UNITED STATES NAVY
Medical News Letter

Surgeons General of the Past

(The twenty-first in a series of brief biographies)

Charles Edward Riggs, the 21st Chief of the Bureau and 17th Surgeon General, was born in Iowa City, Iowa on 15 September 1869. He was graduated from the State University of Iowa College of Medicine in 1892 and was commissioned Assistant Surgeon in the Navy 13 April 1898. He was first assigned to the Mare Island Hospital, then served in the San Francisco and Detroit, being aboard the gunboat Newport during the Spanish American War. He later had duty at the New York Navy Yard and the naval station at Port Royal, S.C., in the Dolphin, at the New York Medical Supply Depot, and at the San Francisco Training Station. From 1907 to 1909 he was medical officer with the Marine Guard at the American Legation in Peking, China. He became Fleet Surgeon of the Atlantic Fleet in 1917. From 1918 to 1921 he was a member of the Board of Medical Examiners and Naval Examining Board in Washington, and then became Fleet Surgeon of the Atlantic Fleet. He assumed command of the Newport Naval Hospital in 1923, and while there received high commendation for the manner in which he organized the hospital's medical assistance for victims of an explosion aboard an excursion steamer, the SS Mackinac. Rear Admiral Riggs became Medical Officer in Command of the Washington Naval Hospital 3 June 1927. He was known for his energy and intelligence as an executive and his personal humanitarian interest in all patients. His term as Surgeon General from 1929 to 1933 was devoted to improved training, the building and renovation of hospitals, and the planning of a new naval medical center. He was retired from the Navy 1 October 1933, and died 31 May 1963.

Policy

The U.S. Navy Medical News Letter is basically an official Medical Department publication inviting the attention of officers of the Medical Department of the Regular Navy and Naval Reserve to timely up-to-date items of official and professional interest relative to medicine, dentistry, and allied sciences. The amount of information used is only that necessary to inform adequately officers of the Medical Department of the existence and source of such information. The items used are neither intended to be, nor are they, sus-ceptible to use by any officer as a substitute for any item or article, in its original form. All readers of the News Letter are urged to obtain the original of those items of particular interest to the individual.

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Please forward changes of address for the News Letter to Editor: Bureau of Medicine and Surgery, Department of the Navy, Washington, D.C. 20390 (Code 18), giving full name, rank, corps, old and new addresses, and zip code.

CONTENTS

The issuance of this publication approved by the Secretary of the Navy on 4 May 1964.

PULMONARY LESIONS AFTER NONTHORACIC TRAUMA

B. Eiseman MD and M. Pomerantz MD, Department of Surgery, University of Colorado Medical School, Denver, Colorado.

Clinicians in Vietnam, as well as those in civilian hospitals in the United States, are becoming increasingly aware of serious and occasionally fatal pulmonary lesions that accompany severe nonthoracic trauma. This article reviews what little is known, and how much is unknown of this syndrome which has such obvious importance to military surgeons.

Only patients who do not suffer direct thoracic injury can be considered, for pulmonary contusion obviously may obscure the pathology of the lesion. The purest form of the syndrome appears in severe injury to the extremities, with or without boney involvement.

Characteristically, there is a period of hypotension and stigmata of major blood loss. Occasionally within an hour after injury the severely dyspneic patient complains between gasping respirations, that he cannot "get his breath". The trachea may be filled with frothy or blood-tinged sputum, but there are no rales in the peripheral lung fields. The patient is either deathly pale or cyanotic. The clinician trying to maintain adequate respiration with an endotracheal tube is hard pressed whether to mechanically ventilate the obviously hypoxic patient or to use suction to remove the secretions. Treatment with intravenous sodium bicarbonate or vasodilators occasionally may be of temporary benefit, but, if adequate ventilation with mechanical support cannot be established, the patient dies in respiratory insufficiency.

All quantitative varieties of the syndrome are known. Sometimes the lesion does not become manifest for hours or even days following injury. Both the Navy[1] and Army[2] Research Units in Vietnam have documented unsuspected arterial hypoxemia in apparently asymptomatic patients following severe nonthoracic trauma. Roentgenographic examination of the chest reveals a diffuse bilateral parenchymal infiltrate.

The etiology of the lesion is unknown, but the following may be of significance.

1. *Pulmonary Arteriolar Constriction*

Acidosis causes constriction of the pulmonary arterioles[3] and this may contribute, if not be the primary pathogenesis of this syndrome. The occasional dramatic improvement produced by intravenous sodium bicarbonate would support this thesis. It seems unlikely that this is the primary difficulty, since other forms of acidosis do not produce such severe dyspnea.

2. *Fat Embolism*

A pulmonary syndrome similar to that described often accompanies fat embolism. The simultaneous occurrence of the pulmonary lesion with the other signs of fat embolism makes it almost certain that occasionally this is of major etiologic importance.

3. *Shock Lung*

The lung, itself, may be the "shock organ" in man, just as the kidney, the gut, or the liver are the most sensitive organs to ischemia in other species. Sealy and others[4] suggest that prolonged, poor perfusion results in inefficient pulmonary function. These authors felt that local damage to the lung parenchyma was the etiologic factor producing ventilatory abnormalities during low perfusion secondary to hemorrhagic shock. Loss of surfactant activity which accompanies a decrease in pulmonary blood flow, or pulmonary artery ligation[5] may also be of etiologic significance in the production of the above described syndrome.

4. *Microthrombosis*

Generalized intravascular microthrombosis has been shown to occur following shock and major blood loss, and has been indirectly implicated in its etiology.[6] There are proven pulmonary microthromboses in lungs of patients dying of this syndrome, and this may be of etiologic significance.

Recently, Blaisdell[7] has demonstrated enormous numbers of microthrombi in vena caval blood following release of a cross-clamped aorta. Perhaps similar emboli appear after restoration of flow following poor tissue perfusion. On the other hand such microthrombosis may be a manifestation of a generalized defect in intravascular clotting.

5. *Over-transfusion*

Over-transfusion may obviously produce pulmonary edema, and those suffering severe injury routinely receive large volumes of blood and intravenous fluid replacement. Over-infusion of blood or salt solution is certainly not the cause of the lesion as described, for it variously appears before transfusion is started, before there is adequate replacement of blood volume, and in the face of low or normal central venous pressures. Once the lesion has developed, over-replacement with electrolyte solution or blood might be deleterious, but it is unlikely that this is the primary cause.

6. "*Toxin*"

It has been suggested [8] that a toxic product, such as myoglobin, might be released from damaged tissue and that it chemically might damage the lung. Such an hypothesis is only of conversational value until someone identifies the alleged toxin.

7. *Graft vs. Host Reaction*

Melrose [9] has suggested that the lesion is due to a graft versus host reaction of leukocytes from transfused blood.

8. *Oxygen Toxicity*

High concentrations of oxygen have been implicated as a source of pulmonary damage [10]. Studies of lungs subjected to high concentration of oxygen have revealed microscopic findings similar to those pulmonary lesions described in the present report. Their relationship, if any, needs further study.

Treatment

As befits a lesion with such a poorly understood etiology, many forms of treatment have been suggested. They include:

1. Oxygen.
2. Mechanical respiratory assistance.
3. Positive pressure breathing, either with a natural or a positive expiratory phase.
4. Vasodilators.
5. Digitalis.
6. Bronchodilators.
7. Steroids.
8. Intravenous alcohol and other therapeutic measures designed to avoid or ameliorate the symptoms of fat embolism.
9. Bronchoscopic or endotracheal suction.

Of these, proper mechanical respiratory assistance is without question of greatest importance. The patient fights for air. His trachea fills with frothy edema which refills as soon as it is removed by endotracheal suction.

Ordinary means of mechanical ventilatory assistance, although of minor benefit, do not relieve the dyspnea. Preliminary evidence suggests [11] that a respirator in which a positive pressure can be maintained during the expiratory phase is of particular benefit.

This brief description of a clinical entity seen in the severely wounded once again emphasizes the enormous opportunity that the Medical Officer caring for the combat wounded has to contribute to basic medical knowledge. There is need for contributions ranging from pure clinical observation to the most sophisticated type of laboratory determination.

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ADULT VARICELLA INFECTION

John D. Bagdade MD,* Seattle, Washington, Clin Med 74(7):43–45, July 1967.

Varicella in adults, usually acquired from children with known infections, may be associated with disabling and even fatal sequelae. Pulmonary and central nervous system involvement in particular adversely affect the prognosis in adult patients.

Varicella is a benign, self-limited illness in children, but its clinical course in adults is frequently associated with complications not seen in the pediatric age group. Infection in adults is rare. Because varicella is highly communicable, it is commonly acquired during childhood and lifelong immunity normally results. Activation of latent virus causes herpes zoster infection in adults. Varicella may, however, be fatal in patients of all ages with leukemia, Hodgkin's disease, and in those receiving steroid therapy.

Varicella in adults is usually acquired from children with known infections. In these cases the diagnosis can be made easily. Adults who lack a history of known exposure to infected children may contract varicella from patients with herpes zoster, since the varicella-zoster virus causes both clinically distinct illnesses. Herpes zoster infection is only mildly communicable because it is localized and involves unexposed areas of the body. In contrast, chicken-pox is highly communicable due to the predilection of the varicella-zoster virus for the mucous membranes of the upper respiratory tract. These tissues probably serve as a portal of entry in susceptible hosts and provide an effective means for transmitting the virus to others. Actual isolation of the virus from the upper respiratory tract has been difficult, however.

Clinical Features

The clinical features of adult varicella infection appear to reflect the invasive properties of the varicella-zoster virus. From the upper respiratory tract, the virus is believed to enter the blood stream and invade the viscera and reticuloendothelial tissues, where viral multiplication occurs. The virus again becomes blood-borne after a two-week incubation period, and the typical exanthem appears as the more peripheral structures of the body are invaded. Erythematous macules and papules develop over covered body surfaces. Within a few days these early lesions progress to vesicles and crusts and spread to involve the head, mucous membranes, and extremities. Probably because of multiple viremias associated with fever, vesicles appear in crops, causing the characteristic picture of skin lesions at different stages of development. In contrast to infection in children whose clinical symptoms coincide with the onset of the exanthematous eruption, adults usually experience prodromal symptoms of headache, fever, and malaise indistinguishable from those associated with other infectious illnesses.

The character, distribution, and associated clinical symptoms in any adult exanthem are important in establishing the diagnosis. The exanthem of smallpox (variola) is distinguished by the presence of uniformly developed lesions with a centrifugal distribution involving the palms and soles.

Diagnosis

The diagnosis of varicella can usually be made without difficulty in adults exposed to infected children. Disseminated vaccinia and herpes simplex may be indistinguishable from varicella in atopic individuals. In the absence of known exposure to varicella, it should nevertheless be considered in the differential diagnosis of any erythematous macular eruption associated with fever. If the clinical findings are unclear, biopsy of a typical skin lesion early in the course of any exanthem is a valuable diagnostic aid. Typical intranuclear inclusion bodies are seen on stained histologic sections in varicella infection, while intracytoplasmic inclusions are found in variola. Cytologic evidence of viral invasion may more conveniently be demonstrated by Giemsa-stained smears of vesicle fluid or pus. Although herpes simplex, herpes zoster, and varicella have identical cytologic features, simplex and zoster are easily distinguished clinically from varicella.

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Simple methods which employ negative-staining and electron microscopy for the rapid diagnosis of viral diseases have been developed in England where smallpox has posed serious public health problems. Identification of both variola and varicella-zoster virus has been highly reliable by this technique. Serologic tests based on complement fixation may be useful in confirming the diagnosis of varicella, but are of little value acutely since antibody titers are compared from serum obtained during the first and third weeks of clinical infection. Viral isolation studies also require one to three weeks, but can effectively rule out vaccinia and herpes simplex.

Complications

Although complete recovery usually occurs, adult varicella may be associated with disabling and even fatal sequelae. Pulmonary and central nervous system involvement in particular adversely affect the prognosis.

Pneumonitis is relatively frequent and is the most common cause of fatal adult varicella. Pleuritic pain, cough, dyspnea, and hemoptysis associated with high fever may occur three to five days after the onset of the eruption. Respiratory symptoms correlate with the severity of the skin lesions. Auscultatory findings are characteristically minimal in spite of x-ray evidence of diffuse coalescent bilateral perihilar nodular densities. Alveolar-capillary diffusion abnormalities which may persist for months may be present even in the absence of clinical signs of pulmonary involvement. Many patients have only mild symptoms and recover uneventfully in two to three weeks. Radiographic resolution, however, may take up to eight weeks. Recent x-ray evidence suggests that primary varicella pneumonia may be associated with long-term calcific changes indistinguishable from tuberculosis and histoplasmosis.

Necropsied cases have shown mucosal tracheal lesions, areas of hemorrhagic consolidation, and papular lesions on the pleural surfaces. The proliferative changes and mononuclear infiltration seen histologically in varicella resemble other viral pneumonias such as measles, psittacosis, or influenza. Alveolar septal cell inflammatory proliferation which forms a prominent alveolar lining, and contributes to alveolar-capillary diffusion abnormalities appears to be a frequent occurrence in adult varicella.

Central nervous system (CNS) complications are more ominous in adults than in children who most often recover completely. Evidence of CNS involvement appears gradually about six days after the appearance of the exanthem. Drowsiness and stupor are not serious signs, but coma and convulsions indicate a poor prognosis. Subarachnoid and cerebral hemorrhages can occur acutely. Involvement to this degree is rare and usually fatal, and in such severe cases necropsy reveals multiple organ involvement. Meningoencephalitis and encephalomyelitis are more common. Although hypotension and purpura accompany the most severe forms of varicella, the correlation with adrenal insufficiency or adrenal hemorrhage has been poor.

Treatment

Therapy should be dictated by the patient's general condition. Varicella manifested clinically by rash and fever alone requires only bedrest and antipyretic treatment. More aggressive measures are necessary when clinical evidence of internal organ involvement is present. When pneumonitis is life-threatening, oxygen, humidification, antibiotics and assisted respiration are indicated. Convalescent chicken-pox γ-globulin may also be effective in the treatment of disseminated varicella.

In spite of theoretical objections systemic corticosteroids in therapeutic doses have been reported to be life-saving when used in conjunction with other supportive measures in critically-ill patients with varicella. The dangers of steroid treatment are probably greatest early in the clinical course. Steroid administration in early viral infection may alter the dermatologic manifestations sufficiently to obscure the proper diagnosis, decrease antibody formation, and enhance multiplication of virus in tissue. However, in light of recent experience, steroids may be useful in adults with disseminated varicella, and theoretically of value in suppressing the reactive changes contributing to the post-inflammatory alveolar capillary diffusion abnormalities.

No specific therapy appears effective in treating the CNS complications of varicella. Although steroids may be beneficial in severe cases by decreasing cerebral edema and fever, and perhaps favorably influence the subsequent development of presumably post-infection allergic encephalitis, their value has not been proved. Osmotic agents such as urea and mannitol may be useful in reducing the marked degree of cerebral edema frequently associated with varicella encephalitis.

(The references may be seen in the original article.)

RABIES PROPHYLAXIS

RECOMMENDATION OF THE U.S. PUBLIC HEALTH SERVICE
ADVISORY COMMITTEE ON IMMUNIZATION PRACTICES

The Advisory Committee on Immunization Practices, meeting on February 17, 1967, issued the following recommendations on rabies prophylaxis for the United States. These recommendations have also been published in Morbidity and Mortality Weekly Report, Vol. 16, No. 19, week ending May 13, 1967. Ann Intern Med 67(1):159–163, July 1967.

Although cases of rabies in humans are rare in the United States, thousands of persons receive rabies prophylaxis each year. The following approach to prevention is based on a contemporary interpretation of both the risk of infection and the efficacy of treatment and incorporates the basic concepts of the WHO Expert Committee on Rabies (1).

The problem of whether or not to immunize those bitten or scratched by animals suspected of being rabid is a perplexing one for physicians. All available methods of systemic treatment are complicated by numerous instances of adverse reactions, a few of which have resulted in death or permanent disability. Furthermore, the decision must be made immediately because the likelihood that any prophylactic measure will contribute to the prevention of rabies diminishes rapidly as the interval between exposure and treatment increases.

The acceptable evidence for efficacy of both active and passive immunization after exposure is derived largely from experimental studies in animals. Because rabies on occasion has developed in humans who received antirabies prophylaxis, the value of treatment has been questioned. However, evidence from laboratory and field experience in many areas of the world indicates that postexposure prophylaxis can be highly effective when appropriately used.

Status of Rabies in the United States

The incidence of rabies in humans has declined from an average of 22 cases per year in 1946 through 1950 to one case per year in 1963 through 1966. Rabies in domestic animals has diminished similarly. In 1946, there were more than 8,000 cases of rabies in dogs, compared with 412 in 1966. Thus, the likelihood of humans being exposed to rabies by domestic animals has decreased greatly, although bites by dogs and cats continue to be responsible for the overwhelming majority of antirabies treatments.

In contrast, the disease in wildlife—especially skunks, foxes, and bats—has become increasingly prominent in recent years, accounting for more than 70 percent of all reported cases of animal rabies in 1966. During that year, only four states were reportedly free of wildlife rabies. Wild animals constitute the most important source of infection for both domestic animals and man in the United States today.

Status of Antirabies Treatment in the United States

More than 30,000 people receive postexposure antirabies treatment each year. However, there is no information regarding the number of persons actually exposed to rabid animals.

Nervous tissue-origin rabies vaccine of the Semple type (NTV) was used almost exclusively in the United States until 1957, when the duck embryo-origin vaccine (DEV) was licensed. More than 75 percent of those who received rabies prophylaxis in the United States in 1965 were given DEV.

There has been remarkable variation in the rate of adverse reactions associated with NTV. In the United States, it is generally accepted that one individual among 4,000 to 8,000 persons receiving NTV antirabies treatment develops neurologic complications. Death has been attributed to NTV in a ratio of one to every 35,000 persons treated.

Neurologic complications associated with DEV

have been reported for one of every 25,000 persons treated. One possibly related death has occurred among some 172,000 who have received DEV since its introduction.

Rationale of Treatment

Every exposure to possible rabies infection must be individually evaluated. In the United States, the following factors should be considered before specific antirabies treatment is initiated:

1. Species of Biting Animal Involved—Carnivorous animals (especially skunks, foxes, coyotes, raccoons, dogs, and cats) and bats are more likely to be infective than other animals. Bites of rodents seldom, if ever, require specific antirabies prophylaxis.

2. Circumstances of the Biting Incident—An *unprovoked* attack is more likely to mean that the animal is rabid. (Bites during attempts to feed or handle an apparently healthy animal should generally be regarded as *provoked*.)

3. Extent and Location of Bite Wound—The likelihood that rabies will result from a bite varies with its extent and location. For convenience in approaching management, two categories of exposure are widely accepted:

Severe: Multiple or deep puncture wounds and any bites on head, face, neck, hands, or fingers.

Mild: Scratches, lacerations, or single bites on areas of the body other than head, face, neck, hands, or fingers. Open wounds, such as abrasions, that are suspected of being contaminated with saliva also belong in this category.

4. Vaccination Status of the Biting Animal—An adult animal immunized properly with one or more doses of rabies vaccine has only a minimal chance of developing rabies and transmitting the virus.

5. Presence of Rabies in the Region—If adequate laboratory and field records indicate that there is no rabies infection in a domestic species within a given region, local health officials may be justified in taking this into consideration in any recommendations concerning antirabies treatment after a bite by that species.

Management of Biting Animals

A dog or cat that bites a human should be captured, confined, and observed by a veterinarian for at least 5 days, preferably 7 to 10. Any illness in the animal should be reported immediately to the local health department. If the animal dies, the head should be removed and shipped under refrigeration to a qualified laboratory for examination. Because clinical signs of rabies in a wild animal cannot be reliably interpreted, the animal should be killed at once and its brain examined for evidence of rabies.

Local Treatment of Wounds

Immediate and thorough local treatment of all bite wounds and scratches is perhaps the most effective means of preventing rabies (Table 1). Experimentally, the incidence of rabies in animals can be markedly reduced by local therapy alone.

TABLE 1. Checklist of Treatments for Animal Bites

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1. Flush wound immediately (first aid).
2. Thorough wound cleansing under medical supervision.
3. Antirabies serum or vaccine or both as indicated.
4. Tetanus prophylaxis and antibacterial treatment when required.
5. No sutures or wound closure advised.

See text for details.

1. First-Aid Treatment to Be Carried Out Immediately—Copious flushing with water alone, soap and water, or detergent and water.

2. Treatment By or Under Directions of a Physician

a. Thorough flushing and cleansing of the wound with soap solution. Quaternary ammonium compounds may also be used.*

b. If antirabies serum is indicated, a portion of the total dose should be thoroughly infiltrated around the wound. As in all instances in which horse serum is used, a careful history should be taken and tests for hypersensitivity performed (2).

c. Tetanus prophylaxis (2) and measures to control bacterial infections as indicated.

d. Suturing of wound or other form of primary closure is *not* advised.

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* All traces of soap should be removed before quaternary ammonium compounds are applied because soap neutralizes their activity.

TABLE 2. Guide for Postexposure Antirabies Prophylaxis

Biting Animal		Treatment		
Species	Status at Time of Attack	Exposure		
		No Lesion	Mild*	Severe*
Dog or cat	Healthy	None	None[1]	S[1]
	Signs suggestive of rabies	None	V[2]	S + V[2]
	Escaped or unknown	None	V	S + V
	Rabid	None	S + V	S + V
Skunk, fox, raccoon, coyote, bat	Regard as rabid in unprovoked attack	None	S + V	S + V
Other	Consider individually—see Rationale of Treatment in text			

* See definitions in text. V = rabies vaccine; S = antirabies serum; 1 = begin vaccine at first sign of rabies in biting dog or cat during holding period (preferably 7 to 10 days); 2 = discontinue vaccine if biting dog or cat is healthy 5 days after exposure or if acceptable laboratory negativity has been demonstrated in animal killed at time of attack. If observed animal dies after 5 days and brain is positive, resume treatment.

The above recommendations are intended only as a guide. They may be modified according to knowledge of the species of biting animal and circumstances surrounding the biting incident.

Postexposure Prophylaxis*

1. Active Immunization

   a. Rabies Vaccine Preparations

   1) Duck Embryo Vaccine (DEV)—Prepared from embryonated duck eggs infected with a fixed virus and inactivated with betapropiolactone.

   b. Antigenicity of Vaccines—Antigenicity of NTV is often higher than that of DEV when tested in experimental animals. However, all lots of both vaccines must pass minimum potency tests established by the Division of Biologics Standards, National Institutes of Health. There is evidence that the serum antibody response in humans is detectable earlier after DEV vaccination, but the eventual level of response is frequently higher with NTV.

   c. Effectiveness of Vaccines in Humans—In the United States, comparative effectiveness of vaccines can be judged only by frequencies of failure to prevent disease. During the years 1957 through 1967 when both vaccines were available, there were six rabies deaths among the 117,700 NTV-treated persons (1:19,600) and seven deaths among the 172,000 treated with DEV (1:24,500).

   d. Reactions—Erythema, pruritus, pain, and tenderness at the site of inoculation are common with both DEV and NTV. Systemic responses, including low-grade fever or, rarely, shock, may occasionally occur late in the course of therapy with either vaccine, usually after five to eight doses. In rare instances, serious reactions have occurred after the first dose of DEV or NTV, particularly in persons previously sensitized with vaccines containing avian or rabbit brain tissue.

   As described previously, neuroparalytic reactions occur rarely with DEV. They are considerably more frequent after NTV, especially after repeated courses of treatment with this preparation.

   e. Choice of Vaccine—Rates of treatment failures with the two vaccines are not significantly different; therefore, the lower frequency of central nervous system reaction with DEV makes it preferable to NTV.

   f. Schedule for Vaccine Use

   1) Primary Course—At least 14 single, daily injections of vaccine in the dose recommended by the manufacturer. These should be given subcutaneously in the abdomen, lower back, or lateral aspect of thighs; rotation of sites is recommended.

   For severe exposures, 21 doses of vaccine are recommended. These may be given as 21 daily injections or 14 doses during the first 7 days (either two separate injections or a double dose), the remaining doses given singly during the next 7 days.

   2) Booster Immunization—Two booster doses, one 10 days and the other at least 20 days after completion of the primary course. The two booster doses are particularly important if antirabies serum was used in the initial therapy.

   g. Precautions—When rabies vaccine must be given to a person with a history of hypersensitivity, especially to avian or rabbit tissues, antihistaminic drugs should be used. Epinephrine is

* See table 2.

helpful in those of the anaphylactoid type. If serious allergic manifestations preclude continuation of prophylaxis with one vaccine, the other may be used.

When meningeal or neuroparalytic reactions develop, vaccine treatment should be discontinued altogether. Corticotrophin or corticosteroids are used for such complications.

2. Passive Immunization—Hyperimmune serum has proved effective in preventing rabies. Its use in combination with vaccine is considered the best postexposure prophylaxis. However, the only preparation of antirabies serum now available in the United States is of equine origin. Because horse serum induces allergic reaction in at least 20 percent of those receiving it, its use must be limited.

It is recommended for most exposures classified as severe and for *all* bites by rabid animals, wild carnivores, and bats. When indicated, antirabies serum should be used regardless of the interval between exposures and treatment.

The dose recommended is 1,000 units (1 vial)/40 lb of body weight. A portion of the antiserum is used to infiltrate the wound and the remainder administered intramuscularly. As previously noted, a careful history must be obtained and appropriate tests for hypersensitivity performed.†

Preexposure Immunization

The relatively low frequency of reactions to DEV has made it more practical to offer preexposure immunization to persons in high-risk groups: veterinarians, animal handlers, certain laboratory workers, and personnel stationed in areas of the world where rabies is a constant threat. Others whose vocational or avocational pursuits result in frequent exposures to dogs, cats, foxes, skunks, or bats should also be considered for preexposure prophylaxis.

Two 1.0 ml injections of DEV given subcutaneously in the deltoid area 1 month apart should be followed by a third dose 6 to 7 months after the second dose. This series of three injections can be expected to produce neutralizing antibody in 80 to 90 percent of vaccinees 1 month after the third dose.

If more rapid immunization is desirable, three 1.0 ml injections of DEV may be given at weekly intervals with a fourth dose 3 months later. This schedule elicits an antibody response in about 80 percent of persons vaccinated.

All those receiving the preexposure vaccination should have their serum tested for neutralizing antibody 3 to 4 weeks after the last injection. Tests for rabies antibody can be arranged with or through state health department laboratories. If no antibody is detectable, booster doses should be given until a response is demonstrated. Persons with continuing exposure should receive 1.0 ml boosters every 2 to 3 years.

When an immunized individual with previously demonstrated antibody is exposed to rabies, it is suggested that for a mild exposure one booster dose of vaccine be given and for a severe exposure, five daily doses of vaccine plus a booster dose 20 days later. If it is not known whether an exposed person had antibody, the complete postexposure antirabies treatment should be given.

References

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IS THERE A CHEMICAL THERMOSTAT IN THE BRAIN?

Robert D. Myers PhD, Purdue University, Lafayette, Indiana, Naval Research Reviews XX(4):1-7, April 1967.

One of the most remarkable features of man's ability to survive in his environment is the way his body temperature adjusts to the surrounding climate, whether it be the frigid cold of the Artic or the torrid heat of the jungle. So effectively is body heat conserved in the cold or lost in the hot environment that man can ordinarily maintain his body temperature with great precision at about 98.6°F.

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† A useful guide for use of animal serum is included in the recommendation for tetanus prophylaxis in wound management prepared by the Public Health Service Advisory Committee on Immunization Practices (2).

A number of bodily functions are brought into play to sustain this delicate temperature balance so necessary for survival. During exercise, or in a hot environment, there is an increased flow of blood from the deep tissues to the skin giving the latter a flushed appearance. The evaporation of perspiration cools the skin and the blood beneath its surface, thus achieving a considerable loss in body heat when the cooled blood returns to the deep tissues. In the cold, the opposite occurs—the skin appears white and shivering often sets in. These thermoregulatory systems, although considered to be "peripheral," are largely controlled by a very important "central" structure at the base of the brain—the hypothalamus. The integrative nature of this diminutive structure from a functional standpoint has been known for a long time. Patients in accidents involving severe damage to the hypothalamus lose their ability to control temperature, and, like poikilotherms such as fish, assume the temperature of their surroundings. In experiments with animals, the same results occur when the hypothalamus is purposely destroyed.

Two fundamental issues confront researchers intrigued with man's thermo-regulatory capability. One is the basic system within the cells of the hypothalamus which, at the slightest command, dramatically calls up the resources of the entire body to compensate for changes in environmental temperature. A second is how cellular elements in the hypothalamus react. On one hand, they fight bacterial invasion by elevating temperature to fever level. Yet, on the other hand, they selectively respond to the presence of drugs such as aspirin by lowering the *fevered* individual's temperature—but not the normal person's.

The nature of the thermostatic mechanism which causes the amazing adjustments in temperature to take place has been questioned for a long time. A number of years ago Dr. J. Villablanca, a Chilean neurologist, and I began working on this problem. We decided to introduce typhoid organisms directly into the hypothalamus of cats to try to simulate the type of fever produced during a serious illness. We were able to accomplish this by injecting tiny quantities of typhoid vaccine through minute tubes chronically implanted in selected hypothalamic regions of several cats. We found that the anterior region of the hypothalamus was unusually sensitive to the application of typhoid, because if the vaccine was injected in this region the cats developed extremely high fevers. We were astonished to find that the amount of vaccine needed to produce fever was in some cases as little as 1/10,000 of that required to produce the same high fever if injected by the normal intravenous route. Accordingly, we concluded that the anterior hypothalamus possessed a particular cellular sensitivity to specific molecules and played an important role in the production of fever. But how did the cells of the hypothalamus work to evoke the change in body temperature?

In 1963 Professor W. Feldberg of the National Institute for Medical Research in London and I began an intensive collaboration, partially sponsored by ONR, in an attempt to answer this question. In early experiments, we found that fever produced by an injection of typhoid into the brain of a cat could be reduced or even abolished by an injection of norepinephrine into the brain. Norepinephrine is one of several chemical compounds which occurs naturally in fairly high concentration in the hypothalamus. We selected norepinephrine since Professor Feldberg had discovered earlier that, if injected into the brain, it could abolish tremor or shivering in a cat. Injections were made directly into the cerebral ventricles, internal cavities which extend throughout large areas of the inner brain and are filled with a lymph-like fluid. The cerebral ventricular route of drug administration had to be used because norepinephrine, like so many other compounds, is selectively prevented from passing into the brain from the blood stream by a special kind of "barrier" called the bloodbrain barrier.

Soon after the experiments on norepinephrine's effect on fever, we attempted to mimic a fever of bacterial origin by injecting several other compounds known to be present in the hypothalamus into the brain. Like norepinephrine, their purpose in the hypothalamus was unknown. We soon discovered that another substance, serotonin, if injected into the cerebral ventricles of normal cats, evoked a fever identical to that caused by bacteria. To our surprise, norepinephrine reduced the fever induced by serotonin.

Thus, with these experiments completed, a new theory began to unfold. When the body calls for heat, either for normal adjustment or to induce fever to combat an infection, certain cells of the hypothalamus release serotonin. This activates the neural pathways to those parts of the body delegated to heat production. Conversely, when body cooling is called for, other hypothalamic cells release norepinephrine to activate those neural pathways which shut off heat production and lower temperature. The region in the hypothalamus where

norepinephrine and serotonin release takes place appears to be the anterior hypothalamus, since micro-injections of serotonin directly into this region caused the temperature to rise while similar injections of norepinephrine caused it to fall.

In other species such as the dog, rabbit, sheep, and goat, norepinephrine and serotonin also alter temperature when injected into the brain, again to circumvent the blood-brain barrier. In some species these compounds cause temperature changes in the opposite direction from that of the cat, i.e., serotonin may lower and norepinephrine may raise temperature. Nevertheless, the chemical means in the hypothalamic cells whereby temperature is stabilized or altered appears to be basically identical.

Temperature Regulation in Monkeys

Since we would ultimately like to understand how temperature control is mediated in the human brain, the ONR-sponsored research in our Laboratory of Neuropsychology, Purdue University has centered on the rhesus monkey because of its closeness to man. Before the experiments were begun, we implanted in each monkey an injection tube (cannula) either into the cerebral ventricular fluid spaces or into specific brain structures so that compounds could be administered intracranially to bypass the blood-brain barrier.

The sterile operative conditions during these cannula implantations are as rigid as those used for humans so that the monkey can remain healthy and free from infection and pain. On recovery from surgery, each animal is adapted to a special restraining chair and the drugs are then easily injected into the brain. In this case the cannula had been implanted so that the tip rested in the ventricular fluid between the two halves of the hypothalamus.

The results of injecting the naturally occurring substances, norepinephrine and serotonin, into the cerebral ventricles of the monkey were essentially the same as those for the cat or dog. That is, when the temperature was recorded rectally, norepinephrine lowered and serotonin raised the normal monkey's body temperature. An interesting and perplexing sidelight was the finding that a high dose of serotonin caused an initial, sharp drop in temperature instead of an extremely high fever. After the decline, however, the monkey's temperature rebounded and fever resulted. The actions of these drugs on temperature were once again pin-pointed to the anterior region of the hypothalamus, since micro-injections of minute quantities into this re-

gion caused the appropriate elevation or decline in the monkey's temperature.

Thus far the supposition that chemical systems within the hypothalamus mediate temperature regulation has been propounded on a purely pharmacological basis. The only way to verify the theory, however, is to demonstrate the actual release of neurochemical substances in quantities which vary in proportion to temperature changes.

Transfusion of Brain Factors Between Monkeys

In our search for neurochemical control of a specific bodily function, we have attempted to find ways of determining the release of a chemical substrate from the hypothalamus during some physiological change. The reason is simple enough. A chemical control system would be shown if the amount of a compound released can be correlated with a specific change in the monkey's physiological state. Thus, a new assay procedure was developed by which chemical factors from the hypothalamic region of one monkey (donor) could be traced when transfused to the same hypothalamic region of a second monkey (recipient). The temperature of the donor monkey was either raised or lowered by heating or cooling, and the brain fluid of the donor transfused to the recipient monkey. Whatever changes in temperature or other physiological responses occurred in the recipient monkey were then closely examined. In some experiments the drain-injection cannulae were placed directly into hypothalamic tissue for perfusion of the region, and in others in the ventricular fluid space between the halves of the hypothalamus. The tip of each cannula rested in the base of the ventricle in both animals. Ventricular fluid (cerebrospinal fluid) was drained from the donor animal by means of a small tube into a reservoir. The CSF was then pumped from the reservoir to the ventricular space of the recipient monkey. The total amount of fluid taken from the donor and transfused to the recipient was about 0.5 ml per transfusion. The pumping rate from donor to recipient was always set according to the rate of fluid outflow from the brain of the donor. Hence, the recipient never received more fluid than the donor would produce and discomfort was never observed in either animal.

In a heat or cold stress experiment, the donor monkey was either heated by hot air blown into the chamber surrounding its body or cooled by dry ice packs placed within the walls of its chamber. During heating, the temperature of the monkey's

chamber usually reached 54° C (about 130° F) within 15 minutes after starting the hot air blower. After a half hour, the monkey's temperature rose sharply. Hence, the heat was always discontinued within an hour. During cooling, the donor's chair chamber dropped to as low as −1° C (30° F). Cooling was likewise discontinued within an hour.

The results of our experiments using pairs of monkeys in this manner were rather remarkable. When the donor monkey was cooled by dry ice, a transfusion of its CSF to the ventricle of the normal recipient monkey caused the recipient to shiver within two to five minutes. Accompanying this shivering was an almost immediate rise in the recipient's temperature. If the transfusion was repeated, the recipient monkey's temperature rose to fever level and remained elevated between six and 12 hours. Conversely, if the donor monkey was warmed by blowing hot air into the chair chamber and its CSF transfused to a normal recipient monkey, the temperature of the recipient declined rapidly and often remained down for as long as four hours. The reciprocal effects on the recipient's temperature as a result of heating or cooling the donor occurred in approximately 50 percent of the experiments. One explanation for this may be that the positioning of the cannula in each monkeys' ventricle determines the kind of effect obtained. For instance, if the monkey's roles are switched and the donor becomes the recipient, altering the donor's temperature sometimes has little effect on the recipient. In control experiments, the recipient's temperature is not affected following a CSF transfusion from a donor which has not been heated or cooled. The temperature of the CSF, whether from a heated, cooled or normal donor, when pumped into the recipient approaches ambient temperature as it passes through the plastic tubing; hence, this could not be a factor in the results obtained thus far.

From these experiments it seems that two independent chemical systems are activated when a primate is exposed to heat or cold stress. During heat stress, a chemical factor is apparently released from the hypothalamus during the compensatory effort to lower temperature. When this factor is transfused to a normal recipient monkey, its temperature falls. On the other hand, when an animal is exposed to cold, a different factor is ostensibly released from the hypothalamus in order to activate mechanisms to generate heat. When this factor is transfused to a normal monkey, the recipient's temperature rises. These findings involving brain

transfusions between monkeys are still in an exploratory stage. Even so, they parallel the pharmacological results in which different drugs injected into the brain act to elevate or lower temperature. It may be that the two pharmacological substances in question, norepinephrine and serotonin, are not the substances released from the hypothalamus during heating and cooling. Instead they may simply mimic factors released during temperature changes. At present the characteristics of these chemical factors are unknown, but analyses of the active constituents present in cerebrospinal fluid of the heated or cooled donor monkey are presently being undertaken.

Conclusion

In the broadest sense, research in this scientific area will ultimately explain how the brain governs temperature. In and of itself this is a justifiable and worthwhile endeavor; but even more important are the possibilities which lie ahead in medicine, engineering, psychology, physiology, pharmacology, and other allied fields.

It is entirely conceivable that, given the biochemical code of the hypothalamus, new long-lasting drugs (e.g., anti-pyretics) could be developed to combat high fevers caused by infectious diseases or brain injuries. These drugs, or ones similar to them, could likewise be employed to selectively lower body temperature in order to produce deep hypothermia for reducing blood pressure, bleeding, and metabolic activity during major surgery on such vital organs as the heart and brain.

The regulation of body temperature in unusual or abnormal environments could also be facilitated by appropriate drugs. It may be possible to modify and then stabilize temperature at slightly higher or lower levels so that an uncomfortable environment would become more tolerable. It is entirely probable that in the years to come the chemical systems of the brain can be organized in order that temperature and basal metabolism are reduced to a preselected point for protracted periods of time. For certain kinds of space exploration, it would be desirable, if not essential, to slow man's high metabolic activity level to a point where such problems as oxygen requirements, waste, and sleep could be overcome.

Since potentially thermo-active drugs would be most easily administered orally, compounds must be developed which will pass the blood-brain bar-

rier. This stage in our progress may have to wait until a way is found to make the blood-brain barrier selectively and temporarily permeable to thermo-active drugs. In any event, the future appears to hold great promise for artificial,

external control over the temperature regulating systems in the human brain.

(The omitted photographs may be seen in the original article.)

MALARIA AND THE LUNG

LTCOL James J. Bergin MC USA,* Milit Med 132(7):522–526, July 1967.

Dr. Cahill in his book on Tropical Diseases, made the following statement: "In the vast underdeveloped areas of the tropics where the majority of the world's population struggled to exist and which, in this jet age, have become the playground of tourists, the arena of diplomatic conflicts and the reservoirs of expanding business cartels, malaria rules."

The World Health Organization has estimated that over 300,000,000 individuals in the world population encounter malaria per year. Out of this group approximately 3,000,000 die of this disease. The military importance, evident historically, was repeated in World War II when over 500,000 cases of malaria were reported. The disease has many synonyms: marsh fever, miasma, remittent fever, ague, paludisme, jungle fever and others. The recent hostilities in Vietnam have highlighted the importance of this disease. Approximately 90 percent of the civilian population in certain areas of Vietnam has malaria. The type of malaria often encountered, namely, falciparum is resistant or relatively resistant to standard therapy of chloroquin and quinine. The impact of this disease to both civilian and military in Southeast Asia is obvious.

History

From 460–370 B.C. Hippocrates, in his book on Epidemics, noted the existence of periodic fever. He divided the illnesses into quotidian, tertian, quartan and subtertian, and noted the association of an enlarged spleen. In 116 B.C. Columella postulated that an agent emanated from marshes carried by swarming insects. The wife of a Viceroy of Peru was cured of intermittent fever by a treatment from the bark of a certain tree. This was noted in 1638 and since the individual so cured was the

Countess de chinchon, the tree was called the cinchona tree. It is to be noted that the "h" of chinchona was omitted. Documentation of this event is unclear. Lancisi in 1718 felt that gnats from marshes could introduce with their proboscides a putrefying organic matter and animalcules. It was around 1820 that the active principle of the disputed tree bark was isolated in the form of quinine. In 1847 Meckel noted that the dark color found in red cells and in malaria organisms was due to a pigment and Virchow in 1848 further described the pigment as intracellular. In 1880 Laveran recognized the parasites of malaria and described spherical bodies, crescents and the exflagellation of the male gamete, thus proving to his satisfaction that the invading organism was living. In 1884 Gerhardt was the first to produce malaria by injection of blood from those affected into human volunteers. In 1894 Manson formulated the hypothesis of the mosquito transmission of malaria. In the early 1960's the emergence of a resistant strain of falciparum malaria in South America, Africa, and Southeast Asia was noted.

The Malaria Organism

This parasite is a protozoan of the class sporozoa and from the family plasmodidiiae. Six strains have been known to infect man: vivax, malariae, falciparum, ovale, knowlesi- and cynomolgi. The last two are parasites of the rhesus monkey and other simians and have been successfully inoculated into man particularly in the treatment of paresis. A few cycles of chills and fever have followed but the infection itself is limited. Man is the intermediate host and harbors the asexual development of the organism. Monkeys and apes, especially after splenectomy, may become susceptible to human malarial strains. Primates, other than man, have been considered as important reservoirs

of human plasmodiae, analogous to the simian reservoir of yellow fever in South America. In the definitive host, the Anopheles mosquito, sexual development occurs. The relationship between the various strains of Anopheles mosquitoes and the type of malarial organism infecting is remarkably specific. The life cycle involves the blood feeding of the definitive host. A male and female gametocyte are ingested and enter the stomach of the mosquito. The male gamete exflagellates and one of the flagellum penetrates the female gamete. The resulting zygote then moves between the epithelial cells of the stomach to oocyst. The oocysts then develop through a number of generations until rupture releases numerous sporozoites. The sporozoites disseminate throughout the body of the mosquito to rest in multiple organs; one of these organs being the salivary gland. When the mosquito again feeds on the human the sporozoites are injected. These sporozoites enter the human body and circulate for approximately 30 to 60 minutes. They then retreat into the liver where they enter the preerythrocytic phase. The development occurs within the hepatic cells with rupture of the infested cell followed by involvement of other hepatic cells. At a given period of time for each form of malaria, the preerythrocytic phase then leads to the erythrocytic phase. The invading organism of the red cell is then known as a trophozoite. When the chromatin body of the trophozoite divides, it is known as a schizont. Multiple divisions then occur with the ultimate development of a mature schizont. The rupture of this schizont from the red cell releases a number of merozoites. The merozoites then invade other red cells to repeat the cycle. Eventually, some of the merozoites released from the maturing schizonts become gametes, male and female, to permit continuation of the cycle in the Anopheles mosquito. In the falciparum form of malaria the cycle within the liver terminates with the onset of the erythrocytic phase. Thus, the battle between the erythrocytic development of the parasite and the host defense concludes with termination of the illness or death of the host. In the other forms of malaria, the hepatic phase may continue for months and years accounting for relapses. Morphologic distinction of the various forms of malaria is important from the prognostic and therapeutic standpoint. The falciparum variety invades any red cell regardless of age and thus may overtake a vast bulk of the erythrocytic population. Multiple infections occur within a single cell and bizarre forms are not uncommon. The developing schizont is rarely seen in the peripheral blood. Intravascular development within various organs occurs with release of the mature gametes. Thus in falciparum infection developing trophozoites and occasional gametes are seen. Marked pigmentation is unusual. In vivax infection, the younger 10 to 15 percent of the red cell population is involved. There is usually a single trophozoite per cell occurring in the midportion of the cell and occupying one-third of its diameter. As the schizont develops, pigmentation is easily recognized and known as Shüfner's dots. Gametes, when seen, are round and within red cells. All stages from the early trophozoite to the mature gametocyte are often seen on a single blood smear. In malariae infection, the developing schizont contains 8 to 12 merozoites. This schizont has the appearance of a "daisy head." The malariae form usually invades the older red cells and thus shares a small segment of the total red cell population. The ovale form involves very subtle differences in size of the developing parasite and a one slide diagnosis may not be made because of the similarity of ovale to vivax.

Case Presentation

A 24-year old caucasian male left Vietnam in a state of good health. From 6 days prior to admission until 2 days before being seen, he noted chills, fever, nausea and vomiting. The evening prior to admission he again noted chills, fever, lethargy, vomiting and diarrhea. He consulted his local physician in a small Colorado community who performed a blood smear. The diagnosis of falciparum malaria was made. This physician referred the patient to Fitzsimons GH. On admission the patient was noted to be acutely ill. Temperature was 101°, pulse 100, blood pressure 85/50 and respirations 24/per min. He was alert but had a sallow complexion and the sclerae were icteric. Careful examination of the heart and lungs was within normal limits. The spleen was moderately enlarged. On ECG there were nonspecific ST–T wave changes compatible with myocarditis. Chest x-ray was normal. Abdominal scout film revealed splenic enlargement. A few red cells and white cells with an albumin of 3 + were noted in the urine. BUN was 68. Electrolytes were within normal limits. The patient was placed on the intensive care ward with constant cardiac monitoring. A blood smear corroborated the referring physician's diagnosis of falciparum malaria. It was noted that approximately 50 percent of the total red cell population was invaded.

By previous guidelines a count of 10,000 organisms per cc is dangerous and usually over 500,000 per cc is fatal. Approximately 3,000,000 red cells per cc of invaded cells were present in this patient. A central venous catheter was placed in the superior vena cava. The patient was cautiously given saline and a small dose of aramine. Within 2 hours the blood pressure became normal. His oliguric state was replaced by an output varying between 100 and 200 cc's per hour. He was given quinine 3 grams in divided doses the first two days and 2 grams for the next 28 days. Chloroquin 1 gram initially and ½ gram every 6 hrs for three doses was also given. Heparin one-half mgm per kilo per 8 hours was then given IV and dextran 1 unit of 90,000 molecular weight was administered every 8 hours. On the second day it was noted that the urine which was amber on admission was black. Subsequent analysis revealed 30 grams Hb in the urine per 12 hrs. On the night of the second hospital day the patient was noted to be drowsy and disoriented. A lumbar puncture revealed an elevated spinal fluid pressure of 260 mm of water. Remaining studies were normal. The patient was given 8 mgm decadron every 8 hrs for the next four days. Rapid improvement occurred until the 4th day of admission when the patient became dyspneic. At that time it was noted that his weight was unchanged from the previous three days. Blood volume determinations were unchanged. Examination of the heart revealed slight enlargement to percussion and a late diastolic gallop at the apex. P_2 was increased and split widely over admission. Moist and inspiratory rales were noted at both bases. The circulation time was 10 seconds and central venous pressure unchanged on hourly determinations. The PO_2 was 50.5, PCO_2 25.3, pH 7.5 and hemoglobin saturation 90 percent. The patient was administered nasal oxygen at 3 liters per minute and intermittent positive pressure breathing every two hours for 15 minutes. Within 24 hours he was improved. Chest x-ray at the time of symptoms revealed slight cardiac enlargement, statistically not significant, but definite engorgement of the vascular markings of both lungs and an effusion noted in the minor fissure. Lateral decubitus film layered out this effusion on the right. The patient's subsequent course was uneventful except for a persistent reticulocytopenia, leukopenia and modest thrombocytopenia lasting for 40 days.

Pathology of the Lungs

Spitz in a study from the AFIP of 50 cases of fatal malaria noted that pulmonary edema was universal. Dilatation and hyperemia of the septal capillaries by parasitized red cells was common, whereas hemorrhage, although accompanied by macrophages filled with pigment usually was not associated with parasitized red cells. She noted that thrombosis in major vessels was not found. Pneumonia was prevalent, especially bronchopneumonia in 42 percent of the patients. Lobar pneumonia occurred in one case. Interstitial pneumonitis was present in 12 percent and there was a rare case of purulent bronchiolitis. A prominent hyaline membrane was found in five of the 50 cases and each of these had a significant renal lesion. Applebaum and Schrager reporting from the Canal Zone in Panama noted an incidence of pneumonia in well over 100 consecutive cases of 3.7 percent. They classified the pneumonia on the basis of therapeutic response as (1) atypical pneumonia without response (2) bacterial pneumonia responding to sulfa and (3) malarial pneumonia responding to antimalarial therapy. Al-Dabagh in a comprehensive study of malaria infestation of birds noted the same pathology as found in humans. He highlighted the absence of fibrin deposition within major vessels and commented upon the enormous swelling of endothelial cells seen very shortly after injection of the parasites in the experimental model.

Pathology of the Heart

Again referring to Spitz, dilatation of myocardial capillaries with parasitized erythrocytes was found prominent. This was associated in 84 percent of the cases with a pronounced interstitial edema of the myocardium. Again, the cells noted outside of the vascular space were free of parasites. Small subendocardial hemorrhages were common. Endocardial veruccae were also seen. Pericarditis was noted in one case of the 50 associated with a lobar pneumonia. No major vessel thrombosis nor arterial involvement was found. In the experimental studies of Al-Dabagh similar pathological findings were encountered.

Therapy in the Case Presented

A comment must be made regarding the therapeutic modalities utilized in the case presented. It

has been well shown that precipitation of hemoglobin, within the renal tubules is not important as long as normal perfusion of the kidneys is maintained. Therefore, efforts were made at restoring the patient's blood pressure. A central venous catheter was placed to monitor right ventricular output. Careful auscultation of the lungs and heart was instituted for similar observations on left ventricular output. With careful vascular loading with saline and modest administration of aramine, the patient's blood pressure was restored to normal. Since the BUN was elevated and the patient was oliguric, a test dose of Mannitol was then administered. Twelve and five tenths gms of Mannitol in a single dose was productive of an increased urine output varying between 100 to 200 cc's per hour. This dose of Mannitol was continued every 6 hrs for the next two days. Gruwich and Thomas have demonstrated that capillary damage by whatever means is followed by platelet thrombosis recognized structurally by aggregated masses of platelets. Experimental models have shown that these platelet thromboses are not inhibited by anticoagulants in any known physiological dose. Inhibition does occur by administration of dextran at 75,000 per 90,000 molecular weight. Because of this data, dextran was administered to the patient. It has also been shown that massive release of thromboplastic substances from lysed red cells is followed by accelerated coagulation. Hypercoagulability is accompanied by fibrin deposition in various vital organs. Interruption of venous thrombosis is accomplished by anticoagulants and this was the rationale for the intravenous heparin. Felsenfeld commented that the red cell destruction is not restricted to parasitized cells. The hypothesis of an accompanying immune red cell destruction is tempting. The edema described in the pathology of the heart and lungs is shared by the cerebrum. Steroids and in particular decadron have had widespread clinical application for nonspecific cerebral edema. Because of the possible autoimmune phenomenon and because of the probable cerebral edema, the decadron was administered. Oxygen plus intermittent positive pressure breathing were given for the pulmonary edema. Chloroquin and prolonged quinine therapy were administered for control of the parasites. Whether or not all the therapy administered was efficacious will not be known until further studies are carried out. It can only be said that the therapy was based upon what was thought to be a rational approach to the pathophysiology and in this one case was effective.

Therapy of Malaria

Recent research and field trials sponsored and supervised by WRAIR and MEDON Command have produced data modifying the previous approach to this problem. A preliminary report noted that following the treatment regimen recommended that relapse to drug resistance falciparum malaria was reduced. The recommended therapy is quinine 975 mgm t.i.d. for two days followed by 600 mgm t.i.d. for 12 more days. Daraprim (Pyrimethamine) 25 mgm per month every 8 hrs is given during the first three days of therapy. Dapsone 25 mgm daily is started on the 7th day of therapy and continued for 28 days so that the total therapeutic time is 35 days. Trial of Dapsone 25 mgm daily in addition to the weekly Chloroquin-Primaquin prophylactic tablet is now being administered selectively to specified units exposed to drug resistant malaria in Vietnam. The drug is also administered for 28 days after leaving the high risk area. Data on these studies are forthcoming.

Pathogenesis

Spitz noted that the intense engorgement of capillaries, and indeed, other manifestations described under pathology of the heart and lungs, were not specific, that these changes are well known to occur in death due to many anoxic states. Brown injecting hematin found that fever, chills, hemolysis, leukocytosis, thrombocytopenia, increase in bleeding and clotting time with multiple small thrombi in the heart and lungs occurred. Knisely in 1947 commented on the stickiness of red cells in a patient with malaria. He noted that endothelial swelling was followed by white cell adhesiveness. The red cells were then noted to sludge and stick followed by fibrin-like deposit. Al-Dabagh, injecting malarial parasites in birds, felt the intravascular agglutination was a nonspecific phenomenon developing in terminal stages of infection and played no important role in tissue injury, but added to the anoxic state. Marked endothelial swelling was primary and occurred rapidly after the injection of malarial parasites. Because of these observations and others it would appear that a reasonable postulate of the pathophysiology in malaria would be as follows: that the infection by the organism perhaps associated with release of products of the parasite or pigments emanated by the parasite causes primary injury to the endothelium manifested by swelling. This is followed by leakage of the capillaries and

dilatation leading to further anoxia and injury. Because of the profound dilatation and alteration in the endothelial lining various blood elements stagnate, leading to further anoxia. These blood elements further adhere to the endothelial cells in a slow, barely moving stream without thrombosis. Marked release of thromboplastic substances from the red cells in the presence of this anoxia may be followed by disseminated intravascular coagulation. If this be true, then therapy would then be directed toward eradication of the parasites, improvement of intravascular volume, and prevention of platelet and venous thrombosis. Reduction of edema through attempts toward maintaining the integrity of the endothelial lining and oxygen to insure maximum carrying capacity of this essential element to perfused vital organs would also be efficacious.

(The references may be seen in the original article.)

THE SURGEON AND THE LASER

Janice A. Mendelson, MD, FACS, Fort Sam Houston, Texas, Surg Gynec Obstet 125(1):116–117, July 1967.

In recent years, the increasing exchange of information between surgeons and engineers has contributed greatly to the improved management of the surgical patient. However, this trend carries with it factors which may actually be detrimental to patient care. The engineers know relatively little about practical details of surgery, and most surgeons know relatively little about the details of electronics. The enthusiastic attempts of various engineers and industrial concerns to contribute to medicine, and the desire of surgeons to utilize the latest developments, may lead unwary surgeons and hospital administrators to invest in expensive and relatively untried equipment. The use of the equipment may detract from patient care both by diversion of needed funds and by distraction of personnel from observing the patient to observing the equipment. Before considering the use of an ingenious and impressive device, one must be certain that its value has been proved and is practical. One must determine whether there are known or potential hazards in its use and whether there are simpler, safer ways of accomplishing the same or better results.

An example of the necessity for applying critical thinking is the new, intriguing subject, laser (light amplification by stimulated emission of radiation). For the past few years, various investigators have been interested in tissue effects of laser action, both as a possible source of trauma requiring surgical treatment and as a surgical or radiologic instrument.

The effects of exposure of biologic targets ranging from tissue cultures and cell suspensions to dogs and the skin of man have been studied, with the use of focused and unfocused beams, and a wide range of power and energy levels. Numerous reports have been written by the relatively few investigators with facilities to do these studies. Many of these have led to the implication that the laser has unique capabilities, but few have compared the laser effects with those from other, simpler energy sources.

Ordinary light sources produce rays diverging equally in all directions, the intensity therefore diminishing as the square of the distance from the source. Laser light is delivered as essentially parallel rays from the end of the laser rod. Therefore, unlike ordinary light, the intensity of laser light traveling through space will theoretically be undiminished with distance from the source. Pulsed laser radiation is emitted in an exceedingly short time, a long pulse being around one to two milliseconds, and a short pulse, which requires modification of the apparatus, being about 15 to 25 nonoseconds. Laser emissions are monochromatic and coherent. The laser is, therefore, merely a highly efficient method of delivering light, with its total energy output concentrated both in time and space, beam width.

When light strikes a target, it is absorbed as heat, the percent absorbed depending on the optical and thermal qualities of the target. Maximum

energy density is obtained by use of a converging lens, which is usually required to obtain sufficient energy density for laser light to produce holes in metal, or the sharply localized small burns of tissue which represent the maximum acute nonocular injury to intact man or large animals. With sufficient energy absorption, the rapid heating results in vaporization of the target, producing a jetlike plume of gas, which is expelled outward from the surface unless the focus is deep to the surface as can occur in the eye or in thin-walled small animals.

Because of its rapid loss of effect upon penetration of tissue, the only place where the laser is capable of inflicting serious, acute injury in intact man is the eye. Laser light passes readily through the eye to the retina, where a very small amount can have a therapeutic effect in attaching a retina that is about to become detached. However, there is an exceedingly close limit between the therapeutic dose and that producing more extensive damage. The absorptive capability of a given retina cannot be adequately determined ahead of time, and there is danger of producing an explosive effect in the eye should vaporization with its jet effect and expanding gases occur. In this closed compartment, pressure waves can occur which could possibly be harmful.

Of especial interest to the general surgeon have been articles suggesting the use of laser irradiation in the treatment of malignant tumors and various nonmalignant skin lesions. The laser is hazardous to the operator as well as to the patient. The eye being designed to collect and focus light is peculiarly susceptible to damage from laser light. In the case of high energy laser source, there is a definite possibility of premature discharge of laser emission or of reflection from polished surfaces causing at least a portion of the radiation to enter the eye of the patient or of personnel in the room. So far, production of high energy laser emission requires very high voltage electrical sources, and the operators may be in real danger from accidental contact with these sources. It is not yet known whether this type of light energy is carcinogenic. Therefore, although laser radiation may destroy some benign skin lesions, it would be preferable to use better known methods for this purpose.

If the laser is being considered as a radiation source for the treatment of malignant lesions, it would have to be proved that it has some advantage, actual or potential, over properly used roentgen rays. The roentgen ray has the advantage of selectively damaging growing cells, whereas selective absorption by light is into areas of deepest pigment. This would not be preferable even in a malignant melanoma, in which the most rapidly growing cells are apt to be the most undifferentiated, with the least pigment.

On nonbiologic material, or microscopic biologic preparations, laser beams can be focused so as to create sharply localized heating and destruction useful for industrial and research purposes. This fact has led to the concept of the laser as a super scalpel. However, this is fallacious for several reasons. The laser beam acts as any light ray in that its depth of penetration into tissue varies depending on the reflectivity and absorbability of the tissue, and the rays begin to scatter as soon as they enter a nonhomogeneous medium. One has much better control of the depth of tissue destruction with skillful use of the high frequency current apparatus already available in most hospitals. The high frequency current devices are much less expensive, can be manipulated by the operator to vary the depth of the incision, and are much less complicated to operate in procedures in which the ordinary scalpel is not the instrument of choice.

Therefore, although the laser has very much to offer in fields such as photography, industry, space communications, and biological research and is justifiably of interest to the ophthalmologist, neither as a general surgical instrument nor as a source of significant nonocular trauma does it now seem worthy of consideration by the general surgical clinician.

MEDICAL ABSTRACTS

HODGKIN'S DISEASE—COMBINED CLINICAL STAFF CONFERENCE AT THE NATIONAL INSTITUTES OF HEALTH

Moderator: Seymore Perry MD FACP,
Ann Intern Med 67(2):424–442, Aug 1967.

Some of the more recent developments in pathology, immunology and therapy of Hodgkin's Disease are presented in this symposium. There has been a great increase in understanding about the disease and its therapy that has perhaps not received the wide dissemination it deserves. It should be clear from what has been presented that there are good reasons for a more optimistic outlook in Hodgkin's disease.

SHOCK—RECOGNITION AND MODERN TREATMENT

James T. Gladish MD, Alon P. Winnie MD,
and Vincent J. Collins MD, Cook County
Hospital, Chicago, Postgrad Med
42(1):41–51, July 1967.

The authors state that for the successful treatment of the patient in shock, the physician must recognize and administer specific therapy for each of the basic pathophysiologic changes associated with the development of shock. Vasoconstriction with resultant diminished tissue perfusion is modified through use of Chlorpromazine as an adrenergic blocking agent. Intravascular sludging of red cells is attenuated by administration of low-molecular weight dextran. Mannitol is prescribed for extravasation of fluid into the extravascular space. Routine use of a central venous catheter and an indwelling urinary catheter will provide essential information in following the patient's response to treatment. The survival of the patient in shock is enhanced by administration of supplemental oxygen.

PROGNOSIS FOR SEVERE PSYCHIATRIC DISABILITIES INCURRED IN NAVAL SERVICE

E. K. Eric Gunderson PhD and Ransom J.
Arthur CDR MC USN, J Occup Med
9(7):327–335, July 1967.

Psychotic and neurotic patients who were retired from the naval service with disabling psychiatric disorders were followed up for 5 years by means of medical and Physical Evaluation Board records. The employment records of these patients indicated that a large proportion were able to make constructive work adjustments in the community 3–5 years after retirement. Diagnosis and clinical symptomatology were found to be highly related to rated degree of disability at the time of retirement while employment status and remission of symptoms were highly related to later disability ratings. A number of demographic variables were significantly related to diagnosis. Certain social background factors, such as race and education, appeared to have short-term effects upon the employment records.

PERCUTANEOUS ABSORPTION—A CRITICAL AND HISTORICAL REVIEW

Frederick Reiss MD, Amer J Med
Sci 588–602, Nov 1966.

The author discusses the mechanism and potential absorbability of several commonly used drugs. Emphasis is placed upon the fact that the percutaneous absorption should be of primary interest to the industrial physician, because of numerous highly toxic insecticides, fungicides, and plasticizers, which are an occasional serious menace to health. Not only does the measurement of penetration depend on the method used, but the rate of penetration is conditioned by the media in which the penetrant is incorporated.

NEW STUDIES OF THE COLONIC POLYP AND CANCER

Clyde E. Culp MD, Surg Clin N
Amer 47(4):955–960, Aug 1967.

This article is a composite study of 1,510 polyps and revealed that 1,255 were adenomatous in origin. As the diameter of the adenoma increased, the frequency of carcinoma in situ became greater; and in some polyps whose diameter exceeded 10 mm., the carcinoma was invasive.

No tiny lesion carcinomatous from its origin was found in more than 26,000 proctosigmoidoscopic examinations carried out by the Section of Proctology, Mayo Clinic, during the past year.

Since investigative methods do not yet allow following intimately the development of a colonic polyp from adenoma to carcinoma, periodic clinical and pathologic findings are to be used to the best advantage. Whether carcinomatous polyps are malignant from the beginning or only become so in the course of time, adenomatous polyps should be destroyed when encountered.

DENTAL SECTION

THE MANDIBULAR MOVEMENTS OF SPEECH AND THEIR SEVEN RELATED VALUES

Earl Pound, J S Calif Dent Ass 34(9):435–441, Sept 1966.

Guidelines for positioning the 6 lower anterior teeth are provided by the patient's mandibular movements. By recording and interpreting the following mandibular movements it is possible to restore the patient's original mandibular tooth position, phonetic sharpness, and occlusal harmony; these are the vertical overlap, horizontal overlap, former lower anterior tooth display, former class of occlusion, maximum usable vertical dimension, an accurate index for incisal guidance, and the maximum serviceable cusp height. Each of these factors is discussed under 4 headings: which mandibular movements to record; the recording method, the 7 benefits, and the management of some atypical occlusal situations.

(Abstracted by: Nelson W. Rupp, From: Oral Res Abs 2(2): 105.)

PULP PHYSIOLOGY—BREAKING THE INSIDE STORY

Edward E. Beveridge, J S Calif Dent Ass 34 (9):442–445, Sept 1966.

The delicate balance between extracellular fluid pressure and the intracellular and intracapillary fluid pressures is discussed. The findings in current dental pulp histology research are related to clinical experiences. Among the findings considered are the revelations Photo and Scheinen exposed in their microphotographs through a dentin window of the blood flow variations in the incisor of a rat caused by selected stimuli. A study of time lapse photography of the flow of dental interstitial fluid to the surface of a cut dentin preparation is presented. Other recent observations included the effects on the pulp tissue of temperature changes and drying resulting from operative procedures (damage to the pulp results not so much from temperature changes as from drying). This disturbance of the dental interstitial fluid balance during dental procedures is one of the most important findings in recent years.

(Abstracted by: Nelson W. Rupp, From: Oral Res Abs 2(2): 148.)

PERSONNEL AND PROFESSIONAL NOTES

MARINES TOP RICH CIVILIANS IN ORAL HEALTH

RADM F. M. Kyes DC USN.

Two recent surveys show that the average Marine on duty in Vietnam has better teeth than the average similar aged civilian in the United States who is in the "$10,000 and up" income status. In a chart entitled "Dental needs of 10,683 white patients by income and by age", the March issue of the Journal of the American Dental Association stated that in the 15–29 year age bracket only 28.4% of the group examined had no current dental needs other than a prophylaxis. This deals with the condition of the top income group in the area surveyed.

While it is difficult to compare studies, a very similar but smaller study of oral conditions of

Marines, who had averaged 5.9 months of duty in Vietnam, disclosed 38% who needed no treatment when examined. Other studies conducted on returning Marines at El Toro, California, disclosed a very high state of oral health.

In the Korean War dental treatment came generally from large concentrations of dental personnel in the rear support areas. In Vietnam much dental treatment is provided at the battalion level. A recent report from one Dental Company disclosed that it operated 17 separate dental clinics over a wide area of distribution. Thirty-nine percent of Marines had received dental treatment during an average of 5.9 months in Vietnam. From this it can be assumed that if a group were surveyed after 12 months, the vast majority would have been cared for while in the county.

The examination tallies were as follows: Needing *no dental treatment* other than prophylaxis

Civilian—age 15-29—all incomes	17.4%
Civilian—age 15-29—$10,000 and up	28.4%
U.S. Marines in Vietnam	39 %

U.S. ARMY INSTITUTE OF DENTAL RESEARCH PUBLICATIONS

Seven publications prepared by the U.S. Army Institute of Dental Research are now available from The Clearinghouse, U.S. Department of Commerce, Springfield, Virginia 22151. Each syllabus is priced at $3.00 per copy.

AD 640200—Oral Surgery, 900 pages
AD 640421—Oral Diagnosis and Therapeutics, 752 pages
AD 640373—Periodontology, 211 pages

AD 640199—Applied Sciences in Dentistry, 532 pages
AD 640195—Prosthodontics, 443 pages
AD 640196—Preventive Dentistry, 567 pages
AD 640193—Anatomy of the Head and Neck, 186 pages

The above publications represent a valuable addition to the literature and can be useful to students, teachers, and those engaged in the general practice of dentistry. The publications consist of a comprehensive series of lecture notes and treatises on widely varied aspects of the dental profession.

JOURNAL OF PERIODONTOLOGY

The Naval Dental School Library has a requirement for the following volumes of the *Journal of Periodontology*:

Year	Volume	Numbers
1950	21	1, 2, and 4
1951	22	1, 2, 3, and 4
1952	23	1, 2, 3, and 4
1958	29	1, 2, 3, and 4
1959	30	1, 2, and 4
1960	31	1, 3, and 4
1961	32	3 and 4
1962	33	3
1963	34	1, 2, 3, and 4

Anyone having copies of the above numbers and willing to donate them, please contact the Commanding Officer, (Code E4), Naval Dental School, National Naval Medical Center, Bethesda, Maryland 20014.

NURSE CORPS SECTION

CORPUS CHRISTI'S INSERVICE PROGRAM

The Nurse Corps Officers of the Naval Hospital, Corpus Christi, Texas, recently presented an outstanding Inservice Program "Establishment of a Coronary Care Unit." Professional nurses representing every hospital, public health agency, school nurses, and student nurses, in the Greater Corpus Christi area also attended as guests of the Navy

Nurse Corps. The two hour program was repeated on a second day.

The speaker was Miss Invelda Artz, R.N., Nurse Consultant, Coronary Heart Section, Heart Disease Control Branch, USPHS, Washington, D.C. Included in her discussion was: planning the physical environment, selecting equipment, preparation of

nurses, developing of nursing procedures, making nursing diagnoses, and nursing care plans for Coronary Care Units.

Using film clips from a forthcoming USPHS movie on Coronary Care Units, Miss Artz showed the impact heart disease has on the nations mortality and loss of manhours. Film clips also showed equipment arrangements which have proven useful in established Coronary Care Units throughout the USA. Since their inception in 1962 (Bethany Hospital, Kansas City, Kansas), in small and large hospitals, Coronary Care Units have proven their value in the survival rate of heart patients.

The purpose of a Coronary Care Unit is to provide concentrated specialized care of heart patient's needs. The success and efficiency of the unit depend on the skill of the personnel and effective organization.

Basic to the establishment of a Unit is the planning. Coordinated planning is needed to include representatives from Medical Service, Anesthesiology, Nursing Service and Hospital Administrator. This group makes policies governing operation of the unit; establishes criteria for selection of patients admitted to the unit; recommends a chief of the unit (internist, preferably a cardiologist); researches legal probabilities; establishes teaching programs for the staff of the unit.

Planning Physical Environment:

1. Number of beds needed by a hospital in a Coronary Care Unit based upon USPHS formula:

$$\frac{365}{\substack{\text{Number of days} \\ \text{in unit} \\ \text{(usually 7 das)}}} \quad \frac{\text{— Number of M I patients}}{\text{— Admitted for past year}}$$
$$X = \text{Number of beds needed}$$

2. Location. Close proximity to ICU to provide back up for CC personnel.

3. Physical arrangement influenced by structural limitations of a hospital.

4. Recommend the unit be composed of multiple rooms with ready access, arranged to facilitate constant observation of the patient, but giving the patient privacy.

Selecting Equipment:

1. Each bed position compact: bed, bedside table, over-bed table are basic.

2. Each bed position equipped with walled O_2 outlets, suction outlets, sphygmomanometers; stop-clock; positive pressure apparatus; electrical outlets; cardiac arrest boards (best position—hang on wall behind head of bed); ceiling to floor IV stands; mounted oscilloscope.

3. Nurses station: Central monitoring unit; provisions for EKG "run throughs"; crash cart.

4. Fluorescent lighting is discouraged due to interference with electronic equipment.

Preparation of Nurses:

1. Understanding of psychological, physical, social, spiritual and nursing needs of heart patients.

2. Review and be well-versed in anatomy and physiology of cardiovascular system as background knowledge.

3. Knowledge of pathophysiology of cardiovascular system in ASHD, atherosclerotic heart disease, myocardial infarction and its complications.

4. Skilled in performing CPR (Cardiopulmonary resuscitation).

5. Knowledge of oscilloscope and how used in monitoring heart action.

6. Knowledge of electrocardiography.

Developing Nursing Procedures:

1. Based upon basic nursing concept of complete care of each individual patient.

2. Continuous re-education by use of in-service education.

3. Constant evaluation of techniques, practice of procedures of Resi-Ann.

4. Methods used to evaluate activity of heart patients.

5. Multi-discipline approach to cardiovascular nursing.

Nursing Diagnosis:

1. Developed by nurses observations, knowledge of each patient, combines with professional knowledge of disease condition.

2. Individualized for each patient. Nursing care planned with ultimate aim the recovery of the patient.

3. Professional caliber of nursing judgment is a continual requirement in making nursing diagnoses.

Nursing Care Plans:

1. Combines with physicians plan of care of each patient.

2. Nursing actions to be taken with continuity of care, indicates steps to be taken.

3. Individualized to each patient's nursing needs.

Conclusion

Nursing in Coronary Care Units is specialized practice. These nurse specialists with primary responsibilities for constant careful observation and evaluation of patient's condition, develop powers of critical observation, learn to observe, control me-

chanical devices, become skillful in recognizing emergencies and initiating treatment of these emergencies.

OCCUPATIONAL MEDICINE SECTION

HEART CASES UNDER WORKMEN'S COMPENSATION LAWS

Leon J. Warshaw MD, New York, N. Y., JOM 9(7):349–352, July 1967.

Workmen's Compensation laws were originally enacted to provide workers with benefits for disabilities due to accidental injuries (fortuitous events causing trauma) occurring during the course of and arising directly from the work being performed. However, a well-known attorney has stated, "By repeated extension and amplification of the laws in the legislatures, Industrial Commissions, and in the court rooms, such benefits are now generally provided for illnesses of whatever nature, whether organic or functional, which are caused, precipitated, aggravated, accelerated or triggered in any way by any condition of the employment or by any aspect of the employment environment."

Existing Heart Disease

The overwhelming majority of cases involve atherosclerotic heart disease in which a myocardial infarction, a coronary thrombosis, or the onset of an angina pectoris has occurred. This disease starts early in life and is influenced by a great variety of factors, some of which render the individual more susceptible to it: heredity, body build, diabetes, hypothyroidism, etc. Others seem to accelerate its progress: a high intake of saturated fat (resulting in elevated blood-cholesterol levels), excessive cigarette smoking, high blood pressure, and lack of exercise. The mechanism involved in acute coronary episodes is not clearly understood; they can be produced experimentally by a variety of circumstances but the multiplicity of factors operative at any one time in the intact human being makes it difficult if not impossible to be precise in attributing a controlling influence to any one.

The Question of "Strain"

Rest, sleep, mild physical or mental stress, and the activities of ordinary living are not thought to be causally related to acute coronary involvement. On the other hand, most physicians agree that, under certain critical circumstances, an extraordinary physical or emotional strain may precipitate an acute coronary episode in some individuals with atherosclerotic heart disease. Thus, many awards are made in heart cases on the basis of evidence that the employee had in the course of his work been subjected to an unusual and excessive physical and emotional strain, one that was "unusual" in comparison to the activities ordinarily required by his job and "excessive" for any individual in reasonably good condition.

This doctrine has been modified with respect to the designation of "unusual and excess" strain. It has become accepted in many jurisdictions that an acute coronary episode may be caused by strenuous physical or mental activity whether usual or unusual, and that in sedentary employment, any exertion beyond the usual requirements of the job might cause such an event. Further, these terms have been held applicable to the particular worker at the time of the acute coronary episode. Thus, a second episode occurring in an employee who came to work even though he had had an acute coronary attack while sleeping in bed was held to be compensable because the effort required by his job was "excessive" for a person in that condition. In the language of a recent decision: "It is not necessary for compensability of a heart attack, that there be an unusual strain from work, or that the strain be due to the occupation rather than the employee's physical condition, if normal exertion of work makes it harder to withstand the attack."

The award of benefits in heart cases is being liberalized in another way. In most jurisdictions, it has been the task of the claimant or his representative to establish the compensable nature of his heart disease. Within the past few years, how-

ever, the courts have begun to presume that where the disability occurred on the job, it is employment-related unless substantial evidence to the contrary is provided by the employer.

The latest development is the notion that the repeated physical and mental strain of a lifetime of work may culminate in an acute coronary episode. The typical result is a case in which the employee directs his claim at some 46 defendants—representing a chronological list of all of his employers since he first went to work. Awards in such cases have been made on the basis that "where there is an extended exposure, the result is regarded as one continuous cumulative injury rather than as a series of individual injuries." Separately, each day's strain may be slight, but when added to the strains which have preceded it, it becomes a destructive force. For such an injury, the Statute of Limitations runs from the date of the last exposure.

Compensability

The ultimate is the passage of legislation providing that a coronary attack in certain civil service workers is automatically compensable as long as the individual was on the payroll when the episode occurred. At least 11 states have enacted such statutes covering for the most part firemen and policemen but, in some instances, also correction officers, forest and wildlife service employees, motor vehicle bureau personnel, and even members of the state legislature.

Employer Liability

As a result, employers in states where awards in heart cases have been liberalized are becoming increasingly reluctant to hire applicants with a history of heart disease. In some instances, employees are being required to submit to periodic examinations, not as a preventive health measure, but to identify those who may have developed heart disease and should, therefore, be dismissed.

Attempts have been made to protect employers from the financial risks involved in hiring a person with heart disease. These include the use of waivers, the technique of apportionment, and the development of second-injury funds. None of these has apparently resolved the problem satisfactorily.

Thus, the employer finds himself in conflict. On the one hand, his fiscal liability impels him to weed out of his work force all those with recognized coronary heart disease and, if he really wants to be careful, all those with a greater-than-normal

susceptibility to acute coronary episodes by virtue of their hereditary disposition, their habitus, their habits of living, and their body chemistry. Then, to be sure that coronary "accidents" do not occur, he must take pains to see that none of his workers is required to withstand "unusual and excessive" strain.

On the other hand, were he to enforce these restrictions, he would deprive his company of a large number of workers of whom many might be making important contributions to the enterprise. Further, there has accumulated a convincing body of evidence showing that regular strenuous physical activity is helpful in preventing acute coronary episodes. Today employers are urged to replace the coffee break with an exercise break and to promote higher standards of physical fitness by encouraging their workers to participate in regular training programs.

Most of the conflict inherent in the heart compensation problem stems from the necessity of establishing a causal relationship between the acute coronary episode and the work or the work situation. For example, a noted professor of law has stated that "all parties concerned should recognize once and for all, that the relationship between an industrial effort and a heart attack is a medical, not a legal problem." Yet, a noted authority in compensation medicine states that the determination of causal relationship is a legal problem. "The physician merely presents the medical facts—the circumstances leading to the acute episode, the exact diagnosis, and the extent of disability—and leaves the determination of causal relationship to the Compensation Board or to the court!"

Interpretive Differences

Part of the problem stems from the lack of detailed knowledge of the facts. The acute coronary episode usually involves so much tension and anxiety—not only in the patient but also on the part of those who treat him—that a detailed history of the circumstances that preceded the attack is rarely obtained.

Even when the facts are known, differing interpretations of the term "Cause" create confusion and conflict. The physician looks for a particular happening that unmistakably contributed to the onset of the episode at the time it occurred and without which the onset of the attack would not have occurred when it did. The attorney, on the other hand, requires only a temporal sequence of events from which one may infer that an acute episode

was triggered, precipitated, accelerated, or aggravated.

But even without the prodding of our legal brethren, physicians frequently disagree. Sometimes this reflects the manner in which they become involved in the case. The physician treating the patient inevitably becomes emotionally invested in him and his welfare. It is difficult for the doctor to take a position that the claim cannot be substantiated when that will deny the patient the benefits to which he believes he is entitled. It would be extremely unusual for such a decision not to disrupt the doctor-patient relationship; hence it is a view that is rarely held by an attending physician, whether he be a general practitioner or a specialist. On the other hand, the physician who derives income and prestige from his support of the employer's or the carrier's viewpoint is likely to resist the concept of a causal relationship.

The mere fact that the testifying physician is "impartial"—that is, favoring neither the claimant or the respondent—does not guarantee an unbiased determination for physicians are not agreed on the criteria for establishing a causal relationship.

Legal Assessment

Lawyers, on the other hand, do not display such uncertainty. The claimant's attorney has no doubt about the presence of a causal relationship and fights hard to establish it while the respondent's attorney strives to have it denied. This is quite proper in our adversary system wherein the attorney is charged with making the best possible case for his client. Yet, tragically, it is often true that in fighting to win the case the attorneys do not serve in the long run the best interests of the person with a heart-case claim. Prolongation of the proceedings, exaggeration of disability, and blocking early adequate rehabilitation may be helpful to the legal case but scarcely to the patient.

Conclusions

This is the crux of the matter—the patient's welfare. It is obvious that there are many problems to be resolved—perhaps even before we can solve them, we need unanimity on just what they are. I have touched on but a few. As in a previous presentation, I would close with the following note:

Workmen's compensation is a system designed fundamentally to help an injured worker heal his wounds, and to help him and his dependents maintain themselves with dignity until he can be restored to the status he appeared to display prior to his disablement. It would indeed be a wretched paradox if, through our attempt to help him, we induced an additional injury that may be significantly greater than the one for which compensation is being sought. Every individual who is in any way connected with a compensation case should keep constantly before him as the goal—not what's the most I can get out of it, nor how can I escape most cheaply—but a decision that is maximally advantageous to the injured man and, at the same time, equitable to his employer and all the others who are involved. If this were done routinely, many of our problems would evaporate leaving the way clear for a more concerted and less emotional attack on those that remain to be solved.

PULMONARY HAZARDS FROM EXPOSURE TO GLASS FIBERS

Ahmed N. M. Nasr MD, Ann Arbor,
Mich. JOM 9(7):345–348, July 1967.

This present review is designed as a critical evaluation of the pertinent investigations concerning pulmonary hazards from exposure to glass fibers. Other materials that bear some resemblance in name or application to fibrous glass have been sometimes inadequately differentiated from it. These include mineral wool, Fiberglass Reinforced Plastic and Plexiglass. Thus, while Fiberglass Reinforced Plastic is a structural material composed of fiberglass and a plastic in approximately equal proportions, Plexiglass is not a glass at all; it is a brand name of a certain plastic. The confusion has extended to misnaming a clinical entity claimed to be due to inhalation of glass fibers.

Summary

The results from animal experiments and human experience with respect to the effects of fibrous glass upon the respiratory tract have been reviewed. The opinion that inhalation of glass fibers may result in irritation of the upper respiratory tract, with no prospect of significant pulmonary involvement is repeatedly encountered in the literature. The size of the glass fibers in common application and their tendency to form felt-like masses upon any object with which they come in contact probably prevent inhaled glass fibers from penetrating into the pulmonary alveoli.

Three cases in which exposure to fibrous glass was associated with the development of inflamma-

tory lung disease have been reported by individual authors. In those cases the illness was acute, and infection played the major role. A case of bronchial asthma in association with exposure to fibrous glass has been also reported. In all four cases, no appraisal was made concerning other air contaminants that may have been present in the work environment.

In a limited number of workers who had been exposed for years to glass fibers, cardiac and pulmonary-function studies revealed no functional impairment.

As far as could be ascertained from a search of the American and European literature, available evidence indicates that fibrous glass is a relatively inert material with no fibrogenic or other significant toxic properties.

OCCUPATIONAL HEARING LOSS AND HIGH FREQUENCY THRESHOLDS

Joseph Sataloff MD, Lawrence Vassallo MS, and Hyman Menduke PhD, Phila., Pa. Arch Environ Health 14(6):832–836.

Comment

To our knowledge, high frequency thresholds of noise exposed subjects have not been reported previously. Observing a typical noise-induced audiogram with its dip at 4,000 and 6,000 cps and its rise again at 8,000 cps would give a "predicted" loss at the higher frequencies approximating that of nonnoise exposed subjects. Such is not the case, however. Noise apparently has approximately the same deleterious effect at 10,000 to 14,000 cps as it has at 4,000 and 6,000 cps. This is apparent in the 15 to 20 db difference in thresholds at 10,000, 12,000, and 14,000 cps between the noise exposed and nonnoise exposed groups.

At 14,000 cps, the mean effect of noise exposure was 15 db, or 5 db less than at 12,000 cps. If this trend were to continue for frequencies above 14,000 cps, it is conceivable that the noise induced curve could either show a gradual rise or at least a leveling off to levels approximating those of nonnoise exposed subjects.

There seems to be, therefore, a deterioration of the high frequency receptors with age, and the burden of extra noise increases the wear. Not fully explained as yet is the reason for less deterioration appearing at 8,000 cps area than at 4,000 and 6,000 cps steps above it. In addition, were there in fact less noise trauma of frequencies above 14,000

cps, the mechanics of this, too, would need explanation.

Summary and Conclusions

Thresholds at 10,000, 12,000, and 14,000 cps of 61 noise exposed, and 39 nonnoise exposed men were compared. The 61 noise exposed subjects were selected from 110 audiograms on the basis of having characteristic dips at 4,000 or 6,000 cps bilaterally.

A two-way analysis of variance was performed for each frequency as to age effect, noise effect, and the interaction between the two.

The effect of noise was roughly the same at every age group. There seems to be additivity of noise effect and age effect.

At 8,000 and 10,000 cps the age effect between the second and fourth decades was not statistically significant. At 12,000 cps the age effect was significant at the 0.05 level (10 db for the decade after the 30's). At 14,000 cps the age effect was significant at the 0.01 level and the increase was roughly 8 db per decade.

The difference between noise exposed and non-noise exposed men was significant at every frequency at the 0.001 level and averaged roughly 19 db.

The shapes of the high frequency curves for both groups were approximately the same with the exception that thresholds of the exposed group were significantly poorer.

Noise apparently has a deleterious effect not only in the well-known areas of 4,000 and 6,000 cps but also in high frequency areas above 8,000 cps.

A MESSAGE TO MEDICAL OFFICERS REGARDING OCCUPATIONAL HEALTH

The Navy has a continuing need for the services of medical officers trained in the specialty of Occupational Health. The occupational health needs of a Navy and Marine Corps of over one million military personnel and 375,000 civilian employees represent a challenge to the Medical Corps and afford an opportunity for an interesting and rewarding career for those medical officers trained in this specialty. Individuals thus trained may look forward to varied assignments at Naval industrial establishments at levels of responsibility commensurate with their training and experience. Board certification requires two years of academic instruction leading to the Master of Public Health degree (or other degree depending on the institu-

tion) and a third year of in-plant residency training. Successful applicants may receive their training at any approved university providing such instruction.

Medical officers interested in receiving occupational health training should apply in accordance with BUMEDINST 1520.10C or write for further information to the Chief, Bureau of Medicine and Surgery (Code 73), Navy Department, Washington, D.C. 20390.

EDITOR'S SECTION

NAVAL MEDICAL SCHOOL'S GLOBAL MEDICINE PROGRAM

*Public Affairs Office, National Naval Medical Center,
Bethesda, Md. Naval Training Bull, Spring 1967.*

With the present global distribution of military personnel there have come many associated unique and rapidly increasing medical problems. To meet the need of preparing medical officers to cope with these, the Naval Medical School at the National Naval Medical Center has developed a Global Medicine Program.

Designed to provide medical department personnel with an orientation toward and instruction in military medicine, the Program was developed under CAPT John H. Stover, Jr., MC, USN, Commanding Officer of the Naval Medical School, who states, "The quality and extent of medical training today determines the characteristics of patient care tomorrow." Assisting in the Program's development was CAPT Julius M. Amberson, MC, USN (Ret), who returned to active duty from the retired list to work in this vital program. An internationally recognized authority in Tropical Medicine, CAPT Amberson has had over 25 years of active Naval service which has encompassed all major military areas of the world. His research activities have included diseases in endemic areas. In addition, CAPT Amberson has dealt with medical problems in both the Arctic and Antarctic.

In view of the current situation in Southeast Asia, training in tropical medicine and military medical problems are the topics requiring attention. An effective and expeditious training system is necessary.

To transmit critical, medical technical information to medical department personnel as efficiently as practicable is a major objective of the Global Medicine Program. To meet this objective, the several instructional routes are being exploited, so as to accommodate all personnel concerned. Where scheduling permits the transportation of personnel to the Naval Medical School, specialized curricula are developed and presented to meet their particular needs. For individual officers who can arrange for a period of study at the School, a "Global Medicine Resources Center" has been established. In cases where assignments preclude the possibility of extended study at the Naval Medical School, "packaged" courses of instruction making up the Global Medicine Synopsis Series are available.

Curricula

The curricula developed to meet the training requirements for particular military medical assignments consists of a variety of specialized courses. For example, Southeast Asia-bound MILPHAP (Military Provincial Hospital Assistance Program) teams receive a tailor-made curriculum consisting of a series of lectures designed to indoctrinate the students in such important topics as geography, geopolitics, and medical aspects of counterinsurgency. These teams are engaged in supplying badly needed medical services to civilians in Vietnam and assist in improving hospital plants, sanitary conditions and practices. Having just completed a tour of duty at the Quang Tri Provincial Hospital, located south of the Demilitarized Zone in Vietnam, LT Robert C. Butler, MSC, USN, of the Special Projects Training Division, Academic Department, is charged with the responsibility of designing such indoctrination courses within this phase of the Global Medicine Program.

Similar programs, adapted to their particular needs, have been prepared for special surgical teams for Vietnam as well as courses for medical personnel bound for Antarctica, and are presented annually.

Global Medicine Resources Center

Within the Global Medicine Resources Center, four self-instructional carrels have been established

which contain the latest in training aids. A compact 8mm cartridge-type rear screen projector is used for viewing single-concept teaching films. Video-taped lecture playbacks are available on a special tie-in from the Naval Medical School's Television Studio. The most up-to-date, slide-sound synchronization equipment is installed in each booth. Binocular compound microscopes are available for study of microslides. In addition, possibilities are being explored for obtaining access to computer facilities for the inclusion of Computer Assisted Instruction; patient location; and a computerized locator service to all photo, microscopic slide, and entomologic specimen collections at the Naval Medical School.

Besides the "hardware" available to the student, each booth contains many reference texts and brochures covering various aspects of operational medicine. Other references are also available within the Resources Center. If further research is desired, the Edward Rhodes Stitt Medical Library of the Naval Medical School is but a few steps away.

Effectiveness of any training program may be gauged by the quality of its instructional materials. In order to maintain highest quality in the Resources Center, a special staff is at work continuously. Headed by a Technical Informational Specialist in Medical Science (assisted by an Educational Specialist in visual aids), the staff provides a constant flow of professional and technical information into the Resources Center. They read, analyze, and search numerous sources; for example, formal scientific journals, audio-visual materials, and abstracts. They also consult the appropriate medical specialists when necessary. The object of their work is to acquire all pertinent data on a given topic under study. New findings are especially important, and will be included immediately in the instructional materials. In this way a great gap is to be bridged; namely, the time between uncovering new knowledge in medical research and its eventual application in the field.

Global Medicine Synopsis Series

Finally, there is the "Global Medicine Synopsis Series," a group of compact refresher courses presented in convenient package form. They are to be made available to all Naval Hospitals and Naval field medicine training schools for use in the training and indoctrination of doctors ordered to Southeast Asia. The series covers diseases indigenous to the tropics—unusual diseases not generally found stateside, such as schistosomiasis, dengue, relapsing fever, and amebiasis. Since the doctor is not likely to have encountered these diseases before, stress is placed on familiarization with symptomatology, diagnosis, and accepted treatment.

In addition, the first unit of the series deals with subjects which are new and very important to the young Navy doctor—problems he will encounter in a field hospital company or a collecting and clearing company. Casualty transport, medical logistics, field medical practice, and environment are all included.

Actual contents of a typical "package" consists of a kinescope recording and a loose-leaf book of instructional materials; in effect it is a self-contained "mini-library." A manuscript of the Kinescope recording is included. It is edited for oral presentation with accompanying slides, which are also furnished in the package. A wealth of other textual material is included, such as articles concerning World War II experience with the given disease, recent publications and bibliographical references. In short, the package makes available vital supporting material—almost the equivalent of a completed medical library research.

All Departments of the Naval Medical School are making an intense cooperative effort in developing the Global Medicine Synopsis Series into a unique and effective training program. Additionally, many experts from other Naval medical activities have contributed invaluable assistance to this program.

Support for the Program

Civilian experts have also contributed much to the program. Professional and technical consultants from universities and other government agencies have generously given much of their time and talent in compiling, composing, and counseling. Practicing physicians have permitted reprints of their research papers to be duplicated and included as supplementary instructional materials. In addition, interservice support for the program has been remarkable. Army, Air Force, and Marine Corps Officers have contributed time, energy, and materials from the backgrounds of their diverse training and experience.

All parts of the NAVMEDSCOL Global Medicine Program are geared to rapid and effective medical refresher training designed to meet rising world-wide commitments. Wherever our medical officers and corpsmen may be called upon to serve, not only in combat but in vital pacification programs as well, their skills will have been en-

hanced by participation in the Global Medicine Program.

CORRESPONDENCE COURSE AVAILABLE

The Medical Department Correspondence Course "Control of Communicable Diseases in Man," NavPers 10772–B, is now ready for distribution to eligible regular and reserve officer and enlisted personnel of the Armed Forces. The course is based on the text, "Control of Communicable Diseases in Man," 10th edition, 1965, published by the American Public Health Association. Applications for the course should be submitted on Form 992 (with appropriate change in the "To" line), and forwarded via appropriate official channels to the Commanding Officer, Naval Medical School, National Naval Medical Center, Bethesda, Maryland 20014.

This objective-question course is designed to acquaint the enrollee with information relative to control of disease. Each disease is discussed in detail and information provided on clinical and laboratory findings, etiological agent, source of infection, mode of transmission, incubation period, the period of communicability, susceptibility and resistance, and prevalence of the disease.

The course consists of six (6) assignments, to be submitted on a schedule of at least one per month. For retirement purposes, Naval Reserve personnel will be credited with twelve (12) points subsequent to satisfactory completion of the course; these points are creditable only to personnel eligible to receive them under current directives governing retirement of Naval Reserve personnel. This is a major revision and personnel who have completed NavPers 10772–A or NavPers 10772–A1 will receive additional point credit for completing this course.—Public Affairs Office, NNMC, Bethesda, Md.

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