thigh stumps. It seems that this treatment, which is fairly effective if constantly supervised and reapplied, is not satisfactory for cases subject to the comparative neglect incident to constant change of conveyance during transport of the patient to rear areas. All traction is soon lost due to slipping of the adhesive strips. The circular strips, usually applied to maintain the linear strips, tend to become constricting bands which result in marked swelling and the formation of an edematous bulb of the tissues of the end of the stump and retraction of the skin and soft parts. All stumps exhibit some degree of retraction when first seen here, and in thigh amputations this may amount to as much as 4 inches.

At best, skin traction, even when constantly maintained, only serves to prevent the retraction of the skin, and it cannot do even that during constant transportation. If elastic traction or other device is used against a splint, such as the Thomas splint, the traction strips slip, and the traction is lost. In addition the patient is frequently unable to move himself enough to prevent the formation of a decubital ulcer.

The Esmarch bandage is used frequently to force down the ends of cut tendons and muscles. A practical application of this principle to the handling of amputation stumps has been found to give very good results. The standard elastic bandage can be used. It is best applied at the time of amputation but can also be used to treat retraction and edema after they have occurred. If applied at the time of amputation, redressing need not be done for 10 days or longer. During this time the patient is quite comfortable, can be moved easily and can move himself enough to prevent the formation of pressure sores.

Method.—After guillotine amputation the distal skin edges are grasped with several towel clips or the subcutaneous fascia may be grasped with hemostats. With these the stump is held up. The

part is then painted with tincture of benzoin or with Ace adherent if it is available. Starting at the joint proximal to the amputation, three overlapping turns of a 3-inch elastic bandage are made under the amount of tension necessary fully to stretch the bandage. The bandage is then carried distally, overlapping two-thirds of its width on each turn so that three layers are applied up to the skin edge.

A piece of felt or other padding may be placed over the proximal end of the adductors of the thigh, or over the tibial crest or head of the fibula, to prevent too much pressure, but if the bandage is not applied too tightly this will not be necessary. A 2-inch strip of adhesive tape is placed around the proximal end of the bandage to prevent its rolling down the stump. This step is very important. At this point the end of the stump is usually definitely cupped.

The clips are removed and if the bandage has been properly applied, no retraction takes place. A separate end dressing of vaseline gauze and sulfanilamide is then applied. This end dressing may be changed as often as necessary without disturbing the compression bandage.

If such a dressing is applied at the time of amputation, edema does not develop and the closure is rapid. If applied after edema has a start, there will be profuse serous drainage until the edema is reduced. This necessitates frequent change of the end dressing and earlier reapplication of the compression dressing. There is some discomfort for from 30 minutes to an hour if the bandage is applied several days after amputation, but after this it is very comfortable. The patient can be moved and can shift position easily. He will soon be able to be up in a wheel chair or on crutches. This is mentally and physically beneficial.

With this dressing it has been possible to close completely thigh stumps which when first seen at the hospital had as much as 4 inches of soft part retraction. This is a very important advantage in the shorter thigh stumps.

In conclusion it may be said that the widely used and recommended traction dressing for amputation stumps is entirely inadequate under field conditions. A compression dressing with the readily available elastic bandage has been proved ideal for such dressings, and it offers many advantages over traction for use anywhere.

TRANSPORTATION OF PATIENTS BY NAVAL AIR TRANSPORT SERVICE

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and
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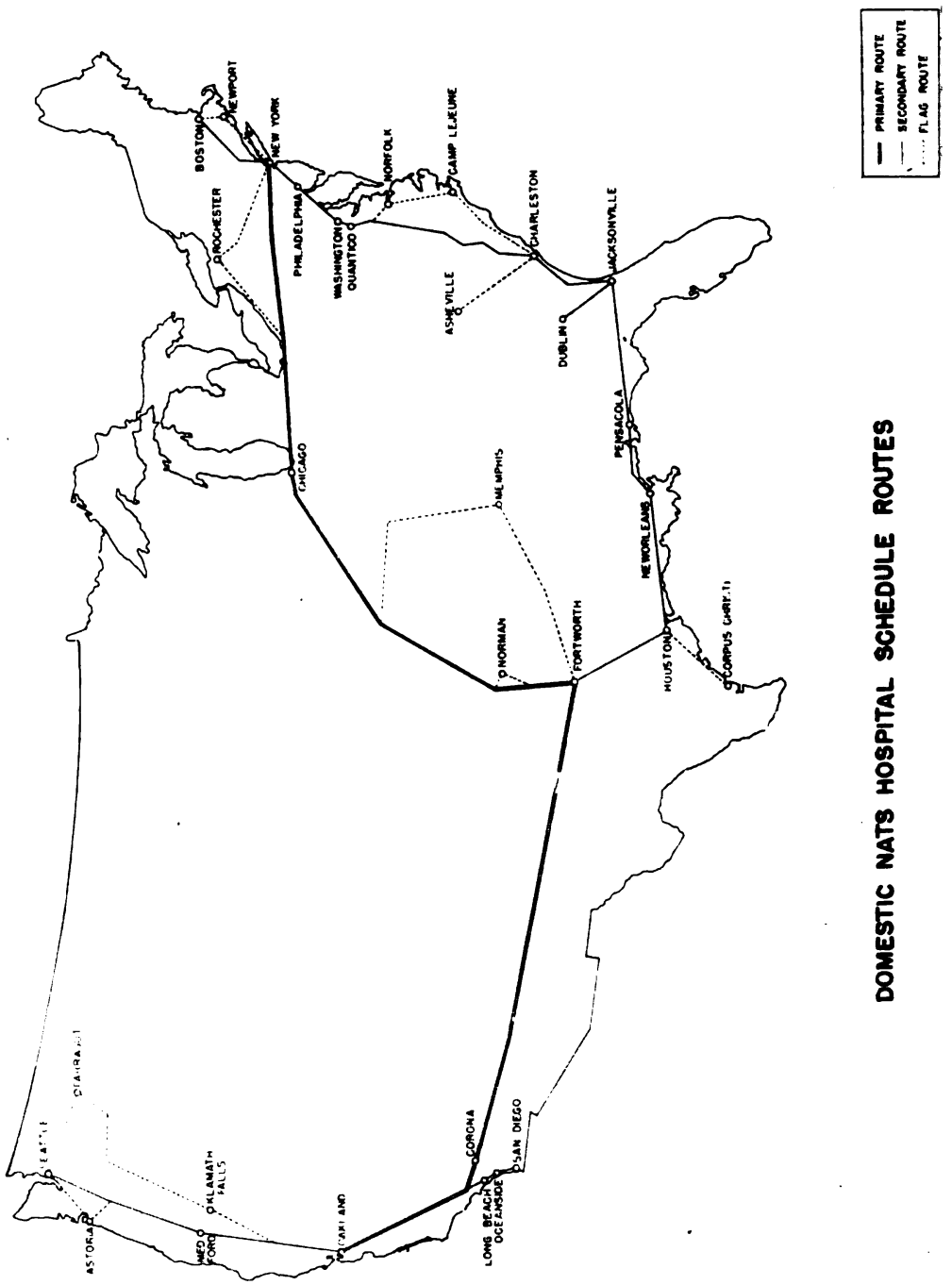
Experience accumulated since the beginning of the war has proved that most patients can be transported by air without undue hazard. The purpose of this article is to discuss a method by which patients can be transported as a part of an existing, regularly scheduled air service. The methods presented are now in operation in the Naval Air Transport Service within the continental limits of the United States and are applicable, with certain minor modifications, to Naval Air Transport Service operations in all theaters of the war.

The patients moved by NATS originally were members of the NATS organization stationed at far-flung detachments who became ill and required rapid transportation to the nearest Naval hospital. As hospitals along the route became aware of this movement they requested NATS to assist them by transporting certain patients who required urgent treatment in specialized hospitals. Although the mission of NATS is to move high priority cargo and passengers, its facilities are readily adaptable to the transportation of patients. Therefore as the demand for this type of service developed, NATS began to carry increasingly larger numbers of patients. The responsibility for the medical care of these patients while en route, however, remained with the medical activity effecting the transfer, as NATS had no medical attendants or supplies available for this purpose. The airline performed primarily the services of a carrier, exercising only such controls as were deemed necessary for the safety of the aircraft.

For the transportation of psychotic patients between the Naval Hospital, Mare Island, and the Navy Unit USPHS Hospital, Fort Worth, special flights were conducted regularly. As a result the Commander, Naval Air Transport Service, West Coast, devised a scheduled hospital airplane service between all Naval hospitals within the continental limits of the United States, as recommended



DOMESTIC NATS HOSPITAL SCHEDULE ROUTES

by the squadron flight surgeons under his cognizance. Plans and schedules for this service were approved by the Chief of Naval Operations and the Bureau of Medicine and Surgery and were disseminated by the Surgeon General and the Naval Air Transport Service.

It is interesting to note that, operating under the present NATS hospital schedule, psychotic patients from Mare Island are boarded at 2100, a normal bedtime hour, and proceed to Fort Worth where they arrive after a full night's sleep, being deplaned in time for breakfast. Interference with their normal daily routine is thereby reduced to a minimum. This method of effecting the transfer may be contrasted with a 3-day train trip and its attendant difficulties. Further, the attendants return by air and are enabled to resume their assigned duties with a minimal disruption of the hospital routine.

In the beginning there were unavoidable delays in the procurement of travel orders for small groups of patients, and therefore the aircraft frequently were not utilized to the fullest possible capacity. However since the issuance of authority for the medical officers-in-command of Naval hospitals to issue orders, including per diem, for patients and attendants, full utilization of the schedule has been achieved.

Advantages of utilizing NATS facilities for the transportation of patients are many. The NATS organization is 3 years old and is operated by personnel experienced in commercial airline operation. Airplane commanders are required to possess instrument flight rating qualifications equivalent to the standards of the Civil Aeronautics Administration for commercial airline pilots. The standards, therefore, exceed those of any other military organization.

The selection of routes for use by hospital flights was made by the Commander, Naval Air Transport Service, West Coast, utilizing the suggestions of the flight surgeons. Factors influencing the selection of routes were terrain, prevailing weather conditions, and the availability of intermediate governmental hospital facilities. Prior arrangements with all such medical establishments for the accommodation of patients in the event of unpredictable delays to flights were made. Flights proceed along established civil airways, conforming to CAA flight procedures. Within the continental limits of the United States all flights carrying patients are designated Hospital Aircraft Flights (HOSAIRC). This designation carries with it certain privileges of operation, granting these flights air traffic priority.

Flight crews are rotated between hospital, cargo, and passenger flights, thus obviating duplication of personnel. Complete

changes of aircraft crews are accomplished at certain set points, permitting maximum route familiarization. Scheduled crew layovers for rest are established at definitely designated stops. This results in the maximum safety of flight. Because the operations are conducted on a scheduled basis by well-qualified personnel, they are semi-independent of weather conditions, the entire trip being flown under instrument flight rules when necessary. For this reason the efficiency of a transport pilot is apt to be impaired after 8 hours of flying in any one day, a finding which is in conformity with the experience of the commercial airlines.

Flights are conducted under positive flight control procedures, whereby the plane commander en route is in communication with the flight control officer on duty at squadron headquarters, where the latest reports of weather conditions are continuously available. In the event of unfavorable weather conditions en route or at the terminal, the flight control officer will direct the flight to proceed to an alternate airport or return to its place of departure, as the safety of operations dictates. His duties are comparable to those of a chief dispatcher on a railroad.

No separate engineering facilities are required for the operation of hospital flights as described, as preventive maintenance is provided by the engineering facilities of NATS detachments located throughout the country. Under the engineering department the maintenance dispatcher so arranges the schedule of each individual aircraft that it is available at predetermined points for routine maintenance checks. This procedure permits an orderly staggering of aircraft maintenance, thereby making available a maximum number of aircraft for operation of the schedule.

The existing facilities of NATS within the continental limits of the United States are at present being utilized to the fullest extent, and the patients now being transported by air are actually displacing regular traffic. The present rate of operation of the hospital service has for this reason required no increase in equipment or personnel; however further expansion of the transportation of patients will, of necessity, require the assignment of additional equipment and personnel proportionate to the increase in service rendered. Even so, augmentation of the existing facilities for this purpose is both economical of personnel and feasible inasmuch as the NATS organization is already well established and is peculiarly adapted to rapid expansion in this type of operation. In this way any desired increase in the hospital service may be achieved upon a commensurate increase in equipment, aircraft maintenance personnel and flight crews.

Minor modifications of the interior of the standard R4D to pro-

vide more comfortable accommodations for the patients have been accomplished by NATS. These changes include an increase in the capacity of the oxygen system by the installation of an additional J-1 cylinder (18,000 cu. in.), construction of a baggage bin aft of the litters, addition of a plywood deck, complete insulation of the cabin, modification of the heating ducts for more uniform distribution of heat throughout the cabin, and installation of the latest type urinals and airline-style lavatories. These modifications in no way affect the utilization of the aircraft for the transport of regular passengers or cargo when necessary.

In order to transport the maximum patient load on flights within the continental limits of the United States, stops for fuel are scheduled approximately every 4 hours. These stops also add greatly to the comfort of the patients and permit them to be fed while on the ground. In cooperation with NATS, the Red Cross has provided canteen service at the majority of these locations. At Red Cross canteens a wide variety of food is available, ambulatory patients are served over the counter, and litter patients are served aboard the plane. To insure a comfortable cabin temperature for litter patients while the aircraft is on the ground, portable heaters are provided at all points served by the scheduled operation.

Space control in NATS is essentially the same as provided by the commercial airlines and by the Pullman Company. Space is confirmed for each patient on a hospital flight from his point of departure to his destination. By this means it is possible to operate the aircraft at capacity load for its entire flight. For instance a full load of patients may be boarded at Oakland, California, five of whom may be destined for the Naval Hospital, Corona. When these five patients are deplaned the space vacated by them is filled by five patients for whom Corona has arranged a transfer to the Naval Hospital, Great Lakes, and so on along the entire route.

If on a particular flight the aircraft is not loaded completely with patients, or if there are no patients to fill the space made available by the deplaning of patients, the squadron commander may, on the recommendation of the squadron flight surgeon, make the unoccupied space available to passengers. The purpose of this control is to insure that passengers will not be boarded on flights with infectious, dangerous, or objectionable patients. These data are assembled by the space control officer and disseminated to the various interested air transport officers prior to the origin of the flight. Obviously this system of space control could be based only upon a regularly scheduled hospital flight service.

It should be noted that arrangements were made for these transfers and the space confirmed several days in advance by dispatches sent over the NATS communication system between the air transport officers stationed at the scheduled stops and the space control office at squadron headquarters. The air transport officers function in a manner similar to station passenger agents of the commercial airlines, space control being a portion of their regularly assigned duties.

The procedure for the movement of patients on a scheduled basis is eminently preferable to any other plan of operation. Among other advantages, it simplifies the problem of obtaining the maximum utilization of available hospital beds. That division of the Bureau of Medicine and Surgery which allocates hospital space can direct the flow of small numbers of patients into hospitals in any area as beds become available. Since these patients travel by air, they arrive in the shortest possible time, thus keeping to a minimum the number of vacant beds in critical areas.

A scheduled type of operation increases the ease by which small groups of patients may be moved to the various Naval hospitals which specialize in particular types of treatment or where specialized research problems are in progress. It also provides a feasible means of transporting small groups of patients to hospitals adjacent to their homes.

As the tempo of the war in the Pacific increases and the flow of Naval casualties from the Atlantic area diminishes, the arrival of a preponderant number of Naval and Marine casualties at hospitals in the Pacific area will necessitate their being transported to the mainland most expeditiously. At the same time, increased pursuit of the war in the Pacific will demand the transportation of a greater quantity of highly essential war material, much of which will of necessity travel via air. By utilizing an existing scheduled operation, it is possible to coordinate the West-to-East flow of patients and the East-to-West flow of priority cargo and thus to achieve maximum utilization of aircraft and personnel.

A mode of transporting patients similar to that used within the United States could well be employed to advantage in the NATS operations in the Pacific. It becomes of even greater import as one approaches the combat zone, because of the critical transportation problem which always exists in forward areas. This has been amply demonstrated by the experiences of SCAT and similar organizations. High priority cargo, passengers, and whole blood are urgently needed at the battlefront, necessitating a large number of scheduled trips into the combat area. Since the flow of material and personnel is predominantly toward an ad-

vanced base, it is obvious that space is available on returning NATS aircraft for the evacuation of casualties. This dual utilization of aircraft and personnel is comparable to the dual purpose of an attack transport.

In order to accomplish this overseas operation efficiently, only a minimal increase of medical personnel in the already existing NATS squadrons would be required for the present. To insure adequate screening of patients in the forward area, a medical officer attached to the advance base being served should be available. He should realize that those patients who are unable to stand any other transportation are unable to stand air transportation. Well-trained nurses and hospital corpsmen, under the supervision of NATS flight surgeons, could attend to the needs and wants of the patients while in flight. Adequate medical facilities are also available at each scheduled NATS stop in the Pacific to care for any medical problems which may have developed while the patient is en route. In view of the critical shortage of medical officers, utilization of this procedure affords a necessary economy of personnel without jeopardizing the quality of the medical attention offered.

Since the average flight in the Pacific operation of NATS is of about 8 hours' duration, patients should be so screened that only those in a condition comparable to patients being transferred from an evacuation hospital to a base hospital should be carried. Because of the coordinated NATS schedules now being operated in the Pacific and the continental United States, it is entirely possible to move patients from Leyte to Bethesda in 5 days, entailing an actual flying time of approximately 65 hours, the remaining 55 hours being used for rest and care en route. In many cases medical officers being returned to the continental United States under travel orders will be available to augment the assigned medical attendants. This is particularly true from Hawaii to California where there are numerous daily scheduled flights.

The modifications required on the R5D for the transporting of patients are nominal, as the aircraft is factory-equipped with litter gear, cabin oxygen equipment and plywood decks. Installation of the AG-1 galley would be required, or, preferably, procurement of frozen precooked foods and the installation of a refrigerator and warmer. The weight of the latter is negligible.

Inasmuch as an R5D can carry a great number of patients, it is believed that a large-scale evacuation of patients to the mainland could be accomplished by using present equipment, crews, and maintenance facilities. With extensive growth of this service,

an economical increase in equipment and personnel to implement the existing organization would necessarily be required.

SUMMARY

The transportation of patients within the continental limits of the United States by the Naval Air Transport Service over regular routes on a scheduled basis is in operation, utilizing the services of flight personnel especially trained in air transport operations. To the present no additional equipment or maintenance facilities and no essential increase in personnel beyond that normally required by NATS for its routine operation has been required. However an increased domestic service of any desired proportions may be rapidly and economically provided by the expansion of the existing experienced organization.

The overseas scheduled operations of NATS embraces those areas of the world in which the maximum number of Naval personnel are stationed. The complete use of the present existing organization by the Medical Department would permit an orderly movement of patients with a maximum of safety and speed between Medical Department activities. Further it would allow a more complete utilization of existing hospital facilities. To accomplish this immediately it would be necessary only to assign well-trained nurses and hospital corpsmen to the existing NATS organization.

Because of the dual nature of the operation, the normal expansion of NATS due to the increased demand for the movement of essential war materiel into the combat areas will provide some additional increase in service beyond that at present available. A further increase beyond that potentially available from the normal expansion of NATS may be attained by the assignment of additional equipment and personnel to the existing organization as the exigencies of the service require.

CONCLUSIONS

The facilities of the Naval Air Transport Service within the continental limits of the United States are now being used to advantage by the Medical Department. It is the considered opinion of the authors, based on their collective experiences in the transportation of patients by air, that the facilities of the Naval Air Transport Service in the Pacific area could be utilized to similar advantage.

INTERTROCHANTERIC FRACTURES OF THE FEMUR

EARLY CARE ON A HOSPITAL SHIP

HAROLD LUSSKIN
Lieutenant Commander (MC) U.S.N.R.

Fracture problems confronting surgeons aboard ship, or at a forward base, are different from those in civilian life or at Naval hospitals. Foremost among these is transportability; patients must be immobilized in such a manner that they can be transported or evacuated quickly on relatively short notice.

The problem is further complicated by the necessity of handling the fracture patient in bunks or racks, in place of in beds. Large wards with high overheads and well spaced beds are not available aboard ship. Patients are in bunks stacked like shelves, often in three tiers. This makes elaborate equipment for traction and suspension available only to one or two patients. For the rest, other means of treatment must be provided. Multiple fractures in the same or several bones, along with extensive wounds, appear to be the rule in forward areas, and of course add to the difficulties.

The treatment of intertrochanteric fractures is the most controversial of those the medical officer is called upon to handle. Methods of attacking the condition vary from simple plaster-of-paris casts to the application of combination nail plates almost as long as the shaft of the femur. All of them have their applications and indications; few of them can be used in all instances. A study of the mechanics of the hip will help clarify these points.

The glutei, tensor fasciae latae, adductors, rectus femoris, long head of the biceps, and inner hamstring muscles, exert on the shaft of the femur a constant pull which is in the direction of the shaft of the bone (fig. 1). The neck of the femur forms an angle of 135 degrees with the shaft (fig. 2) and consequently there is a constant shearing force exerted against the neck. Because the intertrochanteric area is almost at right angles to the neck and not parallel to the shaft of the femur but inclined toward its long axis, a fracture at this point does not cause the shaft to slip past the neck, characteristic of intracapsular breaks. On the contrary the upward thrust is transferred to the lower end of the neck, pushing the proximal fragment upward at the site of fracture, resulting in a coxa vara (fig. 3).

Numerous methods and devices are utilized to combat this ten-

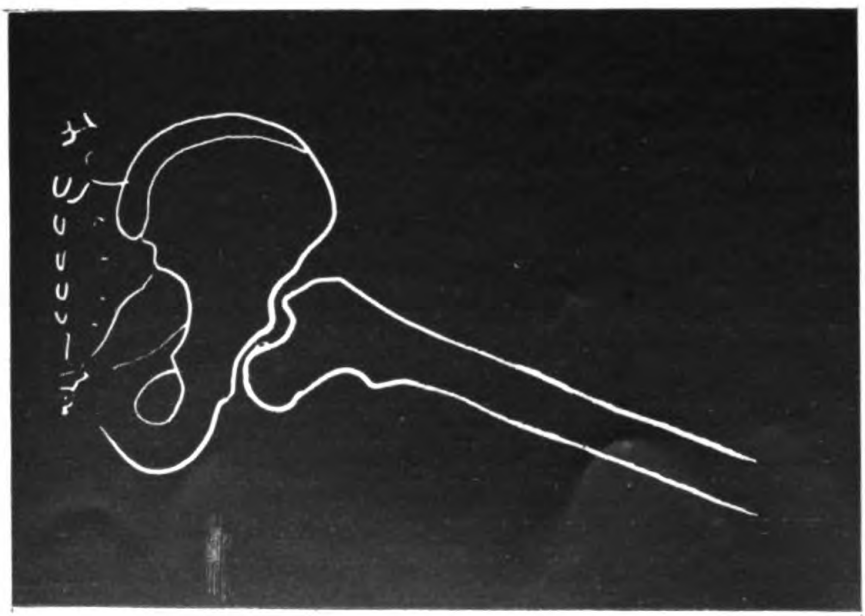
1. Schematic representation of the hamstrings and gluteus maximus posteriorly and the abductors, rectus and gluteus medius anteriorly.

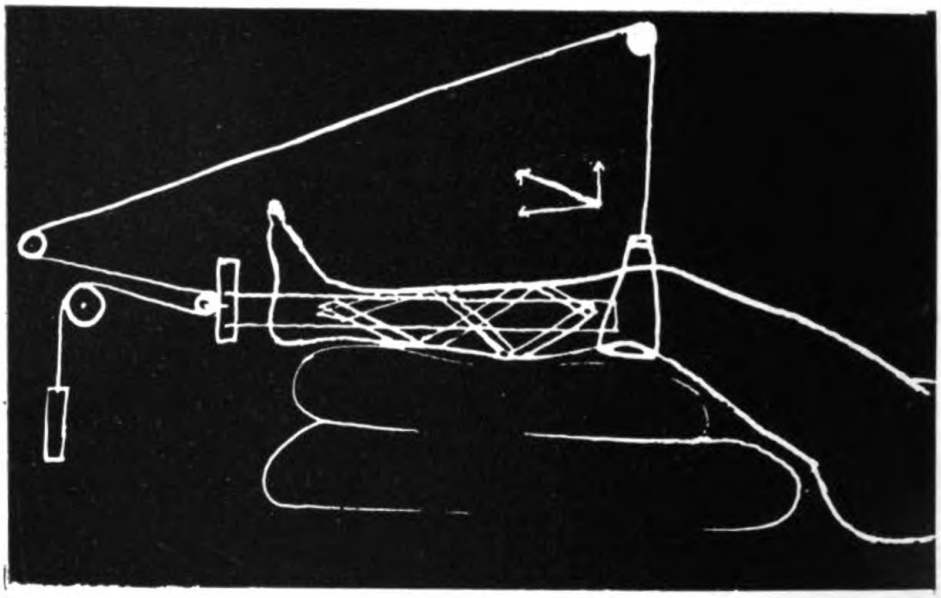
dency to coxa vara. An ordinary plaster-of-paris spica cast will not help. The spica rides up on the body, carrying the femur with it, and causes a recurrence of the deformity. The double spica offers little help in avoiding the deformity as it also will override one or two inches after atrophy takes place or if much padding is employed. Extreme abduction with the application of a plaster-of-paris spica sometimes is adequate, but the abduction must be extreme enough to permit impingement of the great trochanter against the ilium, at the same time maintaining a 135-degree angle between the neck and the shaft. The impingement prevents the shaft from overriding. This position, however, is awkward and painful and transportation is difficult (fig. 4); furthermore there is no room for the patient in his bunk.

2. (Lower). Representation of the angle the neck of the femur makes with the shaft, 135 degrees.

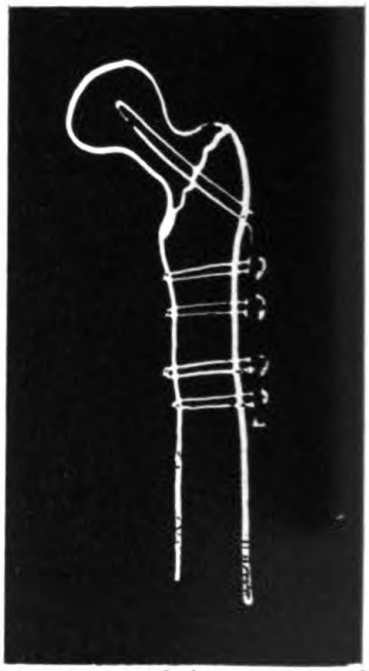
3. (Above). Intertrochanteric fracture with resultant coxa vara. Schematic.

4. (Below). Extreme abduction of the femur so the great trochanter impinges against the ilium.





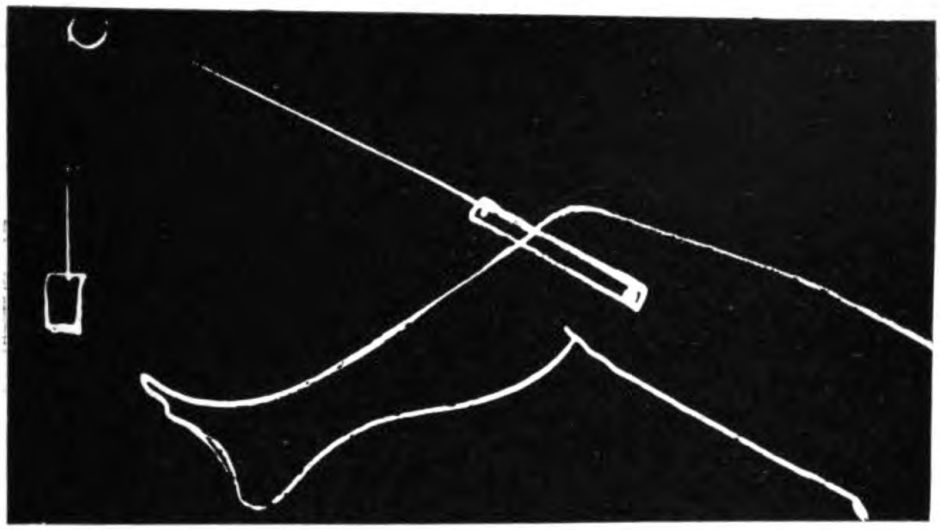
5. Russell traction. The upward pull at the knee is equal to the weight applied. The pull in the direction of the leg is twice the weight applied because of the free pulley at the spreader near the foot. The resultant force as indicated in the insert is greater than the weight and in the direction of the shaft of the femur.



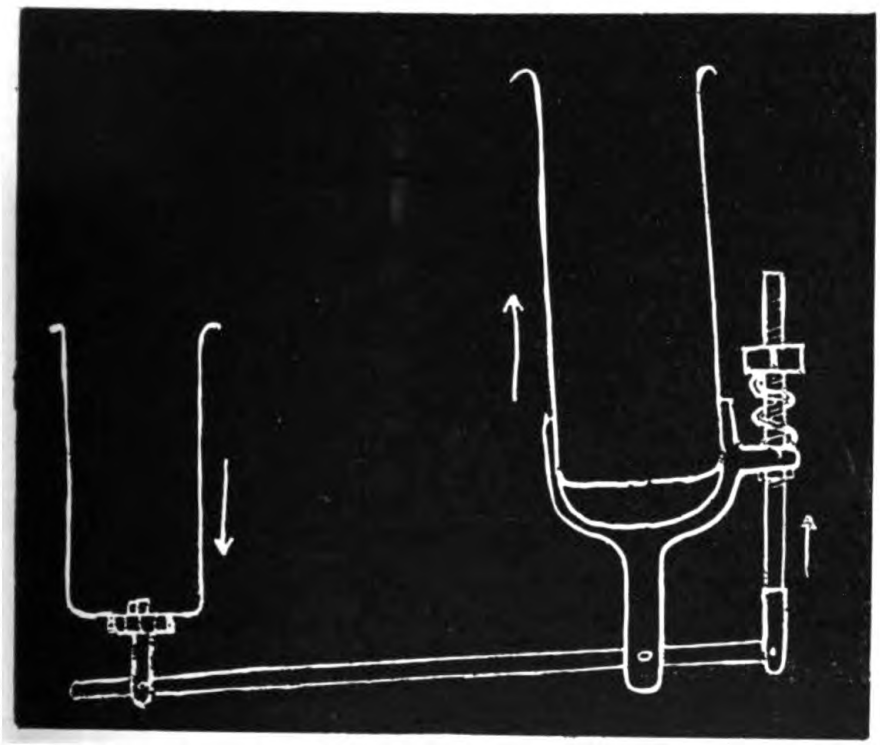
6. The use of a combination nail and plate, the nail going into the neck and the plate being fasened against the shaft. This prevents coxa vara.

Transfixion by the Smith-Petersen nail, multiple pins, or wires, leaves much to be desired, for although there is enough room for a good bony purchase in the neck of the femur it is not adequate in the trochanter. The muscle pull on the limb overcomes this meager bony grip on the pins, and coxa vara returns. The combined nail and plate in various forms obviates this defect and has proved successful in the hands of many, but in comminuted and compound fractures it cannot be used (fig. 6).

Russell skin traction and skeletal traction through a pin or wire are both simple procedures which have given excellent re-

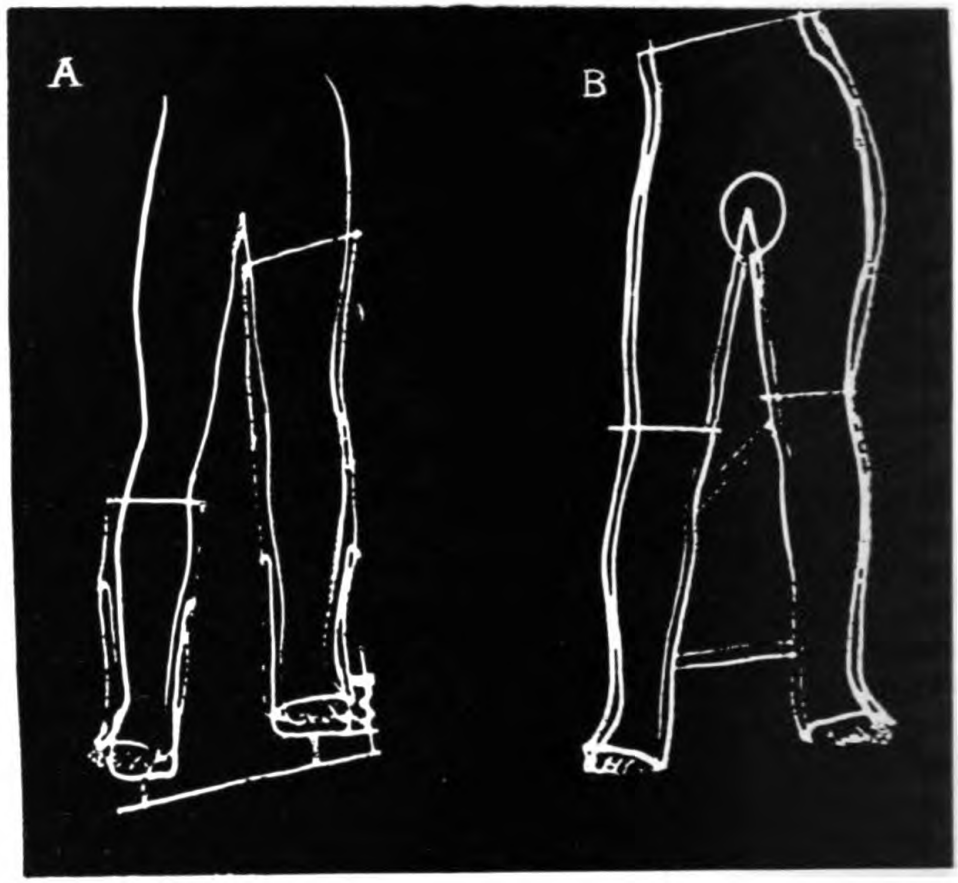


7. Skeletal traction to a Steinmann pin passed through the femur just above the condyles. A stirrup is attached to the pin.



8. Roger Anderson well-leg traction brace which is incorporated in plaster. The arrows indicate direction of pull and pressure. The short "U" goes on the injured leg, the long "U" on the well leg. Turning the winged nut produces the pull indicated.

sults. In the Russell traction one weight is used to suspend the leg at the knee and at the same time it applies twice the pull in the direction of the tibia. The resultant of the two forces is in the



9. A. Well-leg traction brace incorporated in plaster represented schematically. A pin is often used through the tibia of the injured leg. The well leg and the dorsum of the injured limb must be well padded to prevent pressure necrosis. **B.** Pins incorporated in plaster-of-paris spica after traction of the injured leg and pressure on the well leg to correct coxa vara, with the truss and spreader bar used to prevent breakage of cast.

direction of the shaft of the femur and is greater than the weight used (figs. 5 and 7).

The difficulty with these two methods, however, is that the Russell traction requires a special Balkan frame or its equivalent, as well as a regular hospital bed to which it must be attached, and skeletal traction pulleys and weights are needed. Should evacuation or transportation become imperative, these must be detached and Thomas splints applied. Awkward handling, with pain and a loss of position results, and the necessity for constant surveillance of the patient for a prolonged period of time makes these methods impractical.

Well-leg traction, however, permits a constant pull on the injured limb, as in Russell traction and in skeletal traction, and at the same time allows for transportation of the patient should it

become necessary. A special bed, moreover, is not required. By utilizing the good leg both as a fulcrum and as a source from which countertraction can be applied, the injured limb can be held in the proper position at all times. This method is effective in all types of intertrochanteric fractures, simple, comminuted, and compound (figs. 8 and 9). The drawback, however, is the loss of the appliance every time a patient is evacuated, for it leaves with him. Where fractures of this type become numerous the ship or forward area is soon depleted of its equipment and must await new supplies before a similar fracture can be treated by this means.

It was imperative that some method be used which would obviate all the defects noted in the other methods described. A combination of three methods, well-leg traction, skeletal traction, and the double spica plaster-of-paris cast solved the problem. The patient is put on the orthopedic table and a Steinmann pin passed through each femur just above the condyles. Traction is then applied to the injured limb and pressure to the well leg until the coxa vara is overcome. A double plaster-of-paris spica is then applied from just above the crest of the ilium to the toes, incorporating the pins in the cast. Reinforcing bars and a truss are incorporated to prevent the limbs of the cast from breaking and disrupting the traction maintained through the pins (fig. 9B).

SUMMARY

Intertrochanteric fractures can be treated by a single spica with the leg in extreme abduction, by skeletal traction, Russell traction, combination nail and plate, and well-leg traction. But aboard ship where apparatus and beds are at a premium, where transportation and evacuation are often necessary on short notice, the simplest method is the double spica cast incorporating pins through the lower end of each femur after traction on the injured leg and pressure on the good leg have been applied and maintained during the setting time of the cast.

ATMOSPHERIC BLAST CONCUSSION

MEDICAL ASPECTS

RALPH A. KLEMM
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The following analysis of 36 patients who were the victims of blast concussion represents a sampling of 90 such patients admitted to a medical ward at this hospital in a period of 1 month. They were seen from 10 to 20 days after exposure to the blast. Only 8 of these suffered wounds.

The source of concussion in most instances was from 90-mm. mortar shells, some from artillery shells, and a few from aerial bombs, land mines and the so-called concussion grenades. The absence of flash burns in these subjects is presumably due to the type of explosive.

The clinical case histories of this group are so similar that they seem to follow a uniform pattern. The patient often does not remember the explosion. When an estimate of the distance from the shell is possible, it is usually said to have been from 2 to 15 feet away. Following the explosion there is a period of unconsciousness, amnesia, or a dazed state during which the sequence of events is vague. This period of mental oblivion varies considerably, with a few minutes to 5 days as extremes, but usually is well under an hour. In some instances the concussed subject is active or even hyperactive during this period. Usually there is a definite change in the victim's position, caused by the explosion. If standing he is knocked down, or he may be blown out of his foxhole or off a stretcher. Others tell of being blown a distance of from 1 to 10 feet, but under these circumstances estimates of distance are subject to error.

After becoming oriented all of the patients complain of severe headache, usually frontal, but often parietal, or over one eye, and occasionally occipital. The majority complain of dizziness, especially with change of position, and ringing in the ears sometimes accompanied by deafness. In all, sleep becomes a major problem and is usually punctuated with dreams or nightmares recalling combat experience.

In so-called "pure blast" it is established that the lungs usually demonstrate the most obvious damage. In this series 25 percent of the patients gave a history of hemoptysis, which in one in-

stance persisted for 1 week. Chest x-rays taken on 6 of these patients failed to reveal indisputable evidence of pulmonary lesions, although the roentgenograms were probably taken too late to demonstrate this.

Epistaxis occurred in one-fourth of the cases. Hematemesis was reported twice, and was severe in only one of the patients. Blood in the stools was observed twice. The hemorrhage in all these cases was probably superficial, for the bleeding cleared without demonstrable sequelae. Vomiting after the concussion was present in about 50 percent of the victims, and in several instances there was recurrent vomiting for from 2 to 4 days. None noted hematuria, but one reported inability to void for 24 hours.

Symptoms referable to the eyes were present in approximately 50 percent of the cases. They consisted of simple burning, photophobia and blurring of vision. In the 12 patients whose symptoms were most marked there were no changes in media or eye grounds.

The headache, dizziness and inability to sleep were found to be the most refractory symptoms, persisting for a period of from 2 to 3 weeks during which these patients were observed. Faulty hearing usually disappeared completely.

The almost complete absence of physical signs was striking. The vulnerability of the ear drum is well known, but there was only one instance of perforation of the ear drum in this group. It is conceivable that small perforations might have healed before examination. Results of roentgenographic examinations of the skull in seven patients were normal. In no instance did physical examination of the chest reveal evidence of change. Except for occasional epigastric tenderness, abdominal examination revealed no abnormality. No significant changes in blood pressure were noted. Neurologic findings were not remarkable. An exaggerated startle reflex was common, and purposeless movements of the arms and hands were often present. In two cases generalized myoclonus was observed, in one instance present during sleep.

Spinal puncture was considered superfluous at such a late date, but was performed on three patients whose headaches seemed most severe. The pressures were within normal limits. The headaches were questionably improved by the procedure.

Several case reports will serve to illustrate the salient features in all.

CASE REPORTS

Case 1.—A private, first class, was admitted to the hospital on 10 August 1944, with the chief complaint of pain in the ears, over the left eye, and sore-

ness in the lower back. On 30 July a mortar shell had exploded a few feet in front of him. He was dazed by the explosion and about 45 minutes later vomited what he described as a pool of blood and became unconscious for approximately 15 minutes. He was then taken to a ship, where he continued to vomit, without blood, for 4 days. Eight days after the concussion he coughed up blood-tinged mucus on one occasion.

The headaches were frontal, especially over the left eye. The pains in the lumbar region began aboard ship and were worse with motion. He slept fairly well but had occasional wild dreams.

Physical examination demonstrated tenderness over the lower thoracic and lumbar muscles, but otherwise negative findings. A chest x-ray taken 4 days after admission to the hospital showed a slight increase in the vascular markings extending into the lung fields from the hilar regions bilaterally, but this is probably within normal limits. X-ray examination 2 days later did not show any alteration of the pylorus, rugae, or duodenal bulb. At present the patient's condition is good except for persistent headaches.

Case 2.—A private, first class, was admitted to the hospital on 7 August 1944 with the chief complaint of weakness, headache, and poor sleep. On 22 July a mortar shell had exploded behind the patient and knocked him down. He was unconscious for about 30 minutes and awoke confused and dazed. About 4 hours later he vomited a small quantity of blood-tinged mucus, and coughed up bloody mucus intermittently for a week. Periodic nose bleeds lasted until 3 days before admission.

Headaches are both frontal and occipital, and dizziness is marked on change of position. He sleeps poorly and dreams constantly of combat, but no disturbances are present. Except for moderate anemia (4,000,000), examination reveals nothing pertinent. X-ray examination of the skull yielded negative findings, and an x-ray of the chest taken on 15 August revealed very slight feathering in the linear markings which could be the accompaniment of a so-called blast concussion.

Case 3.—A private, first class, was admitted on 7 August 1944 with the chief complaint of headaches and slight deafness in the right ear. A mortar shell had exploded close to his foxhole. He lost memory of subsequent events, but in temporary moments of lucidity remembers being led to the first-aid station. It was reported by the ship's medical officer that he was bilaterally deaf but that the ear drums were normal.

Since that time the occipital headaches have persisted, and there is dizziness on change in position. The patient's hearing has gradually improved, but at present some slight residual deafness remains in his right ear. He experiences great difficulty in falling asleep. Except for purposeless movements of the hands and arms, there is no relevant physical finding.

This group of casualties poses something of a problem as concerns disposition. Even after a month or more following the concussion, many are apathetic and fatigue easily. How much of this is due to the harrowing experience of combat, and how much is the result of the concussion may be open to speculation. It is felt that most of them deserve, and will be benefited by a prolonged rest on the mainland.

WOUNDS OF EYE, EAR, NOSE AND THROAT

FRANK P. SMART
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In general, wounds seen at the eye, ear, nose and throat service of this hospital had been so skillfully handled at more advanced points and en route that there is little to say except in commendation. However a few things should be mentioned which may prove of value, especially for those who have had little training in these specialties.

Experience here confirms the wisdom of the exhortation to refrain from all local treatment in cases of rupture of the tympanic membranes by atmospheric blasts. Local treatment is unnecessary and is almost certain to introduce infection from the skin into the middle ear, whereas if nothing is done primary healing is usual. The only treatment that should be considered is sulfonamides by mouth.

Debridement around the face should be reduced to a minimum. Blood supply in this region is abundant, and many skin tags that look useless and hopeless may later prove to be viable and valuable. Facial tissue is very hard to match with a graft, and the preservation of every possible bit will make the plastic surgeon's problem simpler.

Medical officers near the front are probably overlooking an opportunity that is theirs alone, in cases of powder burns of the face which leave those permanent, unsightly, blue freckles for which almost nothing can be done later. Because we are prone to think in terms of healing and function, and because the presence of the powder does not interfere with either, it is not surprising that we underestimate the importance of this condition. Many of the victims would prefer to face life with one arm or one eye than with a face that always looks cyanotic and unclean, and they might easily become recluses. If the first surgeon to see such a casualty would anesthetize him and give the whole area a thorough cleansing with soap and water, using the scrub brush vigorously, most, if not all, of the powder would be removed and the discoloration prevented. When healing has started it is too late to do much.

In cases of avulsion of the lower lid the wound usually involves the entire thickness of the lid, is more extensive on the cutaneous

an on the conjunctival side, and runs downward and outward the cheek from the inner canthus of the eye. The obvious and ual procedure is to approximate the torn edges of the conjunc-a, then close the muscle wound with a few sutures, and, with eticulous accuracy, to close the skin wound. The result is ex-llent for the time being, but the final result is anything but tisfactory, the reason being that the lid margin has a spring-e action tending to straighten out into a line, so when it is ade to take on the curve of the front of the eye, it exerts a nstant forward drag which the newly-formed scar tissue cannot ccessfully resist. The late result is that the upper lip of the ound seems to migrate forward and downward, producing an tropion, and leaving an unsightly hiatus below the inner can-us, necessitating a secondary plastic operation.

One special suture added to the above operation would have viated this train of events; that suture should anchor the tip the margin of the torn lid to the periosteum of the medial wall the orbit. A raw bed should be prepared for the reception of e torn tip so that it can be brought up to the internal canthal gament, which can be felt in the region of the tear sac as a ort, stout, horizontal cord. Using a small full-curved needle d a stout suture, the needle is inserted vertically downward rough the margin of the lid at the free tip, then carried through e base of the internal canthal ligament from below upward and d. It is left in place at least 2 weeks.

A number of patients have been received here with lacerations the eye through the cornea or sclera or both, which had been sed with one or more cotton sutures. There is no particular jection to cotton as a suture material, but there are several jections to using any sutures in such cases if their use can be oided. They constitute irritating foreign bodies in a very deli-te organ, the protective coats of which are devoid of circula-n, or nearly so. They constitute wicks in open pathways for fection from the conjunctival sac. They seldom make a tight ough seal to retain the re-forming aqueous humor, the escape which wafts more and more of the iris into the wound where will be incarcerated and give trouble later. The toughness of e cornea and sclera necessitates the use of considerable force in acing the sutures; unless it is expertly done there is grave nger of immediate and massive loss of vitreous substance.

A simple, easy procedure that is open to none of these criti-ms is to sew up any gross conjunctival rents, then incise the njunctiva at its attachment to the cornea and sclera at the bus. The incision is carried completely around the cornea;

then, with blunt dissection, the whole conjunctiva is separated from the eyeball. The least traumatizing dissection is accomplished by inserting small scissors, closed, in the cleavage plane between the conjunctiva and sclera, and then opening them. Up to this point the operation is exactly like the first steps in enucleation of the eye.

The next step is to cleanse the eye thoroughly, put a purse-string suture in the free, cut edge of the loosened conjunctiva, snip off all iris or pigmented tissue that protrudes from the original wound, pull the purse-string suture tight, and tie, thus drawing the dissected bulbar conjunctiva up over the cornea. At no time should any pressure be put on the wounded eye, but when it is grasped slight traction should be used, tending to produce negative pressure in the eye; if some air should enter the interior of the eye it will do no harm.

The immediate result is rather startling in that the eye can no longer be seen. It has been sewed up in a vascular, membranous bag. This procedure has several advantages in addition to the passive one of doing no harm. The bulbar conjunctiva serves as a curved splint holding the wound edges in the most perfect apposition attainable. It brings circulating blood to the avascular cornea and the almost avascular sclera. It quickly adheres to the wound edges, forming a perfect, water-tight seal. The pressure, being hydrostatic, is even and equal on all parts and in all directions. Angulation at the wound lips is reduced to a minimum, and the normal roundness of the organ is established and maintained.

In a week or two the purse-string suture cuts through the thin conjunctiva and that membrane retreats across the undamaged parts of the cornea, coming to rest at its former site, leaving a tiny, vascular tag attached to and still sealing the wound. This tag may be snipped off later if it is large or disfiguring. This simple procedure might well save some eyes that would be lost if scleral or corneal sutures were used, and in any case there will be a better functional result.

THORACIC CASUALTIES FROM THE MARIANAS

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The thoracic casualties of this campaign have tended to be of a much more serious nature than those previously seen and have included a proportionately higher incidence of patients seriously and critically injured than has any other class of injuries. This has been due primarily to the high percentage of infected cases and to the extent and nature of these infections. However as was true with previous groups of thoracic patients from other areas, with the exception of some very special types of injuries, the majority of difficult problems have arisen from massive hemothorax and traumatic pneumonitis and their complications, especially infection.

Some of the special types of thoracic injuries in this group might be mentioned briefly. Although they comprise only about 25 percent of the cases, they presented numerous and serious problems.

The injuries to the lung consisted of varying degrees of laceration with associated hemothorax and collapse, foreign bodies in the hilus, varying degrees of bronchial fistula, and traumatic pneumonitis. In one case a large ragged fragment was lodged in the hilus of the right lung, partially imbedded in the main bronchus. There was an associated fistula and a continuous, severe exhausting cough. A transpleural major operation for the removal of the foreign body was imperative to save the patient's life and was successfully undertaken even in the presence of a massive hemothorax infected with Clostridium sporogenes and Clostridium novyi.

There were four cases of pericardial involvement, either as a result of direct injury or extension of the pleural infection, producing a pericardial friction rub. In two of these cases there was also a clostridium infection. It is important to recognize these cases in order that a prolonged bed rest regimen may be followed to prevent, if possible, permanent cardiac impairment from adhesive pericarditis.

The thoracico-abdominal injuries resulted from fragments traversing the thorax and diaphragm and injuring abdominal viscera, or from multiple fragments penetrating both the thorax and

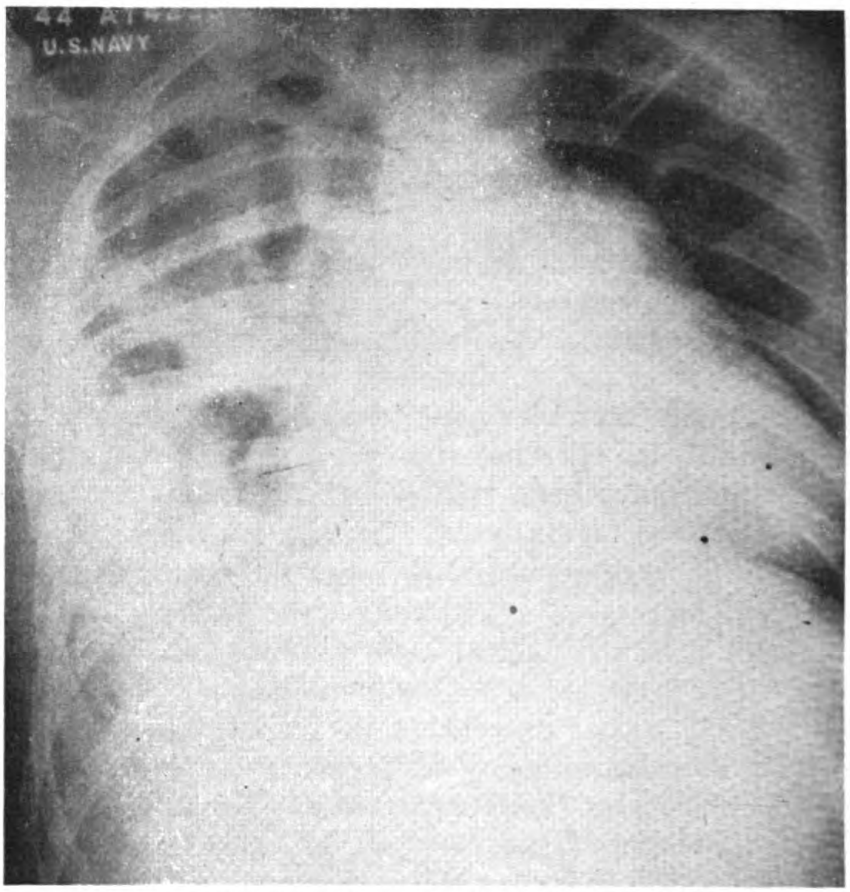
abdomen. Those patients who had gastro-intestinal perforations had already had laparotomies and suture of the perforation in the gastro-intestinal tract. However on admission to this hospital many of them had, in addition to their thoracic problems, infected and separated abdominal wounds, residual peritonitis and subdiaphragmatic infection.

One patient who had a thoracico-abdominal injury with a laceration of the spleen developed an intra-abdominal hemorrhage after being admitted to this hospital, necessitating splenectomy 3 weeks after the original injury had been incurred. There were six patients with thoracico-hepatic injuries with serious liver infection, and both external and transpleural biliary fistulas. Several of these have been treated by continuous suction, as in treating a duodenal fistula.

A number of patients with serious thoracico-spinal injuries with varying degrees of spinal cord damage were seen. These patients were difficult medical and nursing problems; they required particular attention to the management of bladder and gastro-intestinal stasis, prevention of trophic ulcers, control of their pain, the maintaining of their morale, and a proper regimen to aid recovery of their paralyzed extremities. One of these patients had not only a paralysis of his lower extremities and extreme hyperesthesia, but also an infected hemothorax and a thrombophlebitis of the left subclavian, internal jugular and axillary veins. He is now recovering from these complications and showing definite signs of recovering the use of his legs.

There were numerous combinations of thoracic injuries with injuries of the extremities, including amputation, serious compound fractures and peripheral nerve injuries. In most instances the thoracic injuries took precedence in treatment, but it was also essential that the extremity injuries be given adequate treatment with as little delay as possible. Early removal of plaster body spica casts is important and the use of Roger Anderson and Stader apparatus is of material aid in solving these problems. Careful selection of the anesthetic and special measures to prevent shock are of great importance in these cases.

The large majority of the thoracic cases, however, presented problems directly associated with massive hemothorax and resulting disturbance of the intrathoracic dynamics or were complicated by infection. Many of the patients on admission were in extreme respiratory distress from a decided shift of their mediastinal structures and required immediate thoracentesis and administration of oxygen for relief. Another mechanical indication for thoracentesis is for the relief of persistent collapse or com-



1. Suppurative hemothorax—Clostridium perfringens.

pression of the lung or failure of the lung to show clinical physical signs of re-expansion.

The third indication for thoracentesis is a persistent febrile course suggesting infection. Although many of these patients will show a systemic reaction, apparently from absorption from the injured intrathoracic tissues, clinically this reaction cannot be differentiated from suppurative hemothorax except by thoracentesis and culture of the serosanguineous fluid. Early diagnosis and drainage in the infected cases are essential to prevent serious sequelae such as a chronic empyema, fibrothorax, and a permanently collapsed lung.

Careful differentiation between traumatic pneumonitis with superimposed infection and suppurative hemothorax must be made also. This must be done on the basis of clinical physical signs, because x-ray findings are frequently misleading, and thoracentesis may add pleural complications and infection to these serious massive consolidations of the lung.

I have referred to infected hemothorax as suppurative hemothorax rather than using the standard nomenclature of pleurisy, suppurative, or empyema, because I feel that these cases are an

2. Infected fibrinated masses removed at operation from chest shown in figure 1.

entity quite distinct, both in clinical course and management, from classic postpneumonic empyema. The massive hemothorax, acting as an ideal culture medium, becomes rapidly and completely infected, producing not only a total pyothorax but a massive honeycombed fibrinated cast within the thorax (fig. 1).

The first stage in treatment is a trocar thoracotomy and the establishment of closed drainage. This permits intensive intrapleural penicillin therapy, stabilization of the intrathoracic dynamics, and temporary improvement of the patient. At this point the treatment diverges radically from that of classic empyema. These patients will continue to grow rapidly worse unless, as soon as stabilization is obtained, the thorax is opened widely by thoracotomy, the fibrinated infected masses (fig. 2) are removed and the thorax is widely drained. Even with adequate drainage plus intensive penicillin therapy, suppurative hemothorax has been hard to control and the convalescence of these patients prolonged and complicated.

There is another important point to be stressed in this connection, namely, adequate drainage must be maintained much longer than it is in any simple empyema if such sequelae as permanent atelectasis and associated bronchiectasis, chronic bronchopleural fistulas, chronic empyema, and subsequent serious surgical procedures are to be prevented.

In summary we have had at this hospital from the Marianas campaign alone about 150 cases of major thoracic injury, many in combination with other serious injuries, and including a very high incidence of serious infections, such as with clostridium.

With adequate surgical management and intensive penicillin therapy, these patients are progressing satisfactorily. There has been no fatality.

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THE HOUSE THAT BASSINI BUILT

Once upon a time a man called Bassini built a beautiful house on the side of a hill. It soon became the envy and admiration of everyone, but for some reason this house kept falling down and had to be rebuilt over and over again.

Now Bassini was a very popular man, and he suffered from no lack of helpful advisers. Some of his brother architects reinforced the walls for him; some introduced new and indestructible materials; some redesigned the house completely, making the plan so complicated that the onlookers were unable to understand it and naturally considered it a great advance; a few rebuilt it from within outward, working on the principle that if a house is built the hard way it will be harder for it to fall down; while the rest paid little attention to the designs of the masterbuilders, and were thus able to produce new and original methods in enormous quantities. But to the amazement of everyone the house continued to fall down, though on one occasion it stayed up for a whole day longer.

As time went on a great many people became interested in this house because there were a lot of houses to be built and it seemed only right that a house should last its owner his lifetime. But the onlookers were confused by the dissension among the builders, and still more by a curious blindness that seemed to affect them. Each group were unable to see the ruins of their own house, however often it fell down, yet when others failed with the same design they decided that the workmanship must have been bad, and offered correspondence courses on how it ought to be done.

Then a wise man called Ogilvie remembered that his great-grandfather once built a little shack on the side of a hill, because large houses could not be built in those days. He came to the conclusion that, if a man must live on the side of a hill, and can live alone, the lighter he makes his house the less likely will it be to fall down or slide into the valley. He backed his opinion with such lucid and logical arguments that it took only 10 years for the other builders to realize what he was driving at. But once this fact was grasped, everyone became happy and there were great rejoicings till they remembered that this kind of house would not do for a man with a large family. At this stage it became necessary to add a new wing to the local library.

Now about this time a certain simple fellow, who had rebuilt his own house many times with no one to help him, viewed this strife from afar and then pondered over it as follows: "Strengthening the walls does not stop a house falling down; binding them with indestructible materials does not seem to help; even silver spires do no more than improve its appearance; and I cannot see how learned discussions on the merits of the different kinds of mortar and cement have affected the result. If a house persists in falling down in spite of having immensely strong walls, it can only mean that no one has examined the foundations with sufficient care." So he proceeded to do so. And the result of his work is recorded in INGUINAL HERNIA, The House that Bassini Built.—BRANDON, W. J. M.: Inguinal hernia, the house that Bassini built. Lancet. 1: 10, February 10, 1945.

CARE OF THE BURN CASUALTY

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This report briefly outlines the systemic and local treatment of burns at this hospital. Sixty percent of the burn patients admitted here have deep second- or third-degree burns due to two specific chemical agents; two-thirds of these are from high-octane gasoline and one-third are from phosphorus liberated from the phosphorus bomb. High-octane gasoline will not generally burn the clothing but from the high temperature produced causes extensive deep burns beneath the clothing.

Phosphorus enters the tissues in a concentrated state and, using the fluid of the tissues, continues to burn until it is completely neutralized. Copper sulfate, 1-percent in water, ordinarily used to counteract the phosphorus, will not penetrate. As a result the phosphorus continues to burn for from 10 to 15 hours, destroying the deeper layers of tissue.

The extent of body surface burns seen here varied from 5 to 40 percent.

TREATMENT

General.—In the treatment of shock with administration of plasma when laboratory facilities are not available, the following methods of gaging dosage are useful: (1) Berkow's formula: For each 10 percent of the body surface burned, 500 cc. or 2 units of plasma should be given in the first 24 hours. In the second 24 hours approximately one-half this amount will be required. If the burns are not extensive but deep, a greater amount of plasma will have to be administered to relieve shock than is specified by Berkow. (2) The clinical response of the patient.

When laboratory facilities are available, the hemoconcentration is a great aid in the giving of plasma. Here 100 cc. of plasma is given for every point above the normal hematocrit reading of forty-five. If there is pulmonary damage large amounts of plasma must be given cautiously. It is also necessary in giving plasma to take into consideration the later increased total blood volume during the period of resorption, when the excess tissue fluid is picked up from the subcutaneous tissue by the increased protein content in the blood. Pulmonary edema and right heart failure

1. Narrow bandages roll and form cords causing deeper burns.

2. Wide stockinet bandage cut on the bias fits snugly over the shoulders, back and chest.

may occur as a result of this great increase of total blood volume, especially in the presence of an acute toxic myocarditis.

Repeated hematocrit readings should be made in order to judge the success of the plasma therapy. In addition to the calculated amount of plasma, saline solution to complete the replenishment of the plasma volume, water for kidney function, and food for metabolism must be administered. The volume of saline solution required is equal to that of the plasma injected intravenously and is preferably given by mouth. Even if the patient is given plasma intravenously, a large intake of water without salt may result in electrolyte dilution.

Whole blood transfusions are given when secondary anemia is present and in deep burns with infection. Infectious toxemia is accompanied by a decrease in the red-cell volume and oxygen-carrying capacity of the blood. The fall of the hematocrit reading below 45 due to the decrease in the number of red cells must be differentiated from that due to the hemodilution which occurs during the period of resorption of edema fluid. Whole blood transfusions are indicated in the former condition but may be

hazardous in the latter, since the plasma volume may already be increased and transfusion may precipitate pulmonary edema and cardiac failure.

Local.—Preventing secondary infection by covering the burned area as quickly as possible with clean towels and not exposing it until personnel are properly masked, gowned, and gloved, as has been stressed by Koch[1] is vitally important. In treating a burn wound the same precise surgical technic used in all wounds requiring surgery is the rule. To quote Koch, "There are three principles to be recognized as of fundamental importance in the treatment of burns. The surgical cleanliness that prevents infection, the compression of the injured area that decreases fluid loss, the rest that is so important, if tissues are to heal in the minimum period of time."

If the open wound has been contaminated, it is logical to attempt to convert it into a clean wound, by simple cleansing with white soap and water, followed by warm saline solution. Loose pieces of destroyed tissue which cannot be washed away are removed with sterile forceps and scissors. Blisters are left untouched. Burn areas are then covered with an impregnated vaseline gauze dressing which contains:

	Gm. or cc.
Urea	10.0
Oxyquinoline	4.8
Chloratone	19.2
Liquid petrolatum	128.0
Olive oil	50.0
Wool fat	400.0
Petrolatum	500.0

The entire area is covered with sterile gauze and mechanic's waste or lint to create compression of the entire injured surface, which decreases the fluid loss. Over the extremities elastic bandages are applied with different degrees of pressure, the greatest pressure being at the most distal portion. A constricting band proximally will result in occlusion of blood flow, which causes edema (fig. 1). Frequently on the flexor surfaces, where there is any movement, the bandages cut or destroy the tissues, changing what was once a light second-degree burn to a deep second- or third-degree burn.

In order to obtain sufficient compression over the shoulders, thorax and abdomen, wide stockinet bandages cut on the bias will be found quite elastic and can be made to fit snugly over these areas (fig. 2). This type of dressing will stay in place. These

[1] KOCH, S. L.: Surgical cleanliness, compression and rest; as primary surgical principles in treatment of burns. J.A.M.A. 125: 612-616, July 1, 1944.

3. Third-degree burn area cleaned and ready for split skin-grafting and second and third change of dressing.

dressings are not disturbed for from 12 to 14 days. If serum soaks through, more dressings are applied over the original dressing. If severe infection is present, redressing is done every other day until the degree of infection has become less. In many instances second-degree burns are practically healed after the second or third dressing. A warm paraffin mixture is then sprayed on, affording protection to the new skin, and greater comfort to the patient. Daily showers are permitted. The burned area is cleaned by a spray of water, after which a fresh covering is sprayed on the wound. The paraffin mixture (Pendleton formula) consists of:

	Gm. or cc.
Menthol	0.1
Sulfanilamide powder	50.0
Liquid petrolatum, heavy	150.0
Cod liver oil	50.0
Paraffin wax	670.0
Petrolatum	250.0

CHEMOTHERAPY

When the patient is first seen it is determined whether or not sulfonamide therapy has been used. If not, sulfadiazine, 3 gm., is given as soon as the patient can tolerate medication by mouth, followed by 1 gm. four times daily. If the patient has been re-

4. Split skin grafts applied over the lower extremities.

ceiving sulfonamides, 1 gm. three or four times daily is prescribed. Sulfonamide blood levels should be taken daily, as it has been observed that burn patients do not eliminate the sulfonamide freely, but tend to accumulate it in the body.

Penicillin is applied locally on dressings in some cases, using 100 units per centimeter for infected burns. It is effective on most types of bacteria except Pseudomonas aeruginosa, for which a 1-percent solution of acetic acid is used as a wet dressing. Catheters are placed in the dressing, through which it is mois-

tened every 6 hours. In patients who do not tolerate sulfonamides, very good results have been obtained with 20,000 units of penicillin administered intramuscularly every 3 hours.

Large areas of third-degree burns are covered by split skin grafts as early as possible, before excessive fibrosis and scarring develop in the granulating wound. It has been previously established that this immediately stops the loss of body fluids and makes for a smoother and more pliable subsequent skin covering (figs. 3 and 4).

To summarize, the essential features in treating burn casualties at this hospital are:

1. Generous, frequent, supervised plasma or whole blood transfusions are given when indicated. Saline solution is given preferably by mouth.

2. Rigid, sterile surgical technic is used when dressing burn areas. Dressings are changed infrequently.

3. Split skin grafts are utilized early to cover third-degree burn areas.

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MOLD PREVENTIVE FOR BOOK BINDINGS

In warm climates, following a protracted rainy spell, it is not uncommon to find one's book bindings supporting a heavy growth of mold, which if unchecked will disfigure the books. Mere dusting removes the superficial growth without disturbing the mold actually growing in the paste of the bindings. Wiping the following solution over the molded bindings results in permanent freedom from molds: Thymol crystals, 10 gm.; mercuric bichloride, 4 gm.; ether, 200 cc.; benzene, 400 cc.

Treated volumes have never shown any tendency to mold since application several years ago. The solution is poisonous and inflammable and should be used carefully in an open room, or outdoors with no source of fire near by. It is best applied with a cotton sponge tied to a suitable applicator or held by forceps, so that none of it gets upon the fingers. The solution penetrates the bindings readily and dries rapidly, leaving no precipitate. One application is usually sufficient and the books may be returned at once to their places. It is wise to test first one corner of the binding before using the solution to discover whether the dye may run or change in any way. No alteration of the appearance of the goods or the letter stampings has occurred.

The solution may be safely used on record album backs, leather boxes and luggage, but it should never be used on any wearing apparel.—HETHERINGTON, D. C.: Mold preventive for book bindings. Science 101: 223, March 2, 1945.

PNEUMONIA IN THE U. S. NAVY—1882–1942

PART II.—AS CAUSE OF INCAPACITATION AND MORTALITY[1]

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and
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The methods of treatment to reduce incapacitation and mortality due to pneumonia in the U. S. Navy have been many and varied, but it was not until 1937 that any method was found which could effectively curtail pneumonia mortality. As far as incapacitation is concerned, no solution has even yet been found.

Throughout the 61-year period under study, good nursing and supportive treatment, with relief of troublesome symptoms as they occurred, have been the Naval medical officer's chief reliance in the care of pneumonia patients. In 1886, however, there appeared in the Annual Report of the Surgeon General the report of a new method of treatment which involved introduction into the lungs of cold outside air (temperature of 34° F.) by means of a tube and funnel (*10*). Inhalation of this cold air appeared to be bracing and stimulating to the patient and to aid in his recovery.

In 1896, a case of pneumonia reported from the U. S. Naval Academy was treated with ". . . strychnia, ammonia, whiskey in full doses and counterirritation . . . death occurred . . ." (*11*).

Carbonate of creosote was reported as useful in 1903 (*12*) and the Galbraith method of using quinine was recommended as providing "excellent" results in 1907 (*13*).

In 1914, "cold air therapy" was advocated in lobar pneumonia but condemned in "broncho-catarrhal" pneumonia (*14*). In 1916, ethylhydrocupreine was "proved" to have a direct and specific action upon the pneumococci of pneumonia (*15*).

Although Neufeld and Handel had provided pneumococcus serum of two types as early as 1910 and the Rockefeller Institute had provided serum of four types as early as 1912 (*16*), the use of pneumococcus serum was apparently first recommended in the

[1] Pneumonia in the U. S. Navy—1882-1942; Part I.—As Cause of Admission to Sick List, appeared in the May BULLETIN.

Naval service in 1919 and then only for "Type I pneumococcus" cases (*17*).

The addition of the intravenous use of magnesium sulfate and calcium chloride to good supportive and symptomatic treatment was reported in 1921 to reduce the pneumonia case fatality from 41.7 percent to 16 percent (*18*).

By 1925, although roentgenographic examination of the chest for confirmation of the diagnosis of pneumonia was widely used and recommended, there were still but four types of lobar pneumonia recognized, and Type I serum was to serve as an ". . . added feature after body requirements are obtained." The treatment was based ". . . purely upon the physiological principles of health, and the attempt is to place the body in a state that approaches . . . the physiology as found in the normal and healthy body." Morphine was stressed as the most important drug in the treatment of pneumonia, while the use of digitalis in such cases was condemned (*19*).

To Type I and Type II serum were added Huntoon's pneumococcus antibody solution and Felton's concentrated antipneumococcus serum in the twenties (*20*). In 1935, rabbit diagnostic serum replaced horse serum in the Supply Catalog for the Neufeld method of pneumococcus typing (*21*). As late as 1935, however, the universal recognition and use of type-specific pneumococcus serum for the treatment of pneumococcus pneumonia in the U. S. Navy was still by no means an accomplished fact.

The reasons underlying this lack of universal use were apparently: (1) Difficulty in procuring a suitable sputum sample; (2) difficulty in transporting the sputum sample to a laboratory and effecting prompt return of the report to the medical officer; and (3) difficulty in the prompt procurement of type-specific serum in isolated areas.

The history of the sulfonamides needs no further elaboration in this paper; it will suffice to state that their use in the Navy paralleled that in civilian life. They were introduced in 1935 to 1936 and quickly established themselves as therapeutically efficacious in pneumonia. The effect of these agents upon pneumonia mortality is one of the most spectacular accomplishments of modern medical science.[2]

Thus, as is evident from this brief review of the history of the treatment of pneumonia in the U. S. Navy, no appreciable curtailment of either incapacitation or mortality would be expected until very recent times. The statistical presentation to follow

[2] Although it is impossible at the present time to evaluate fully the role of penicillin in the treatment of pneumonia, reports available on its use in the Navy seem to indicate that a still more dramatic decrease in pneumonia mortality can be expected.

bears out this expectation. From the accompanying tables and curves it will be evident that pneumonia in the U. S. Navy is not the "killer" of bygone days. It still, however, causes the loss of many man-days of service despite the many aids provided by modern science.

PNEUMONIA (ALL FORMS)

For a total, over-all picture of the Navy's progress in the battle against all forms of pneumonia, table 1 and figure 1 are presented. The three curves (fig. 1) represent admissions to the sick list,[3] incapacitation (measured in terms of noneffective ratios[4]) and mortality.

Even cursory comparison of the curve representing noneffective ratios with that for admission rates indicates a rather close relationship between the two. Each curve has followed a generally downward trend since 1882, presenting peaks and troughs of varying period and amplitude. Generally speaking, these fluctuations tend to follow a comparable pattern. There are instances, however, where an inverse ratio is evident. Most of these can be explained in terms of the differences between bronchopneumonia and lobar pneumonia; others can be approached merely in terms of variations in the types of the etiologic agents of pneumonia.

It would appear that this relationship between noneffective ratios and admission rates is due to a multitude of factors, the most outstanding of which are the following:

1. A study of the number of sick days per case (to be discussed in a later section) indicates that through the years pneumonia patients have been kept on the sick list for a rather constant number of days. This has remained true despite the numerous variations of treatment for this disease.

2. Contrary to the Navy's experience with many other diseases,

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[3] The curve for admissions is repeated in Part II because it provides the explanation of many fluctuations in the curves representing incapacitation and mortality.

[4] The noneffective ratio is an indication of the loss of time due to illness. Thus the noneffective ratio per 1,000 average strength, as used in this study, represents the average number of men out of each 1,000 personnel constantly on the sick list for pneumonia during a given year. It is computed according to the following formula:

$$\frac{\text{Number of sick days during period}}{\text{Number of man-days during period}} \times 1{,}000 = \text{Noneffective ratio per } 1{,}000$$

In Navy statistics compilation, however, the total number of sick days for all types of admissions to the sick list is listed as a single figure. The admission rates as computed for purpose of this study include only new admissions (A) and (ACD), and omit Remaining (Rem), Existed Prior to Entry (EPTE) and Readmitted (RA). In view of the fact that these latter three types of admissions to the sick list play only a minor role, as far as pneumonia is concerned, in contributing to the total number of sick days, direct comparison between the curves for noneffective ratios and admission rates appears to be warranted.

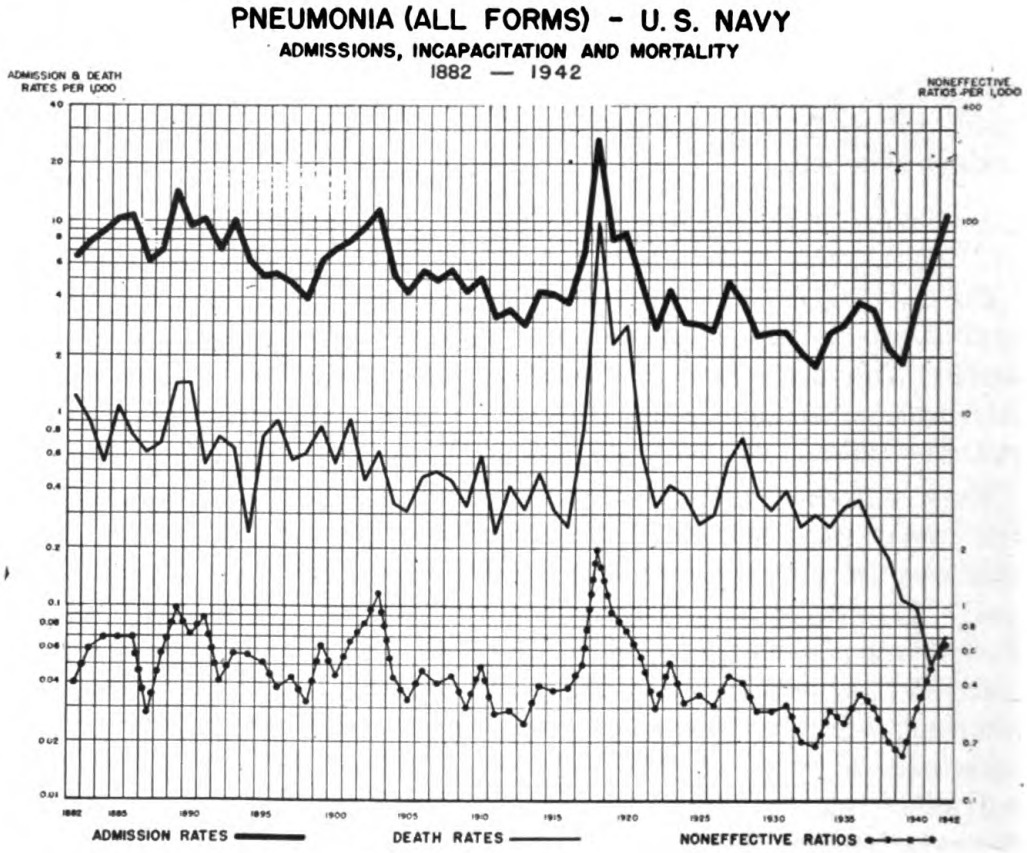

Figure 1.

notably tuberculosis, very few patients are discharged or separated from the service because of pneumonia alone. The absence of the element of chronicity has tended to keep a man on the sick list until he is cured or dies.

3. The recent advent and development of the use of the sulfonamides in the treatment of pneumonia has tended to keep alive those pneumonia patients who otherwise would have died on the third, fifth, or seventh day of the disease. The number of sick days for these previously fatal cases has been increased as much if not more than the number of sick days for the milder cases has been lowered.

4. Perhaps of lesser importance, but still playing a role, is the element of the attitude of the individual medical officer toward the hospitalized patient. Inasmuch as economic considerations do not enter the picture, and the medical officer is permitted to exercise his judgment as to how long to retain a man on the sick list, the period of hospitalization is not prematurely terminated as is often the case in civilian practice.

Although the mortality curve in figure 1 exhibits characteristics of fluctuation somewhat similar to those for noneffective

TABLE 1.—*Pneumonia (all forms), U. S. Navy*
Admissions, incapacitation, and mortality—1882–1942

Year	Average strength	Admissions		Incapacitation		Mortality	
		No. of admissions	Rate per 1,000	No. of sick days	Noneffective ratio per 1,000	No. of deaths	Death rate per 1,000
1882	10,631	68	6.40	1,564	0.40	13	1.22
1883	9,874	77	7.80	2,161	0.60	9	0.91
1884	10,948	97	8.86	2,769	0.69	6	0.55
1885	9,191	96	10.44	2,322	0.69	10	1.09
1886	9,188	98	10.67	2,310	0.69	7	0.76
1887	9,618	59	6.13	995	0.28	6	0.62
1888	9,955	70	7.03	2,085	0.57	7	0.70
1889	11,219	160	14.26	4,034	0.98	16	1.43
1890	11,768	110	9.35	3,079	0.72	17	1.44
1891	11,051	115	10.41	3,563	0.88	6	0.54
1892	11,775	83	7.05	1,761	0.41	9	0.76
1893	12,109	124	10.24	2,502	0.57	8	0.66
1894	12,520	77	6.15	2,579	0.56	3	0.24
1895	13,191	69	5.23	2,439	0.51	10	0.76
1896	14,196	77	5.42	1,960	0.38	13	0.92
1897	15,734	74	4.70	2,455	0.43	9	0.57
1898	23,986	94	3.92	2,764	0.32	15	0.62
1899	20,819	128	6.15	4,755	0.63	18	0.86
1900	23,756	171	7.20	3,840	0.44	13	0.55
1901	26,873	211	7.85	6,437	0.66	25	0.93
1902	31,240	292	9.35	9,349	0.82	14	0.45
1903	37,248	437	11.73	15,723	1.16	24	0.64
1904	40,555	211	5.20	6,368	0.43	14	0.34
1905	41,313	174	4.21	5,015	0.33	13	0.31
1906	42,529	234	5.50	7,339	0.47	20	0.47
1907	46,336	225	4.86	6,727	0.40	23	0.50
1908	52,913	302	5.71	8,445	0.44	24	0.45
1909	57,172	245	4.28	6,319	0.30	19	0.33
1910	58,691	297	5.06	10,547	0.49	35	0.60
1911	61,399	195	3.18	6,277	0.28	15	0.24
1912	61,897	215	3.47	6,646	0.29	26	0.42
1913	65,926	189	2.87	6,110	0.25	21	0.32
1914	67,141	292	4.35	9,488	0.39	33	0.49
1915	68,075	288	4.23	9,156	0.37	22	0.32
1916	69,294	259	3.74	9,663	0.38	18	0.26
1917	245,580	1,697	6.91	44,593	0.50	201	0.82
1918	503,792	13,574	26.94	361,678	1.97	5,006	9.94
1919	298,774	2,352	7.87	102,988	0.94	689	2.31
1920	140,773	1,235	8.77	38,696	0.75	409	2.90
1921	148,861	708	4.76	29,815	0.55	94	0.63
1922	122,126	341	2.79	13,265	0.30	40	0.33
1923	116,565	522	4.48	21,789	0.51	50	0.43
1924	119,280	356	2.98	13,918	0.32	45	0.38
1925	115,381	337	2.92	14,864	0.35	31	0.27
1926	113,756	307	2.70	12,803	0.31	34	0.30
1927	115,316	548	4.75	18,488	0.44	66	0.57
1928	116,047	435	3.75	17,246	0.41	88	0.76
1929	117,388	295	2.51	12,353	0.29	45	0.38
1930	117,453	314	2.67	12,547	0.29	37	0.32
1931	112,767	203	2.68	12,624	0.31	45	0.40
1932	110,717	231	2.09	7,992	0.20	29	0.26
1933	108,183	193	1.78	7,344	0.19	33	0.30
1934	109,383	288	2.63	11,548	0.29	29	0.26
1935	114,188	334	2.92	10,402	0.25	38	0.33
1936	124,408	474	3.81	15,735	0.35	45	0.36
1937	132,855	458	3.45	14,411	0.30	32	0.24
1938	139,216	308	2.21	10,435	0.20	25	0.18
1939	149,618	275	1.84	9,371	0.17	17	0.11
1940	202,614	787	3.88	22,229	0.30	21	0.10
1941	348,926	2,126	6.09	60,662	0.48	17	0.05
1942	833,920	8,987	10.78	193,330	0.64	57	0.07

ratios, its similarity to admissions is not nearly so great. Mortality in the U. S. Navy from pneumonia (all forms) has followed a generally decreasing trend-line during the period under study. There are evident, of course, numerous deviations from the underlying trend, only five of which are of sufficient significance to justify discussion.

The first of these marked deviations was that of 1889 and 1890. It is interesting to note that the rise in 1889 accompanied a corresponding increase in the incidence of pneumonia, whereas this was not the case in 1890. The influenza epidemic of 1890, though unusually mild in itself (*22*), appears to have been a causative factor in the high pneumonia mortality rate of that year.

In 1894 the curve fell to a rate of 0.24 per 1,000, the lowest point reached in the entire 61-year period with the exception of 1911 and 1938 to 1942. The only explanation for this drop is the assumed prevalence in that year of a peculiarly benign type of pneumococcus, but for that hypothesis there is no definite evidence.

The third deviation was the rapid rise of mortality in 1917 to a rate of 0.82 per 1,000, ascension to an all-time high of 9.94 in 1918, and a persistence of the high level in 1919 and 1920 with rates of 2.31 and 2.90 per 1,000 respectively. Correlated with this period of rapid increase were: (1) A marked increase in unseasoned personnel plus a high incidence of measles in 1917; (2) further increases in unseasoned personnel plus the influenza pandemic in 1918; and (3) continued high incidence of a type of influenza particularly prone to give rise to pneumonia as a complication in 1919 and 1920. During this period, 1917 to 1920, pneumonia mortality both increased and decreased at a much more rapid rate than did pneumonia admissions.

The fourth deviation occurred in the years 1927 and 1928. In explanation for this rise in pneumonia mortality are primarily two factors: First, the existence in 1927 of a form of epidemic influenza which was conducive to the development of a highly lethal pneumonia, since in this year the mortality occurred mainly among the bronchopneumonias; and second, the assumed prevalence of a more lethal type of pneumococcus in 1928 because of a peak mortality in lobar pneumonia. It is interesting to note that the high mortality of bronchopneumonia continued into 1928.

LOBAR PNEUMONIA AND BRONCHOPNEUMONIA

In 1937, there began a series of drops from a rate of 0.36 per 1,000 in 1936 to 0.05 per 1,000 in 1941, followed by a slight rise to 0.07 in 1942. This drop must be regarded as a direct result of the introduction and widespread use of the sulfonamides in the treatment of lobar and bronchopneumonias.[5]

From a comparison of the curves in figure 2 representing lobar pneumonia and bronchopneumonia, many points of interest may

[5] The provisional death rate for pneumonia (all forms) in 1943 is also 0.07 per 1,000 strength.

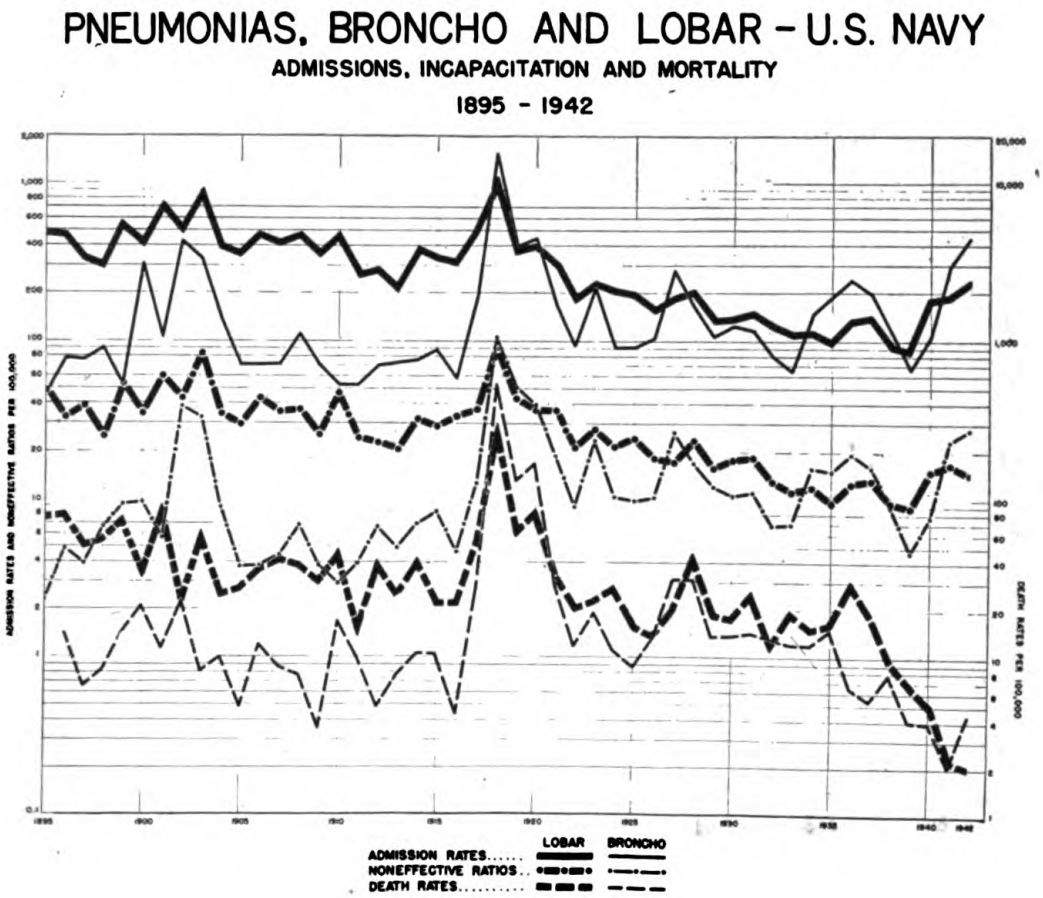

Figure 2.

be deduced. It is immediately obvious from the curves of noneffective ratios that each possesses the same general contour that its admission curve shows. Whereas the noneffective ratios for lobar pneumonia have followed a decreasing trend since 1895 (at which time differentiation between lobar and bronchopneumonias was first recorded in the U. S. Navy), the noneffective ratios for bronchopneumonia have undergone an increase.

As would be expected from the mathematical basis of this measurement of incapacitation, periods of bronchopneumonia epidemicity were usually accompanied by corresponding rises in the noneffective ratios. One notable exception was the period from 1899 to 1900. In 1899 there was a drop in the incidence of bronchopneumonia, but a rise in its incapacitation, while in 1900 just the opposite was true. This might be explained in terms of variation in the types of causative agents.

Although type-specific pneumococcus serum was used in the Navy subsequent to 1919, it appears to have had no direct effect on incapacitation. The use of the sulfonamides as a therapeutic

TABLE 2A.—*Lobar pneumonia, U. S. Navy. Admissions, incapacitation, and mortality—1895–1942*

Year	Average strength	Admissions		Incapacitation		Mortality	
		No. of Admissions	Rate	No. of sick days	Noneffective ratio	No. of deaths	Death rate
1895	13,191	63	477.6	2,330	48.4	10	75.8
1896	14,196	66	464.9	1,713	33.0	11	77.5
1897	15,734	52	330.5	2,233	38.9	8	50.8
1898	23,986	72	300.2	2,188	25.0	13	54.2
1899	20,819	117	562.0	4,059	53.4	15	72.0
1900	23,756	99	416.7	3,010	34.6	8	33.7
1901	26,873	183	681.0	5,878	59.9	22	81.9
1902	31,240	158	505.8	4,952	43.4	7	22.4
1903	37,248	315	845.7	11,247	82.7	21	56.4
1904	40,555	156	384.7	5,059	34.1	10	24.6
1905	41,313	145	351.0	4,459	29.6	11	26.6
1906	42,529	204	479.7	6,760	43.5	15	35.3
1907	46,336	192	414.4	5,990	35.4	19	41.0
1908	52,913	243	459.2	7,118	36.8	20	37.8
1909	57,172	205	358.6	5,519	26.4	17	29.7
1910	58,691	266	453.2	9,916	46.3	25	42.6
1911	61,399	163	265.5	5,401	24.1	9	14.6
1912	61,897	172	277.9	5,153	22.7	23	37.2
1913	65,926	141	213.9	4,939	20.5	16	24.3
1914	67,141	242	360.4	7,759	31.7	26	38.7
1915	68,075	227	333.4	7,087	28.5	15	22.0
1916	69,294	216	311.7	8,348	33.3	15	21.6
1917	245,580	1,234	502.5	33,166	37.0	132	53.8
1918	503,792	4,990	990.5	168,019	91.4	1,350	268.0
1919	298,774	1,053	352.4	47,400	43.7	181	60.6
1920	140,773	556	395.0	18,622	36.1	114	81.0
1921	148,861	453	304.3	19,618	36.1	49	32.9
1922	122,126	226	185.0	9,394	21.1	25	20.5
1923	116,565	264	226.5	11,732	27.6	26	22.3
1924	119,280	246	206.2	9,340	21.4	32	26.8
1925	115,381	224	194.1	10,241	24.3	18	15.6
1926	113,756	178	156.5	7,551	18.2	15	13.2
1927	115,316	214	185.6	7,253	17.2	23	19.9
1928	116,047	237	204.2	9,960	23.4	48	41.4
1929	117,388	161	137.2	6,759	15.8	22	18.7
1930	117,453	162	137.9	7,647	17.8	20	17.0
1931	112,767	169	149.9	7,542	18.3	28	24.8
1932	110,717	139	125.5	5,225	12.9	13	11.7
1933	108,183	120	110.9	4,457	11.3	20	18.5
1934	109,383	123	112.4	4,742	11.9	16	14.6
1935	114,188	112	98.1	3,946	9.5	18	15.8
1936	124,408	165	132.6	5,718	12.6	36	28.9
1937	132,855	184	138.5	6,355	13.1	24	18.1
1938	139,216	129	92.7	4,828	9.5	13	9.3
1939	149,618	128	85.6	4,815	8.8	10	6.7
1940	202,614	367	181.1	11,276	15.2	10	4.9
1941	348,926	656	188.0	21,083	16.6	8	2.3
1942	833,920	1,896	227.4	43,756	14.4	17	2.0

All rates and ratios are calculated per 100,000 strength.

agent likewise had no noteworthy effect, apparently due to the reasons previously stated.

These curves seem to lend added weight to the viewpoint that bronchopneumonia and lobar pneumonia each possesses a specific morbidity pattern. Examination of the mortality curves further substantiates this viewpoint.

Whereas lobar pneumonia mortality presents a constantly declining trend line, apparently following the admission pattern, the mortality curve for bronchopneumonia has undergone no such trend and has deviated quite markedly from the pattern set by the curve for bronchopneumonia admissions. In many years sharp increases in admissions for bronchopneumonia were ac-

TABLE 2B.—*Bronchopneumonia, U. S. Navy. Admissions, incapacitation, and mortality—1895–1942*

Year	Average strength	Admissions		Incapacitation		Mortality	
		No. of admissions	Rate	No. of sick days	Non-effective ratio	No. of deaths	Death rate
1895	13,191	6	45.5	109	2.3	0	0.0
1896	14,196	11	77.5	247	4.8	2	14.1
1897	15,734	12	76.3	222	3.9	1	6.4
1898	23,986	22	91.7	576	6.6	2	8.3
1899	20,819	11	52.8	696	9.2	3	14.4
1900	23,756	72	303.1	830	9.5	5	21.0
1901	26,873	28	104.2	559	5.7	3	11.2
1902	31,240	134	428.9	4,397	38.6	7	22.4
1903	37,248	122	327.5	4,476	32.9	3	8.0
1904	40,555	55	135.6	1,309	8.8	4	9.9
1905	41,313	29	70.2	556	3.7	2	4.8
1906	42,529	30	70.5	579	3.7	5	11.8
1907	46,336	33	71.2	737	4.4	4	8.6
1908	52,913	59	111.5	1,327	6.8	4	7.6
1909	57,172	40	70.0	800	3.8	2	3.5
1910	58,691	31	52.8	631	2.9	10	17.0
1911	61,399	32	52.1	876	3.9	6	9.8
1912	61,897	43	69.5	1,493	6.6	3	4.8
1913	65,926	48	72.8	1,171	4.9	5	7.6
1914	67,141	50	74.5	1,729	7.0	7	10.4
1915	68,075	60	88.1	2,065	8.3	7	10.3
1916	69,294	40	57.7	1,162	4.6	3	4.3
1917	245,580	459	186.9	11,234	12.5	67	27.3
1918	503,792	7,591	1,506.8	193,315	105.1	2,673	530.6
1919	298,774	1,175	393.3	55,248	50.7	387	129.5
1920	147,773	621	441.1	20,074	39.0	237	168.4
1921	148,861	251	168.6	10,185	18.7	42	28.2
1922	122,126	114	93.3	3,871	8.9	14	11.5
1923	116,565	256	219.6	10,147	23.8	22	18.9
1924	119,280	109	91.4	4,489	10.3	13	10.9
1925	115,381	106	91.9	4,114	9.8	10	8.7
1926	113,756	119	104.6	4,229	10.2	15	13.2
1927	115,316	325	281.8	11,191	26.6	36	31.2
1928	116,047	193	166.3	7,279	17.1	36	31.0
1929	117,388	124	105.6	5,172	12.1	16	13.6
1930	117,453	146	124.3	4,558	10.6	16	13.6
1931	112,767	130	115.3	4,631	11.2	16	14.2
1932	110,717	90	81.3	2,767	6.8	14	12.6
1933	108,183	70	64.7	2,731	6.9	13	12.0
1934	109,383	162	148.1	6,247	15.6	13	11.9
1935	114,188	216	189.2	6,313	15.1	17	14.9
1936	124,408	301	241.9	8,731	19.2	8	6.4
1937	132,855	260	195.7	7,599	15.7	7	5.3
1938	139,216	158	113.5	4,527	8.9	11	7.9
1939	149,618	100	66.8	2,529	4.6	6	4.0
1940	202,614	216	106.6	5,734	7.7	8	3.9
1941	348,926	1,039	297.8	29,396	23.1	7	2.0
1942	833,920	3,697	443.3	82,721	27.2	37	4.4

companied by a decrease in mortality, while in other years the reverse held true.

Type-specific pneumococcus serum appears to have had no curtailing effect on lobar pneumonia mortality, but the sulfonamides produced a marked alteration, effecting an almost straight-line decrease from a death rate of 28.9 per 100,000 in 1936 to a rate of 2 per 100,000 in 1942.[6]

The mortality curve for bronchopneumonia, however, fell very rapidly in 1936, prior to a distribution of the sulfonamides sufficient to cause such a decrease. This sudden fall occurred despite a high admission rate and seems to elude explanation. Then, not-

[6] Provisional figures for 1943 indicate a slight rise to 3.1 per 100,000 strength.

FIG. 3

PNEUMONIAS, BRONCHO AND LOBAR - U.S. NAVY
NUMBER SICK DAYS PER CASE TREATED
1915 - 1942

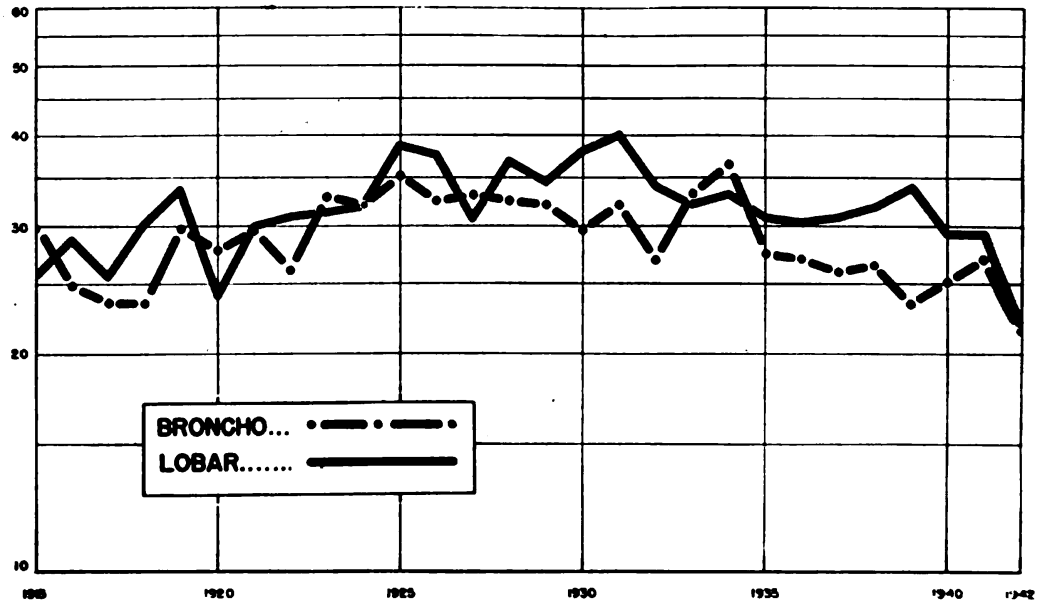

Figure 3.

withstanding the widespread use of the sulfonamides, bronchopneumonia mortality, unlike that of lobar pneumonia, rose in 1938 and again in 1942. Perhaps the characteristic variation in the etiologic background of bronchopneumonia will explain such fluctuations.[7]

Thus far, incapacitation and mortality have been discussed with only an indirect, visual comparison with the variations of admissions to the sick list. In order more fully to grasp these relationships, it is necessary that the problem be approached through two additional means; namely, sick days per case treated, and case fatality rates per 100 cases treated. These data are graphically presented in figures 3 and 4 respectively.

The convex contours of the curves for sick days per case (fig. 3) for both bronchopneumonia and lobar pneumonia lend support to some very interesting observations. To interpret these curves properly, references must again be made to the mortality experience of pneumonia and the history of the treatment of this disease in the U. S. Navy. When mortality rates are high, an increased incidence can only result in a low figure for sick days per case. When mortality is lowered and patients are maintained on the sick list for longer periods of time, sick days per case must nec-

[7] Provisional figures for 1943 indicate a drop in the bronchopneumonia death rate from 4.4 per 100,000 in 1942 to 2.4 in 1943, thus bringing bronchopneumonia to a point below lobar pneumonia.

TABLE 3.—*Bronchopneumonia and lobar pneumonia, U. S. Navy. Sick days per case treated—1915–1942*

Year	Lobar pneumonia			Bronchopneumonia		
	Cases treated	Sick days	Sick days per case	Cases treated	Sick days	Sick days per case
1915	277	7,087	25.6	69	2,065	29.9
1916	293	8,438	28.8	47	1,162	24.7
1917	1,298	33,166	25.6	475	11,234	23.6
1918	5,552	168,019	30.3	8,237	193,315	23.5
1919	1,416	47,700	33.7	1,857	55,248	29.8
1920	779	18,622	23.9	722	20,074	27.8
1921	659	19,618	29.8	343	10,185	29.7
1922	305	9,394	30.8	148	3,871	26.2
1923	374	11,732	31.4	308	10,147	32.9
1924	293	9,340	31.9	140	4,489	32.1
1925	264	10,241	38.8	117	4,114	35.2
1926	201	7,551	37.6	130	4,229	32.5
1927	237	7,253	30.6	338	11,191	33.1
1928	270	9,960	36.9	224	7,279	32.5
1929	196	6,759	34.5	161	5,172	32.1
1930	201	7,647	38.0	154	4,558	29.6
1931	189	7,542	39.9	144	4,631	32.2
1932	154	5,225	33.9	103	2,767	26.9
1933	139	4,457	32.1	82	2,731	33.3
1934	143	4,742	33.2	171	6,247	36.5
1935	128	3,946	30.8	230	6,313	27.4
1936	188	5,718	30.4	323	8,731	27.0
1937	207	6,355	30.7	293	7,599	25.9
1938	152	4,828	31.8	171	4,527	26.5
1939	142	4,815	33.9	108	2,529	23.4
1940	385	11,281	29.3	227	5,734	25.2
1941	720	21,083	29.3	1,086	29,396	27.1
1942	1,980	43,756	22.1	3,837	82,721	21.6

essarily increase. This would be so only if the factors operative upon the curtailment of mortality did not, at the same time, tend sharply to reduce the number of days required to cure the patient. Thus in figure 3 we find first a period of high mortality, then a period of what may be considered normalcy, and finally the use of the sulfonamides, all acting to produce the convexity of the curves.

Some fluctuation, no doubt, can be attributed to chance variation in the type of the causative agents of the pneumonias, with the result upon length of stay on the sick list.

It is also worthy of note that during the entire 27-year period, the sick days per case for lobar pneumonia varied between a high of 39.9 in 1931 and a low of 22.1 in 1942; bronchopneumonia, during the same period, between 36.5 in 1934 and 21.6 in 1942.

In general, then, it may be stated that because of the above-mentioned factors, the number of sick days has not been materially diminished by the advancements in the treatment of lobar pneumonia and bronchopneumonia.

The mortality picture presented by the case fatality rates in figure 4 is more favorable. Following the period from 1917 to 1920, the rates apparently resumed a normal level through the twenties and early thirties. Here again is evidenced an "unexplainable" drop in the mortality of bronchopneumonia prior to

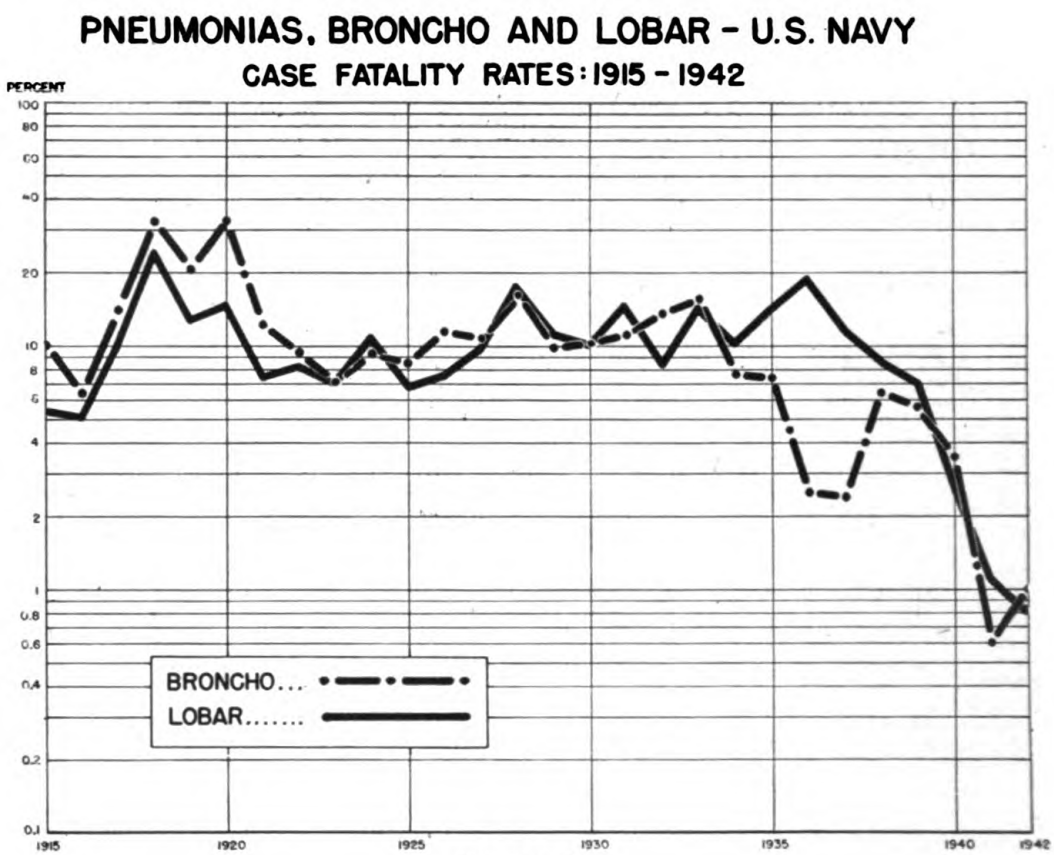

Figure 4.

TABLE 4.—*Lobar pneumonia and bronchopneumonia, U. S. Navy. Case fatality rates per 100 cases treated—1915–1942*

Year	Lobar pneumonia			Bronchopneumonia		
	Cases treated	Deaths	Case fatality rate	Cases treated	Deaths	Case fatality rate
1915	277	15	5.4	69	7	10.1
1916	293	15	5.1	47	3	6.4
1917	1,298	132	10.2	475	67	14.1
1918	5,552	1,350	24.3	8,237	2,673	32.4
1919	1,416	181	12.8	1,857	387	20.8
1920	779	114	14.6	722	237	32.8
1921	659	49	7.4	343	42	12.2
1922	305	25	8.2	148	14	9.4
1923	374	26	7.0	308	22	7.1
1924	293	32	10.9	140	13	9.3
1925	264	18	6.8	117	10	8.5
1926	201	15	7.5	130	15	11.5
1927	237	23	9.7	338	36	10.6
1928	270	48	17.8	224	36	16.1
1929	196	22	11.2	161	16	9.9
1930	201	20	10.0	154	16	10.4
1931	189	28	14.8	144	16	11.1
1932	154	13	8.4	103	14	13.6
1933	139	20	14.4	82	13	15.8
1934	143	16	11.2	171	13	7.6
1935	128	18	14.1	230	17	7.4
1936	188	36	19.1	323	8	2.5
1937	207	24	11.6	293	7	2.4
1938	152	13	8.6	171	11	6.4
1939	142	10	7.0	108	6	5.6
1940	385	10	2.6	227	8	3.5
1941	720	8	1.1	1,086	7	0.6
1942	1,980	17	0.8	3,837	37	1.0

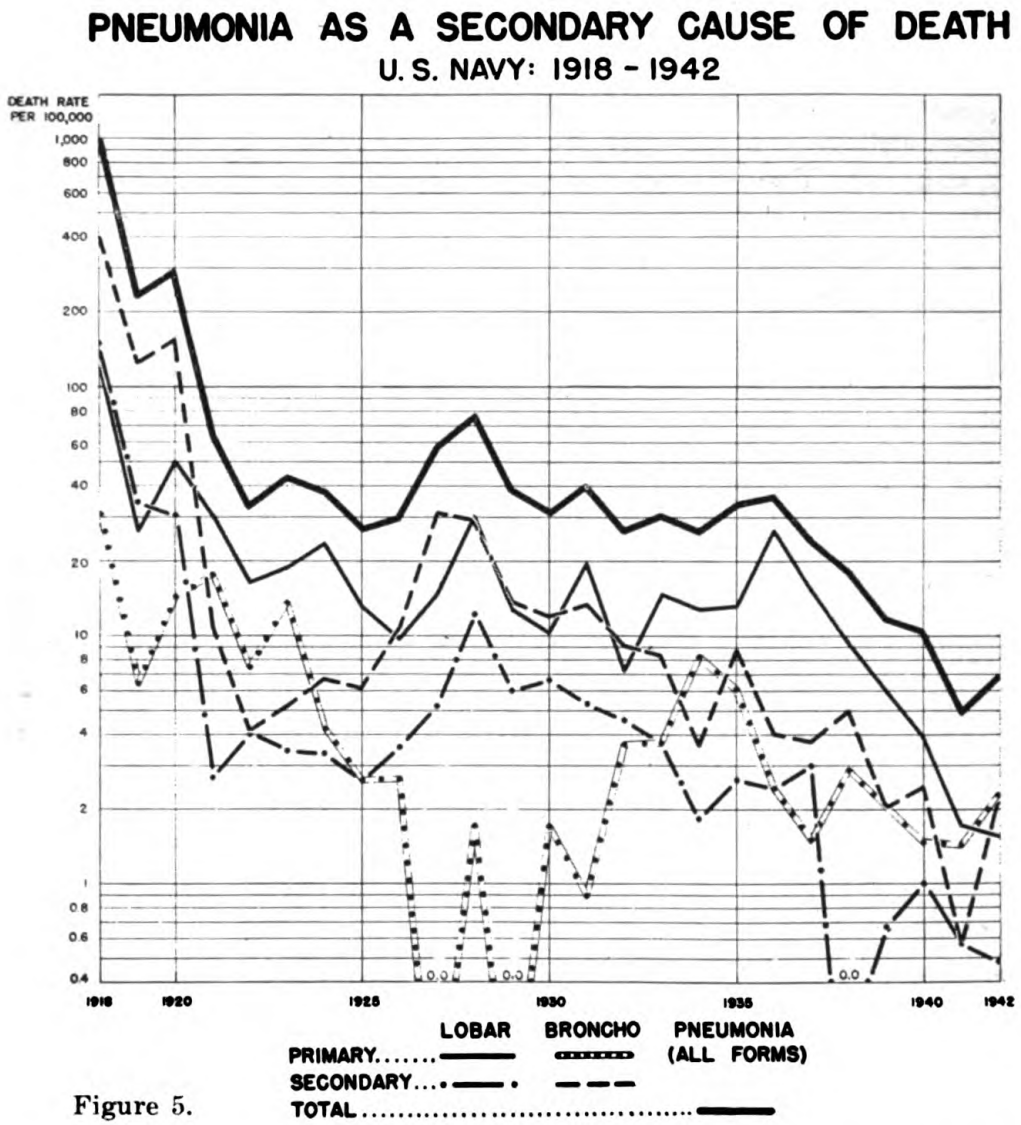

Figure 5.

the introduction of the sulfonamides, becoming evident in 1934 rather than in 1936 as was indicated by the crude mortality rates of figure 2. This "presulfonamide era" drop carried the curve to a rate of 2.4 percent in 1937, the lowest point attained during the previous 22 years. Then despite the use of the sulfonamides, the rate rose to 6.4 percent in a single year's time. The greater part of the decrease in the case fatality rates subsequent to 1938 must be ascribed to the use of the sulfonamides, and a smaller part to the increased incidence of the "nonfatal" atypical pneumonia.[8] In 1942 the case fatality rate for lobar pneumonia was only 1.1 percent. and 0.6 percent for bronchial pneumonia. What the effect of penicillin will be on the case fatality picture of the pneumonias remains to be seen.

[8] There has been reported in the U. S. Navy only a single death attributable to atypical pneumonia; that occurred in 1942.

It was indicated in Part I of this study that lobar pneumonia and bronchopneumonia each exhibits independent characteristics as causes of primary and secondary admissions to the sick list. These differences are even more marked in a comparative study of mortality due to these forms of pneumonia. Figure 5 graphically presents the data for such a comparison.[9]

Although the curve for mortality of pneumonia (all forms) was discussed earlier in this paper, it is again presented in figure 5 (1918 to 1942) in order to gain a better comprehension of the chief components causing its fluctuations during this period. It is evident that primary deaths due to lobar pneumonia and secondary deaths due to bronchopneumonia generally have been responsible for the variations demonstrated by the curve for pneumonia (all forms). Secondary lobar pneumonia deaths and primary bronchopneumonia deaths obviously must be viewed as occupying a relatively minor position.

It is interesting to note the spectacular effect of the sulfonamides on deaths due to both primary and secondary lobar pneumonia. The decrease in bronchopneumonia deaths, as would be expected, shows a considerably more irregular pattern.

SUMMARY

For pneumonia (all forms) in the U. S. Navy, 1882–1942:

1. The fluctuations of the curve for noneffective ratios are rather closely related to the curve for admissions.

2. The mortality curve does not as closely follow the curve for admissions as does the curve for noneffective ratios.

3. The mortality curve exhibits a generally decreasing trend-line broken by five major deviations, as follows:

(a) *1889 and 1890*—an abnormally high pneumonia mortality rate (synchronous with a high pneumonia incidence but a low influenza-catarrhal fever incidence in 1889, and synchronous with a moderate pneumonia but a high influenza-catarrhal fever incidence in 1890).

(b) *1894*—an unusually low pneumonia mortality (associated with only a moderate pneumonia and influenza-catarrhal fever incidence).

(c) *1917 through 1920*—an abnormally high pneumonia mortality (apparently correlated with all-time high incidences of pneumonia and influenza-catarrhal fever).

(d) *1927 and 1928*—high pneumonia mortality (synchronous

[9] This phase of the study of mortality due to pneumonia is necessarily limited to the period from 1918 to 1942.

with a moderate pneumonia incidence but an increased incidence of influenza-catarrhal fever).

(e) *1937 through 1942*—extremely rapid decrease of pneumonia mortality (despite moderate to high incidences of pneumonia and influenza-catarrhal fever) apparently due to the use of the sulfonamides.

For lobar pneumonia:

1. The curve for noneffective ratios has followed a decreasing trend since 1895, seemingly closely related to the curve for lobar admissions.

2. Lobar pneumonia mortality likewise was on the decline during this period.

3. The introduction of type-specific pneumococcus serum did not appear to accelerate the downward trend in the mortality curve, but the advent and widespread use of the sulfonamides caused the lobar pneumonia mortality to decrease precipitously.

4. The use of the sulfonamides apparently did not alter the "normal" trend of incapacitation as measured in terms of either noneffective ratios or sick days per case.

5. The case fatality rates, which had an upward trend from 1921 through 1936, have consistently fallen since 1937; this is apparently attributable to the use of the sulfonamides.

6. Lobar pneumonia as a primary diagnosis has been mainly responsible for the total lobar mortality; secondary lobar pneumonia deaths occupy a relatively minor role.

For bronchopneumonia:

1. Although both incapacitation and mortality have undergone a relative increase during 1895 to 1942, the noneffective ratios have generally followed the pattern set by admissions, while the death rates have deviated widely from such a pattern.

2. The reduction of bronchopneumonia mortality with the increased use of the sulfonamides was not as pronounced as that demonstrated by lobar pneumonia. (The drop occurred prior to the "sulfonamide era" and the curve deviated from this decline in 1938 and 1942.)

3. The use of the sulfonamides has not apparently influenced the noneffective ratios or the number of sick days per case.

4. Secondary bronchopneumonia deaths are of considerably greater importance than are primary bronchopneumonia deaths.

During the six years in which cases of atypical pneumonia have been reported in the U. S. Navy (either under the title of acute pneumonitis or atypical pneumonia) only one death has been attributed to that condition; the death occurred in 1942.

CONCLUSIONS

Parts I and II

1. The long-term trend of lobar pneumonia incidence is downward, while that of both bronchopneumonia and atypical pneumonia incidence is upward.

2. Previous to the influenza pandemic of 1918, the bronchopneumonia incidence was considerably and consistently less than that of lobar pneumonia; since the pandemic, bronchopneumonia incidence has exceeded that of lobar pneumonia in ten years out of the twenty-four.

3. Although the incidence of influenza and acute catarrhal fever remained high from the time of the pandemic through 1940, the incidence of pneumonia (all forms) during this same period decreased.

4. The incidence of atypical pneumonia has rapidly increased since 1938; in 1942 the rate for this infection was higher than the rate for lobar pneumonia and almost as high as the rate for bronchopneumonia. (Provisional figures for 1943 indicate atypical pneumonia incidence to be relatively more than double the combined lobar pneumonia and bronchopneumonia incidence.)

5. Primary admissions for lobar pneumonia and bronchopneumonia follow an incidence curve seemingly independent of any other disease, while secondary admissions for bronchopenumonia tend to follow acute catarrhal fever, acute bronchitis, influenza and measles.

6. About one-half of the complicating pneumonias are bronchopneumonia; one-quarter are lobar pneumonia and the remainder are reported as acute pneumonitis.

7. Only in acute catarrhal fever and measles does acute pneumonitis outweigh lobar pneumonia as a complicating condition.

8. There is very little evidence that the use of type-specific pneumococcus serum significantly reduced the lobar or bronchopneumonia mortality.

9. The noneffective ratios and sick days per case for lobar pneumonia and bronchopneumonia do not show a great reduction correlated with the increased use of the sulfonamides. This is probably because there are more sick days added through the saving of the patient who otherwise would have died on the third or fifth day than there are sick days saved through the more rapid recovery of the less seriously ill patient.

10. The reduction in the mortality rates and case fatality rates during the sulfonamide era has been much more consistent for lobar pneumonia than for bronchopneumonia.

11. Spectacular success has been attained in reducing the mortality from lobar pneumonia since 1937; marked but less spectacular success has been attained in reducing the mortality from bronchopneumonia. Slight success has been attained in reducing the incidence of lobar pneumonia; no success is so far evident in the effort to reduce the incidence of bronchopneumonia.

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OPEN YOUR MOUTH; STICK OUT YOUR TONGUE

In the diagnosis of vitamin deficiency states such as have been studied, it is curious that evidence of deficiency of most of the vitamins is to be found in the mouth. This fact should be another stimulus to the modern practitioner to return somewhat to the time-taking physical diagnostic methods of his predecessors (sticking out the tongue) rather than rely too much upon the mechanical contrivances now at his disposal.—WRIGHT, L. D., JR.: Effect of vitamins on intestinal function. New Orleans M. & S. J. 97: 400-406, March 1945.

OBESITY'S DEFENSE

American physicians and life insurance offices have always taken a gloomy view of the prospect for the obese, but in this climate the "fair round belly" not infrequently survives into the "lean and slippered" stage. Herein it is laid down as an axiom that "a plethora of calories is the explanation of obesity, all the protestations to the contrary notwithstanding," for the law of conservation of energy must apply here as elsewhere.—LEADING ARTICLES: Pain, fear, and fatness. Brit. M. J. 1: 301-302, March 3, 1945.

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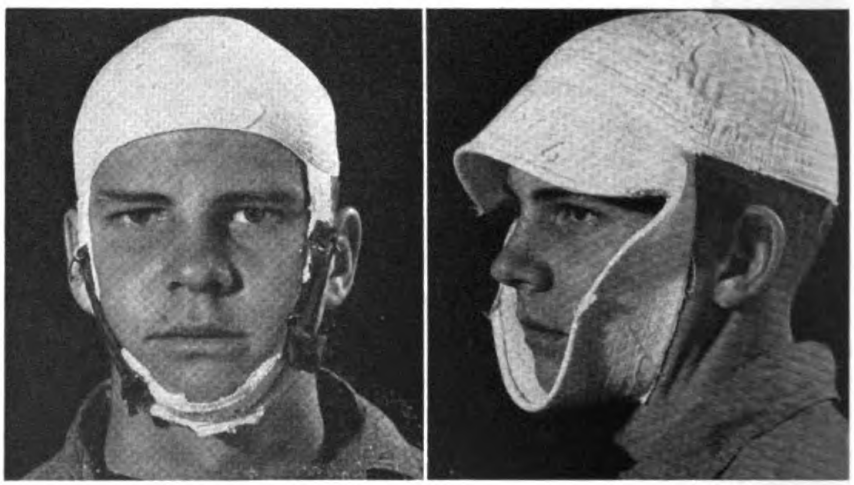
MAXILLARY AND MANDIBULAR IMMOBILIZATION DEVICE

A simple traction device for reduction of maxillary fractures makes use of the rim of the bluejacket's white hat. Tabs are cut for position and proper angle; a posterior tab may also be employed, cut on an angle at which traction is desired. The rubber dam traction unit may be cut to various lengths for rotation traction and the amount of traction on either side is governed by the number of rubber dam strips used. The section supporting the mandibular symphysis may be made of a sock top or underwear wrist or ankle band; muslin, however, is preferred.



Following coaptation of fragments a support may be applied by utilizing the full rim of the white hat. To prevent slipping, two strips of adhesive plaster, two inches in length are placed from the posterior of the cranium down to the nape of the neck.

This device seems practical and easily adaptable to service emergency use, inasmuch as no extra materials are required, and the appliance can be made and applied with only first-aid knowledge.—KYES, F. M., Commander (DC) U.S.N.; OPENSHAW, R. W., Lieutenant (DC) U.S.N.R.; and HUDSON, A. L., Lieutenant (DC) U.S.N.R.

CLINICAL NOTES

TRANSIENT COMPLETE HEART BLOCK IN A 17-YEAR-OLD MALE

T. HAYNES HARVILL
Lieutenant (MC) U.S.N.

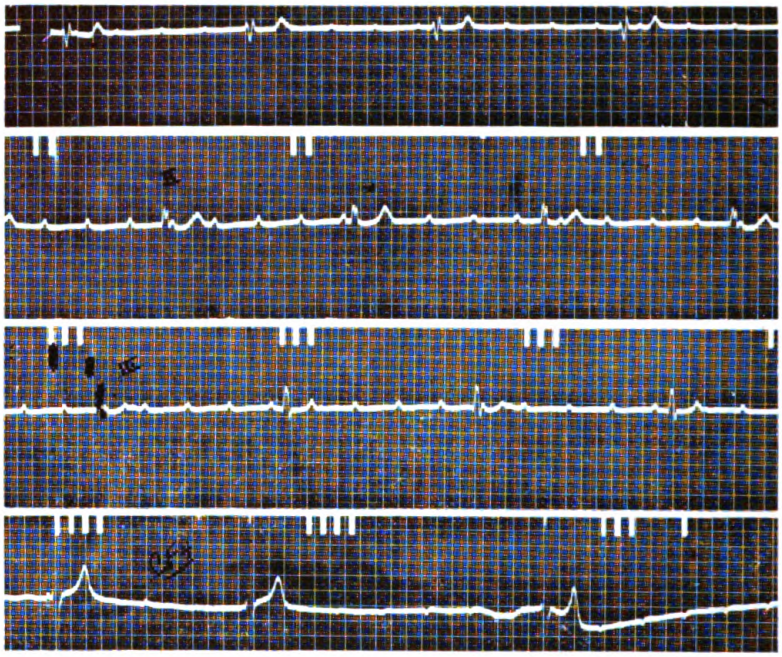
Complete heart block in young persons is not rare, but the following case was unusual in several respects.

Case report.—A seaman, second class, age 17 years, was found unconscious and brought to the dispensary on 22 May 1943. His illness had begun 12 days previously with blurring of vision and a throbbing, generalized headache, together with weakness and a light-headed "fainty" feeling, particularly on walking or other exertion. These symptoms continued until the day prior to admission when he lay in bed all day and was relatively comfortable. On the morning of admission he awakened to go to the head and remembered nothing until the guard was lifting him from the deck.

He had been short of breath on exertion during the present illness, but not before its onset. There also had been occasional precordial pain accentuated by deep inspiration. There was no history of previous syncope, or of a recent cold or other symptoms of infection. He had vomited undigested food on two occasions in the 2 days preceding admission. The patient had no other complaints and he said he had taken no drugs except a headache proprietary for several days preceding admission and had applied tannic acid jelly to the back for sunburn. There was no history of rheumatic conditions. Tonsillectomy had been performed 5 years previously. There had been no other operations.

His temperature on admission was 97° F., pulse rate 20, and respirations 20 per minute. The blood pressure was 86 mm. of mercury systolic and 30 diastolic, the diastolic transition being indistinct. He was apathetic but not acutely ill. There was an ashen color to the skin but no true cyanosis, and the nail beds were of good color. The pupils were in mid-dilatation and reactive. The heart was borderline in size by percussion, the left border of cardiac dullness extending to the midclavicular line. The apical heart rate was regular at 20 beats per minute, and auricular beats could be heard distinctly in the third intercostal space to the left of the sternum at a regular rate of 120 per minute.

When the patient was recumbent, the jugular veins were moderately distended and the auricular beats were visible in the jugular pulsations. At the left of the sternum, in the third and fourth intercostal spaces, there was heard an early systolic murmur, blowing in quality and not transmitted. There was no diastolic murmur. Other than a desquamating second-degree



1. Electrocardiogram on the day of admission, showing complete auriculoventricular block with slight variation in the ventricular rate. Auricular rate 108, ventricular rate 24 beats per minute (classic leads and CF_4).

sunburn of the posterior thorax, the remainder of the physical examination showed nothing abnormal.

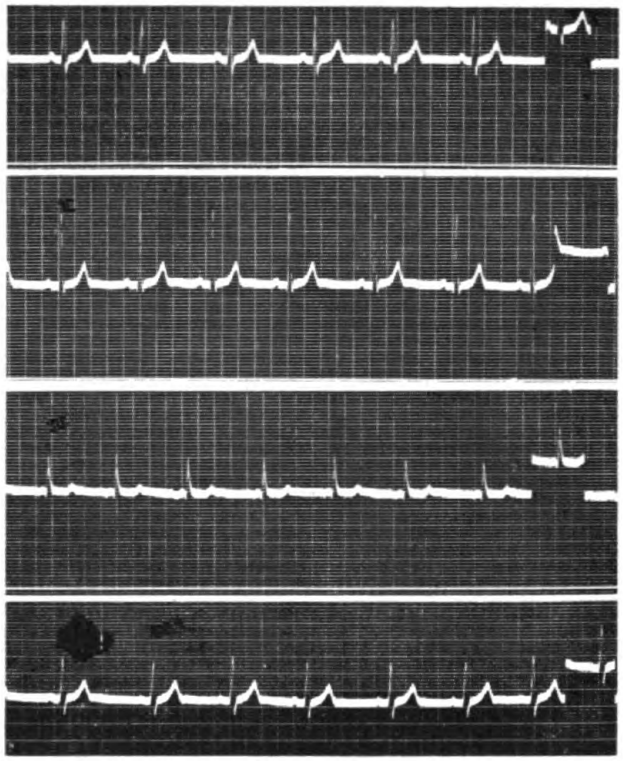
Epinephrine hydrochloride (1:1,000), 0.25 cc., was injected hypodermically. Within 10 minutes the headache became much more severe and a pulsus bigeminus developed. During the bigeminy, alternate beats were detected at a systolic level of 170 mm. of mercury on blood pressure determination, and at 140 mm. of mercury all beats were transmitted. Diastolic blood pressure at this time was 90 mm. of mercury.

After from 20 to 30 seconds of this phenomenon, there developed a dominant rhythm, with a premature contraction every 3 to 5 beats, then every 10 to 20 beats, and then the pulse became regular at a rate of 100 beats per minute. With resumption of the regular rhythm at this rate the headache disappeared, the color returned to normal and the patient felt well.

Forty-five or 50 minutes later, the complete heart block returned with a ventricular rate of from 20 to 24 beats per minute, and headache was again experienced.

Urinalysis disclosed an albuminuria of two-plus, but the urine was otherwise normal. Subsequent urinalyses yielded only negative results. The red blood count was 3.38 million per cu. mm. and the hemoglobin was 100 percent (Tallqvist method). The white blood cell count was 11,350 per cu. mm., with 77 percent polymorphonuclear leukocytes, 20 percent lymphocytes, and 3 percent monocytes. The blood Kahn test was negative.

An electrocardiogram (fig. 1) taken on 22 May showed complete auriculoventricular heart block with a slight variation of the ventricular rhythm at a rate of 24 and an auricular rate of 108. The patient was given 100-percent oxygen by a closed cone mask, and nausea, which was present during the night, disappeared suddenly and completely. He was then given ephedrine



2. Normal findings on electrocardiogram taken 28 June 1943, 37 days after admission (classic leads and CF_4).

sulfate by mouth, and on the following day he showed decided clinical improvement, with a pulse rate of 62 and a premature contraction every 4 or 5 beats. A check physical examination did not disclose any clinical evidence of infection. The blood sedimentation rate was 25 mm. in 1 hour (normal by this method being 10 mm. or less in 1 hour). Urinalysis showed from 2 to 4 white blood cells per high-power field and otherwise negative findings.

On 25 May the pulse rate was regular at from 50 to 60 beats per minute. At intervals of every 10 to 20 beats there would be an asystole, lasting about 5 seconds. After breakfast on this day the patient had a generalized convulsive seizure lasting a few seconds. Although he was not examined at this time, it was thought that this was an Adams-Stokes attack. Blood pressure on 25 May was 116 mm. of mercury systolic and 80 diastolic. Administration of oxygen by closed cone mask was continued intermittently.

Sodium salicylate 4 gm. was given daily, and in the ensuing 5 days the pulse rate gradually increased from a level of from 50 to 60 beats per minute to a sustained level of from 60 to 90 beats per minute, with occasional premature contractions during the first few days of this period. On 31 May the blood sedimentation rate was 22 mm. in 1 hour and the leukocyte count 9,400 per cubic millimeter. At this time there was a soft blowing systolic murmur at the apex.

During the following 20 days, the dosage of ephedrine was gradually reduced and finally discontinued, and the sedimentation rate returned to normal. On 10 June the first heart sound at the apex was rough but there was no distinct systolic murmur, and a teleroentgenogram of the chest made on 16 June failed to show any evidence of abnormality.

Clinical examination 12 days later showed the heart to be normal; the

roughened first heart sound and the systolic murmur had disappeared. The sedimentation rate at that time was 9 mm. in 1 hour. An electrocardiogram (fig. 2) made on this day was entirely normal. The patient was subsequently transferred to a Naval hospital for further convalescence and observation, and after a period of hospitalization with no further significant findings, he was returned to limited shore duty by action of a board of medical survey.

COMMENT

It is thought that the heart block in this case was caused by an acute myocarditis, possibly of rheumatic origin. There was no evidence of infection other than the elevated sedimentation rate and a temperature of 99° F. on two occasions during the first 2 days of hospitalization. At no time were there any joint signs or articular symptoms of a rheumatic fever and the past history revealed no suggestion of the rheumatic state.

This case is unusual in several respects. Unless it is assumed that the heart block was due to myocardial infarction, which is not supported by findings from electrocardiograms taken after recovery, infection of some nature might be regarded as the causative agent. There was no diphtheria or other demonstrable clinical infection unless it is assumed that the causative factor is an acute myocarditis of rheumatic origin. This is occasionally seen in young persons but usually in association with other manifestations of the rheumatic state and not as an isolated phenomenon (*1*).

In addition the ventricular rate was persistently lower than is usual in complete block. The ventricular rate in complete auriculoventricular heart block usually is in the range of from 30 to 50 beats per minute, and a persistent rate of from 20 to 24 is exceptional (*2*).

Furthermore the pounding headache as a presenting complaint is infrequent in such cases. It is possible that the headache was due to the excessive ventricular stroke volume, although the blood pressure at the time of admission was somewhat low. This assumption is supported by the observation that the headache disappeared dramatically and completely upon the resumption of a normal rate under the influence of epinephrine.

The cardiac reaction to the epinephrine was an interesting phenomenon to observe. This increase in cardiac rate was caused by one of two mechanisms, either by an increase in rate of the independent ventricular rhythm or by a temporary reversion to a nodal or supraventricular rhythm. If the former were the mechanism, one would expect a variation in the quality and intensity of the first heart sound due to the auriculoventricular dissociation, the persistence of the premature contractions throughout the period

of influence of the drug, and probably a gradual decline in ventricular rate as the effect of the drug diminished. Such findings were not encountered. Although the epinephrine effect was present, the auricular sounds disappeared and the first sound was pure in quality and regular in intensity. Premature contractions were present only in the early phases of the transition in rate (and possibly rhythm).

Finally from 45 to 50 minutes after injection of epinephrine the ventricular rate dropped rather suddenly to its previous level of from 20 to 24 beats per minute. Because of these observations, it is thought that the probable action of the epinephrine was to overcome temporarily the block and to establish a nodal or supraventricular rhythm. However this is clinical speculation and it is unfortunate that an electrocardiograph was not available for the graphic demonstration of this change.

It is thought that prior to the spontaneous disappearance of the block, the effect of the oral ephedrine was an increase in rate of the independent ventricular rhythm, as the rhythm was frequently interrupted by premature contractions and the rate was variable even while the patient was at bed rest. Wedd (*3*) reported a case of rheumatic fever in a 41-year-old woman, in which the heart rate was 50 beats per minute and in which attacks of syncope accompanied by convulsion occurred. The attacks were not influenced by epinephrine but were relieved by the intramuscular injection of atropine. Gross and Fried (*4*) reported the disappearance of first-degree auriculoventricular block after atropine. Small doses of epinephrine decreased the P-R interval and large doses were followed by irregular responses, ectopic beats, and transient complete heart block.

Sprague and White (*5*) reported 11 cases of high-grade heart block affecting persons under the age of thirty. All of these differed from the case reported here in that the heart block was persistent. Several cases of heart block in later life have been reported and were ascribed to previous illnesses, but the causal relationship is subject to doubt (*6*) (*7*). The case reported here was observed during the presence and disappearance of a transient complete heart block, which it is believed resulted from an acute myocarditis, possibly rheumatic in origin.

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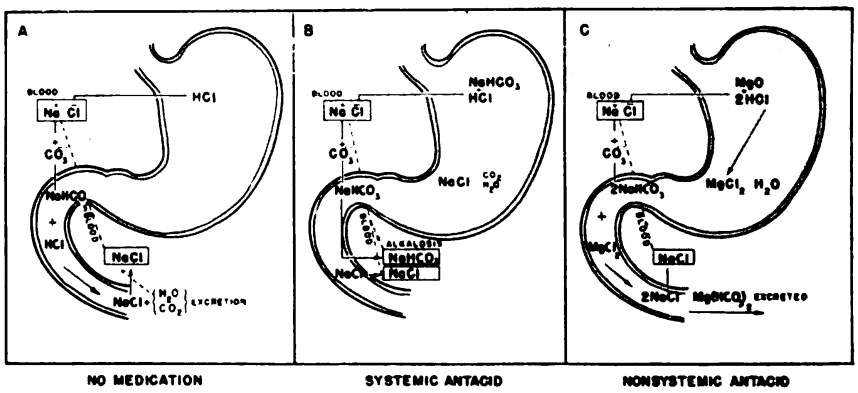
BIOCHEMISTRY OF ANTACIDS



A. Normally the sodium chloride in the blood is utilized to produce hydrochloric acid for gastric secretion and sodium bicarbonate for the intestinal juices. After digestion these substances react in the intestine again to form sodium chloride, which is absorbed into the blood, and the cycle is repeated.

B. Sodium bicarbonate reduces hyperacidity by reacting with hydrochloric acid of the gastric juice to produce sodium chloride in the stomach. This neutral salt does not react with the bicarbonate salts of the intestinal juices and both the chloride and bicarbonate are absorbed. Thus bicarbonate used as an antacid, even though not in excess of the amount needed to neutralize the gastric acid, will temporarily increase the alkalinity of the blood.

C. Magnesium oxide reduces hyperacidity in the stomach by reacting with hydrochloric acid of the gastric juice to produce magnesium, the latter being excreted. The sodium chloride is absorbed into the blood, completing the normal cycle without increasing the alkalinity.—GREEN, M. W.: Use and abuse of antacids. J. Am. Pharm. A. 6: 68-72, March 1945.

ACUTE PANCREATIC EDEMA WITH STONE IN THE AMPULLA OF VATER

REPORT OF A CASE

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Acute pancreatitis may assume two forms: (1) Mild, in which obstructive edema is often spontaneously relieved during a period of conservative noninterference; and (2) severe, in which an acute lytic process causes hemorrhage, fat necrosis, and rapid dissolution of the pancreas.

Acute pancreatic edema without suppuration or acute interstitial pancreatitis has been well described by Elman (*1*) (*2*) and others (*3*) (*4*). The parenchyma of the pancreas in the reported cases was indurated and edematous. Section occasionally showed a marked infiltration of inflammatory cells in the interstitial tissue. There was no hemorrhage, necrosis or suppuration.

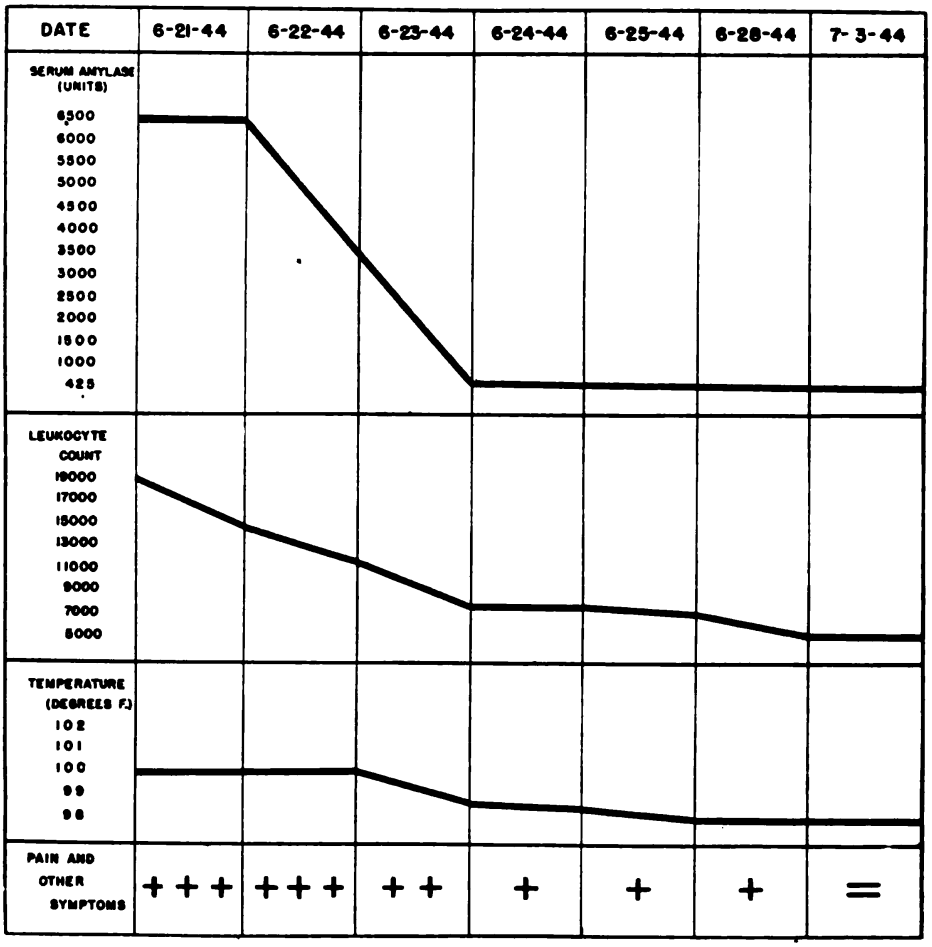
The following case is presented because it illustrates some already well-established principles that can bear re-emphasis:

Case report.—A seaman, second class, 36 years old, had experienced sudden severe epigastric pain on the day before admission. He began to vomit and continued to do so intermittently for 18 hours. There was no hematemesis. He had had only one small bowel movement. The pain radiated over the entire abdomen but was especially severe in both hypochondria.

The patient stated that for the past 2 years he had had recurrent sharp pains in the upper part of the abdomen, associated with nausea and pyrosis. There were long remissions between attacks and there was no history characteristic of ulcer. There had been no jaundice at any time and no fat intolerance.

Upon admission on 6 June 1944 the patient was acutely ill and appeared dehydrated. The temperature was 100° F., the pulse rate 88, and blood pressure 118/60. There was no clinical evidence of shock. The pupil reactions were normal and the scleras were not icteric. The heart and lungs were normal.

The abdomen was slightly distended, and there was exquisite generalized tenderness, most severe in the epigastrium and left upper quadrant. The abdominal parietes were semirigid but not boardlike. There was marked rebound tenderness. No masses were palpable. The liver, spleen and gallbladder were not felt. The percussion note was tympanic. There was no fluid wave. High-pitched, infrequent peristalsis was occasionally heard. The rectal examina-



Progress chart.

tion suggested lateral tenderness, but there was no rectal obstruction or internal mass. The impression was peritonitis from a ruptured hollow viscus.

X-rays of the abdomen taken in the supine, left lateral, and erect positions did not show any evidence of free air in the peritoneal cavity. There was no evidence of small bowel ileus.

The leukocyte count was 17,100, with 90 percent neutrophils, 1 band form, and 89 segmented cells. Urinalysis and Kahn test yielded negative results. The blood sugar was 85 milligrams percent. A serum bilirubin determination was not done.

The patient was transferred to the surgical service pending laparotomy. Before this procedure was carried out the laboratory reported a blood amylase level of 6,400 units. The specimen had been obtained about 36 hours after onset of symptoms.

Surgery was therefore deferred; a Miller-Abbott tube was inserted and the patient was given parenteral fluids, and morphine with atropine.

On 22 June the patient's condition was almost the same, although there was no further vomiting. The intake and output of fluids were balanced and adequate. The leukocyte count was 14,600 with 85 percent neutrophils. The serum amylase was again 6,400 units. The urine showed 16 diastase units. The temperature remained about 100° F., and there was no evidence of shock. The diagnosis was changed to acute pancreatitis.

On the following day the temperature was still the same. The patient

seemed generally improved. Abdominal tenderness was diminishing. As there was no further vomiting and there were no signs of ileus, the Miller-Abbott tube was removed. The leukocyte count at this time was 9,700 with 86 percent neutrophils. The blood sugar was 85 milligrams percent.

During the next two days there was slight continued improvement in the patient's condition. The temperature was around 99.4° Fahrenheit. The serum amylase was reported as 457 units and the urine showed 32 diastase units. The leukocyte count was 8,550 with 76 percent neutrophils. On the second day penicillin therapy was begun.

Four days later the temperature was normal. The patient had no symptoms and there was very little residual tenderness. During the 5-day period from 23 June to 28 June the patient had received a total of 780,000 units of penicillin.

Following the acute episode recovery was rapid. Ten days later the serum amylase was 400 units.

On 10 July a cholecystogram revealed faint visualization and many negative shadows suggesting calculi in the gallbladder. A series of gastro-intestinal tract x-rays was reported negative. Eight days later a cholecystectomy-choledochoduodenostomy was performed. The gallbladder was filled with small stones; four stones were removed from the common duct as well as a stone impacted in the ampulla, with a wedge in the pancreatic duct. The latter stone could not be dislodged from its position and had to be removed through an incision in the duodenum. The pancreas appeared normal upon inspection and palpation.

A T-tube was placed in the common duct and a drain in Morison's pouch. The postoperative course was uneventful. The T-tube was removed on the twelfth day, and by the sixteenth day all drainage had stopped and there was no evidence of bile obstruction.

COMMENT

This case illustrates the fulminating character of some cases of pancreatitis, and spontaneous remission with nonoperative methods. At some point in the pathogenesis of acute pancreatitis the mechanism is abortive and serious chemical necrosis does not ensue. The assumption for the milder form of acute pancreatic lesion is well authenticated (*1*) (*2*) (*3*) (*4*) (*5*) (*6*) (*7*) (*8*). Whether penicillin was a factor in the rapid subsidence of the acute process is difficult to say.

For many years the dramatic nature of symptoms of acute pancreatitis has been stressed. Symptoms of shock, cyanosis, and early collapse have been over-emphasized (*9*). To insist upon classic signs before making a diagnosis is apt to result in error. This is especially true in cases of acute pancreatitis without necrosis or acute pancreatic edema.

In the milder cases the symptoms are less severe and tend to subside (*5*). Symptoms of shock, extreme muscle spasm, and all the grave signs of peritoneal insult are often absent. The onset is likely to be gradual, and the picture of an abdominal emergency

slowly progressive. Gallstone colic may be simulated. High intestinal obstruction, perforated peptic ulcer, acute appendicitis, or coronary disease are necessarily excluded (*3*).

At least half of a reported series of cases of acute interstitial pancreatitis presented unmistakable signs of biliary tract disease (*3*). These included jaundice. In the case reported here, it is considered unusual to have had a 2-year history suggestive of stone in the choledochus and an operative finding of multiple stones in the gallbladder, the choledochus and an impacted stone in the ampulla, without a clinical history or appearance of jaundice. Judd and Marshall (*10*) reported 160 cases of stone in the ampulla of Vater, in 37 (23 percent) of which there was no history of jaundice. It is well known that a stone in the common duct may be asymptomatic for a long time. However in the present case, with no signs of precedent sepsis or jaundice, it seems logical to explain some of the attacks of intermittent pain by the mechanism of recurrent and transient pancreatic edema.

In any case of uncertain acute upper abdominal emergency a routine blood diastase determination is as important as a leukocytic index. Elman (*7*) has pointed out that this must be done early and repeatedly, because as early as 36 hours after onset the levels may revert to normal. Blood lipase levels may show a more prolonged elevation.

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COMMENTS ON CASUALTIES ABOARD ASSAULT CARGO VESSEL

WITH REPORT OF TWO THORACIC CASES

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During a recent operation in the Pacific, this assault cargo transport received a total of 50 Army, Marine, and Naval casualties. Of this number, 41 were litter patients and 9 were considered ambulatory. The largest single group, 17 patients, was received on "D" day-plus-five. Thirty-four casualties were cared for over a period of 13 days before their evacuation to a shore hospital.

The majority of casualties were taken aboard from landing craft hoisted to the rail of the main deck. The sling lift for litters was used on one occasion to evacuate several casualties to a small vessel which in turn transferred them to an outlying hospital ship.

The limited facilities of this type of ship (only nine hospital beds) made it necessary to take over the officer and enlisted personnel berthing spaces. The latter space, located below the main

Classification of injuries

Injury	Number	Deaths
Head		
Skull fracture (compound)	2	0
Ear (concussion), ruptured drums	1	0
Maxillofacial and orbital fractures	2	0
Neck		
Soft tissue (uncomplicated)	2	0
Chest		
Open pneumothorax associated with multiple wounds	1	1
Hemothorax	1	0
Abdomen		
Soft tissue, nonpenetrating	1	0
Upper extremity		
Soft tissue	8	0
Simple fracture	4	0
Compound fracture	4	0
Lower extremity		
Soft tissue	10	0
Simple fracture	1	0
Compound fracture	4	0
Burns		
Second-degree (right arm, right side chest)	1	0
Third-degree (hand and wrist)	1	0
Miscellaneous		
Dislocation, hip	1	0
Combat fatigue	2	0
Bronchial asthma	2	0
Filariasis	1	0
Biliary dysfunction	1	0
Totals	50	1

deck, was utilized chiefly for the less serious litter cases and the ambulatory casualties.

The accompanying table lists the injuries encountered. The majority of these were multiple in character, but only the major injury is indicated in the tabulation.

In this group there were but two thoracic injuries, an incidence of 4 percent. The clinical observations on these cases follow.

CASE REPORTS

Case 1.—A Marine private, first class, was received on board in a state of moderate shock only a few hours after being wounded. The left side of his body was enveloped in voluminous dressings. Dark blood was oozing from the left posterior chest dressing and it was obvious that the patient was gravely injured. There was moderate cardiorespiratory distress but no cyanosis.

A check of the position of the trachea in the suprasternal notch and the position of the apical impulse revealed no unusual mediastinal shift. Plasma infusion was immediately begun as an inspection of the thoracic wound was carried out. A large irregular soft-tissue and rib-structure defect was present below the angle of the left scapula. It appeared as though a large jagged metallic fragment had struck this region tangentially, penetrating the thorax and leaving considerable tissue and bone destruction in its path.

Air sucking was minimal, due undoubtedly to the obliquity of the pleural wound in relation to the external wound. The open pneumothorax was easily controlled by a firm vaseline gauze pack.

Inspection of the remaining bandaged areas revealed very extensive multiple fragment wounds extending the entire length of the left trunk and extremity. It was obvious that conservatism could be the only safe policy. Consequently after a rapid, loose packing of the multiple wounds with vaseline gauze, attention was directed chiefly to the cardiorespiratory mechanism.

The patient was placed in a moderately propped-up position, lying toward the affected side as soon as the quality of the pulse had improved and the systolic blood pressure had reached 100 millimeters of mercury. Respirations ranged from 30 to 38 per minute, and a thoracentesis proved the absence of any tension pneumothorax. All supportive measures were carried out and the patient rallied for a few hours. Oxygen was administered by oronasal mask, chemotherapy was begun, and combined tetanus and gas gangrene prophylactic therapy was given. The patient was conscious, cooperative and appeared to have recovered from his initial shock.

Gradually, however, in the next 12 hours toxemia and septicemia developed and became fulminating. The patient gradually lapsed into stupor and urinary incontinence became evident. The accumulation and retention of bronchial secretions accentuated the mild paradoxical respiration present in the left hemothorax. Bronchial aspiration was urgently indicated but facilities for suction were lacking. The increasing anoxia with rapid shallow respirations was quickly followed by a complete peripheral vascular collapse and death.

Although there was never any doubt as to the eventual outcome of this case, it was interesting to note that throughout the entire period there had been no grave alteration of the hemorespiratory

physiology. It was only after the overwhelming toxemia had abolished the voluntary reflexes that a vicious respiratory cycle was initiated. The moderately limited respiratory field was further encroached upon by the accumulating bronchial secretions, thereby increasing the obstructive anoxia and leading to complete hemorespiratory collapse.

Case 2.—A Marine private, first class, was received on board several hours after being wounded in the right side of the chest. Except for moderate fatigue and exhaustion, his general condition was good and no cardiorespiratory distress was apparent. He complained only of pain in the chest.

Examination revealed a roughly circular wound of entrance in the region of the right fourth intercostal space adjacent to the sternal margin. There was no wound of exit. At first glance, in view of the wound site, it seemed amazing that there was no obvious evidence of cardiac damage or at least of injury to the internal mammary vessels. Pulse and blood pressure were within normal limits. Fluoroscopy revealed normal cardiac contour and pulsations, with slight haziness over the base of the right lung. Further inspection of the wound proved it to be tangential, extending toward the dome of the diaphragm.

Minimal debridement was carried out at this time and an equal mixture of sulfanilamide and sulfathiazole powder was instilled, followed by packing with vaseline gauze. A firm pressure pad completed the dressing and chemotherapy was instituted. The patient was placed in bed, lying toward the affected side, while other more urgent casualties were being prepared for treatment.

About 12 hours later, the patient's respirations increased to 30 and within the next hour to 44 per minute. The pulse rate was 120 and blood pressure 110/70. Dullness was noted over the lower lung field and breath sounds were absent in this region. Thoracentesis was performed and 500 cc. of bloody fluid removed. Shortly thereafter the respirations returned to 24 per minute and the pulse rate to 84 beats per minute. An anteroposterior x-ray revealed several irregular metallic fragments at the level of the fifth intercostal space anteriorly. A lateral view showed the fragments to be almost certainly in the extra-pleural tissues. The patient was observed very closely for signs of increasing hemorrhage. Within 24 hours his condition was almost normal with the exception of a slight fever of 100° to 101° F. and a frankly purulent discharge from the wound.

Under 1-percent procaine hydrochloride field block anesthesia, the wound was opened further and extended downward over the fifth intercostal space. An irregular track could easily be followed through the soft tissues, extending through the intercostal muscle planes and dipping beneath the fifth costal cartilage. At this point pus gushed into the wound and was aspirated, followed by irrigation of the track. The sinus apparently ended immediately adjacent to the posterior surface of the fifth costal cartilage in the fibers of the transversus thoracis muscle.

A curved hemostat was carefully inserted and two pieces of metal were removed. A piece of soft rubber catheter was fenestrated, inserted to the depth of the wound and vaseline gauze was loosely packed around it. A solution of azochloramid was instilled through this catheter every few hours. Another piece of metal appeared in the wound discharge shortly thereafter.

The purulent discharge gradually decreased in amount, although the temperature remained elevated. Several repeated chest aspirations well away

from the wound failed to demonstrate any intrapleural communication. By the seventh day the temperature had returned to normal and the discharge had become scant. Check x-rays showed evidence of a completely reexpanded lung, and the patient was subsequently transferred to a Naval hospital where he was reported to be convalescing uneventfully.

This case emphasizes the importance of careful investigation of a penetrating chest wound. Fragments of relatively slow velocity can follow bizarre paths when deflected by the rib structures, and what initially may seem a trivial wound may prove to be a very serious one, and vice versa. Infections of the chest wall may prove serious problems if any of the cartilaginous structures become involved. Despite adequate drainage, it often becomes necessary to resect any infected cartilage for complete cure.

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SHIPBOARD DIET AND GLYCOSURIA

Inspired by the unusually high incidence of glycosuria among officers given annual physical examination aboard this ship, a project was undertaken to determine whether shipboard diet in the tropics was proper. The problem involved quantity and nature of food served by the commissary, as well as the confections available in the canteen and Ship's Service Store.

Urinalyses of 64 officers and 800 men were done to determine the presence or absence of sugar. All known factors which might produce false positive reactions were eliminated. Each person having urine positive for sugar was advised to restrict his carbohydrate intake to a minimum. Subsequent check of specimens during several days was done in the case of urines positive for sugar. Surprise checks of urine of those showing a transient glycosuria showed positive, in a few cases, after several weeks.

The urine of 3 officers showed from 3 to 4 plus, and that of 28 enlisted men showed urines positive for sugar. Investigation of the duties of the enlisted men manifesting a glycosuria revealed that 9 had sedentary occupations (radiomen, yeomen, radarman); 4 were food handlers (ship's cooks, mess cooks); 15 were engaged in duties involving moderate to great muscular activity (seamen, engineers).

The blood sugars of the 3 officers and 2 of the enlisted men were in the upper limits of normal after 3 days of carbohydrate-restricted diet.—HAUN, J. J. D., Lieutenant Commander (MC) U.S.N.R., and PLOTNICK, M., Chief Pharmacist's Mate U.S.N.R.

TROPICAL EOSINOPHILIA

REPORT OF A CASE

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and
WILLIAM J. McCANN
Lieutenant (MC) U.S.N.R.

The following case of tropical eosinophilia is considered of interest because of the comparative rarity of the condition, and because previous cases reported have occurred or originated in the coastal areas of India. In Emerson's[1] case the condition was complicated by other diseases.

As described by Weingarten[2] the syndrome is characterized by a gradual onset with malaise, weight loss, a low-grade temperature, a paroxysmal type of dry hacking cough, most noticeable at night or early morning, and physical findings similar to those encountered in bronchial asthma. After several weeks a chronic stage is reached, at which time the patient may be subfebrile, the weight loss may cease, but paroxysms of coughing and wheezing may persist indefinitely if not treated. Early in the febrile stage the spleen may be palpable. X-ray examination of the chest in the febrile stage reveals a diffuse bilateral mottling of the lung fields, resembling somewhat the picture of acute miliary tuberculosis; this rarely persists longer than 4 weeks. Subsequent x-ray studies of the lung fields reveal increased bronchial markings as in chronic bronchitis. The distinctive laboratory finding is the massive eosinophilia which is greater than in any other condition except an eosinophilic leukemia.

Case report.—A Navy officer reported to the sickbay on 26 February 1944 complaining of a feeling of congestion in his chest associated with episodes of nocturnal coughing and accompanied by severe headaches. These symptoms had their onset 2 years previously when he was stationed in Samoa.

He enlisted in the U. S. Naval Reserve in 1920. Overseas duty had been in Central America and the Central and South Pacific islands exclusively. It is significant that at no time in his Naval career has he been in India, and his only contact with East Indians was early in his service while in Panama. He stated that while ashore in the South and Central Pacific islands his con-

[1] EMERSON, K., JR.: Tropical eosinophilia. U. S. Nav. M. Bull. 42: 118-123, January 1944.

[2] WEINGARTEN, R. J.: Tropical eosinophilia. Lancet 1: 103-105, January 23, 1943.

tacts with the native populace were few, and not intimate. Rarely did he eat a native meal, all water was boiled, and his excursions into the "bush" were few.

Shortly before leaving Samoa he began having what he thought were frequent head colds associated with a feeling of congestion in his chest. He became increasingly weak and noticed a feverish sensation in the afternoons. On one occasion he stayed home for 3 days because of general malaise, but on several subsequent visits to the sickbay his temperature was normal.

In February 1943 a tonsillectomy was done and seemed to give some temporary relief, but within the next few weeks the old symptoms returned and gradually became more severe. This was described as an "asthmatic congestion of the right chest." Regularly between 0200 and 0500 he would be awakened with a suffocating sensation of wheezing and crackling in the chest, followed by a violent paroxysm of coughing. A slight amount of mucoid, tenacious sputum might be expectorated. The attacks at night lasted from a few minutes to over an hour and greatly interfered with his sleep. Afterward he would have a severe headache and arise feeling nervous, weak, and irritable. Occasionally on arising he would expectorate approximately a tablespoonful of brown, thick, foamy sputum which never contained fresh blood or formed elements, and which was raised without effort.

In May of 1943 his symptoms had reached maximum intensity and shortly thereafter began to subside. By August he had reached a stage of chronic chest ailment with exacerbations occurring approximately each month. Attacks of coughing still occurred mainly at night or in the early morning and were heralded by a "brassy or metallic taste arising deep in the chest and coming up into the mouth." The chronic phase of the illness persisted to the time of admission here in February 1944.

The patient stated that throughout this illness he never had chills, high fever, night sweats, jaundice, gastro-intestinal symptoms, significant weight loss, anorexia, or lymph gland enlargement or soreness. There was no history of urinary difficulties, venereal disease, or allergy, and the family history was unimportant.

Examination revealed a well-nourished, muscular, athletic male, 42 years of age. His temperature on admission was 97.8° F., pulse rate 68, and respirations 16 per minute, regular and unlabored. The blood pressure was 126 mm. of mercury systolic and 86 mm. diastolic. The skin was clear and there were no palpable lymph nodes. Eyes, ears, nose, throat, and neck were normal. There was no evidence of emphysema, or the so-called asthmatic type of chest deformity. The heart was not enlarged and all sounds were normal. Percussion of the chest revealed no areas of dullness or diminished fremitus. Breath and voice sounds were clearly heard throughout, and only rare sibilant râles were heard over the right side of the chest posteriorly. There were no posttussal râles.

The abdomen was moderately obese, soft, and there were no palpable masses. The liver edge, felt beneath the costal margin on full inspiration, was smooth and nontender. The spleen could not be felt. The genitalia and extremities were normal.

Erythrocytes numbered 5,600,000 per cu. mm., hemoglobin content was 92 percent (Sahli) and the color index 0.82. The initial leukocyte count was 15,520, with 16 percent polymorphonuclear leukocytes, 72 percent eosinophils, 9 percent lymphocytes, and 3 percent monocytes. Blood smears reviewed at a civil hospital, were normal morphologically, and nothing suggesting a causative agent was found.

Subsequent white cell counts prior to starting therapy revealed a startling rise in eosinophils, the highest count being 82 percent. The urine was normal and repeated stool examinations did not show any parasites or ova. The sedimentation rate was 14 mm. per hour, and the blood Kahn test was negative. Skin tests with echinococcus antigen in dilutions of 1:100 and 1:10 were negative. The sputum, water-clear and very tenacious, contained no ova, parasites, or crystalline bodies. Smears prepared with Wright's stain showed large numbers of eosinophils, many of which were found in clumps of four or five.

An x-ray film of the chest was suggestive of chronic bronchial disease, and showed a questionable cystic lesion in the hilus of the right lung. The patient was sent to a nearby Naval hospital for further x-ray study and the following report was returned: "Postero-anterior film of the chest shows the costophrenic angles to be clear. The heart and great vessels are within normal limits. Both lung fields show an increase in the perivascular and peribronchial markings."

Several conditions were considered in the differential diagnosis, namely, allergy, leukemia, and all the parasitic infestations, particularly hookworm disease, which Allen[3] found to be a frequent cause of eosinophilia in the South Pacific area. These diseases were ruled out on the basis of the physical findings and laboratory work cited. It is of interest that none of the differential counts recorded by Allen presented the extremely high eosinophilia seen in this case.

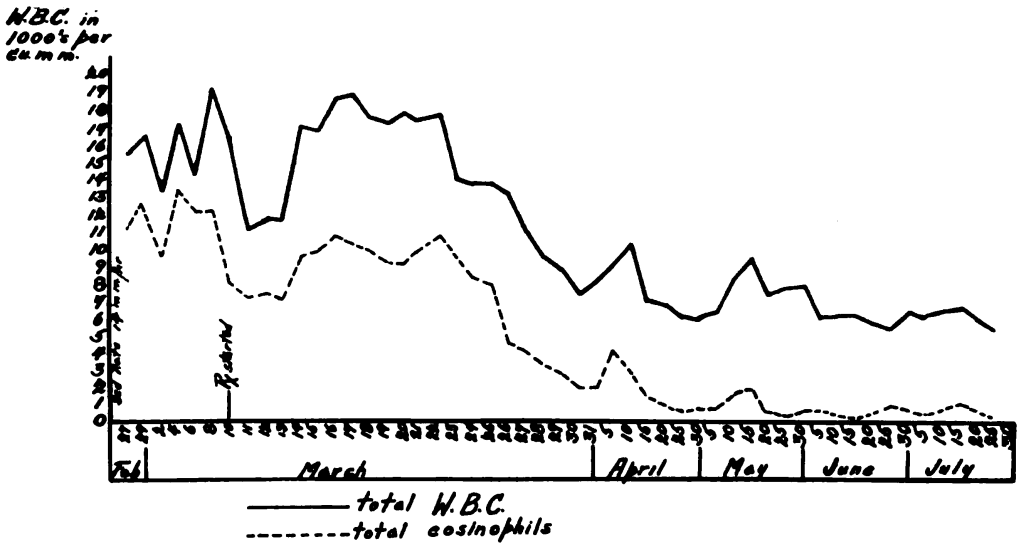
A tentative diagnosis of tropical eosinophilia was made, and the patient was placed under observation. He was given a clinical thermometer, and being extremely intelligent and cooperative, he was instructed to record his oral temperatures at 0800, 1200, 1600, and 2000 daily. In order that a comparison might be established, treatment was withheld for 14 days during which time the patient was seen each morning and night, and a differential count was taken every other day.

During this period of observation the patient continued to have nightly attacks, although they were seldom severe. Two days prior to the beginning of treatment he reported that he had had no attack the previous night. It is considered probable that he may have reached a stage of remission in the cyclic course of his disease. He improved slightly, but this proved to be only temporary, and within a week he had a moderately severe attack in the early morning.

On 10 March treatment as outlined by Weingarten was instituted. An initial injection of 0.15 gm. of neoarsphenamine was followed by doses of 0.3 gm., 0.45 gm., 0.6 gm., and another 0.6 gm. at 4-day intervals. The drug was well tolerated. Daily leukocyte counts were taken throughout the course of therapy. Thereafter weekly blood counts were done.

The patient's response to this treatment was dramatic. The day following the first injection the leukocyte count fell to 11,050, with a differential count of 65 percent eosinophils, 18 percent polymorphonuclear leukocytes, and 17 percent lymphocytes. Within 2 days, however, it returned to between 16,000 and 18,000 with a lesser rise in the eosinophils (the typical rise described by Weingarten following beginning of treatment). The total white cell count remained between 17,000 and 19,000 for approximately 10 days, following which there was a rapid and proportionate decrease in both the total number of white cells and of eosinophils.

[3] ALLEN, H. C.: Eosinophilia in South Pacific. U. S. Nav. M. Bull. 42: 1241-1244, June 1944.



1. Leukocyte and eosinophil counts as affected by neoarsphenamine.

Slightly over 3 weeks after treatment was begun, the total white cell count was within normal limits, or only slightly above, while the total number of eosinophils remained disproportionately high, ranging from 25 to 35 percent. Since that time the leukocyte count has remained normal, the eosinophil percentages varying from 4 to 16 percent.

The patient has improved steadily from the mid-point in his course of therapy, and in his own words he has "never felt better." There has been no recurrence of his clinical symptoms, the sedimentation rate has returned to normal, and an x-ray taken in June shows no significant change from that taken in February 1944. Although the number of eosinophils in differential counts has been slightly elevated, the remarkable disappearance of clinical evidence of the disease following treatment would seem to indicate that a clinical cure has been effected.

SUMMARY AND CONCLUSIONS

A case of so-called tropical eosinophilia of unknown cause, with typical symptoms, physical signs, and laboratory findings, and showing the characteristic dramatic response to arsenotherapy has been presented. Although a single case is hardly an adequate basis from which to draw conclusions, several considerations present themselves.

1. Since the patient had had symptoms of the disease for nearly 2 years, the possibility that, lacking appropriate therapy, evidence of the disease may persist indefinitely is suggested.

2. As pointed out by Emerson the dramatic response to arsenotherapy suggests a spirochetal or protozoan causation, which in turn leads to the consideration of involvement of intermediate vectors.

3. The fact that the patient had never been in India presents the possibility that either the disease exists endemically in the South

Pacific area as well as in India, or that it is transmissible directly from man to man.

4. This syndrome should be considered in the differential diagnosis of any illness presenting a high eosinophilia.

5. In cases with a massive eosinophilia, where no known cause may be found, a therapeutic trial of an arsenical, either orally or intravenously, may be warranted.

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WOUND HEALING BY EMBRYONAL TISSUE

The stimulating influence of embryonal ointment upon regeneration of connective tissue and epithelium has been demonstrated on experimental animals and clinical cases of wounds, bedsores, burns, and trophic ulcers. This ointment does not disturb the equilibrium of the dermo-epithelial system during regeneration. Only in cases of neglected ulcers or eroded scars has the epithelial growth been retarded. It appears that the early growth of epithelium resulted from the stimulating effect of embryonal juices diffusing through the tissues and encouraging the growth of epithelial rests. The anti-inflammatory effect of this embryonal substance also is important. It is known that absorbed cytolytic products have an injurious effect upon the entire organism by blocking the reticulo-endothelial system and lessening its reactivity.—GOLDBERG, D. I.: Stimulation of wound healing by embryonal tissue. Am. Rev. Soviet Med. 2: 225-229, February 1945.

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PROTECTING MICROSCOPE LENS FROM FUNGUS

One of the plagues of laboratory workers in West Africa has proved to be a fungus which grows on and between lenses of microscopes, etching the surface of the glass and eventually rendering the instruments unusable. The most promising method of combating the fungus is by inserting a small piece of cotton impregnated with creosote in an out-of-the-way corner of the microscope case. Microscopes treated by this method remained unblemished for years. Care must be exercised in placing the cotton, as creosote tends to remove the black paint from the metal. Once the cotton is in place, it need not be disturbed for as long as a year, when resoaking in creosote is necessary. Camera lens affected by the fungus also can be protected in this manner.—NEWS AND COMMENT: Protection of microscope lens from fungus. Bull. U. S. Army M. Dept. No. 86: 26, March 1945.

THYROTOXICOSIS COMPLICATED BY HYPOTHALAMIC AND DUODENAL HEMORRHAGE

REPORT OF A CASE

HAROLD WOOD
Lieutenant Commander (MC) U.S.N.R.
and
JOSEPH N. HAMM
Lieutenant (MC) U.S.N.R.

The following case of thyrotoxicosis is reported because of the unusual combination of lesions which led to a rapid termination.

Case report.—A 37-year-old serviceman was admitted to a hospital ship on 8 July 1944 with the diagnosis of hyperthyroidism. Since December 1943 he had lost 60 pounds in weight, grown progressively weaker, and developed a tremor of the hands. He was said to have avoided medical treatment ashore until be became seriously ill.

The patient appeared ill but mentally clear. He was emaciated, and had a noticeable tremor of the hands. The thyroid gland was bilaterally enlarged, more so on the right side, and was smooth. A bruit was heard over the gland. There was a tachycardia of 120, and the blood pressure was 150/50. The temperature was 99.4° Fahrenheit.

Treatment consisted of administration of Lugol's solution and barbiturate sedatives, and the patient was placed on a high protein diet. On the second hospital day the pulse rate had decreased to 96, but the patient was very restless. Two days later the temperature rose abruptly to 103° F., the pulse rate increased to 140, and the respiratory rate from 20 to 28 per minute.

There was no improvement on the following day, and he had diarrhea and upper abdominal pain, and vomited large quantities of watery "coffee ground" fluid. Immediately thereafter he became disoriented and agitated, and developed air hunger. The abdomen at this time was firm but not rigid, the pulse became very feeble, and the patient was obviously in a state of shock. Plasma infusion, a blood transfusion, morphine, and oxygen did not improve his condition. The temperature rose rapidly to 105.2° F., and the patient expired 7 hours later. Death was attributed to thyrotoxicosis, with thyroid crisis and gastric hemorrhage.

Autopsy findings.—The body was emaciated. The thyroid gland was diffusely hyperplastic, and a small hyperplastic nodule was embedded in the right lobe. There was definite hyperplasia of the thymus gland. Except for slight left ventricular hypertrophy, the heart was normal.

In the hypothalamic region, the paraventricular nuclear areas, the infundibulum of the pituitary body, and the upper midbrain and substantia nigra, evidence of petechial hemorrhages of recent occurrence was found.

The stomach, the duodenum, and the proximal jejunum contained a large quantity of thin brown fluid. A test for occult blood in this fluid was

strongly positive. In the preampullary portion of the duodenum there were large and small mucosal hemorrhages. At the sites of hemorrhage, capillaries and the venules were ruptured, and many of them communicated with the lumen of the duodenum.

While the spleen was not enlarged, the reticular tissue was hyperplastic and there was phagocytosis of erythrocytes.

The lungs were edematous.

It is believed that the hypothalamic, midbrain, and infundibular hemorrhages were causally related to the thyrotoxicosis, and that the duodenal hemorrhages were secondary to the central nervous system lesions. That the duodenal hemorrhage was somewhat prolonged was indicated by the digested state of the blood and the reticular hyperplasia and erythrocytic phagocytosis in the spleen. The mechanism of death was complicated, but hemorrhage into the duodenum and circulatory collapse were prominent features.

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QUININE BLINDNESS

While blindness caused by quinine is known to those whose experience in dealing with malaria has been extensive, the report of a recent case of total and permanent blindness in a healthy strong man who developed malaria in India 12 years ago, who had often had quinine without any toxic effects except tinnitus and transient deafness, and who in a recent attack, was given about 12 doses of 30 grains of quinine bihydrochloride in one day, may serve as a warning to those less familiar with what may occasionally be expected as the result of the drug's misuse or from ignorance of the disastrous toxic effects of quinine.

Ophthalmologists do not know certainly how quinine acts on the retina and the brain. The changes in the retinal arteries seem to be organic, but because of the infrequency of this type of blindness opportunity for the study of sections has been impossible. It is not surprising that this unfortunate man who received the colossal dose of 360 grains in 24 hours should have had quinine toxemia in one of its many manifestations.

It is a horrible illustration of the toxic effects of quinine which at best is a tricky drug. The avoidance of such catastrophies is not difficult if the dosage does not exceed the conventional amounts and if it is stopped at once, if visual or other toxic symptoms appear.—EDITORIAL: Quinine blindness. Internat. M. Digest 46: 125-126, February 1944.

MEDICAL AND SURGICAL DEVICES

FIRST-AID KIT FOR AVIATION PERSONNEL

M. C. SHELESNYAK
Lieutenant H (S) U.S.N.R.

First aid for the aviator and the aircrew must be provided for under special conditions, in which limitations of space in aircraft or in life raft, remoteness from available medical assistance, environment in the rafts and lack of specially trained personnel, are but a few of the many factors to be considered. An individual first-aid kit for aviation personnel was designed by various groups (medical, aeronautic, technical (industrial), and production) and the Naval Medical Research Institute after consideration of as many related factors as possible.

The kit consists of a plastic container and a cloth carrying case. The container is made up of two clear, water-resistant plastic shells, hinged together with plastic tape. Each shell is divided into different-size, different-shape compartments into which all items of the kit except the triangular bandage are fitted. The plastic container is made by injection molding of cellulose acetate butyrate. The wall thickness is 5/64-inch and the over-all size of the container is 4.2 by 1.375 by 2.4 inches.

The plastic container holds the following items:

Bandage, gauze, compress, 4 by 4 inches.....	1
Bandage, gauze, roll, 3 inches by 6 yards.....	1
Sulfadiazine tablets, 0.5 gm.....	12
Scopolamine hydrobromide tablets, 1/100 grain..	6
Morphine tartrate, Syrettes, ½ grain.....	2

Each item except the morphine Syrettes is separately wrapped and sealed in thermoplastic coated aluminum foil. All items are specifically labeled on the foil, and instructions are printed on the wrapper of the bandages.

The open face of each shell is covered with a nonhygroscopic pressure sensitive tape sheeting, and both shells close so that the sheet-covered faces are contiguous. A nonhygroscopic pressure sensitive cloth tape binds the edges and closes the container.

A triangular bandage is folded so that one side is as wide as the plastic container, and the other side as long as the combined heights of the front and back and the width of the top. It is wrapped in a plastic envelope, and held in the inside pocket of a cloth carrying case so that it wraps around, but is separate from the container. A cloth carrying case, made of field green mildew-proof cotton twill, has been designed so that it can be worn on the belt or in the pocket of a flying suit.

The complete kit measures 2 by 3 by 4.375 inches and weighs 8.2 ounces.

Instructions for use are cemented to the inside of the plastic container to permit reading through the plastic. A list of the contents is cemented to the inside of the second plastic shell.

DIRECTIONS FOR USE

To open kit.—Peel off tape (do not discard) and open like book. After using desired item reseal with tape.

Pain.—If severe, use morphine Syrette. Remove cover cap, pierce tube end with plunger, remove plunger, stick needle into thigh or arm and squeeze.

Wounds.—If severe, take 4 tablets sulfadiazine, then 2 tablets ever 4 hours.

Burns.—If severe, use sulfadiazine as above. Bandage affected area snugly.

Seasickness.—If severe with vomiting, take one seasickness tablet every 8 hours.

CAUTION

If morphine has been taken, do not take seasickness tablets.

For directions on bandages, see each item.

Factors used as guides in the development of the kit, the design and construction of the container, and the packaging of the various items were that: (1) The size and weight be minimal; (2) the contents be limited to essential basic items; (3) the quantities be limited; (4) the container afford shock and abrasion protection; (5) the container be refillable; and (6) that the kit can be worn on the person or packed in the aircraft seat or back pack. The conditions aboard life rafts set the criteria for packaging, so that (a) moisture protection would be afforded before and after the seal was broken, and (b) the removal of any item would not interfere with the protection of the remaining items.

The selection of items included in this kit was guided by certain considerations which limit and define the kind and quantity. These were:

1. Adequate space for first-aid equipment to care for extensive injury is not available.

2. The organization of air-sea rescue units has changed the emphasis from "survival" to "rescue," so that the period spent on rafts should be greatly shortened.

Photograph of first-aid kit complete in carrying case; carrying case open showing triangular bandage and container; and plastic compartment container open.

3. The alleviation of pain is essential not for comfort alone but primarily to permit the injured person to carry out survival measures and to assist in his own rescue.

4. Precautions against infection are prophylactic rather than therapeutic. The amount of sulfadiazine is small because of the limited water supply.

5. Measures for control of bleeding should be as adequate as possible. The compress bandages, the gauze bandage and the triangular bandage can all be used for this purpose.

6. Vomiting provoked by seasickness should be controlled as much as possible because of water limitation. To this end six tablets of scopolamine, 0.01 grain, were included. The danger from the combined effects of scopolamine and morphine (twilight sleep) was considered, and warning against this combination has been included in "Direction for Use."

Certain items which are usually included in larger first-aid kits were omitted for various reasons. Burn ointment is not included

because the allotted space does not allow for an adequate supply. The instructions given for the treatment of burns provides for pressure (snug) bandaging. Thus a single item, a bandage, may be used for either burns or bleeding. Antimalarials are not needed in all operational areas, so local provision is considered preferable. Antiseptics or bactericides are omitted because control (prophylactic) of infection is achieved by the use of sulfadiazine tablets.

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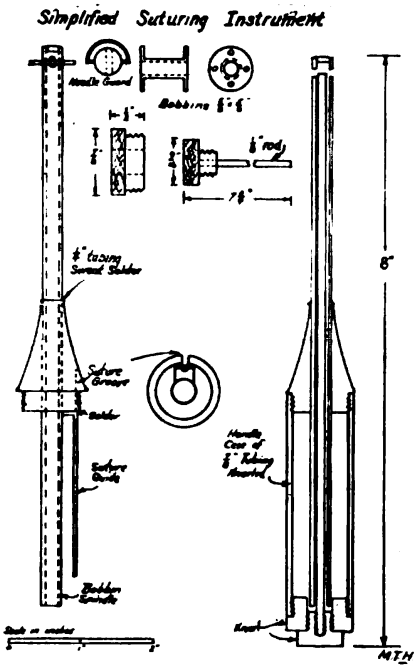
A SIMPLIFIED SUTURING INSTRUMENT

As an improvement on the commercial surgical sewing instrument now on the market the following adaptations are suggested.



The construction is made easily aboard any ship on which there is a metal-turning lathe. There are no exposed parts or sharp edges on which the surgeon's glove may be torn. The instrument is well balanced, and does not tend to rotate when held loosely. In addition the tension on the suture material is applied either by the thumb or forefinger by merely compressing the suture material against the instrument in a normal comfortable grasp. The handle contains four bobbins, thus allowing for a wide range and ample supply of suture material at all times. Its construction is such that it can be taken apart readily for thorough cleaning and sterilization. The unique feature of absolute control of the angle of the needle, through 360 degrees, is retained. The instrument uses the regular Singer surgical needle.

Six of these instruments were made by the author and given to colleagues of different specialties. The opinions of all were compiled. In general it is agreed that this type of instrument is of definite value, though it does not replace the older methods of suturing in most cases of intra-abdominal surgery.—HURLEY, M. T., Lieutenant, junior grade (MC) U.S.N.R.

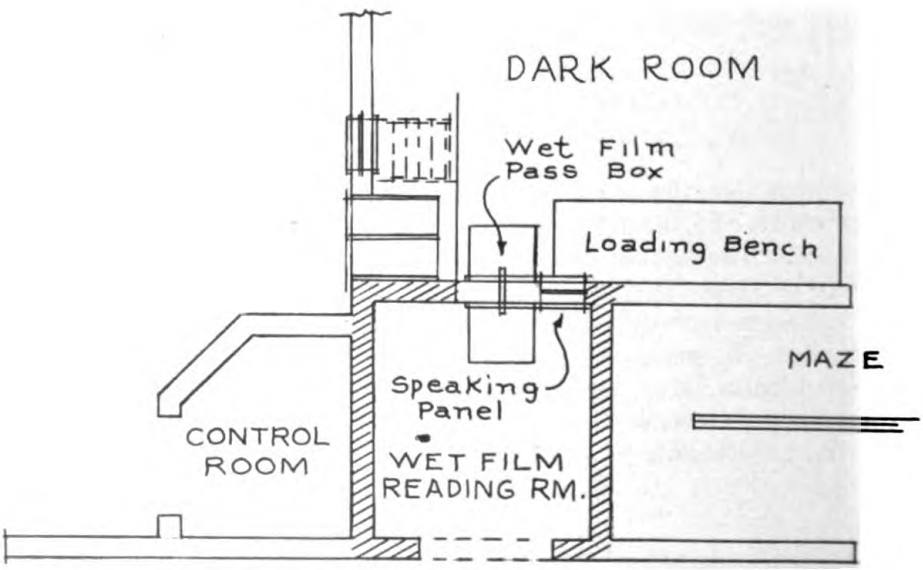
WET-FILM X-RAY VIEWING ROOM

LEO H. GARLAND
Lieutenant Commander (MC) U.S.N.R.
and
MILO T. HARRIS
Commander (MC) U.S.N.R.

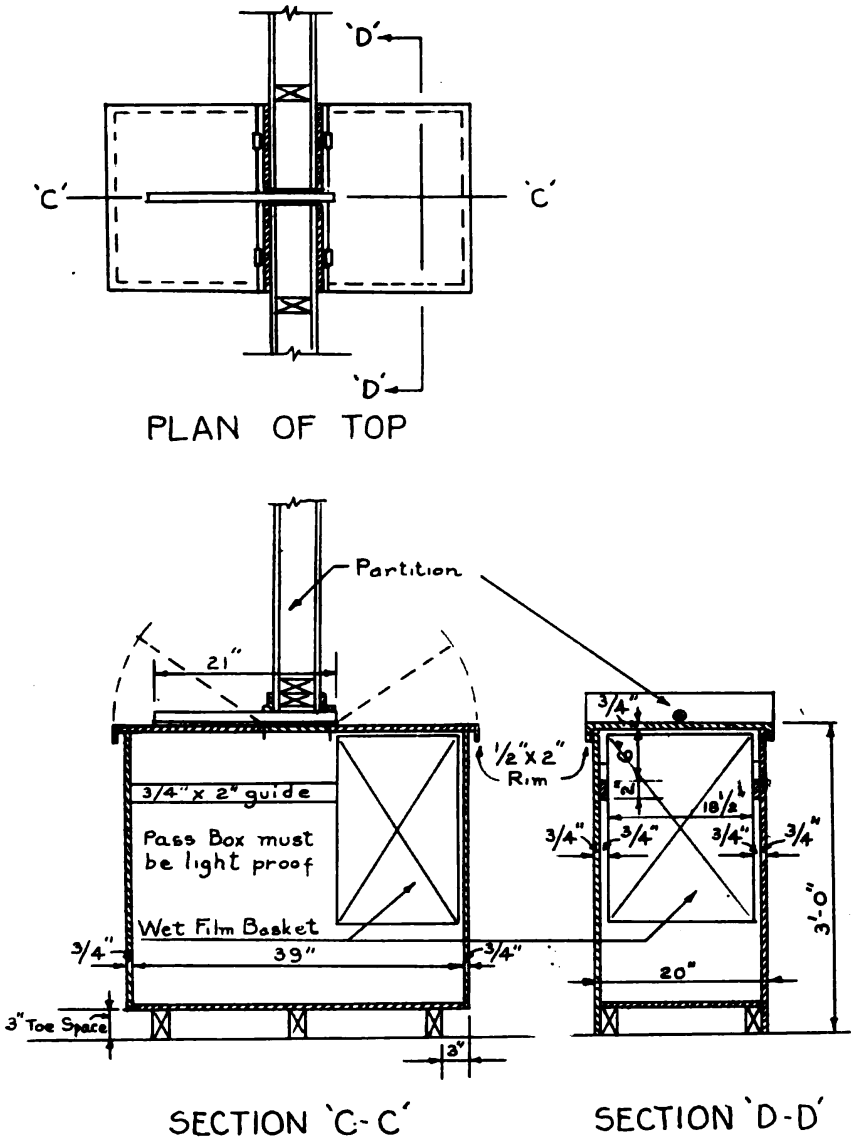
To circumvent interruption of darkroom work in order to see the roentgenograms on patients sent for x-ray examination while the films are still wet, and to avoid the hazard of fogging or spoiling films, many radiologists utilize an elongated wash-water tank which projects through the wall of the darkroom into an adjoining room. This is a convenient and efficient manner of meeting the problem, but entails the use of special stainless steel equipment in the wash tank, a motor unit to keep the films moving and certain other materials difficult to obtain in wartime.

In an already existing department it may not be possible to extend the tank into a room adjoining the darkroom. In such event the small separate wet-film viewing room designed along the lines shown in the accompanying illustrations makes a satisfactory substitute.

The basic construction requirements consist in (1) a space from 4 to 6 feet square adjoining the darkroom and fitted with



1. Layout of wet-film viewing room and adjoining spaces.

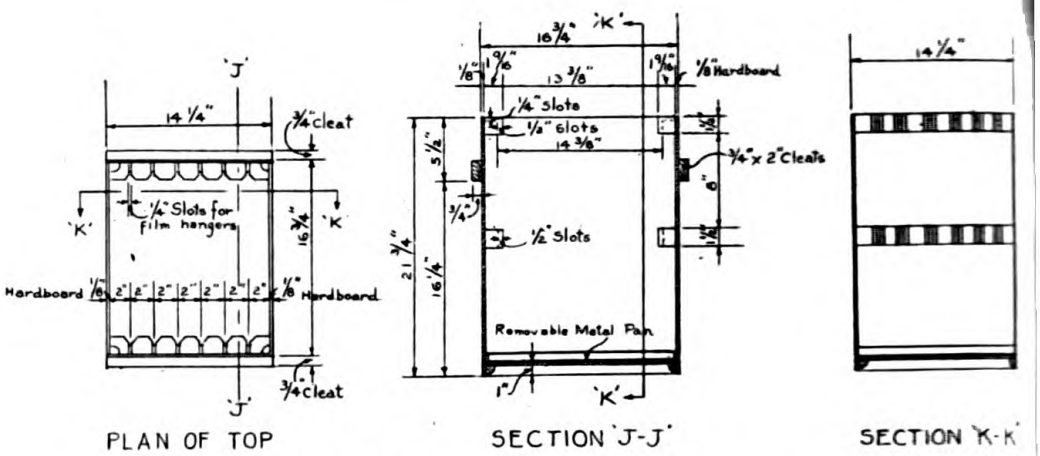


2. Wet-film pass box and tunnel.

film illuminators, preferably wall-mounted; (2) a lightproof pass tunnel of suitable size; (3) a convenient loading rack or frame to hold from 4 to 8 film hangers; and (4) a speaking tube or baffle permitting easy conversation with the darkroom.

In order to view wet films, and because it was not possible to extend the wash tank into the radiographic room on the right side of our darkroom, it was decided to create a small separate room by shortening the maze, utilizing a "dead" space which happened to be present, and shortening the control booth on the left side of the darkroom (fig. 1).

A lightproof voice baffle consisting of a pair of rectangular openings in the wall between the wet-film viewing room and the



3. Details of film hanger rack or basket.

4. Wet-film viewing room in use.

darkroom, each covered with a double thickness of black cheesecloth mounted on wooden frames, was installed.

A pass tunnel below bench level and large enough to carry a wooden frame holding six 14- by 17-inch films was constructed

(fig. 2). This frame slides on two wooden rails and is pulled manually into either room. The light-tight lids of the pass tunnel are guarded by a simple sliding metal bar on top, so that when one lid is opened, the other cannot be raised.

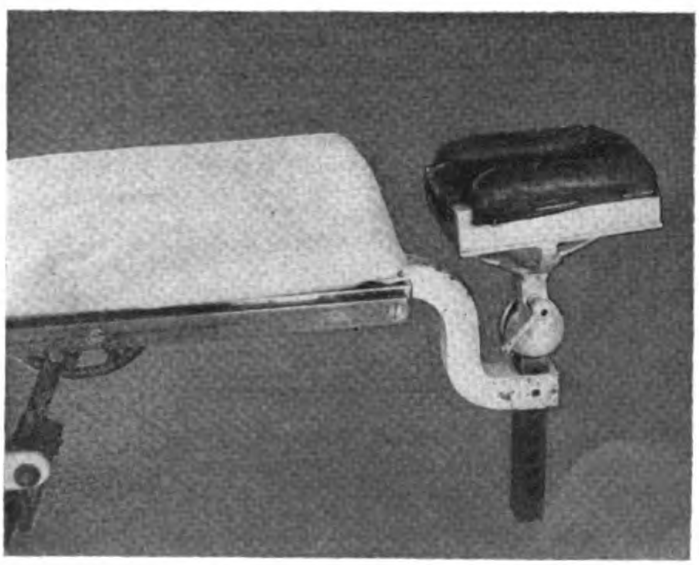
The inside dimensions of the room are 5 ft. 6 in. square and 7 ft. 6 in. high. It opens directly onto the x-ray corridor by a wide doorway. It was not considered desirable to have any door on this entrance, in order to provide consultants and interns with adequate room in which to stand while examining the wet films.

HEADREST FOR NAVY OPERATING TABLE

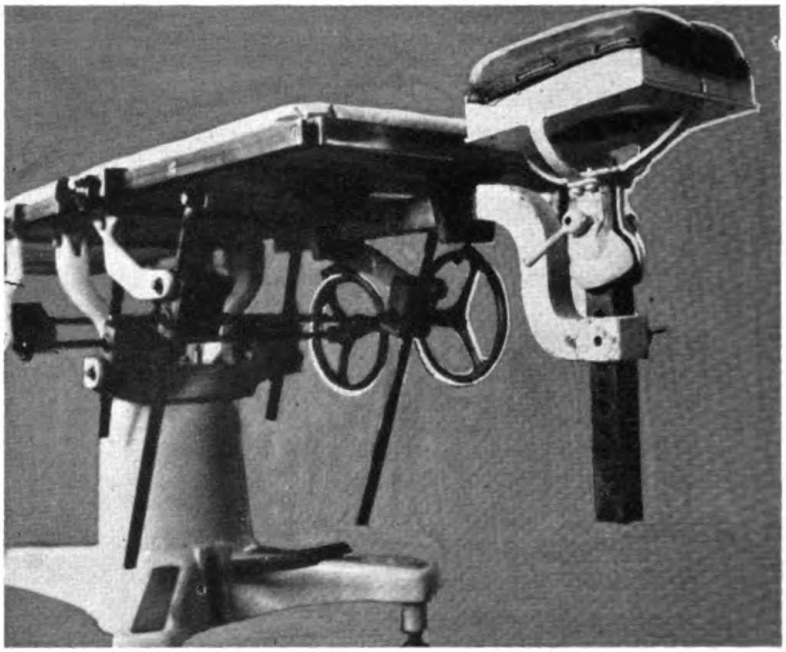
E. LYLE GAGE
Lieutenant Commander (MC) U.S.N.R.

The need for an adjustable and sturdy headrest attachment for the standard Navy operating table, one which allows for the brow-down position, is acute. In the earlier days at this advance base a Mayo stand was used, then a basin stand. Neither of these was comfortable despite padding, nor were they steady enough to be satisfactory.

A satisfactory unit designed after the headrest on the operating table at the Montreal Neurological Institute was constructed by the local Seabees and fitted to the standard operating table as shown in the accompanying illustrations (figs. 1 and 2). The



1. Headrest showing the padding, the vertical bar and the ball-and-socket joint.



2. Headrest showing attachment to the table and the means of adjustment in all directions.

2-inch square adjustable sliding bar is held firmly in place by the two brackets which are welded to the table. These, with the vertical bar and the ball-and-socket joint, make adjustment in all directions possible. They were made in the machine shop according to plan; the leather padding for the headrest was obtained from a baseball mask. During operations a rubber-sheet cover is used on the headrest to prevent soiling of the padding.

The unit is adaptable for use in head, face, and neck operations, and affords a comfortable brow-down support for the patient's head during operations on the spine and chest. It can be constructed easily and fitted to the standard Navy operating table by any machinist. It is quickly removed from the table and takes up little storage space when not in use.

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RUBBER TUBING AFFECTS PENICILLIN

Rubber was found to have a variable effect on penicillin solutions; some samples inactivated a considerable proportion of the antibiotic and others had no observable effect. In continuous intra-muscular infusion the long contact of solutions with the rubber tubing affords ample time for the destruction of from 25 to 50 percent of the penicillin if the rubber is unsuitable.—COWAN, S. T.: Effect of rubber tubing on solutions of penicillin. Lancet 1: 178-179, February 10, 1945.

TECHNIC FOR REMOVING FOREIGN BODIES FROM CORNEA

ALVAN G. FORAKER
Passed Assistant Surgeon (R) U.S.P.H.S.

Because of the delicate tissue involved, the danger of perforation from movement of a noncooperative patient, and the necessity of not causing added trauma, the removal of foreign bodies firmly embedded in the cornea at times is difficult even for an eye specialist. The movement and vibration of a ship at sea increase these dangers. For this reason a technic of removing foreign objects by syringing has been developed which has proved safe and effective.

In this procedure the patient may be either sitting or lying, the cornea anesthetized in the customary manner, and the eyelids held open (by an assistant) with gauze pads. A hypodermic needle from which the point has been clipped to reduce the possibility of corneal trauma is attached to a 10-cc. syringe filled with warm boric acid solution. The base of the needle is grasped firmly between the left thumb and index finger to prevent pressure in the syringe from loosening the needle and propelling it against the eye. The back of the operator's left hand is braced on the patient's malar prominence in order that sudden movements of the ship or of the patient may not ram the needle against the cornea. The tip of the needle is held about 1 inch from the cornea so that a fine oblique stream is directed on and around the embedded object when pressure is made on the plunger of the syringe by the right hand. This stream tends to force its way under the foreign object and float it free. A very gentle syringing for a brief period by this method usually dislodges the object and washes it into the conjunctival sac, where it can readily be removed. If the object is not dislodged at the first attempt, directing the stream from a different angle usually results in success.

It is believed that this procedure is safer in the hands of the average medical officer or pharmacist's mate, ashore or afloat, than attempting to remove embedded foreign bodies from the cornea with spuds, knives, or other instruments.

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PHANTOM LIMB PAIN

Irritation of centrally conducting axones by neuromas, local inflammatory changes, or by abnormal scar tissue formation about the end of the nerves may give rise to intractable pain in the phantom limb following amputation.

Placing a tight ligature about the uninjured large nerve trunk at a point about one inch above the level of amputation constitutes a simple and physiologic method of preventing the regeneration of axones from the cut end of the nerve.—HERRMANN, L. G., and GIBBS, E. W.: Phantom limb pain; its relation to treatment of large nerves at time of amputation. Am. J. Surg. 65: 168-180, February 1945.

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VITAMINS AND GASTRO-INTESTINAL SYMPTOMS

A large number of gastro-intestinal symptoms, including anorexia, constipation, diarrhea, dysphagia, flatulence and vomiting, have been ascribed to deficiency of components of the B complex. Of these symptoms it is clearly established that anorexia and diarrhea accompany vitamin B_1 deficiency in man. Thiamine and nicotinic acid are essential for normal functioning of the gastro-intestinal tract, but it is difficult to establish a definite part of the B complex as the specific agent in the etiology of the various and sundry changes in the gastro-intestinal tract. It is much easier to ascribe the changes to the group as a whole. It is undoubted though, in an over-all view, that B_1 is by far the most important member of the group, with nicotinic acid a very close second.—WRIGHT, L. D., JR.: Effect of vitamins on intestinal function. New Orleans M. & S. J. 97: 400-406, March 1945.

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FOLIC ACID IN INTESTINAL THERAPY

Folic acid and biotin promote the synthesis by residual intestinal bacteria, of additional essential dietary factors. Thus these substances may prove to be valuable adjuncts to sulfonamide therapy, as they affect primarily the vitamin synthesizers (colon bacilli) and leave more or less uninfluenced the vitamin requirers (lactobacilli, streptococci, and anaerobic bacilli). Para-aminobenzoic acid partially counteracts the effect of the sulfonamides, especially the chief offender, sulfasuxidine, on vitamin synthesis in the intestinal tract.—WRIGHT, L. D., JR.: Effect of vitamins on intestinal function. New Orleans M. & S. J. 97: 400-406, March 1945.

EDITORIALS

ETIOLOGY OF SHOCK: FIBRINOLYSIN (?)

Despite the tremendous volume of work on shock, the causal relationship is still undetermined. Among the theories proposed, the liberation of a toxic chemical which may be productive of shock has repeatedly been suggested. Unfortunately there has been no convincing evidence in support of this theory.

There are, however, a few toxin-liberating substances which could function in this manner. Histamine is one, but after extensive study its value has been discounted. Callicrein,[1] a substance present in most mammalian tissues, has recently been shown to possess shock-producing properties. It is hypotensive in action, affecting the tonus of blood vessels and the resulting splanchnic and peripheral vasodilatation when injected intravenously into a related species.

Trypsin also when injected intravenously brings about a fall in blood pressure, and a prolongation of the clotting time similar to that produced by anaphylactic shock. It has been used,[2] moreover, experimentally in hemophilia; and Tagnon[3] has shown the possibility of its plasma origin, inasmuch as he was able to obtain a trypsin-like substance from the blood of depancreatized dogs.

Among the more recent substances investigated from the viewpoint of shock production, none, however, holds more promise than fibrinolysin, the relationship of which to shock dates back to the classic experiments of Yudin[4] in the use of cadaver blood for transfusion. Impressed with the phenomenon that some bloods, when samples were collected for Wassermann reaction, remained liquid in contrast to the blood of living donors, this investigator showed that if the blood is obtained from the body of a person

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[1] WESTERFELD, W. W.; WEISIGER, J. R.; FERRIS, B. G., JR.; and HASTINGS, A. B.: Production of shock by callicrein. Am. J. Physiol. 142: 519-540, November 1, 1944.

[2] TAGNON, H. J.: Fibrinolysis and pancreas. Arch. Internat. de Physiol. 51: 472, 1941.

[3] IDEM: Effect of intravenous injection of trypsin on blood coagulation. Proc. Soc. Exper. Biol. & Med. 57: 15-47, October 1944.

[4] YUDIN, S. S.: Transfusion of stored cadaver blood; practical considerations: first thousand cases. Lancet 2: 361-366, August 14, 1937.

who died from a chronic disease such as cancer, it slowly formed a coagulum which could not be dissolved but remained firm until putrefaction.

Contrarily the blood of corpses in cases of sudden death, whatever the cause, when taken into the test tube quickly coagulated into an ordinary clot, but anywhere from ¼ to 1½ hours thereafter it dissolved spontaneously, becoming liquid again. It was further shown that blood taken from patients in severe shock, even before death, possessed this fibrinolytic feature.

Capitalizing on this information, cadaver blood with fibrinolysis came into demand for transfusion purposes, particularly because no undesirable anticoagulant addition was required.

Further investigation, however, revealed the proteolytic character of the substance responsible for the fibrinolysis, and Tagnon[5] has shown its ability to prolong the clotting time as well as its enzymic nature. There are indications that fibrinolysin is an intracellular constituent which is released into the blood, and from a parallelism with chymotrypsin, a substance similar to trypsin in every respect except that it does not clot blood, it could be produced by a proteolytic enzyme derived from intracellular substance. Its toxicity when injected intravenously, furthermore, is of an order comparable to proteolytic enzymes.

The relationship to shock has been recorded, in that fibrinolysin appears in the dog's blood 3 hours after the onset of shock and disappears only after shock subsides. It is seen, moreover, in venous blood before it is obtained from arterial blood.

Fibrinolysis occurs in shock states brought on by the intravenous injection of peptones, typhoid vaccine, mercupurin, and from hemorrhage, as well as in shock wherein rapid death follows from trauma.

The significance of these findings awaits further experimental confirmation. Considering, however, that proteolytic enzymes are very toxic when given intravenously and that fibrinolysin is most probably a proteolytic enzyme, Tagnon is of the opinion that the release of such a proteolytic enzyme during shock might constitute at least a sustaining and aggravating factor. It may be the explanation, moreover, for the alleged prolongation of the clotting time in shock.

Notwithstanding the preliminary character of Tagnon's experiments, the release of enzymes in the blood during shock seems certain. That these are not confined, however, to proteolytic enzymes, but may include other types, is equally apparent. In shock induced by hemorrhage, the Boston investigator was able to

[5] TAGNON, H. J.: Personal communication.

demonstrate 100 percent increase of alkaline phosphatase in the samples of blood with fibrinolysis.

It is suggested, therefore, that as in shock from hemorrhage, perhaps in other types of shock various enzymes are released into the blood and contribute to the clinical and biochemic picture associated with shock.

REHABILITATION OF AMPUTEES

The truism that a man is forced to toil in the sweat of his brow, and with the labors of his hands win his bread, is realistically understood only by an amputee. What mental repercussions the loss of an extremity initiates cannot be fully appreciated except by one who has been so afflicted.

How the Navy is meeting the challenge of amputee rehabilitation is seen elsewhere in this BULLETIN.

The war's trend in Naval activity, and experience with early casualties, prompted the amputation-center idea, the realization of which has justified every endeavor spent in its pioneering. It is apparent that the Bureau of Medicine and Surgery is seeing to it that the country's debt of gratitude to those whose disabilities necessitates their return to civilian life is being adequately fulfilled, and is returning these people to their communities in the best possible condition.

Reamputation, plastic procedures, and intensive conditioning of the stump are major factors in the amputation program. A comfortable, serviceable custom-made prosthesis adapted to a physiologic and painless organ is the aim of orthopedic rehabilitation.

Solicitude, however, does not cease with the fitting of an appliance. The education of the amputee in the proper use of his prosthesis, in appropriate balance, in gait, and in the dexterous manipulation of his apparatus is of equal concern. Supervision of the manufacture of the instrument, with time allotment for the detection and correction of its defects, is a novel innovation paying high dividends in morale.

However the Medical Department is not interested only in the fact that a man requires a prosthesis but also in that he is a thinking, feeling person who will wear the prosthesis. He is, therefore, as far as possible emotionally conditioned to his deformity. This has a salutary effect and materially buffers the

shock of readjustment, enlightening the veteran regarding what to expect on his return to civilian society.

These men have visible evidence of their injury, and as Braceland[1] has aptly put it, they want to feel equal to other men. They want to be accepted as normal human beings. They have a difficult personal problem to solve and they resent being regarded as handicapped or objects of pity. They resent it because it rearouses the inevitable insecurity implanted in them by their injury.

To overcome this latent insecurity the amputee is given opportunity at the amputation center to mingle with others similarly afflicted, an association which engenders confidence.

He is moreover allowed to follow the manufacture of his prosthesis step by step, assist in its production, giving it that personalized feature which creates interest and pride in its accomplishment.

As no amputee is released until he is physically capable of handling himself under reasonable and ordinary circumstances, so no veteran is discharged until every effort is bent to fit him psychologically for the task of assuming his place in the community in which he elects to live.

The amputation center is a monumental work, the Navy's answer to the problem of rehabilitation of the veteran amputee.

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[1] BRACELAND, F. J.: Role of psychiatry in rehabilitation; attitudes toward returning veterans. Address before Forum of Women's International Exposition of Arts and Industry, Madison Square Garden, New York. November 15, 1944.

BOOK NOTICES

Publishers submitting books for review are requested to address them as follows:

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Washington 25, D. C.
(For review)

SURGERY OF THE HAND, by *Sterling Bunnell, M.D., Honorary Member of American Academy of Orthopedic Surgeons, Member of American Association of Plastic Surgeons and of American Society of Plastics and Reconstructive Surgery, Licentiate of American Board of General Surgery and Plastic Surgery.* 734 pages; 597 illustrations. J. B. Lippincott Co., Philadelphia, Pa., publishers, 1944. Price $12.

Undoubtedly this new work is one of the finest contributions to medical literature. It represents the experience of a master who has spent over 30 years dealing with all different types of hand pathology.

In the first section one finds an unusual departure in that the author discusses the phylogeny and comparative anatomy of the hand. This is followed by an exposition of the normal hand anatomy, movements, and skeletal growth findings.

The second section deals with the physical examination of the hand and this in turn is followed by a detailed description of the reconstructive surgery. Not only does this cover cutaneous contractures, Dupuytren's and Volkmann's ischemic contractures, but also the repair of bone, joint, nerve, and tendon injuries. The latter group, which falls essentially into the field of orthopedic surgery, is well described. However the reviewer feels that the section dealing with surface restoration is apt to be misleading to one who is not thoroughly conversant with the indications and uses of different types of skin grafts. Too much emphasis is placed on the use of the tube pedicle flaps for the correction of many surface lesions. While this method may be applicable, the majority of modern plastic surgeons are correcting many similar deformities by quicker and less cumbersome methods, utilizing

thick split-thickness and free full-thickness skin grafts. Where a fat pad is needed, a direct abdominal flap can be transferred in one stage, grafting the donor area with a split-thickness skin graft at the same operation. The use of Z-plastic procedures is given its rightful emphasis and limitations.

The pocket or glove flap method shown on page 141 is not too practical because of the inevitable contamination and drainage from the donor bed. As an alternative, an open direct flap with grafting of the donor site at the same time will give rise to fewer complications.

The author shows the advantages of his ingenious "pull-out" stainless steel wire suture for the approximation of divided tendons.

A third section takes up the management of recent injuries and infections of the hand. Included in this is the treatment of burns, fractures and dislocations and finally, the "industrial hand."

The fourth and final section discusses congenital deformities, vasomotor and trophic conditions, and includes a part on tumors of the hand by Dr. L. D. Howard.

The reviewer feels that while reconstructive surgery of the hand may leave much to be desired in the final result, certainly various degrees of improvement will be accomplished when the surgery is performed by an operator who is familiar with this type of work. Consequently this book should stimulate those plastic and orthopedic surgeons who have the patience, to improve their knowledge so that their cases may be given the maximum of thoughtful care. This work is a definite contribution toward this end.

Bunnell's masterpiece should be a standard reference text for all medical libraries and could well be owned by every plastic, orthopedic, or general surgeon treating traumatic lesions arising from industry or war.

PRINCIPLES AND PRACTICE OF SURGERY, by *W. Wayne Babcock, M.D., Emeritus Professor of Surgery, Temple University; Acting Consultant, Philadelphia General Hospital;* with the collaboration of *37 members of the faculty of Temple University.* 1331 pages; illustrated with 1141 engravings and 8 colored plates. Lea & Febiger, Philadelphia, Pa., publishers, 1944. Price $12.

This volume by the surgical staff of Temple University, Philadelphia, is undoubtedly one of the finest surgical texts of the present generation. It depicts the old and the new in surgery with a clearness that few books possess. The entire field is reviewed and organized in such a manner that the reader is made to appreciate the exhaustive character of the work without becoming fatigued over unimportant details. The tone and style of the book

appear to be those of a single author rather than those of 38 independent collaborating specialists, a desirable feature so frequently lacking in works of multiple authors.

Of the 57 chapters several are deserving particular mention. That on Infection and Disinfection contains a discussion of familiar as well as many unfamiliar antiseptics, whereas the chapter on Operative Plastic Surgery illustrates and describes the use of the more common surgical instruments, a worth-while innovation in surgical texts. Too often the intern comes to a surgical service unable to name many of the instruments. For knowledge on this subject he has been forced to rely on surgical instrument catalogs, or whatever information he can obtain from the head surgical nurse. The usefulness of such a discussion, consequently, is apparent and is deserving more attention by surgical textbook writers.

The chapter on chest surgery is particularly well done and those chapters dealing with visceral pathologic processes place the book in a category surpassed by few, if any, works in this field.

Despite the high character of Principles and Practice of Surgery, the disproportion of space allotment between the principles of surgery and their practical application detracts from the value of the work as a guide in surgical technic. Moreover where practical methods are discussed the fine type and lack of descriptive detail make reading laborious and discouraging. Elucidation of unusual operations and hurriedly dismissing the common daily varieties with a mere mentioning is regrettable and makes the work of less importance to the ordinary practitioner.

The bibliography section, although voluminous, is not complete and leaves much to be desired from a documentary viewpoint.

Notwithstanding these adverse criticisms, surgeons will find this new addition to surgical literature a comprehensive survey of the entire field, so lucidly and brilliantly written that reading is a refreshing task.

MODERN CLINICAL SYPHILOLOGY, Diagnosis, Treatment, Case Study, by *John H. Stokes, M.D., Professor of Dermatology and Syphilology, School of Medicine and Graduate School of Medicine, University of Pennsylvania; Herman Beerman, M.D., Sc.D. (Med.), Assistant Professor of Dermatology and Syphilology, School of Medicine and Graduate School of Medicine, University of Pennsylvania;* and *Norman R. Ingraham, Jr., M.D., Assistant Professor of Dermatology and Syphilology, School of Medicine, University of Pennsylvania.* 3d edition, reset. 1332 pages with 911 illustrations. W. B. Saunders Co., Philadelphia, Pa., publishers, 1944. Price $10.

It may be assumed that almost every modern practitioner is familiar to some degree with one or the other of the two earlier editions of this work. This appraisal is confined entirely to its

latest edition which is not only an extended revision but, compared to the first edition, an entirely new book. Only the format is familiar, the content is as current as this month's medical journal. The publication date was delayed sufficiently to include all pertinent information and current evaluation on penicillin therapy in syphilis, and as a result a complete summary with a critical discussion forms a valuable addition to the text. Another timely inclusion is considerable material on public health and on military medicine as it concerns syphilis.

Since the previous edition of 1934, considerable change and progress has followed. This volume evaluates several of the newer drugs that have appeared (and disappeared) and gives considerable discussion on the currently used mapharsen. This 10-year period has seen the rise of the rapid treatment methods for early syphilis, from the intensive 5-day drip method to the more rational speeded-up routine measured in weeks rather than hours. Stokes and his co-authors have written at reasonable length and with exceptional clarity on the management and treatment of latent syphilis, the bête noire of the practitioner. A chapter on "Treatment Planning" if read carefully answers almost all the questions that any student may have on the rationale of treatment management, a feature previously lacking.

The literature of the past 10 years has been carefully evaluated by Stokes, Beerman and Ingraham, considerable of it accruing from their own clinical experience and investigative groups. A formal bibliography is not included and this is not to the disadvantage of the book; when investigators are cited, the year of their published observations is given, making it possible for the searching reader to reach the source readily. There have been some changes in illustrations to the distinct advantage of the present revision and the tables and charts so typical of the previous editions are still present and carry the same punch. Succinct case histories dramatize with startling effect the salient points of the text. This volume may be encyclopedic in its scope but it is still in handy and readable form. Each edition has benefited by the infusion of additional collaborators and this time with two able clinicians as co-authors. The style is still Stokes'. The index in its completeness and accessibility reflects the high standard of the work.

THE DIAGNOSIS AND TREATMENT OF ACUTE MEDICAL DISORDERS, by *Francis D. Murphy, M.D., F.A.C.P., Professor and Head of the Department of Medicine, Marquette University School of Medicine and Clinical Director of the*

Milwaukee County General Hospital and Emergency Unit, Milwaukee, Wisconsin. 503 pages. F. A. Davis Co., Philadelphia, Pa., publishers, 1944. Price $6.

This volume was prepared for "the general practitioner and medical student," and should prove particularly valuable to the former. It is essentially a concise compend on therapy, although under each subject is a short discussion of etiology, and a more complete one on diagnosis. Subjects include all ordinary diseases seen by the internist, and there are chapters on the nervous system, tropical disease, acute poisoning, and drugs. The latter is far from complete, including only drugs used in the treatment of heart disease, the sulfonamides, abuses of thyroid therapy, and the therapeutic hazards of benzedrine. Other drug therapy, however, is covered in chapters on the various disorders. There is no bibliography, although the completeness with which the subject of therapy is handled indicates that the literature was well covered. Except for its use in the treatment of patients with pneumonia due to staphylococcic infection, penicillin is not discussed, which is unfortunate, since the author has undoubtedly had sufficient experience with this drug so that its inclusion in the volume would have been a worth-while contribution. The author has had years of experience as a teacher and consultant, and diagnosis and therapy are presented much as in a class for senior medical students. It should prove of great value as a ready reference to the busy practitioner of medicine.

AN OUTLINE OF TROPICAL MEDICINE, by *Otto Saphir, M.D., Director of the Department of Pathology of the Michael Reese Hospital; Professor of Pathology, University of Illinois College of Medicine.* 86 pages. The Michael Reese Research Foundation, Chicago, Ill., publishers, 1944. Price $1.

New books are being published on tropical medicine because of the current interest in this subject. Some of these will be written by men with long experience in the field; others by men with little experience after careful study of the authorities; and still others by men who have read the authorities without understanding the meaning of the words.

This book is introduced as "an extended vocabulary of Tropical Medicine." It is a new and inaccurate vocabulary in some respects; the definitions of "stomach index" and "salivary gland index" are new to the reviewer. Many controversial points are stated as facts, perhaps for the sake of brevity; yet some irrelevant material is included, suggesting that brevity was not important. Only the most classic clinical symptoms are presented for each disease, limiting the usefulness of the presentation. The arrangement of material is poor, and not consistent in different parts.

The book begins with yellow fever. Why yellow fever? Certainly not because of its importance today or its position in the alphabet; possibly because of an interesting pathologic picture. It is stated that the discussion of leprosy "will be more cursory;" yet the space devoted to it exceeds that given to typhus, leptospirosis, yaws, or plague.

There are many statements that must be considered inaccurate, misleading, or confusing. Instead of giving local malaria vectors, the author has picked out two that occur thousands of miles from the source of the book. The second most important entity to the Navy, the dysenteries, is omitted as being too commonplace for this publication.

PRACTICAL NEUROLOGICAL DIAGNOSIS, With Special Reference to the Problems of Neurosurgery, by *R. Glen Spurling, M.D., Clinical Professor of Surgery (Neurosurgery) University of Louisville School of Medicine (on leave of absence)*. 3d edition. 237 pages; illustrated. Charles C Thomas, Springfield, Ill., publishers, 1944. Price $4.

Every practitioner of medicine should be able to make a thorough neurologic examination. Not only should he be able to do this but he should be conversant with the common neurologic lesions.

Should he want a book which is compact and comprehensive, Spurling's "Practical Neurological Diagnosis" will prove of great value. This book contains the essentials of neurologic diagnosis and is superior to many textbooks on the subject. It does not pretend to be anything but an outline which can be easily followed and consulted. The illustrations are graphic and informative. The book as a whole is one that every physician should have.

Medical students also should find this book valuable, as it organizes the subject and clarifies some of the diagnostic problems.

The book is divided into three parts: (1) Neurologic Examination, (2) Cerebrospinal Fluid, and (3) Roentgen Diagnosis.

This book has been revised and brought up to date and so contains the latest information on the subject.

FOSTER HOME CARE FOR MENTAL PATIENTS, by *Hester B. Crutcher, Director of Social Work, State of New York, Department of Mental Hygiene*. 199 pages. The Commonwealth Fund, New York, publishers, 1944. Price $2.

Miss Crutcher's monograph treats of an aspect of social and administrative psychiatry which merits serious consideration. The problem posed by the care of mental patients is, in the final analysis, a community problem. Only after this basic responsibility is fully accepted can one afford to argue the relative merits of hospital care versus foster home care in special cases.

The care of the mentally sick is costly. One half of all the

hospital patients in the United States are mental patients. Calculated on the basis of five beds per thousand population, there exists a deficit of 94,000 beds at present. To this number must be added an increment of bed replacements. And yet the staggering total of 191,000 beds at the cost of $573,000,000 is but a part measure of the burden. Cost must be reckoned in terms of a social specie as well as an economic one.

In most instances, institutional treatment of the chronically mentally ill means permanent segregation from a social life. The mental patient is forced to make adjustment in the atmosphere of an institution which at best is only an imitation of home and family. The limitations of this form of care for all patients are obvious. It must be more generally recognized that there is not only economic value in the partial services of disabled people but also there is rehabilitative value in placing them back in the community.

The trend toward a more widespread use of extra institutional facilities for the rehabilitation and care of mental patients is growing. Miss Crutcher's exposition of this important sociomedical problem is scientific, timely and compelling.

AND NOW TO LIVE AGAIN, by *Betsey Barton.* 150 pages. D. Appleton-Century Co., Inc., New York, publishers, 1944. Price $1.75.

Miss Barton interprets the difficulties of the severely handicapped in making their personal adjustment to their disabilities and to society in the light of her own experiences. The book gives an excellent insight into her thoughts and her reactions during her long struggle to attain the apparently excellent adjustment she has achieved.

It is believed that the book has its greatest value to those who are associated with the handicapped, as relatives or fellow-workers, and those who are treating them medically, or otherwise assisting them toward a proper outlook on life and toward the place in life which they can best fill. The book as a whole brings strongly into relief the necessity for early and continued attention to the needs of the handicapped patient as a person and for individualizing everything that is done to fulfill the particular requirements of each.

NORMAL LIVES FOR THE DISABLED, by *Edna Yost,* in collaboration with *Dr. Lillian M. Gilbreth.* 298 pages. The Macmillan Co., New York, publishers, 1944. Price $2.50.

This book is designed primarily as a manual for a disabled person to use as a guide in rehabilitating himself. As such it contains much information, good advice, and helpful suggestions.

It deals with the practical problems the disabled man meets in getting proper medical treatment, vocational rehabilitation and training, Government aid, a job, and advancement. It emphasizes the importance of the disabled person's attitude and shows him the way to deal with the difficulties arising from his own and other people's attitudes toward the disabled.

The book is disquieting. Professional men, politicians, businessmen, and workers in governmental agencies would do well to read the first three chapters of Part II alone, to appreciate the formidable nature of the disabled person's difficulties in overcoming shortsightedness, red tape and prejudice, and his own discouragement. Rehabilitation is coming of age, and is suffering growing pains which the book attempts to diminish for the individual.

On the other hand, the book is difficult to read. The familiar style and the many accounts of persons who surmounted their handicaps were doubtless meant to encourage and arouse determination, but the conversational freedom with which the author writes in the first, second and third persons, and the impersonal, and mixed exclamations, anecdotes, information, explanation, exhortation, advice, biblical quotations, and outworn analogies, will make her lessons hard to find by anyone who has the patience to finish the book.

ESSENTIALS OF PHARMACOLOGY AND MATERIA MEDICA FOR NURSES, by *Albert J. Gilbert, M.D., Instructor of Pharmacology, Aultman School of Nursing, Canton, Ohio;* and *Selma Moody, R.N., Instructor in Nursing Arts, The Presbyterian Hospital of the City of Chicago.* 2d edition. 290 pages; illustrated. The C. V. Mosby Co., St. Louis, Mo., publishers, 1944. Price $2.50.

This appears to be a good textbook for the young student nurse. It describes the more common drugs and omits the vast number of others which serve only to confuse and discourage.

The essential drugs are described in sufficient detail regarding source, dosage, action, and uses. The symptoms of overdosage and the warnings against self-medication and drug addiction are especially good. The newer drugs, such as the sulfonamide group, penicillin and atabrine, the vaccines developed as a result of the war, and the war gases are included.

In the opinion of the reviewer, the section on arithmetic and preparation of solutions is an over-simplification of a subject which most student nurses find difficult at best. It is not complete enough to be useful.

The section on posology stresses the responsibility of the nurse in knowing the right dose even though she never prescribes. The reasons for spacing administration of drugs and giving them on time are well-treated.

The appendix contains a summary of the official doses of the commonly used and dangerous drugs, which should be useful for quick reference.

TABER'S DICTIONARY OF GYNECOLOGY AND OBSTETRICS, by *Clarence Wilbur Taber, Medical editor, and author of Taber's Cyclopedic Medical Dictionary, Taber's Condensed Medical Dictionary, and Dictionary of Food and Nutrition, etc.;* with the collaboration of *Mario A. Castallo, M.D., F.A.C.S., Assistant Professor of Obstetrics, Jefferson Medical College.* Over 700 pages; illustrated. F. A. Davis Co., Philadelphia, Pa., publishers, 1944. Price $3.50.

This book presents a novel conception in several respects.

It is unusual to consider that there should be a medical dictionary of terms used only in one specialty, and if this were all that the book provides it is probable that any medical dictionary would adequately cover the subject. However it develops on inspection that this is actually a small encyclopedia covering gynecology and obstetrics.

Words and terms are not merely defined but throughout the book generous discussion is given to subjects worthy of the space, many of these being accompanied by excellent illustrations. As a compendium, this book should be of definite value to students and physicians interested in obstetrics and gynecology; its definitions are accurate and its information reliable even though so concise.

A BIBLIOGRAPHY OF AVIATION MEDICINE SUPPLEMENT, by *Phebe Margaret Hoff; Ebbe Curtis Hoff;* and *John Farquhar Fulton.* 109 pages. Published by the Committee on Aviation Medicine, Division of Medical Sciences, National Research Council, Acting for the Committee on Medical Research, Office of Scientific Research and Development, Washington, D. C., 1944. Distributed by Charles C Thomas, Springfield, Ill., publishers. Price $2.50.

Three years ago E. C. Hoff and Fulton published "A Bibliography of Aviation Medicine" which gave a classified and well indexed list of the literature of aviation medicine. In order to bring this volume up to date (1944) the present Supplement has been issued. The same form has been followed as in the original volume with some new titles, such as Survival and Rescue.

Unfortunately this volume does not and cannot represent the real advances in aviation medicine which have been made in the past two years. The reports covering these researches are contained in the confidential files of the Army, Navy and National Research Council. For example a glance through the titles on decompression sickness (6600-6641) in the Supplement gives no indication of the tremendous amount of work done in the past two years in this field. Only when both the unpublished reports as well as the published articles are listed in a similar bibliography

will the research worker in aviation medicine have a complete working list of titles.

The original volume and its supplement give a complete list of published titles of works in the fields relating to aviation medicine. These volumes are very valuable for obtaining the background of work in any of these many fields.

AN INTRODUCTION TO PUBLIC HEALTH, by *Harry S. Mustard, B.S., M.D., LL.D., Director, and Professor of Public Health Practice, Delamar Institute of Public Health, College of Physicians and Surgeons, Columbia University, New York City, New York.* 2d edition. 283 pages. The Macmillan Co., New York, publishers, 1944. Price $3.25.

This comprehensive text of public health is, as the title implies, an introduction to the subject designed primarily for the professional student. It furnishes a background of information of interest to physicians concerned with disease problems of an individual patient or an aggregate population.

The text should prove of value to the service medical officer dealing with mass medical phenomena in his service practice.

The new chapter, "Medical Care", appearing in this second edition presents a guide in the thinking necessary to a logical and satisfactory approach to this problem of increasing importance to the medical profession.

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MALARIA FROM BLOOD BANK TRANSFUSIONS

The transmission of malaria with blood which has been refrigerated for 5 days and which has been drawn from donors who have had no symptoms of the disease for 25 years, is reported in 2 patients. Blood which has been stored for as long as 8 days has been known to cause infection. The addition of quinine to the blood has been found to be without effect. Prophylactic administration of the drug to the recipient when questionable blood is being given has been suggested. The proper screening of donors is the logical means of preventing the accident of malarial transmission. Questions relating to geography would probably be more effective than those regarding past illnesses. For example, it would have been better to have asked our donors, who spoke English poorly, if they had ever lived in Sicily than to have made our routine inquiries regarding streptococcus infection, furunculosis, encephalitis, and twenty other diseases, including malaria. It is suggested that when possible, the blood of donors who have lived in malarial areas be converted to plasma.—MCCLURE, R. D., and LAM, C. R.: Malaria from blood bank transfusions. Surg., Gynec. & Obst. 80: 261-262, March 1945.

PREVENTIVE MEDICINE

Captain T. J. Carter, Medical Corps, United States Navy, in Charge

DETERMINATION OF WELDING FUMES IN SHIP CONSTRUCTION

JOHN F. EGE, JR.
Lieutenant H(S) U.S.N.R.
and
LESLIE SILVERMAN, D.Sc.[1]

The large amount of ship construction in Navy, Navy contract, and Maritime Commission shipyards has resulted in a tremendous increase in the number of workers exposed to welding fumes[2] and their health hazards. The most common health hazards are created by welding or cutting steel in confined spaces, welding galvanized material, and welding leaded or lead painted steels. The fumes which are toxic to welders and cutters are lead, zinc, and fluorides from rod coatings. It is therefore important that the air concentrations of these materials be kept at a safe level. In confined-space welding, the concentration of oxides of nitrogen produced by the arc or torch becomes important. As a general rule, if fume concentrations are controlled by ventilation, unsafe oxide of nitrogen concentrations will not occur.

In order to make determinations of fume concentrations during shipbuilding operations, it is necessary to have apparatus which is portable and simple to use. It is desirable to have a method with high or constant efficiency of collection and a device which will allow rapid collection of an adequate sample for chemical analysis.

The method investigated for application to this purpose is the collection of the fumes on filter papers. Whereas many investigators (*1*) have employed filter papers for the collection of air-borne material, none has used them for welding fumes. Furthermore none of the investigations reported in the literature has given any

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[2] Fumes in this case are considered to be metallic oxide or solid particles formed in the arc by the burning of the materials involved. They usually range from 0.001 of a micron to 1 micron in size.

information regarding the efficiency of the method or allowable air-flow rates in sampling.

EXPERIMENTAL PROCEDURE AND RESULTS

In order to establish the efficiency of the filtering method for various fumes, it is necessary to consider all of the factors involved. These factors are the type of filter paper to be used, the sampling rate or filtering velocity (for a given sampling rate, volume per minute, and filter area, the filtering velocity is fixed) and the particle size of the fumes encountered. The recent development of the electron microscope has enabled investigators to obtain electron micrographs of metallic smokes. Von Ardenne and Beischer (*2*) and Barnes and Burton (*3*) have published electron micrographs of metallic smokes. We have made the measurements of particle size shown in table 1 from their electron micrographs. Table 1 indicates that the fumes of cadmium, lead, and iron would be the most difficult to catch by filtration. Since cadmium exposures are not common in welding, lead fume was chosen as a representative test suspension.

TABLE 1.—*Particle sizes of metal fumes**

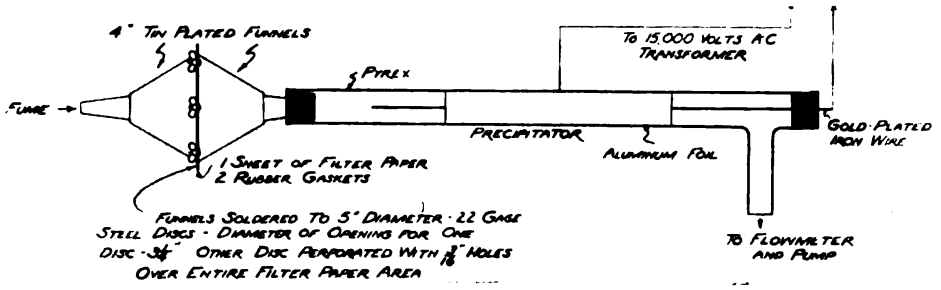
Fume material	Particle size in microns (μ)		Remarks
	Minimum	Mean	
Lead (from a charged electric arc).	0.01	0.1	Micrograph shows no definite particle shape and they occur in large clusters and connected chains. Small discrete 0.01μ particles appear infrequently.
Zinc	0.1	1	Large star-shaped particles which are clumped together. Discrete particles are rare.
Magnesium	0.05	0.1	Cube-shaped particles which are flocculated.
Iron	0.01	0.2	Irregular shaped particles with occasional spheres. Almost all particles have flocculated.
Cadmium	0.001	0.005	Indistinct particle shape with a large amount of flocculation.

*Based on measurements by the authors.

Lead fume from electron micrograph by von Ardenne and Beischer (*2*). Other particle sizes determined from electron micrographs by Barnes and Burton (*3*).

Lead fume concentrations were produced in a large fume chamber (1,200 cubic feet volume) by burning a mixture of tetra-ethyl lead in alcohol. The fumes were kept in suspension by means of a circulating fan system.

To determine the efficiency of the filter papers, two test procedures were conducted with various grades of analytic paper. These procedures determined the relative and absolute efficiencies of the filter paper. The relative efficiency of the paper was obtained by placing two papers in series in the funnel apparatus shown in figure 1. The funnel apparatus consists of two tin-



1. Apparatus used for the determination of the relative and absolute efficiency of filter papers for lead and zinc fumes in air.

plated steel funnels fitted with flanges and rubber gaskets. One funnel flange consists of a perforated surface which acts as a support for the paper and prevents the paper from being torn by the suction due to the air-flow resistance of the paper. The lead in the filter paper samples was analyzed by a modified dithizone technic or by the chromate method when a large amount of lead was present. The lead was removed from the papers by washing with nitric acid. The amount of lead obtained in blank determination on HF washed papers is about one microgram and not significant for these samples.

TABLE 2.—*Collection efficiency for lead fume based on two papers in series*

Paper number	Sampling rate liters per min.	Total concentration mg. per 10 cu. m.	Lead on filter paper in micrograms	Efficiency percent
42	18.4	9.8	269	100.0
42	25.3	12.3	1240	99.5
44	3.5	150.0	1530	97.5
44	5.6	340.0	3740	98.2
44	5.6	248.0	2730	98.2
44	5.6	185.0	3250	98.3
44	6.1	271.0	1600	96.8
44	12.4	29.2	1080	99.6
44	12.4	19.0	707	100.0
44	12.4	11.9	295	99.3
44	12.4	38.4	704	98.5
44	18.4	11.6	640	98.7
44	18.4	10.0	270	98.9
44	18.4	17.7	484	99.0
44	25.3	10.1	370	85.9
44	25.3	16.7	634	99.4
44	29.0	23.3	1350	99.8
44	29.0	21.7	739	96.7
			Average efficiency	98.0

The results obtained with two filter papers in series for Whatman filter papers Nos. 42 and 44 are shown in table 2. The effect of sampling rate and concentration is also indicated.

It was noted that when high lead fume concentrations were sampled, a visible stain appeared on the front of the first paper. Since this stain did not extend through the paper, it indicated

that a high efficiency of collection existed. After analysis of the first two samples of Whatman No. 42 paper, Whatman No. 44 paper was substituted. The latter paper is thinner and has lower air-flow resistance, which makes it desirable for our purpose, although its application in quantitative chemistry is quite similar to No. 42.

The concentrations of lead fume in table 2 range from 7 to 230 times the present accepted American Standards Association threshold limit of 1.5 mg. per 10 cubic meters (*4*). Efficiencies range from 86 percent to 100 percent with a mean value of 98 percent. The quantity of air flow varied from 3.5 to 29 liters per minute, which gives filtering velocities (based on the exposed area of the paper) of from 2 to 18 feet per minute. No relation between filtering velocity and relative efficiency was found for the range of flows studied with the funnel apparatus. It is of interest to note that these filtering velocities are within the range of commercial bag and screen filter installations for industrial dust recovery.

A study of table 2 leads to the observation that the fume particles which are not obtained by the first paper are not significantly affected by the second paper and are evidently small enough to pass through both papers without being trapped. It is apparent, therefore, that the absolute efficiency of the paper must be determined.

The absolute efficiency of the paper was obtained by using the electrostatic precipitator which is known to be 100 percent efficient for dusts and fumes if operated correctly. In the early experiments performed to determine the absolute efficiency, simultaneous parallel samples were taken with the filter funnel unit described above and the commercial field electrostatic unit. When these samples were analyzed, however, the funnel unit values were higher, indicating that the field electrostatic unit was not giving reliable enough results to use as a standard. This observation has been confirmed recently by Keenan and Fairhall (*5*) who also found that the commercial field instrument was not a reliable standard in determining the efficiency of the impinger. As a standard procedure, therefore, we used the apparatus shown in figure 1. The funnel unit is followed by an alternating current precipitator of the type described by Drinker, Hazard, and Ishikawa (*6*) and which is known to be 100 percent efficient. Keenan and Fairhall have also shown that this unit is a reliable standard for lead fume at air-flow rates as high as 3 cubic feet per minute (85 liters per minute). The apparatus shown in figure 1 also eliminates any error due to selective sampling, since the atmosphere is only sampled at one point.

TABLE 3.—*Collection efficiency for lead fume of single filter paper*

Paper number	Sampling rate liters per min.	Total concentration mg. per 10 cu. m.	Lead on filter paper in micrograms	Efficiency percent
42	25.2	21.7	488	74.3
42	25.2	17.0	518	84.0
42	48.9	12.3	583	92.6
42	48.9	14.1	633	92.3
43	27.3	30.5	823	90.5
44	22.7	19.7	518	96.0
50	25.4	18.3	428	83.4
50	25.4	12.8	343	80.9
			Average efficiency	86.7

The absolute efficiency of the filter papers tested by this method is given in table 3. Air-flow rates as high as 48.9 liters per minute were investigated. This air-flow rate is the highest that can be obtained with ordinary sampling pumps used for field collection. Table 3 shows that the absolute efficiency varies from 74.3 to 96 percent with a mean value of 86.7 percent. Again no relation between filtering velocity and efficiency was observed. Whatman papers 42, 43, or 44 appear to be the best. Number 50 is a hardened paper and its flow resistance is too great. Number 44 was selected as being the most suitable for field work. It was also noted that no effect of the age of the fume particles could be detected. It has been observed that as metal fume clouds age, or remain suspended in air after generation, the particles tend to aggregate and larger particles are obtained. Freshly generated fume particles usually are quite small (see table 1) and are therefore more difficult to catch. Occupational exposures usually have a mixture of freshly generated and aged fume particles.

Table 3 indicates that the filter paper method will collect lead fume with an 85-percent absolute efficiency and that approximately 15 percent of the fume will pass through the paper without being retained. The retention of the fume on the filter paper does not create resistance to air flow unless very high concentrations are sampled for a long period.

Because zinc fume is also of importance in welding and burning operations in shipbuilding, it was considered important to evaluate the efficiency of the filter method against this material. Table 1 indicates that the particle size of zinc fumes is quite large and that the particles also tend to aggregate quite readily. It can be surmised, therefore, that zinc fumes should be caught with a higher efficiency.

Zinc concentrations were generated in the same fume chamber by burning zinc metal in a Bunsen burner flame. The same apparatus shown in figure 1 was used for zinc sampling, but only

Whatman No. 44 and two air-flow rates were employed. Zinc samples were analyzed on a Leeds and Northrup Electro-Chemograph (polarograph).

TABLE 4.—*Collection efficiency for zinc fume by Whatman No. 44 filter papers*

Relative efficiency of two papers in series

Sample No.	Sampling rate liters per min.	Total concentration mg. per 10 cu. m.	Efficiency		Total of both papers percent
			Paper No. 1	Paper No. 2	
1	22.5	160	99.20	0.16	99.36
2	22.5	208	99.50	0.03	99.53
3	22.5	103	99.60	0.02	99.62
				Mean percent	99.50

Absolute efficiency of single paper

Sample No.	Sampling rate liters per min.	Total concentration mg. per 10 cu. m.	Percent
4	51	60.5	99.7
5	51	47.5	98.9
6	51	72.0	99.4
7	51	101.0	99.8
8	51	95.3	99.8
9	51	82.0	99.5
10	51	82.8	97.1
11	51	65.3	99.3
12	51	57.2	96.0
13	51	43.4	97.4
			Mean percent 98.7

The results of the zinc samples are given in table 4. It is evident from these data that the relative efficiency and the absolute efficiency are both quite high and for all practical determinations can be considered as 100 percent. Zinc fume, however, has a tendency to "plug" the filter paper much more rapidly than the lead fume and to increase its flow resistance. This "plugging" is not serious unless the paper is used as a flowmeter or the flowmeter is placed after the sampling apparatus. The allowable concentration of zinc is one hundred times that for lead, or 150 mg. per 10 cubic meters, and high zinc concentrations are usually encountered because the fumes are easily generated. Therefore it usually is not necessary to take large air volume samples for zinc. The analytic procedures for lead and zinc are equally sensitive to low concentrations of the metal.

The conclusion drawn from the data on lead and zinc fume is that the efficiency of the filter paper method is largely dependent upon the particle size of the fume. The data in table 1 and the results we have obtained indicate that all but cadmium fumes

2. Field form of filter paper fume collection apparatus.

can be collected with high efficiency by the filter paper technic. Work now in progress (*7*) indicates that fluoride fumes also may be collected with efficiencies close to 100 percent.

FIELD APPARATUS

The apparatus employed for collection during shipbuilding operations consists of a filter paper holder, a flowmeter, and a suction source. The filter paper holder may be of the type constructed from funnels as used by Yant et al. (*8*) or any specially-built holder. The unit shown in figure 2 was made from brass tubing and sheet brass. The essential features to be provided in this holder are a pair of rims to provide seating surface for the edges of the paper, a pair of rubber gaskets to provide a leak-proof seat for the rims, a grilled or perforated surface for one

TABLE 5.—*Air-flow resistance of Whatman No. 44 filter papers selected at random** (Air volumes measured at room temperature 22.1° C. (70° F.) and 760 mm. of Hg.)

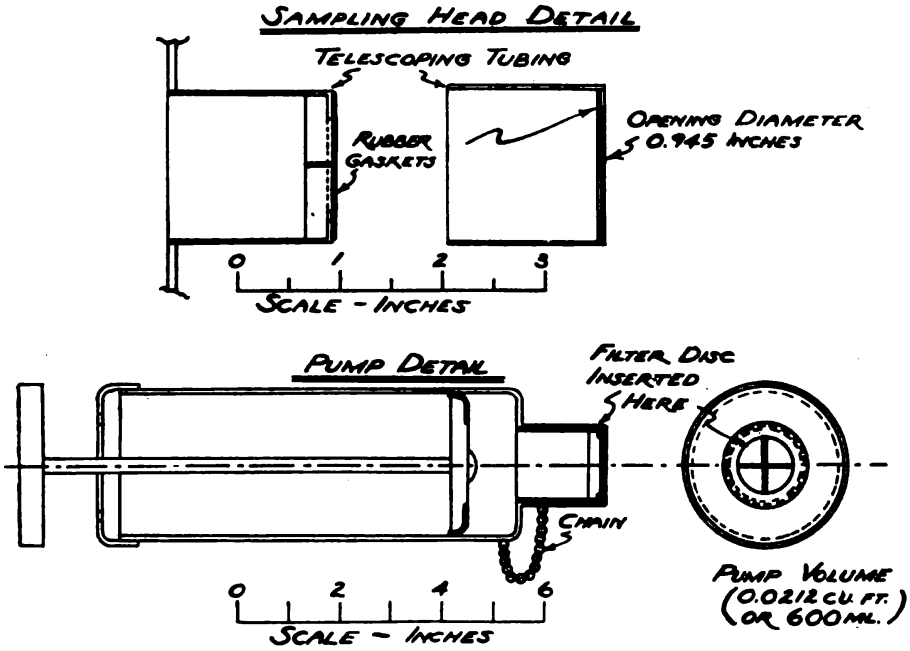
Air flow liters per min.	Air-flow resistance in millimeters of water				
	Filter paper				
	1	2	3	4	Mean
10	105	105	86	102	99.5
20	205	205	177	198	196
30	307	294	277	286	291
40	410	396	368	396	393
50	505	478	478	491	488
60	615	615	573	600	601

*Papers tested in field sampling unit. They were selected from a box of 100 filter papers 12.5 cm. in diameter. Tests on papers from other boxes (lots) may not agree with these figures but each lot of paper gives the agreement shown above.

side of the paper to prevent its inversion or damage by the negative pressure due to suction, a series of fastening screws to hold the paper rims together, and a connecting section and nipple for attachment to the hand vacuum cleaner which serves as a suction source. The filter section of the filter paper apparatus shown in figure 2 has a diameter of 108 millimeters. The dimensions are not critical as long as the filtering velocity is kept within the range used in this study. Any other type of sampling pump (motorized) will be satisfactory.

Flow regulation is obtained by means of a short section of rubber tubing and a pinch clamp. The pressure drop through the filter paper varies directly with air flow as shown in table 5, hence the filter paper can be used as a flowmeter if a pressure tap just after (downstream) the paper holder is provided. Several sheets of paper were tested to obtain variations in calibration due to differences in papers. A rotameter and a gasometer were used for calibration of the flow. The data in table 5 for Whatman No. 44 paper shows a variation from the mean of only 15 percent for four papers selected at random, thus indicating that it is practical to use the paper as a flowmeter. Each new box of paper should be checked if greater accuracy is desired, and each paper can be checked if necessary. Only one pressure and flow determination is necessary.

For measuring the pressure drop, a small U-tube manometer as shown in figure 2, or a small mechanical pressure gage (range 0 to 15 inches of water) can be used as a measuring gage. The only limitation to use of the filter paper as a flowmeter is when large samples of high concentrations of fume are taken. In this case, the deposit of fume will increase the resistance of the paper and affect its calibration; however most analytic methods do not require large amounts of material, hence it is not necessary to



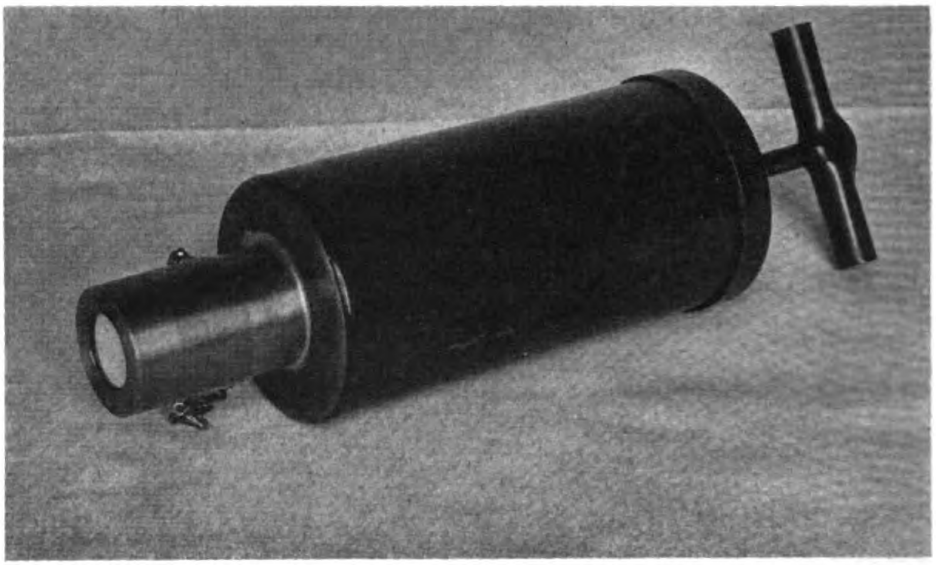
3. Details of iron fume sampling pump construction.

sample high concentrations long enough to have the filter resistance increase to a point where it will interfere.

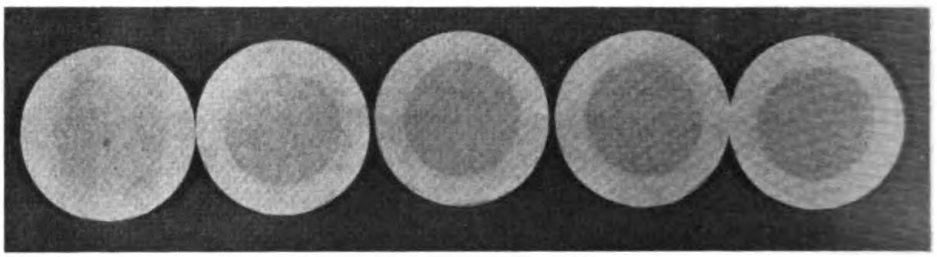
Since No. 44 paper is also an ashless filter paper, air samples can be obtained for gravimetric determination. In this case, however, because of the large amount of material collected, an auxiliary flowmeter should be used. An orifice type preceding the filter paper is preferable, since the change in air density due to the pressure drop through the paper will not affect the flowmeter calibration.

IRON FUME DETERMINATION METHOD

A study of atmospheric conditions during welding operations where lead or zinc was not encountered indicated that a large amount of iron fume was present in the atmosphere, especially in confined spaces. These welding operations are performed with coated electrodes on black iron. Drinker and Nelson (*9*) have recently described the composition and coatings used in welding electrodes. The presence of iron fumes in the workers' environment does not create a toxic atmosphere but does constitute a nuisance and a source of irritation. As an index of air cleanliness, the U. S. Maritime Commission uses a threshold concentration of 30 milligrams per cubic meter for iron oxide fumes (*10*). It is not implied that moderate variations from this figure are significant hygienically. It is known that when concentrations exceed 30 mg. per cu.m., the air becomes cloudy and unpleasant



4. The completed sampling pump.



5. A typical set of standard stains. In increasing density of color these standards for iron fume correspond to 30, 60, 90, 120, and 150 mg. per cubic meter per single pump stroke. Actual standards are red–brown in color.

to breathe, visibility is poor, and working conditions are unsatisfactory.

When iron fume samples were taken by the filter paper method, it was observed that the stain on the paper was very definite and also proportional to the amount of fume. This observation forms the basis of the simple rapid sampling method. By using a small filter disk and a hand sampling pump a quantitative stain could be obtained with less than one liter of air.

The sampler is made from an inexpensive foot-operated automobile tire pump. The pump is easily converted to a hand suction pump (volume 600 ml.) and is fitted with a sampling head to take disks of filter paper 38 mm. in diameter. Details of the pump conversion are shown in figure 3 and the completed pump is shown in figure 4.

A commercial model of this converted pump is now available. In the event that a pump cannot be obtained, a pump of similar

dimensions can be made from brass or steel tubing. It is only important that the same ratio of the disk filtering area to pump volume be maintained.

In selecting a filter paper for the hand pump unit it was not necessary to have a paper which was 100 percent efficient but a paper which would yield uniform and reproducible stains for a given concentration was desired. Whatman papers Nos. 1, 42, and 44, and Eaton & Dikeman No. 613–21 were found suitable. The Eaton & Dikeman paper was selected because it was the least expensive and could be obtained in quantity punched to the correct size (diameter 38 mm.). The relative efficiency of this paper by actual test against welding fumes is over 99 percent and the particle size of iron fume (table 1) would indicate that its absolute efficiency also should be high.

In preparing standards for comparison, welding fumes were created in the fume chamber by welding coated steel welding rods on black iron. A concentration of approximately 30 mg. per cubic meter was obtained by completely burning one 5/32-inch rod. Hand pump and electrostatic (A.C.) precipitator samples were taken simultaneously. Several hand pump samples were taken for each precipitator sample. The precipitator samples were weighed to give total fume concentration. A five-fold variation in stain color was found readily distinguishable and standards were made on that basis. Figure 5 shows a set of typical stains corresponding to 30, 60, 90, 120, and 150 mg. per cubic meter, or 1 to 5 strokes of the hand pump at 30 mg. per cubic meter. The stains are reddish brown (iron oxide) in color and are easily duplicated in a fume chamber or in the field if a comparative set of standards is available. Lower concentrations are evaluated by finding the number of pump strokes necessary to match a given standard. For higher concentrations, less than one pump stroke is used. As a practical rule it was found in field work that if a faint tinge or stain is evident on the paper disk after one pump stroke, the fume concentration is 30 mg. per cubic meter or less.

The standards for field use are made from filter disks calibrated against known concentrations of total fume and they are cemented between two sheets of transparent plastic (lucite). Standards made 1½ years apart show no significant difference in color, indicating that no fading or deterioration has taken place in that time.

The method has proved to be quite valuable in controlling welding fume concentrations and checking ventilation during ship construction. It can be used by an inexperienced investigator and less than one minute is required for a single determination. Many

of these units have been used routinely during the past 2 years in U. S. Maritime Commission shipyards.

SUMMARY

The application of filter papers to the sampling of fumes of lead, zinc and iron has been investigated. The method has been found to be simple, accurate and efficient. The efficiency of analytic filter papers varies with the particle size of the fume sampled. The efficiency for lead fume is high (87 percent) and constant at high flow rates. Zinc fume can be collected with almost 100 percent efficiency at flow rates of 50 liters per minute. A simple and portable apparatus for using the filter paper method for field determinations and a simple hand pump and filter paper procedure for indicating iron fume concentrations are described. Both devices are of simple design, light in weight, portable and easily operated.

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ANALYSIS OF 100 FOOD POISONING OUTBREAKS

FOOD INTOXICATION, WATER- AND FOOD-BORNE INFECTIONS

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Reported data for 100 so-called food poisoning outbreaks, involving 3 deaths, were analyzed to tabulate and classify principal and contributory faults in messing sanitation and insanitary food handling. This figure (100) represents the majority of outbreaks reported to the Bureau of Medicine and Surgery in the last half of 1944 and a few reported during 1943 and the first half of 1944. Because many minor outbreaks are not reported and reporting of others is deferred for submission in periodic sanitary reports, the analysis certainly does not include the majority of food poisoning outbreaks that occurred in the United States Navy during this period. It is believed, however, that this series represents a fair cross section of typical outbreaks reported recently.

Results as presented in tabular form below are self-explanatory and sufficiently informative to require little in the way of comment or elaboration.

I. Total number of cases in 98 outbreaks..... 9,512
(No figures reported for number of cases in 2 outbreaks)

II. Average number of cases per outbreak in series of 98..... 97

III. Deaths in 100 outbreaks..... 3

IV. Outbreak by location:

	Ships	Shore stations outside U.S.A.	Shore stations in U.S.A.
Number of outbreaks...	17	23	58
Total number of cases...	909	3,096	5,099
Average number of cases per outbreak.....	53.5	134.6	87.9

V. Mode of transmission:

a. Food (specific item determined) in 74 outbreaks:

Item	*Number of outbreaks*
Ham	25
Beef	11
Desserts and dessert fillings	8
Chicken	6
Turkey	5
Pork	4
Sandwich fillings	3
Milk	2
Duck	1
Veal	1
Pork-veal chop suey	1
Cheese	1
Meat (unclassified)	1
Potato salad	1
Bologna	1
Bread	1
Canned corn	1
Spaghetti	1

b. Food (specific item undetermined) in 21 outbreaks.

c. Other agents in 5 outbreaks:

Agent	*Number of outbreaks*
Water	4
Cadmium	1
Total	5

VI. Type of organisms cultured from suspected food:

Type	*Number of outbreaks*
Staphylococcus	20
Shigella	4
Salmonella	2
Esch. coli	3
Paracolon bacilli	2
Proteus	1
Mixed	2
Total	34

VII. Number of outbreaks in which negligence in food handling was determined:

	Number of outbreaks
1. Exposure to excessive temperature (room temperature) for 4 hours or more between preparation and serving	48
2. Use of grossly contaminated food containers	2
3. Use of cadmium-plated containers	1
Total	51

VIII. Other insanitary conditions reported:

	Number of outbreaks
1. Disease carriers demonstrated among food handlers...	2
2. Transmission of pathogens to food by flies.....	3
3. Serving of food reported "spoiled" or decomposed before delivery to galley.....	5
Total	10

SUMMARY

In more than 60 percent of the outbreaks the reporting medical officer attributed the intoxications or infections to gross carelessness and deficiencies in messing sanitation, or to insanitary food handling—most of which can be controlled by simple preventive measures. Inadequate equipment and poor quality food were blamed infrequently. A majority of reports indicated contamination of wholesome food after delivery and in process of preparation, cooking, or serving in galleys and mess halls.

This study emphasizes the need for rigid maintenance of high standards in messing sanitation and food handling. Appreciation of the importance of personal hygiene and the simple rules for its practice should be inculcated among galley crews. Commissary personnel should understand the ways by which pathogenic organisms are introduced into food which will serve as a culture medium, and they must realize the necessity for adequate refrigeration (below 45° F.), if serving of such food is to be delayed for a period of time. Uncovered containers of food invite contamination from a number of sources, including droplet infection. Procedures which allow pathogenic organisms in contaminated food to incubate while it is held for several hours at galley temperature, are so prevalent that concerted efforts should be made to discontinue this dangerous practice. It should be remembered that staphylococcal enterotoxin is not destroyed by heat within limits of usual cooking temperatures. Using left-over meats or other foods for a succeeding meal is a danger to be avoided by careful planning of menus.

Frequent inspections of galleys and mess halls will enable the medical officer to appraise the adequacy of supervision and general level of sanitation. Where there is incompetent or lax galley supervision, repeated inspections, however, may accomplish little until the chief commissary steward (or senior rated man) appreciates the importance of messing sanitation.

Physical inspections of food handlers should detect the presence of respiratory infections, draining abscessed teeth, pustular

lesions on arms and hands, and communicable diseases.

Cleanliness and general hygiene of personnel should be stressed continually. Laboratory examinations should be made routinely when possible to exclude carriers of enteric pathogens and hemolytic streptococcal throat infections among food handlers, especially where civilian help is employed.

CONCLUSIONS

It would be of value and interest to determine, if possible, the cause of every food poisoning outbreak. The relatively large number of outbreaks for which the causal factors are not definitely determined indicates important gaps in our present knowledge. Prevention is handicapped without this information. This study emphasizes the value and need of thorough investigations and careful reporting.

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SODIUM PENICILLIN CREAM FOR IMPETIGO

Sodium penicillin cream consisting of equal parts of lanolin, codliver oil, and water, to which was added enough sodium penicillin to make a cream of 500 Oxford units per gram, was applied thinly twice daily (after de-scabbing with warm eusol) to a patient having a widespread intractable facial impetigo. The treatment was repeated for three days. On the second day of treatment there was a vast improvement, with at least 50 percent reduction of the lesions, the remaining areas being dry and showing signs of healing. On the third day of treatment all the smaller spots were healed and the larger ones were 25 percent of their original size. The spots on the pinnae were much slower in healing than those on the cheeks or neck. On the fourth day all areas except the lower part of the right ear were healed. Two days after this the spot on the ear showed no change. Treatment was altered to Ung. hydrarg. ammon. dil., and this spot cleared 10 days after penicillin treatment had been started.

In all, 10 gm. of cream was used, each gram containing 500 Oxford units: total local dosage 5,000 Oxford units. No parenteral treatment was given. This cream has also been employed with equal success on septic burn cases. As a face cream it is too soft, tending to run downward.—GOLD, J. M.: Impetigo treated with sodium penicillin cream. Brit. M. J. 1: 152-153, February 3, 1945.

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Klemm, Ralph A., Commander (MC) USNR (*Atmospheric Blast Concussion*, p. 1228). B.S., Haverford College, 1922; M.D., University of Pennsylvania School of Medicine, 1926. Intern, Germantown Dispensary and Hospital, Philadelphia, Pa.; private practice, Philadelphia, 1928–; associate in medicine, Temple University School of Medicine and Temple University Hospital, 13 yrs. Fellow American Medical Association; member: Medical Society of the State of Pennsylvania; Philadelphia County Medical Society. Diplomate National Board of Medical Examiners.

Lusskin, Harold, Lieutenant Commander (MC) USNR (*Intertrochanteric Fractures of the Femur*, p. 1221). M.D., Columbia University College of Physicians and Surgeons, 1919. Intern, 1919–20, and orthopedic staff, 1922–, Beth Israel Hospital, New York City; resident in orthopedics, Jan.–Aug. 1921, and orthopedic staff, 1922–, Hospital for Joint Diseases, New York City. Fellow American Medical Association; American Academy of Orthopaedic Surgeons. Diplomate American Board of Orthopaedic Surgery.

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McKeever, Duncan C., Commander (MC) USNR (*Compression Dressing of Amputation Stumps*, p. 1211). M.D., University of Kansas School of Medicine, 1929. Intern: U. S. Naval Hospital, Brooklyn, N. Y., 1929–30; St. Luke's Hospital, Kansas City, Mo., 1931–32; private practice: Kansas City, Mo., 1933–39; Houston, Tex., 1939–40; staff, St. Joseph's Infirmary, Houston. Fellow: American College of Surgeons; American Medical Association; member: Clinical Orthopaedic Society; American Academy of Orthopaedic Surgeons; State Medical Society of Texas; Texas Orthopaedic Society; Harris County Medical Society; Southern Medical Association. Diplomate American Board of Orthopaedic Surgery.

Nesting, Orlando S., Lieutenant Commander (MC) USNR (*Revision of Below-Knee Amputation Stumps*, p. 1187). A.B., 1933, B.S. in medicine, 1935, University of North Dakota; M.D., Rush Medical College, 1937. Intern, July 1937–July 1938, resident in medicine, July 1938–July 1939, and resident in surgery, July 1939–40, St. Luke's Hospital, San Francisco; private practice, Vallejo, Calif., 1940–.

O'Connor, Gerald B., Lieutenant Commander (MC) USNR (*Plastic Surgery of Amputation Stumps*, p. 1167). A.B., University of California, Berkeley, 1921; M.D., St. Louis University School of Medicine, 1925. Intern, Southern Pacific General Hospital, San Francisco, 1925–26; resident, St. Francis Hospital, San Francisco, 1926–27; private practice, San Francisco, 1927–28;

postgraduate study, clinics in the United States and Europe, 1928–29; private practice in plastic and reconstructive surgery, San Francisco, 1929–; plastic surgeon: St. Mary's Hospital, Mary's Help Hospital, Southern Pacific General Hospital, St. Francis Hospital, St. Joseph's Hospital, French Hospital, and San Francisco Polyclinic, San Francisco; Sonoma County Hospital, Santa Rosa, Calif.; Sonoma State Home, Eldridge, Calif. Fellow: American College of Surgeons; American Medical Association; member: California State Medical Association; San Francisco County Medical Association; American Society of Plastic and Oral Surgeons; Pacific Coast Railway Surgeons; Northwestern Pacific Railway Surgical Association. Diplomate American Board of Plastic Surgery.

Olson, Paul F., Lieutenant Commander (MC) USNR (*Revision of Thigh Amputation*, p. 1180). B.A., Luther College, 1926; M.D., Rush Medical College, 1932; and M.S. in surgery, University of Minnesota Medical School, 1934. Intern: department of surgery, Albert Merritt Billings Hospital, Chicago, Oct. 1930–Oct. 1931; and department of gynecological surgery, Chicago Lying-In Hospital of the University of Chicago, Oct. 1931-Apr. 1932; resident and fellow, division of surgery, Mayo Clinic, Rochester, Minn., 1932–37; private practice, Dubuque, Iowa, 1937–; staff, Finley Hospital and St. Joseph Mercy Hospital, Dubuque. Fellow: American College of Surgeons; American Medical Association; member Iowa State Medical Society. Diplomate American Board of Surgery.

Shelesnyak, M. C., Lieutenant H(S) USNR (*First-Aid Kit for Aviation Personnel*, p. 1284). A.B., University of Wisconsin, 1930; Ph.D., Columbia University, 1933. Fellow, Columbia University, 1932–33; student, Columbia University College of Physicians and Surgeons, 1933–35; instructor in physiology and pharmacology, Chicago Medical School, 1935–36; research associate, Mount Sinai Hospital, New York City, 1936–40; General Education Board fellow in child study (work carried out under Dr. McFarland, Columbia University), 1936–38; dean of boys, Academy, New York Association for the Care of Jewish Children, 1938–40; research fellow, Friedsam Foundation in Child Neurology, Beth Israel Hospital, New York City, 1940–. Member: Society for the Research of Child Development; American Association for the Advancement of Science; Association for the Study of Internal Secretions; American Association of Scientific Workers.

Shronts, John F., Lieutenant Commander (MC) USNR (*Analysis of 100 Food Poisoning Outbreaks*, p. 1321). B.S., Northwestern University, 1930; M.D., Northwestern University Medical School, 1935; M.S. in public health, University of Michigan, 1938. Intern, City of Detroit Receiving Hospital, Detroit, Mich., 1936; resident, Lucas County General Hospital, Toledo, Ohio, 1937; attending physician, Northwestern University Medical School Clinics, 1939–40; District health officer, Illinois State Department of Public Health, 1939–41. Member: Illinois State Medical Society; McHenry County Medical Society; American Public Health Association; Illinois Public Health Association.

Smart, Frank P., Commander (MC) USNR (*Wounds of Eye, Ear, Nose and Throat*, p. 1231). B.S., Vanderbilt University, 1907; M.D., University of Virginia Department of Medicine, 1911. Student assistant in histology and embryology, 1908–10; instructor in anatomy, University of Virginia Department of Medicine, 1911–12; intern, Episcopal Eye, Ear and Throat Hos-

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Smiley, Dean F., Lieutenant Commander (MC) USNR (*Pneumonia in the U. S. Navy—1882–1942*, p. 1245). A.B., Cornell University, 1916; M.D., Cornell University Medical College, 1919. Instructor in hygiene and preventive medicine and medical adviser, 1920–21; assistant professor of hygiene and preventive medicine and medical adviser, 1922–28, professor of hygiene and preventive medicine and health officer, 1929–42, Cornell University, Ithaca, N. Y.; formerly field investigator for Carnegie Foundation for the Advancement of Teaching; acting director, Division of Health and Physical Education, New York State Department of Education; president, American Student Health Association. Fellow: American Public Health Association (former councilor); American Medical Association. Author of college textbooks in field of hygiene and preventive medicine.

Thompson, Charles M., Lieutenant Commander (MC) USNR (*Acute Pancreatic Edema with Stone in the Ampulla of Vater*, p. 1269). M.D., Hahnemann Medical College and Hospital of Philadelphia, 1931. Intern, 1931–32, and assistant visiting physician, gastro-enterological service, 1934–41, Abington Memorial Hospital, Abington, Pa.; private practice, Newtown, Pa., 1932–41. Fellow American Medical Association; associate American College of Physicians; member: Medical Society of the State of Pennsylvania; Bucks County Medical Society; National Gastroenterological Association.

Toffelmier, Douglas D., Commander (MC) USNR (*Manufacture and Fitting of Artificial Limbs*, p. 1149). B.S., St. Louis University, 1924; M.D., St. Louis University School of Medicine, 1926. Intern, Samuel Merritt Hospital, Oakland, Calif., 1926–27; special courses in orthopedics, Berlin, 1929, and Vienna, 1929–30; orthopedic staff, Samuel Merritt Hospital and Alameda Hospital. Fellow American Medical Association; member: American Academy of Orthopaedic Surgeons; Alameda County Medical Society; California State Medical Society; Western States Orthopedic Society. Diplomate American Board of Orthopaedic Surgery.

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Wood, Harold, Lieutenant Commander (MC) USNR (*Thyrotoxicosis Complicated by Hypothalamic and Duodenal Hemorrhage*, p. 1282). M.D., Tufts College Medical School, 1933. Intern: Newton Hospital, Newton, Mass., 1933–34; Rhode Island Hospital, Providence, R. I., 1934–35; assistant resident, pathology, Duke University School of Medicine, 1935–36; instructor in pathology, Medical College of the State of South Carolina, 1936–38; in-

structor in pathology and bacteriology, Tufts College Medical School, 1938–; assistant pathologist, Cambridge Hospital, Cambridge, Mass., 1940–; pathologist, Lynn Hospital, Lynn, Mass., 1941–. Member: American Medical Association; Massachusetts Medical Society; New England Pathological Society; American Association of Pathologists and Bacteriologists; Boston Branch, International Association of Dental Research. Diplomate: National Board of Medical Examiners; American Board of Pathology.

INDEX TO UNITED STATES NAVAL MEDICAL BULLETIN

VOLUME 44

INDEX TO SUBJECTS

(* Filler)

INDEX TO UNITED STATES NAVAL MEDICAL BULLETIN

VOLUME 44

INDEX TO AUTHORS

(* Filler)

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