

GUNSHOT WOUNDS OF THE CHEST

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At the beginning of the war, the expectant principle of treating chest wounds was followed for small through-and-through punctured wounds produced by rifle or machine-gun bullets. This did very well, but a more active plan was essential for the so-called "stove-in chest" with retained foreign bodies, wounds, for the most part, produced by high explosive shell fragments. Active treatment of chest wounds was started by the English and French surgeons in 1916, following the battle of the Somme, and consisted in the excision of the wound, complete cleansing of the pleural cavity, removal of the foreign body, when possible, and primary suture. From the similarity of lung and pleura wounds to other wounds of war, it will readily be seen that the same surgical treatment should apply.

In a series of gunshot wounds classified according to the anatomical region involved, our records show that wounds of the thorax (139) constituted 8.6 per cent. Of these 118 involved the chest wall. Twenty-one were intrathoracic wounds. There were no wounds of the heart seen. Penetrating wounds of the lung and pleura (21) composed 17 per cent. of our gunshot wounds of the chest.

The cases that reached this hospital had already received treatment, and the work here consisted principally in having all chest cases X-rayed and in watching them carefully for complications. As soon as a case came into the hospital, cultures were taken from the surface of the wound and from the wound cavity. The subsequent treatment depended upon the clinical and laboratory reports. The X-rays taken at the front did not always coincide with those obtained at the base. Fluid from the pleural cavity was subjected to microscopic and bacteriologic examination. At times the only guide to infection was the temperature and pulse.

There was a certain number of cases showing severe injuries to the chest wall, and this type required careful X-ray examination to determine the presence of foreign bodies.

In these cases in which there had been penetration of the lung substance with retention of the foreign body, an interesting series of cases developed. These cases bring up the question of what final disposition is made of the retained foreign body in the lung. The general opinion seems to be that a retained foreign body wherever situated will sooner or later give rise to trouble. It is possible for a foreign body in the lung

to become encapsulated, it may be a nidus of infection or it may eventually project itself into the pleural cavity. There are cases reported in which the foreign body was coughed up with a spontaneous cure. Early removal is the best plan, however, when possible. If not removed early and an empyema develops, it cannot then be removed with safety, unless easily accessible, until a later period.

A case illustrating this is shown in a German prisoner of war received at this hospital on October 15, 1918. He was wounded October 9, at 8 A.M., and was dressed after his capture on the field two hours later. He was removed in an ambulance, but the car was wrecked by shell fire and the patient crawled into a dugout. He received no attention for three days, and was without food for this time. He was admitted to this hospital on the 15th, and as we had no X-ray equipment at the time no picture was taken. The operation consisted in the removal of the broken ribs and bone fragments with the evacuation of large quantities of pus from the pleural cavity. Rubber-tube drainage was inserted. Cultures of the fluid showed staphylococcus, Gram-positive and Gram-negative cocci. Later an X-ray of his chest was obtained which showed a foreign body $2\frac{1}{4}$ by 1 cm. Following the operation the patient continued to improve with a gain in weight. The empyema ran the usual course and he was later discharged from the hospital. No attempts were made to remove the foreign body. The above case shows the extraordinary resistance the lung has to a foreign body.

Another instance of retained foreign body in the lung was seen in the case of Sergeant C. W. of the 326th Infantry, aged twenty-two years, who received multiple gunshot wounds of the right forearm, thigh, and top of shoulder. It was through the latter that the missile penetrated the chest. This patient was wounded October 14, 1918, in the Argonne, at 8 P.M. At 8.30 he jumped on a moving ambulance and was taken to Field Hospital 328. He remained two hours and was taken to Evacuation Hospital 11. October 15 an operation was performed on the arm and thigh under local anæsthesia. A foreign body was removed from the thigh. X-ray demonstrated a foreign body in the chest. The patient coughed up blood.

He was admitted to Base Hospital 61 October 16, 1918. The X-ray showed a foreign body which moved with respiration in upper right chest. The foreign body had entered the chest through the wound on the top of the right shoulder between the outer end of the right clavicle and the spine of the scapula. He showed the physical signs of a thickened pleura, from the fifth space to the base anteriorly, and the angle of the scapula to the base posteriorly.

This patient also had a partial paralysis of the ulnar and radial nerves, but showed improvement. The wounds healed.

Upon discharge physical examination of the chest was negative. Total expansion was $2\frac{1}{4}$ inches, right side 1 inch, and left side $1\frac{1}{4}$ inches. Heart action at rest was 86, after exercise, 120. Absence of complications in this case is noteworthy.

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There are two definite groups of late symptoms in cases of retained foreign bodies of which these cases complain; those having a physical basis and those in which the symptoms are largely nervous. In that class showing nervous symptoms the presence of the foreign body appears at times to cause a certain amount of mental anxiety. The question of operation in these cases for the removal of a foreign body is a difficult one to settle. We must remember that these cases have recovered from a severe injury, and that a thoracic operation can not be considered lightly. In certain selected cases in which the symptoms are very pronounced, and localization shows that the foreign body is easily accessible, a secondary operation is justifiable.

There is a group of hæmothorax cases, for the most part through-and-through wounds, which entered the hospital. These cases were carefully screened and rayed and if infected were drained. The following will illustrate a case in which aspiration sufficed to effect a cure.

M. B., private, Co. R, 165th Infantry, received a through-and-through bullet wound of the right chest. He was wounded in the Argonne on October 13, 1918. He was in the field for an hour and crawled behind a bank at the roadside. He remained there for several hours and then walked three kilometres until picked up by an ambulance. He was driven about six kilometres to a field hospital where he received an injection of anti-tetanic serum. Several hours later he was removed to Evacuation Hospital 16, where he arrived at 2 A.M., October 14. Here he was fluoroscoped and no fluid or foreign body demonstrated. En route to the evacuation hospital he coughed up blood. On October 16 he arrived at Base Hospital 61, and examination revealed a healed wound of entrance in the mid-clavicular line $1\frac{1}{2}$ inches above and somewhat internal to the nipple. A wound of exit was found $2\frac{1}{2}$ inches to the outer side and below the angle of the right scapula. Vocal fremitus was decreased posteriorly on the right side and there was dullness over the same area. Breath and voice sounds were decreased below the angle of the scapula behind. Total expansion was $1\frac{1}{2}$ inches, right $\frac{1}{2}$ inch and left 1 inch. An X-ray picture indicated fluid to the level of the third rib in the axillary line. On aspiration 900 c.c. of bloody fluid was obtained. Culture of this fluid showed Gram-positive diplococci. Another picture, taken November 29, still showed a small amount of fluid at the base of the right chest. On November 3 and 4 the temperature reached 101.4° . At all other times it had been normal. This soldier was later returned to the United States.

As is to be expected, pneumonia and empyema are frequent occurrences. The latter may be the usual post-pneumonic type, or the mode of origin may be directly traced to the infection by the foreign body. It must not be forgotten that an otherwise uninfected hæmothorax may be easily converted into an empyema, either from insertion of a dirty aspirating needle into the chest, or if the needle punctures the lung in an infected

area the chest fluid may become infected upon the withdrawal of the needle. Pathogenesis in these cases may be impossible to determine. This is true of the following case:

Private, Co. D, 167th Infantry, aged twenty-four years. Diagnosis: Perforating wound of the right chest. Fracture of the superior angle of the scapula, fracture of the fourth, fifth, sixth, seventh, eighth, and ninth ribs. The patient was wounded on October 14, 1918, and passed through Evacuation Hospital 11 two days later. The wound of entrance was in the right shoulder. He suffered from shock and hæmoptysis. The right chest was aspirated and a pint and a half of bloody fluid removed. Three days later a quart was withdrawn. On October 22 he was admitted to Base Hospital 61. On admission he complained of dyspnœa and thoracic pain. His temperature was 103°. An exploratory puncture was at once made and no fluid was obtained. Examination of the chest showed definite signs of broncho-pneumonia. On October 24 an X-ray showed the right chest markedly opaque. A machine-gun bullet was located in the left side of the chest, on the level with the first lumbar vertebra and a small foreign body in the right chest. The following day 20 c.c. of sanguinous pus was removed. The aspirations were continued daily until November 1, when a portion of the ninth rib was excised under local anæsthesia and drainage secured with two rubber tubes. A week later special Carrel tubes were placed in the wounds and the right chest was irrigated with Dakin's solution. Smears taken showed Gram-negative diplococci, staphylococci, and streptococci. Under this treatment his general condition improved with a fall in temperature. The patient did not take the irrigations well and they were subsequently discontinued. This was probably due to a communication with a bronchus, as he coughed considerably, which was thought to be due to the chlorine vapor. On December 9 an X-ray plate showed the foreign bodies and an abscess cavity on the right side surrounding the small foreign body. During this time the patient was in such poor condition that it was doubtful whether he would recover. Physical examination showed a machine-gun bullet under the skin on the left side, between the eleventh and twelfth ribs, about 5½ inches from the spine. The patient ran the usual course of an empyema, the machine-gun bullet was removed, the operative wound closed, and the patient subsequently evacuated to the United States.

Small localized empyemas are very likely to be overlooked. Repeated X-ray and physical examinations are necessary to detect them. Sinuses are sometimes misleading, as they are not always connected with a demonstrable foreign body, being at times due to imperfect obliteration of a cavity.

A case of mixed infection, bilateral broncho-pneumonia, following a penetrating gunshot wound of the right chest with subsequent empyema, was seen in the case of Private V. A., Co. G, 166th Infantry, aged twenty-three years. He was wounded October 14, 1918,

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and admitted to Evacuation Hospital 10 two and a half hours later. On fluoroscopic examination a foreign body (character not mentioned) was located between the ribs. The chest cavity was not entered. Débridement and removal of the foreign body $\frac{1}{4}$ cm. long (probably shell fragment) was done. He was admitted to Base hospital 61 October 16, 1918. There was a wound on the right chest between the seventh and eighth ribs anterior to the axillary line. A bilateral broncho-pneumonia developed. The sputum showed Type 2 Pneumococcus. The heart was pushed to the left. Definite signs of fluid. On November 2, 1800 c.c. of cloudy fluid was withdrawn from the right chest. This, upon examination, showed Gram-positive streptococcus and diplococcus.

On November 4, 300 c.c. of fluid was again aspirated from the right chest. On November 16 excision of one inch of the eighth rib in the right posterior axillary line was made, and the chest drained. The temperature was subsequently within normal limits. Upon discharge expansion of the right lung was good. Percussion note was somewhat impaired in the lower chest. This patient was sent to the United States.

Pneumothorax of varying degrees is seen as such, but more frequently associated with hæmo- or pyo-thorax. A marked degree of subcutaneous emphysema is rare, but may result, as was noted in the following soldier:

Sergeant W. M. C., 61st Infantry, M. G. Co., was admitted to our hospital November 14. He had a penetrating wound of the chest produced by a machine-gun bullet. This patient was wounded November 6, and passed through Field Hospital 25 and Mobile Hospital 8. There a machine-gun bullet was located in the muscles of the back and removed. Débridement of the anterior and posterior wounds, with primary closure of both pleura and skin, was done. The day following he developed an extensive subcutaneous emphysema from head to lower abdomen. On November 14, the date of admission to this hospital, he showed, upon examination, two sutured wounds in the chest. One was on the right side below the clavicle and the other at the lower angle of the scapula posteriorly. The sutures were removed and a large amount of pus removed from the posterior wound and a small amount from the anterior. There was a subcutaneous emphysema of chest and abdomen. The scrotum was distended with air to the size of a foetal head. Radiographic findings showed a fracture of the second rib with evidence of thickened pleura. The patient's condition gradually improved so that on December 2 he had only a slight cough and the wounds were healing with slight discharge. On December 8 his sputum was tinged with blood and he complained of pains in the upper right chest. Physical examination showed an area of cavernous breathing in the right mammary region near the sternum, but three days later this had disappeared, leaving a few râles at the bases. At no time did the temperature rise above 100.8°. The average temperature was 99.4°. On

December 16 the breathing and expansion of the right chest was good with slight increased sounds over the lower chest. The patient was transferred to the United States a few days later, perfectly well.

In the series of penetrating gunshot wounds of the lung and pleura there were five deaths. The mortality was about 23 per cent. The autopsy protocols of these cases are appended.

The preceding record presents two main points for discussion, (1) the treatment of retained intrathoracic foreign bodies, (2) hæmothorax. In general the proper procedure to apply in the first is governed by the principles which apply to foreign bodies retained elsewhere in the body, *i.e.*, if they are the cause of symptoms they should be removed.

As regards the treatment of the second condition, if infected, these cases should be opened and drained as in empyema.

Combier and Hertz practiced extraction of missiles only in cases that seemed likely to be poorly tolerated or especially likely to reinfect the wound. They were influenced by the fact that the removal of intrapulmonary projectiles was less grave in its consequences when the inflammatory process had subsided. Although they rarely practiced primary extraction in cases of infected pleuræ, yet they were forced to undertake it in five cases. In five other cases the projectile was removed in the course of thoracotomy for pleural suppuration. In searching for foreign bodies the rib-spreader of Tuffier helps greatly.

Pehu and Daguet, in a paper upon the late results of gunshot wounds of the chest, found that 27 of 146 cases under examination were bearers of intrathoracic projectiles. These were apparently well tolerated and around them could be seen no modification of the radioscopic image. These writers believe that the clinical signs are of much less importance than those signs revealed by X-ray examination.

Olivier, in a study of thirty cases of gunshot wounds of the chest in which projectiles were retained in the lung, subjected fifteen to operation. The small size of the foreign body and the absence of symptoms contra-indicated intervention in some cases. In others patients refused to subject themselves to operation, believing that they were doing sufficiently well. Of the fifteen who accepted operation, some did so because of the anxiety which the projectiles, imbedded in their chests, seemed to cause. Two of Olivier's cases are worthy of note. In one hemorrhages were brought on by a slight effort. In another, in addition to repeated severe hemorrhages, there was a constant expectoration of foul pus. In both the general health was seriously affected. The first case was subjected to operation with cessation of the hæmoptysis. The second case declined operation.

One may often be surprised in operating upon these cases at the very slight extent of the pulmonary lesions. A varying degree of adhesions are usually present. The projectile is very frequently surrounded by a thin sack, well limited, and immediately outside this the area of pulmonary tissue becomes healthy. On the other hand, a condition quite different may be encountered if the foreign body is the cause of symp-

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toms. There may be an intense local reaction, the sack being less clearly limited. Sometimes an abscess is found surrounding the foreign body.

A retained projectile may easily become the cause of abscess of the lung or pulmonary gangrene.

The history of surgery of the lung has been dominated by the fear of pneumothorax. That little danger attaches to this has been demonstrated by the experience of Duval and others, who, in their search for projectiles, have performed wide thoracotomy.

When a sufficiently long period has elapsed between the infection of the wound and operation, mortality will be slight. Thus, Marion, in one hundred and fifty cases, had but one death. The final results apparently warrant its practice in those cases in which projectiles produced symptoms of pulmonary reaction, hemorrhages, and purulent expectoration. Cases which have been operated upon and examined five months later presented a functional condition identical with, or less satisfactory than, that which had preceded operation, excepting in those cases in which hæmoptysis and purulent expectoration had been present.

Colonel G. E. Gask, D. S. O., Consulting Surgeon to the British Expeditionary Forces in France, agrees that all large missiles (by this is meant a shell fragment about 1 by $\frac{1}{2}$ inch) should be removed at an early date, namely, during the first two or three days after injury.

According to Duval, the mortality of wounds of the lung from portions of the shell with retention of the missile is 28 per cent. Duval was an early advocate, beginning with personal experiences following the battle of the Somme in 1916, of treating all wounds of the lung by excision of the wound, complete cleansing of the pleural cavity, excision of the parietal wound, and primary suture of the chest. He is of the belief that every wound of the lung which, on fluoroscopic examination, shows a large intrapulmonary hæmatoma should be operated upon, because it almost invariably becomes infected. According to his latest statistics for operations not urgent he has operated upon but eighteen cases out of one hundred and eighteen. He considers the favorable time for operation on the lung as soon as possible after the injury, and after thirty hours it is, as a rule, not advisable to perform any operation.

Prior to 1916, in a series of three thousand cases, excluding a large number of deaths which occurred in the very advance posts and in base hospitals, the general mortality in evacuation hospitals and advanced dressing stations reached 30 per cent. The predominating causes of death were hemorrhage, mechanical disturbances of respiration from open thorax and, above all, infection of the lung and pleura.

The serious complication of chest wounds, then, is infection of the pleural cavity. These wounds are contaminated with the same germs that infect other war wounds. A very rapid traumatic gangrenous pleurisy, which kills in forty-eight to seventy-two hours, is probably due to organisms carried by the projectile itself. It must not be forgotten,

however, that streptococci, as well as those organisms which are the normal inhabitants of the bronchial tree, are also present.

If a foreign body is present in the chest the surgeon himself should verify localization. This is more important in the parietes than in the lung. It is desirable to know the presence and extent of adhesions. Major G. Grey Turner, R. A. M. C., employed a simple plan which has proved useful. A straight needle 3 inches long is thrust into the lung and its excursion noted. If there are no adhesions present the needle follows an up and down course a distance of $\frac{1}{2}$ to 1 inch with each respiration. Depending upon the extent of adhesions the excursion of the needle will be seen to be absent or much limited. Turner advises operation in penetrating wounds with retained foreign bodies in the pleura or lung, if there are definite irritative symptoms leading to disability or continued discomfort, and in those cases in which the removal of the foreign body would rid the patient of anxiety preying detrimentally upon his mind. He hesitates to operate when localization shows the foreign body in or near the hilus.

As regards the treatment of hæmothorax, we should content ourselves with aspirating as completely as possible and make every effort to detect early signs of infection at the earliest possible moment by repeated bacteriologic examination. Infection having developed, the chest should be emptied of all blood and clots by excision of an inch of rib and insertion of a tube. It is believed to be better surgery if operation is performed within a few days after injury to do a wide thoracotomy, cleanse the pleural cavity, and close the chest, keeping the pleural cavity subsequently dry, if necessary, by repeated aspiration. In this way the chest may remain closed, the lung is allowed to expand, and respiratory distress is lessened. If, however, the infection persists, the wound may be reopened and the tube inserted. We may summarize the indications for operation in gunshot wounds of the chest as follows:

1. Foreign bodies in the parietes, with or without sinuses.
2. Foreign bodies in the lung, irrespective of size, if associated with persistent cough, hemorrhage, or suppuration.
3. Large foreign bodies in the lung, even if the symptoms are purely nervous.
4. All foreign bodies in the pleura, with or without empyema.
5. All cases of infected hæmothorax.
6. All cases of through-and-through wounds with shrinking of the side, lessened lung expansion, and interference with movements of the diaphragm in which treatment by exercise, et cætera, has failed.

AUTOPSY RECORDS OF GUNSHOT WOUNDS OF THE CHEST

CASE I.—Private P. P., No. 2981368, Co. M, 7th Infantry, aged twenty-three years.

Wounded October 11, 1918. Multiple gunshot wounds. Extensive pneumothorax of the right chest with emphysema of the sub-

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cutaneous tissues. Disappearance of liver dullness. Apex beat two fingers to left of nipple line. Aspiration of pleural cavity showed a large quantity of foul-smelling yellow fluid and defibrinated blood. Death. Autopsy.

The wound of entrance was about two inches below the clavicle, slightly outside the nipple line, between the first and second ribs. The bullet had fractured the second rib, passed through the upper and middle lobe of the lung, passed downwards and backwards, leaving the thorax in the mid-axillary line. It fractured the eighth and ninth ribs and, passing through the skin between the tenth and eleventh ribs, it reentered the buttock slightly posterior to the anterior superior spine of the ilium. Empyema of the right thorax. Traumatic diaphragmatic hernia containing 6 to 8 inches of the proximal end of the transverse colon. Pericarditis by extension. Slight laceration of the liver. Collapse of the right lung.

Postmortem examination showed an under-nourished individual. On opening the abdomen the hepatic angle of the colon could not be located and was later shown to have become herniated through the diaphragm. The pleural cavity contained about 200 c.c. of yellow-green, putrid pus. The right lung was collapsed and on section contained no air. It was covered with a thick, greenish-gray exudate. The bullet had traversed the anterior part of the upper lobe. The posterior surface of the right lower lobe had been slightly lacerated by spicules of bone from the rib. About 8 inches of colon were found in the right thorax, protruding through a rent in the diaphragm.

Upon opening the pericardium there was a slight increase in the amount of fluid and a fibrinous deposit on the mesial side of the parietal pericardium. This had extended from the pleura. The stomach and intestines were normally placed with the exception of the hepatic flexure of the colon, as noted above. There apparently had been no obstruction of the bowels.

The upper part of the right lobe of the liver had been slightly injured by the passage of the bullet through the diaphragm. The gall-bladder, genito-urinary system, pancreas, thyroid, adrenals, and brain were normal.

CASE II.—Private J. V. H., No. 1757896, Co. D, 312th Infantry, aged twenty-five years.

Wounded October 18, 1918, when he received a gunshot wound which penetrated the left lung. He entered Base Hospital 61 October 19. The wound of entrance was above the spine of the scapula posteriorly, and the wound of exit in the second interspace in the mid-clavical line. Râles were heard over the left lobe, posteriorly. Pneumothorax. Dullness over the right lower lobe. Fluid in the right pleural cavity. Symptoms of meningitis. Death. Autopsy.

Anatomical diagnosis: Acute purulent meningitis due to Gram-negative diplococcus. Fracture of the first and second ribs, penetrating bullet wound of the right chest. Subscapular abscess connected with a localized empyema at the apex of the right pleural

cavity. Hæmothorax. Atelectasis of the right lower lobe. Sub-acute parenchymatous nephritis. Chronic endocarditis of the mitral valve, with stenosis. Acute cholecystitis.

The right lung was very firmly adherent to the base. There was a large, bulging mass at the apex, about the size of a man's fist. The lung was firmly adherent to this. This mass was opened and was found to be filled with pus. The left lung was free and no fluid was present. The bronchi were intensely congested and contained some pus. On section, the right upper lobe of the lung contained many consolidated lobules. This appeared to originate by extension from above. Right lower lobe was very small and collapsed and contained no air. The left lung contained air throughout. The mediastinum contained large, swollen lymph-glands and showed considerable œdema.

Circulatory system. The valves were free and soft except the mitral, which showed a distinct vegetation, causing stenosis. There were yellow, elevated nodules on the aorta around the openings of the intercostal vessels.

On section the kidney capsule stripped with considerable difficulty. The surface was torn. They cut less easily than normal, apparently due to an increase in connective tissue. There was a considerable plastic exudate around the gall-bladder. It was adherent to the duodenum. The pancreas, the adrenals, the liver, thyroid and the bones and the gastro-intestinal systems were normal.

Upon examination of the brain there was a slight exudate along the course of all the vessels, especially in the Sylvian fissure and on the inferior portion of the cerebellum.

The course of the bullet was traced from the supraspinous fossa on the right side of the posterior chest, passing through the chest wall and fracturing the first and second ribs on the left side. There was a marked infection along the course of this tract. The large pus pocket at the apex of the right lung was connected with another large pus pocket in front of the right scapula. Infection had extended to the periosteum of the spinal column and apparently affected the central nervous system by direct extension.

Bacteriology: Cultures from the heart blood showed no growth. From the abscess at the apex of the lung streptococcus and pneumococcus. Smears from the brain showed a Gram-negative diplococcus.

CASE III.—Private E. B. C., Co. I, 308th Infantry, aged twenty-four years.

Lacerated gunshot wound of the right chest. Empyema. Collapse of the right lung. Infraction of the spleen. Death. Autopsy.

Admitted to Base Hospital 61 October 7, 1918. Wound of the right chest penetrating at the fifth interspace in the anterior axillary line.

This extended from the nipple to the costal margin. A counter opening was seen at the eighth interspace in the posterior axillary line.

Much mucus in the left bronchus. The right lung had collapsed

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completely and was firmly adherent to the diaphragm and mediastinum. This was firm and contained no air and was beef-red in appearance. The pleural cavities were covered with a thick, yellow, fibrinous exudate. There was a large communication with the exterior, admitting two fingers easily through the fourth and fifth interspaces. The fifth rib had been broken and partly removed. The bullet left the chest about the eighth interspace. The circulatory system, gastro-intestinal system, genito-urinary system, liver, thyroid, adrenals, and brain were normal. The spleen was one and one-half times its normal size. The capsule was not thickened and on section was very soft and congested.

CASE IV.—Private D. C. J., aged twenty-five years, Co. C, 324th Machine Gun Battalion.

Wounded November 10, 1918. Bullet penetrated the soft parts of the left upper arm, entered the left chest below the axilla. Admitted to Base Hospital 61 November 14. Wounds dressed and drainage tubes inserted. His general condition was poor. Temperature, 104°. Dullness of the left lobe. Aspiration in the sixth interspace. Much foul-smelling gas removed. Wound culture showed an anaërobe. November 24, patient delirious, in extremis. Died the following day.

Anatomic diagnosis: Empyema. Collapse of the left lung. Broncho-pneumonia. Fracture of the left fourth rib. Gunshot wounds multiple, penetrating left chest. Retained foreign body.

There was a penetrating wound on the external surface of the left arm, which passed posteriorly to the humerus. There was a ragged, superficial wound on the lateral surface of the thorax in the left mid-axillary line at the level of the fourth rib.

The left pleural cavity contained about 600 c.c. of frothy, foul-smelling pus. The lung had collapsed and was firmly adherent to the mediastinum and diaphragm. The lower end of the trachea and bronchi were very congested and contained considerable sero-sanguinous material. The left lung was covered with a thick, black exudate. The lateral surface, half way between the base and the apex, was lacerated. The terminal bronchioles were much dilated. The middle lobe was the same as the upper and there were some dark, depressed alveolar outlines. Many were consolidated along the inferior and posterior surfaces. These areas were dark red, stood out distinctly from the surrounding air-containing tissue, and sank rapidly in water.

Circulatory system, gastro-intestinal system, and genito-urinary system normal.

The liver was about one and one-half times its normal size, enlargement chiefly confined to the left lobe. The surface was very mottled, with yellow edges, and on section this presented a distinct nutmeg appearance. Other organs normal.

Bacteriology: Heart's blood showed a non-hæmolytic streptococcus. From the lung was obtained a Gram-negative, motile, putrefactive bacillus (undetermined), staphylococcus and streptococcus.

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CASE V.—Corporal A. W., No. 735837, aged twenty-two years, Co. F. 11th Infantry.

Wounded November 5, 1918, at 6 A.M. Diagnosis: Gunshot wound of the left lower chest and upper abdomen. At operation eight hours later, the upper abdomen was found filled with blood. The pleural cavity was cleansed and the lacerated spleen removed. No evidence of injury to the intestines. Closure of the abdominal wound with rubber-tube drainage. Intravenous saline. Patient in poor condition. November 12 a large amount of sloughing tissue was removed.

November 14 he was admitted to Base Hospital 61. The sutures had pulled out and the entire wound was open for a distance of 8 inches. Cultures from the wound showed streptococcus and an anaërobe. November 19 the wound was partially drawn together with heavy through-and-through silk sutures. November 24 signs of a right broncho-pneumonia.

Gunshot wound of the chest in the mid-scapular line, fracturing the eleventh rib. Wound of the abdomen in the left hypochondriac and lumbar region. Collapse of the left lung. Empyema left, acute fibrinous pleurisy, localized peritonitis, hæmolytic streptococæmia.

Postmortem examination showed an emaciated individual. A large suppurating wound on the anterior abdominal wall. There was a large wound perforating the thorax, through the space occupied by the eleventh rib.

The intestines were adherent to the anterior parietal peritoneum. Localized peritonitis limited to the intestines subadjacent to the wound. Adhesions were easily broken up. The spleen had been previously removed. There were many adhesions in this region.

The left lung had collapsed. There was no pus in the pleural cavity, but a thick, fibrinous exudate on the visceral and parietal pleura. The right lung was very voluminous and the posterior part of the lower lobe was slightly reddened and showed subpleural hemorrhages. On section the upper and lower lobes were air-containing throughout. The lower appeared reddish on the surface and on section sero-pus escaped. The left lung was about one-third its normal size. The parietal pleura was removed with the diaphragm. It was very thick and tough, like shoe leather, as was the visceral pleura. Both surfaces were covered with much fibrinous exudate. The pleural cavity had evidently been the seat of a marked suppurative process, which had drained out completely through the opening of the thorax. The lower and posterior parts of the lobe were consolidated. The inferior surface was firmly adherent to the diaphragm. The genito-urinary system, pancreas, and adrenals were normal. The thyroid was much enlarged and gave the appearance of colloid degeneration. Some loops of the ileum were adherent to the colon and the abdominal wall. There was no ulceration or obstruction. The cæcum and transverse colon were evidently involved by direct extension from the wound. On section the liver showed some evidence of cloudy swelling.

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The surface of the brain was much congested and there was a brown spot 5 cm. long and 2 cm. wide on the inferior surface of the frontal lobe, involving the extreme anterior portion. This appeared to be the seat of an old hemorrhage.

Bacteriology: Heart's blood showed hæmolytic streptococcus, abdominal wound staphylococcus, Gram-negative and Gram-positive diplococcus. From the lung hæmolytic streptococcus and staphylococcus were recovered.