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Special Autopsy Methods

By WILLIAM G. MACCALLUM

Issued from the Surgeon General's Office
for the Use of Army Officers.

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For the standardization of methods in the performance of autopsies in Base Hospitals the following suggestions are made :

Removal of the Brain:

Precautions must be taken to avoid the disfigurement of the corpse. Since removal of the calvarium is commonly performed for the investigation of cases in which meningitis is suspected it is important to make cultures from the meninges. If satisfactory cultures have been obtained from fluid removed by spinal puncture, the head and neck may be embalmed before any scalp incision is made, since after removal of the brain satisfactory embalming of the face is difficult, if not impossible. If, however, it is important that cultures should be made from the cerebral meninges the scalp incision may be made, the calvarium removed and a flap of dura mater raised so that cultures can be obtained, after which the scalp should be replaced and the embalming performed. Some leakage occurs, but not enough to make the proper embalming of the face impossible. When this is completed the brain is removed for study.

Certain elementary features of this whole procedure may be mentioned :

1. The incision through the scalp begins behind one ear and passes upward over the top of the head and down to a similar point behind the other ear. If after beginning, the point of the knife is pushed under the scalp and the incision made with the edge turned outward the hair will not be cut, and will serve to cover the suture. The disastrous effect of making an incision round the head, across the forehead need not be mentioned.

2. When the scalp is loosened and pulled forward over the face and back over the occiput the skull is sawed through all around and the calvarium pulled off. The appearance of the forehead is better preserved if the saw incision passes across above the hair line and slants downward to meet the horizontal

saw cut from the occipital region at an obtuse angle. It is much more difficult to remove the brain through such an opening. The remnants of the temporal muscle should be preserved, because by sewing through them on each side the calvarium can be replaced accurately and held in place. Some substance which will absorb any excess of fluid and restore to some extent the weight of the head should be put into the cranial cavity.

3. The scalp is most carefully sutured after replacing the calvarium, and the hair made to cover the suture as much as possible. The embalmed scalp must be moulded carefully over the skull.

Removal of the Organs of the Neck:

Again since embalming of the face is impossible after the blood vessels of the neck are cut, the embalming must be performed first.* This is readily done by the undertaker when the chest is open, but in his absence may be done very easily by anyone else. The undertaker's embalming fluids should be used if available; if not, an 8-10 per cent solution of formalin in water, to which a few drops of eosin solution are added to give it the faintest possible tinge of pink, is injected through the aorta with an alpha enema syringe. Of course the open end of the aorta as well as any leaking arteries (internal mammaries) must be closed with clamps. It is most convenient to tie the nozzle of the syringe into the descending aorta below the arch. As the fluid is pumped into the arteries and begins to drive blood before it out of the veins, the face and ears must be massaged and moulded with a gauze sponge into a natural pose, with eyes and lips closed. When the tissues become blanched and firm the process is complete.

The actual removal of the organs of the neck may then be undertaken and is bound up with the making of the primary incision.

* If shaving is necessary, it must be done before the face is embalmed.

The Primary Incision:

Ordinarily the incision runs from the supra-sternal notch to the pubes in a single straight line, but after such an incision it requires considerable dexterity to remove the organs of the neck without mangling the pharynx or nicking the skin.

This task is rendered easy and the final appearance of the body more presentable if a different incision is made. This can be rendered plain by a drawing. (Fig. 1.) The median incision extends from about the middle of the sternum to the pubes. Across it at its upper point runs a transverse incision which curves up on each side to the anterior fold of the axilla and even down a short way on the upper arm. By dissection the whole skin of the upper part of the thorax and the neck can be thrown up like an apron over the face, exposing the whole lower edge of the lower jaw. Then the organs of the neck and the pharynx can be most easily dissected out.

When the flap is replaced the space left by the removal of the larynx and trachea must be filled with some substance and the neck moulded into a natural form. When this is done no evidence of an incision is visible in the clothed corpse.

The Lungs and Pleural Cavities:

Since diseases of the respiratory organs loom so large in the present war certain suggestions may be made as to their study.

A separate and detailed note should be made of the condition of each pleural cavity, starting with the left, and cultures should be made from the pleural exudate.

All possible care should be exerted not to tear the lung in removal. As a routine procedure the left lung should be removed and described first. When the lung has been removed to the small wooden table which stands on the autopsy table, cultures are made from the most obviously affected area. The pleural surface is seared with an old table knife heated in a Bunsen flame. A pair of toothed forceps and a pair of sharp-pointed scissors have been wrapped separately in paper and

sterilized in the hot-air oven. These are unwrapped with precautions and the central point of the seared area grasped so that a pyramid or cone of tissue can be cut out, with the scissors going quite deep. This is transferred to a sterile petri dish and the culture later made from the tip of the cone of tissue which has not been heated. It may be touched once to the surface of a blood agar plate, and the material thus left on the medium spread over the surface with a platinum loop or a sterile swab.

Since with the occurrence of interstitial broncho-pneumonia with empyema, extensive collapse of the lung is extremely common it becomes difficult to see clearly the areas of consolidation in the atelectatic or airless tissue. There are therefore great advantages in blowing up the lung with air which distends the bluish collapsed lung, reddens the blood in its capillaries and makes the consolidated area stand out most conspicuously. It has the disadvantage that for microscopical purposes the condition of atelectasis is done away with, but it is easy to excise a small piece for the study of this condition, or it may be desirable to insufflate only one lung or only one lobe. From the point of view of the microscopical study, however, the distension of the lung with air makes it perfectly easy to understand the condition of the tissue, while it is very difficult to disentangle all the changes in a section of the collapsed lung. It may also be objected that the contents of the bronchi can be forced along into the alveoli. The distension may be effected with a bulb with valves, such as is furnished with an atomizer, or with the enema syringe or with a bicycle pump with a canula tied into the bronchus.

When the lung is sufficiently distended it should be laid on the small table with the main bronchus down and cut through from apex to base, with a long knife, with one sweeping stroke in the direction shown in the drawing (Fig. 2), so that the knife splits the main bronchus longitudinally. Then while the lung is still held together in the same position another perfectly parallel cut is made about an inch or slightly less away from the first one. This will furnish a representative

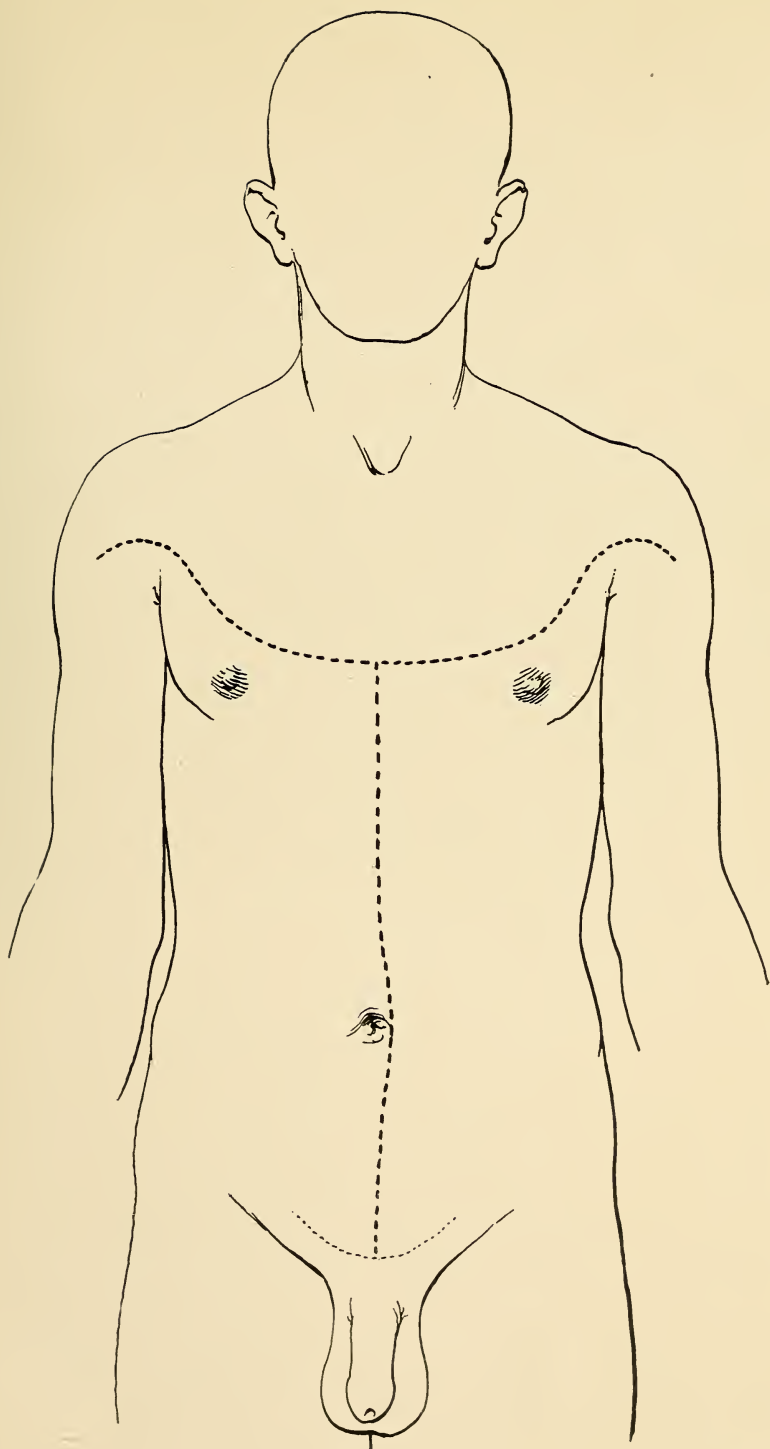
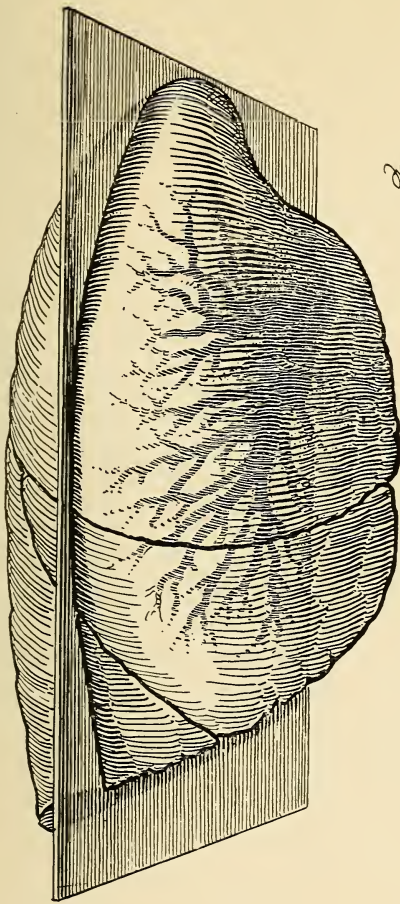


Fig. 1



Max Brödel
1915.

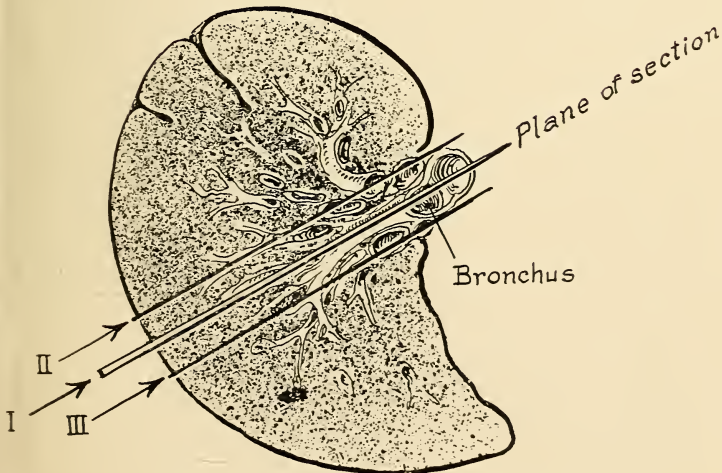
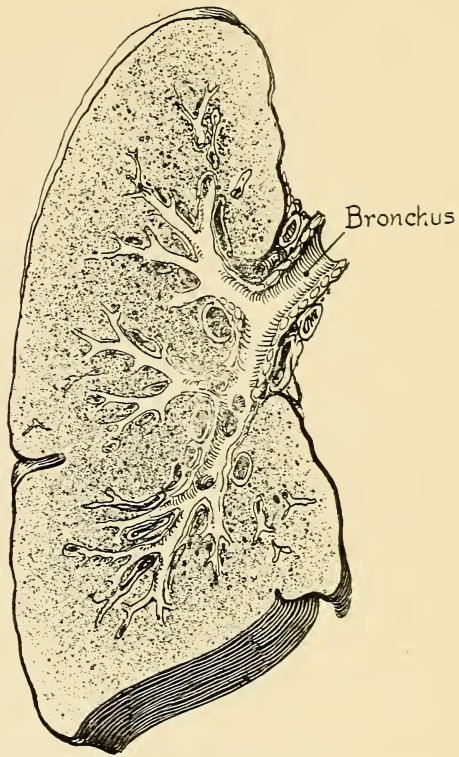


Fig. 2

median slice to serve as a museum specimen. If two such museum specimens are desired, another or third incision is made parallel with the first and just as far on the other side of it. If two specimens are not needed, the third incision should be made much nearer the first so as to produce a slice from top to bottom of the lung about $\frac{3}{8}$ of an inch or 1 cm. in thickness. This is for microscopical study and is most useful when cut in a complete slice through the lung so that large sections may be made for study of the topography of the lesions. All these incisions must be made while the lung is held together in the original position and are possible only when a long and very sharp knife is used and carried through with a drawing stroke without undue pressure. The slices should be tagged with the number of the autopsy and marked also right or left. The most satisfactory tags are made from white sheet celluloid cut in small pieces and punched with a card punch. The numbers should be written in lead pencil. (Such tags will dissolve in strong alcohol or chloroform.) They should be sewed to the tissue and the thread tied. Tags of hard linen paper marked with lead pencil will answer, but soften and tear after long immersion in watery fluids.

The thicker slice should be washed off and preserved by the method of Kaiserling or one of its modifications as described in the circular from the Army Medical Museum, or since the materials for the solutions intended to preserve the natural colors are not always available, it is fairly satisfactory to place the specimen in 10 per cent formalin for two days and then preserve in 50 per cent alcohol.*

This specimen should be forwarded with all possible clinical and bacteriological data and the protocol of the autopsy to the Army Medical Museum, Washington.

*The method of preservation advised by Klotz has great advantages in that specimens may be placed in a single fluid and shipped without further treatment after which the colors may be restored on arriving at their destination.

The first fluid which must be used in rather large quantities and freshly made up for each batch of specimens is as appears in the following directions:

The *thin* slice (which, if two median thick slices are preserved, may be cut from the remaining lung just beyond them) should be laid flat in Zenker's fluid in an enamel pan. It is important that the pan should be large enough to allow the slice to lie flat. Since such a slice usually floats, it should be turned over once or twice and left in the fluid 24 hours. (Instead of the 5 cc. of glacial acetic acid usually added to 95 cc. of Zenker's fluid, add 5 cc. of pure formalin just before using.) The tissue is then washed in running water for 48 hours and preserved in 50 per cent alcohol. Such a slice representing as nearly as possible the whole lung should be sent (carefully tagged) to the Army Medical Museum in Washington.

It is obvious that in order that a permanent and representative collection may be made which will allow of comparison of the respiratory diseases in all the Army camps, it is very desirable that medical officers should comply with this request and attend especially to the preservation and labelling of specimens and the forwarding of the corresponding data.

1. Fix from three to five days according to the size of the specimen in

Klotz 1:

Carlsbad salts	375 gm.
Chloral hydrate	375 gm.
Formalin	375 cc.
Water	15 liters

Transferring to fresh solution if necessary during period of fixation.

Then wash two to three hours in running water and transfer to the following for permanent mounting fluid:

Klotz 11:

Carlsbad salts	375 gm.
Chloral hydrate	150 gm.
Formalin	75 cc.
Water	15 liters

Formula for Carlsbad Salts:

	20 times.
Potassium sulphate	40 gm.
Sodium chloride	360 gm.
Sodium bicarbonate	720 gm.
Sodium sulphate	880 gm.

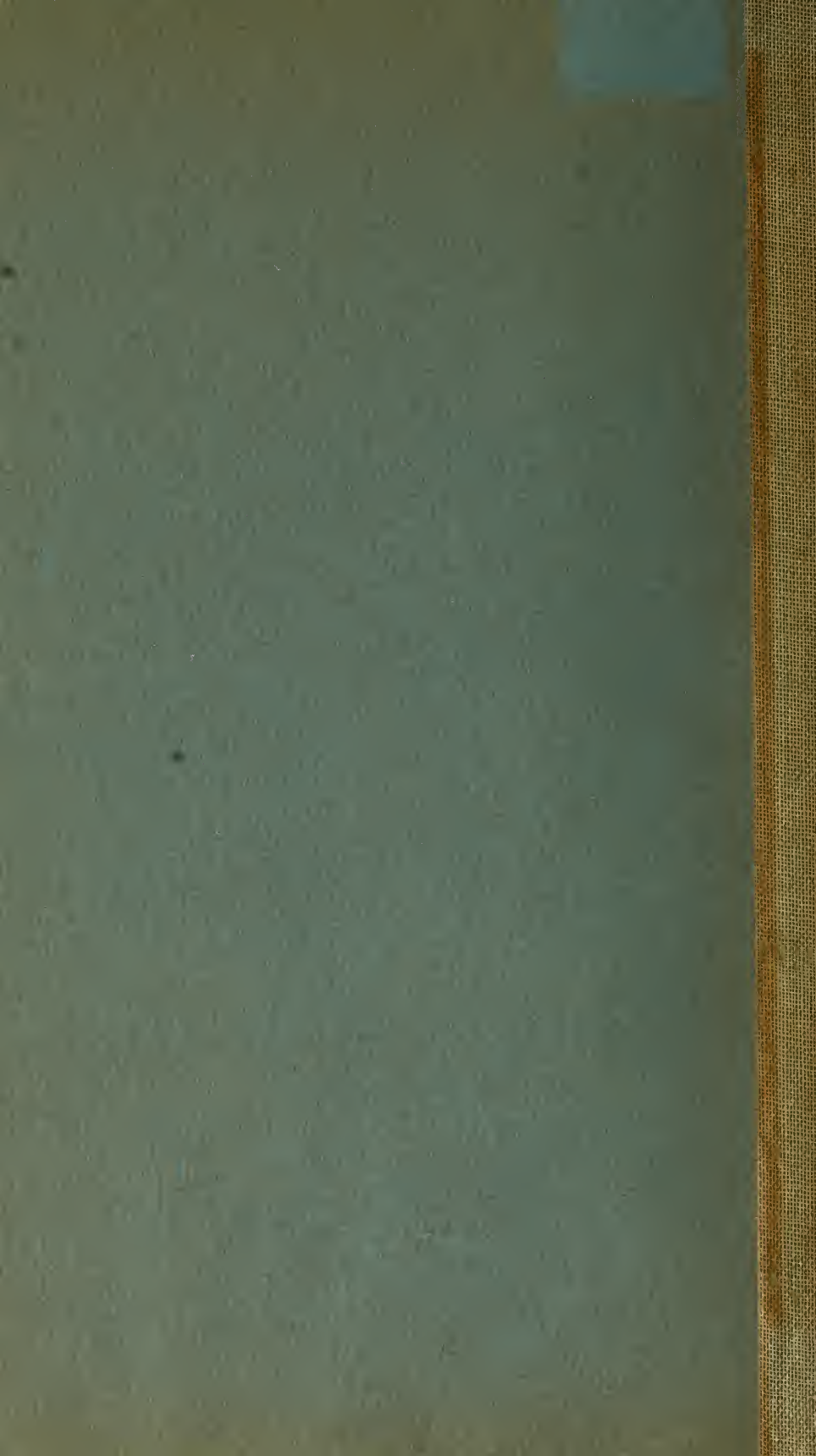
Materials of this sort may be forwarded to the Army Medical Museum from any camp through the quartermaster's department.

Boxes of tin or galvanized iron measuring 9 x 9 x 12 inches should be made by the tinsmith so that the top may be soldered on. It is preferable that the Zenker's fluid specimens should be forwarded in a separate can since they tend to stain the other specimens unless they have been very well washed. The cans should be enclosed in a wooden box for shipment.

The same method should be employed for the preservation of other organs when they present lesions of interest, and in any case thin slices of each should be fixed for microscopical study. All these pieces of tissue from one autopsy may be tied up with a tag in a piece of gauze after the fixation and washing is complete.

Pieces of intestine presenting lesions may be preserved as museum specimens by being pinned out on a board with thumb tacks with the mucosa exposed and floated face downward on the fixing fluid. The preservation of more complicated intestinal lesions must be left to the ingenuity of each worker. In general, slices of solid organs such as the liver or spleen, or half of one kidney, make the best museum specimens. In all cases the cut surface should be smooth and washed free of adhering blood before fixation. As to the preservation of the heart one will not go astray in opening the organ if the course of the blood is followed with knife or scissors.

Once more, it should be emphasized that after the organs are removed the body must be sewed up carefully and all blood stains removed before it is handed over to the undertaker. While it is the business of the undertaker to make the body presentable, it is the duty of the pathologist to see that no body is allowed to leave the autopsy room except in a presentable condition, and he will be held personally accountable for it.



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