GAS GANGRENE IN COMPOUND FRACTURES

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Gas gangrene probably is the most serious complication of compound fractures. While the treatment of the condition furnished a conspicuous part of the surgery of the World War, fortunately its incidence in civil practice usually is rare.

However, in the eighty compound fractures in negro patients treated at the Emory University Division of the Grady (Municipal) Hospital, Atlanta, during the seven years from 1922 to 1929, gas gangrene developed in fifteen cases, a percentage of 19. During the same period, in the same institution, the disease was recorded in five other cases, not compound fractures. One of these cases followed diabetic gangrene. Glycosuria has been reported as being found in gangrene due to gas-forming bacilli, but this patient was known to have diabetes before gas gangrene appeared.

During the same period I saw two cases of the malady in white patients. One was a young woman the victim of an automobile accident. The muscles of her arm were severely macerated, without fracture. The other patient was a physician who contracted the infection through a small wound in his finger received in his office. Amputation was done in the first case, and débridement in the second; both patients died.

Also, during the same period of seven years, among the ninety-seven cases of compound fractures treated in the white division of the Grady Hospital, seven developed gas gangrene, a percentage of about 7. The nature of the compound fractures in both classes of patients seemed equally severe, so that it would appear that the negro is more susceptible to the disease than the white man, or that his resistance is less.

The common habitat of the various anaërobic gas bacilli is thought to be cultivated soil and animal excreta, and it may be that the apparent susceptibility of this class of negroes is due to uncleanliness. On the other hand, Gage[1] believes that all kinds of wool and woolen goods harbor the microöganisms. He not only found gas bacilli in the wool pads interposed between powder and shot in ordinary bullets, but also grew them in cultures taken from woolen clothes just returned from a pressing club, and in samples of unused cloth taken from a tailoring establishment.

The bacteria usually described as causing the condition are: (1) B. welchii, or B. aërogenes capsulatus, called by the French perfringens. (2) Vibrion septique, probably identical with the bacillus of malignant œdema. (3) B. œdematiens. (4) B. sporogenes, neither causal nor gas-producing, but said to be most responsible for the characteristic odor of the disease. In addition to these, several other bacteria have been named as etiological factors, such as B. fallax and histolyticus. The B. welchii, although it is the most frequently found, and was the only organism found in this series, and is the greatest gas producer, rarely is the sole causative agent, except in cases of localized gangrene. It is by symbiosis, the combination of two or more of these bacteria, and

probably aërobic germs, such as streptococci, that the most virulent types of the disease are produced. The bacillus of Welch was demonstrated by smear or culture, or by both, in all these fifteen cases except two, and in these the clinical signs and history established the diagnosis. Blood cultures were tried in several cases without success.

I am indebted to Dr. Jack C. Norris, pathologist in the Grady Hospital, for the following description of cultural methods used in the detection of gas bacilli: "Material is obtained directly from the wound, either by sterile swab or sterile aspirator, and is placed into ten cubic centimeters of a fresh meat extract bouillon. This bouillon is faintly alkaline, and contains 1 per cent. dextrose. After the inoculation of the culture media, a layer of sterile liquid petrolatum, approximately 1 centimeter in thickness, is added. This oil settles over the top of the bouillon, and insures practical anaërobiosis. It is then incubated at 37.5°C.

"The culture is noted at six, eight, twelve, sixteen and twenty-four hours. The appearance of gas bubbles after six hours indicates a specific gas former. The appearance of gas bubbles sufficient to penetrate the oil layer and rise to the surface is almost a positive indication of the presence of gas bacilli. Smears are made at intervals, and if the large Gram-positive bacillus is found, animal inoculations are made, and the bacteriological diagnosis confirmed.

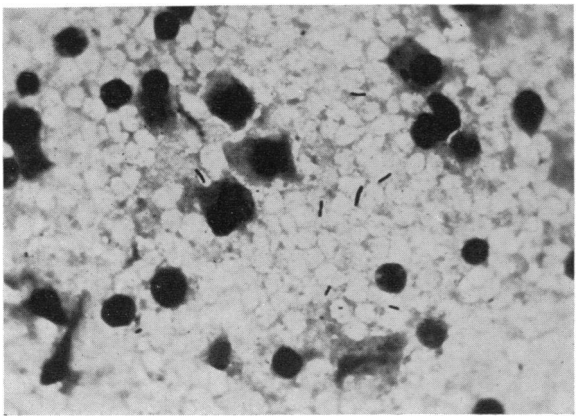

FIG. 1.—Smear from deep tissue.

"This method of bacteriological determination seems to be most satisfactory, especially for B. welchii, which is the organism usually found in this section."

The tissues attacked by these putrefactive organisms must first be damaged by direct trauma or by interference with the blood supply. While bacteria may enter the body through the alimentary canal, it is probable that in compound fractures they enter directly through the wound. While the disease is essentially one of muscle tissue, occasionally it begins in other tissues. Nearly always, however, muscle is the starting point, the infection spreading rapidly through the fibres to the end, when it attacks the next muscle beyond. The infection tends to travel longitudinally, rarely transversely.

The muscle fibres become separated from the surrounding interstitial tissue by a clear space which becomes filled with septic fluid, bacteria and gas. An X-ray film may show the gas before it is detected by crepitation. The muscle is at first dull and opaque, brick red in color, resembling cooked meat; it does not contract when pinched nor bleed when cut. Bubbles may now be pressed up and down between the fibres. Great swelling of the limb occurs, well described by Weintrob and Messeloff[2] as tense, not giving the fluctuation of an abscess or the pitting of œdema. The color changes to green, brown or black, a bloody exudate comes from the wound, and gas can be felt in the tissues over an area considerably greater in extent than that of the dead tissues. The characteristic odor, which must be encountered to be recognized and described, is extremely foul and sickening.

In this series of fifteen cases of gas gangrene in compound fractures, eleven patients were males, and four females; ages ranged from five to fifty-

two years; two fractures were due to gunshot wounds; two fractures involved the upper extremity, and thirteen the lower extremity. Six patients died, giving a mortality rate of 40 per cent. No autopsies were performed. The shock of amputation apparently was the immediate cause of the demise of one or two of the patients, but since the operations were done to cure gas gangrene, and the patients would have died without such treatment, gas gangrene must be assigned as the cause of death. One of the gunshot cases died and one got well. All published series give a larger number of cases of gas gangrene in fractures of the lower extremity than in fractures of the upper extremity. Such records no doubt are due to the fact that the lower extremity is more exposed to infection from the soil than the upper extremity, and also to the fact that the tight muscles about the tibia furnish better ground for the propagation of anaërobes than the looser muscles of the forearm. Is it not also true that compound fractures are commoner in the leg than in the forearm?

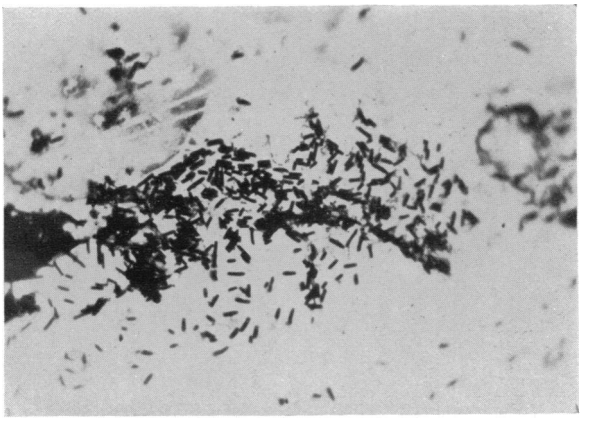

FIG. 2.—B. welchii shown in culture grown from case of gas gangrene. The culture is young, and spore formation does not appear.

Signs of the disease may be noticed in from six hours to three days after injury, the average time being about twenty-four hours. It is difficult to enumerate the different signs and symptoms in the order in which they appear. Certainly no single symptom always appears first with the regularity that pain, as stated by John B. Murphy, is always the first symptom to be noted in acute appendicitis. However, it has been commonly observed how often the first symptom of gas gangrene is a pulse rate higher than should be expected from the patient's general condition. Instead of 80 or 90, it is 110 or 120. Sometimes the temperature keeps pace with the pulse rate, and sometimes it does not. The leucocytes usually run from 15,000 to 20,000. At the same time the patient may complain that the dressing is too tight, and he seems to be restless and anxious.

At this juncture it would be better if the fracture is immobilized in an apparatus which permits easy and adequate inspection of the limb, because such an examination should be made without delay. The color changes described are not of much value in negroes. The order in which the other symptoms appear is not at all constant. Smear and culture should be made immediately, and may prove positive as early as six hours after the injury. The X-ray does not always show gas, but sometimes will demonstrate it

before bubbles are seen. As a rule the odor is an early sign, but in two or three of these cases it was not definite until after the culture was positive.

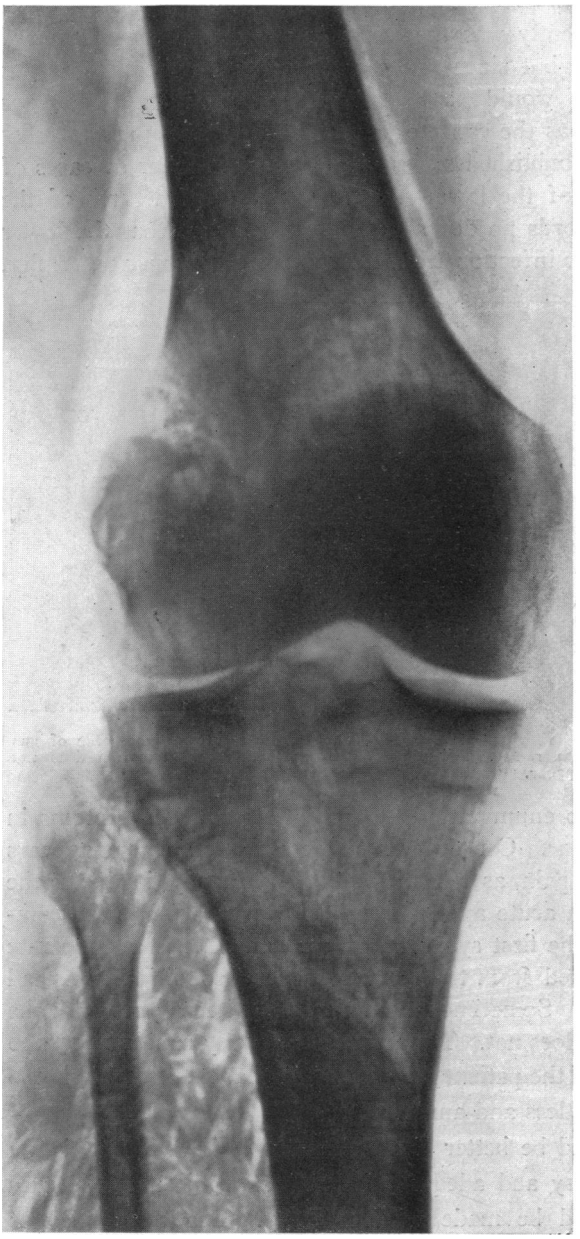

FIG. 3.—Gas gangrene in gunshot fracture of knee-joint.

The treatment of a compound fracture complicated with gas gangrene resolves itself into treating the gangrene, and treating it as promptly and vigorously as possible. If its spread is not controlled, death from septicemia, or possibly gas embolism, is almost the invariable outcome. The alignment of the broken bones can be taken care of later, and the patient will be fortunate indeed if, after he is rid of the lethal infection, there are bones to be aligned. More than likely the fracture will disappear in an amputation. Only one of these cases was cured by débridement alone, while another one was cured by débridement, and later multiple incisions. Four were cured by amputation alone, and three cured by débridement, and later amputation. Four died following débridement and amputation; one died after amputation alone; one died after linear incisions alone.

The idea of operative treatment is the excision of all obviously and supposedly damaged tissue, preserving as much skin and as many important nerves as possible. The adjacent tissues should be widely exposed to the air by multiple longitudinal incisions. Many different kinds of after-treatment have been proposed, but nothing in our hands has given better results than the application of the

Carrel-Dakin technic. Dressings should be loose and few in order to discourage the growth of the anaërobic bacteria by the admission of oxygen.

The involved parts and the general progress of the patient should now be watched diligently. Upon the appearance of the first signs of the extension of the disease, either local or constitutional, further débridement should be done, or better a high amputation. The aim must be to save the patient's life, and not his leg or arm. In the case of the physician who died from gas gangrene of the arm, if he and the rest of us had not thought so much of how incapacitated a laryngologist would be with one arm gone, and had amputated instead of débrided, we might have avoided a mortality. The routine care of the patient's septic condition is most important. Blood transfusion does not seem to produce appreciable results.

FIG. 4.—Gas gangrene complicating compound fracture of tibia and fibula.

The last eight patients in this series were given the anaërobic antitoxin of a New York firm, the first four being given the perfringens antitoxin, the last four being given the more efficient polyvalent preparation. In the last four cases the antitoxin was administered both as a prophylactic and therapeutic agent, the average prophylactic dose being twenty cubic centimetres, and the average therapeutic dose being fifty cubic centimetres repeated once or twice every twenty-four hours. Intravenous injections were preferred and generally employed. Two

of the seven patients who did not get the antitoxin died, and four of the eight who received antitoxin died. This sounds discouraging, but other factors must be considered. Certainly in two of the patients who received antitoxin and died, surgical shock played a large part in the fatal termination. This series is too small to draw any kind of conclusions as to the value of antitoxin in the treatment of gas gangrene, but it is evident that the virulence and rapidity of the infection differ materially among patients, whose resistance manifestly is not always the same. B. H. Clifton [3] reports a case from the white division of the Grady Hospital which he believes was saved by the antitoxin after shoulder-joint amputation apparently had failed.

At present all patients with compound fractures and other wounds which might give rise to gas gangrene, in addition to tetanus antitoxin are given on admission polyvalent anaërobic antitoxin as a prophylactic measure. It is advisable also that smears and cultures be taken at once. No doubt the dose of antitoxin should be larger than heretofore, probably fifty cubic centimetres as a preventative, and 100 to 200 cubic centimetres as treatment. On account of the small demand for the antitoxin its cost is high. The reactions from some of our small doses has been marked, with temperature as high as 105° and urticaria persisting for ten days.

Although the toxin produced by the tetanus bacillus is claimed to be a thousand times more lethal than that of B. welchii, it is difficult to conceive how the serum prophylaxis against gas gangrene can ever become as successful as antitetanic serum. The period of incubation of the gas bacillus infection is too short. The more rapid course of this disease is said to be due to a constantly occurring exhaustion of the suprarenal glands.[4]

Simple fractures require more consideration from the surgeon than reading an X-ray report and the application of a splint; compound fractures demand unremitting care to avoid serious contamination and give the best possible end-result, while the attention and judgment necessary to save a limb or life in a compound fracture infected with gas bacilli equals that of any problem in surgery. Lister achieved his first step toward immortal fame by his successful treatment of a compound fracture.

CASE REPORTS

CASE I.—Male, thirteen years of age. Admitted to the Grady Hospital (Emory University Division) November 11, 1922. Compound comminuted fracture of the left tibia and fibula, from automobile accident. Patient given 1500 units tetanus antitoxin on admission, as in all cases. Wound débrided and closed, plaster cast applied, with window. November 13, patient became stuporous, pulse rose from 100 to 142. November 15, foul odor from wound, sutures removed, bubbles of gas escaped. Smear showed B. welchii. Carrel-Dakin treatment instituted. Swelling and crepitation extended, general condition grew worse. November 17, high guillotine amputation of thigh. November 18, patient died. No gas-bacillus antitoxin used.

CASE II.—Male, twenty-four years of age. Admitted November 13, 1924. Compound fracture of left fibula, from fall from window to ground. Wound cleaned with iodine, cast applied. Temperature and pulse normal on admission, third day pulse 110, temperature 101°. Discharge developed typical gas-bacillus odor. Smear positive for B. welchii. November 18, amputation lower third of leg; December 10, secondary closure. Good recovery. No gas-bacillus antitoxin used.

CASE III.—Female, thirty-seven years of age. Admitted December 21, 1924. Compound fracture of tibia and fibula, from automobile accident. Wound débrided and closed immediately, plaster cast applied. December 23, patient complained of severe pain in leg, temperature 99°, pulse 80. Dressing removed, typical odor and discharge discovered. Smear positive for B. welchii. December 25, guillotine amputation lower third of thigh; patient died same day. The pulse and temperature appeared to be but little affected by the disease. No gas-bacillus antitoxin was given.

CASE IV.—Male, six years of age. Admitted July 11, 1926. Compound fracture of right ulna, from being hooked by a cow. Patient began to complain of severe pain a few hours later, when his mother noticed marked swelling of forearm, and brought him to the hospital at once. On admission, which was not more than six hours after the injury, temperature was 101°, pulse 110; child was very restless, and general condition was poor. One hour later temperature was 103°, pulse 130, respiration 30, leucocytes 17,600, polymorphonuclears 88 per cent. Gas-bacillus odor was present, and the swelling extended to the middle of the arm, and to the wrist. X-ray showed fracture of the ulna, and gas in the tissues. Amputation was done the same day. The patient's temperature dropped to normal, and remained practically normal the six weeks he was in the hospital. Unfortunately a culture was not made from the wound until the second day, when it showed a long Gram-positive bacillus with some spore formation, morphologically consistent with B. welchii. No gas-bacillus antitoxin was given. Recovery was satisfactory.

CASE V.—Female, fifty-two years of age. Admitted September 1, 1926. Compound fracture of left tibia and fibula, from street accident. On admission, two hours after injury, crepitation was felt in the surrounding tissues, but no gas bubbles could be expressed. A smear taken at this time was negative. Leucocytes 18,160, polymorphonuclears 90 per cent. Débridement, closure of wound with drainage, application of plaster cast. September 4 patient had well-developed gas gangrene, with positive culture; guillotine amputation was performed in the lower third of the thigh. October 26, stump was skin-grafted. Recovery. No gas-bacillus antitoxin.

CASE VI.—Male, twenty-one years of age. Admitted December 13, 1926. Compound fracture of tibia and fibula, from truck accident. Leucocytes 12,575, polymorphonuclears 93 per cent. Wound débrided, plaster cast applied. The next day the swelling and odor suggested gas-bacillus infection, and smear was positive. Patient discharged to another hospital, and reported as a recovery.

CASE VII.—Male, eighteen years of age. Admitted July 13, 1927. Compound fracture of right tibia and fibula, from motorcycle accident. Amputation a few hours later. Temperature and pulse normal until forty hours later, when temperature rose suddenly to 102.4°, and pulse 128. Leg swollen, with foul, putrid odor, no crepitation. Smear and culture showed Welch bacillus, and later crepitation appeared. July 16, second amputation, above knee; July 27, third amputation. Recovery. No gas-bacillus antitoxin given.

CASE VIII.—Female, five years of age. Admitted August 16, 1927. Compound fracture of upper extremity of left femur, and left fibula and tibia, from being struck by a truck. Débridement of wounds, application of Thomas splint. Twenty-four hours later temperature was 105°, wounds had swelling, odor and crepitation of gas gangrene; definite Welch bacillus grew on culture. Smear also positive. Fifty cubic centimetres of perfringens antitoxin (not polyvalent) given intravenously, thigh amputated; patient died two hours later, apparently from shock.

CASE IX.—Male, thirteen years of age. Admitted September 8, 1927. Compound fractures of both legs, from street-car accident. One hour after admission right leg was amputated, left leg débrided. Next day temperature was 102°, patient very restless, definite crepitus, no odor. Smears from both legs showed B. welchii. Ten cubic centimetres perfringens antitoxin given intravenously. Second amputation next day; patient apparently died from shock.

CASE X.—Male, thirty years of age. Admitted December 15, 1927. Compound

fracture of knee-joint, from gun-shot wound. Débrided and splinted. Twenty-four hours later temperature was 103.8°, pulse 120; patient had anxious expression; there was bloody drainage, but no gas, and smear was negative. The next day there were crepitation and foul odor, and smear and culture were positive; temperature was 102°, and pulse 140. Thirty-five cubic centimeters of "double strength" antitoxin given, and guillotine amputation middle half of thigh performed. Temperature then dropped to 97°, pulse 160. One-hundred cubic centimeters of antitoxin given daily for four succeeding days. Recovery. After the amputation a rabbit was injected with six cubic centimeters from the stump, and killed immediately. The B. welchii was recovered from the peritoneum. Twelve hours after death the rabbit was enormously distended, and gave the characteristic odor of gas-gangrene.

CASE XI.—Female, twenty-six years of age. Admitted February 12, 1928. Compound fracture of right tibia and fibula, from auto accident. Amputation immediately, just above knee. The next day temperature was 103°, pulse 140, but there was no odor nor bubbles from the wound, and the smear was negative. February 14, the smear was positive, although the odor and crepitation were not marked. Patient was given fifty cubic centimeters of double strength perfringens antitoxin every twelve hours for three doses, and recovered.

CASE XII.—Male, sixteen years of age. Admitted June 19, 1928. Compound fracture of both legs, from fall in attempting to "swing" freight train. Both legs amputated below knees. Two days later there were sero-sanguinous discharge from the wounds, and suggestive odor. The next day the X-ray showed gas in both stumps, and the culture was positive from the left leg, and negative from the right leg. Ten cubic centimeters of polyvalent anaërobic antitoxin administered on admission, and for the two succeeding days, after which fifty cubic centimeters was given daily for three days. Later necrosed bone was removed from the stump of the left leg, followed by a third operation for grafting skin. After seven months in the hospital the patient was discharged as well.

CASE XIII.—Male, forty years of age. Admitted August 5, 1928. Compound fracture of left fibula and tibia, from motorcycle accident. Débrided two hours later. Twenty cubic centimeters of polyvalent anaërobic antitoxin given on admission. The next day swelling, pain, crepitation and odor were present in the wound, which was treated by multiple, longitudinal incisions, fifty cubic centimeters antitoxin being administered daily for three days. Smear and culture the second day were positive. Recovery.

CASE XIV.—Male, twenty-five years of age. Admitted August 5, 1928. Compound fracture of both legs, from automobile accident. Wounds cleaned with iodine, Dakin treatment instituted, plaster cast applied. Two days later positive culture from left leg; treated by multiple longitudinal incisions. August 6, seventy cubic centimeters of polyvalent antitoxin administered; August 7, fifty cubic centimeters; August 8, patient died.

CASE XV.—Male, twenty years of age. Admitted October 14, 1928. Gun-shot compound fracture of right ulna and radius. Twenty-four hours later odor, crepitation and bubbles of gas appeared, although culture was negative. October 16, amputation. Fifty cubic centimeters of polyvalent antitoxin given October 15, 16, and 17; October 19, patient died.

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DISCUSSION: DR. FREDERIC W. BANCROFT, of New York City, said that usually trauma is a very big factor in the development of gas gangrene, but he could report three cases of gas gangrene that occurred in a Municipal Hospital of New York through simple hypodermic injection. Two were treated by an ambulance surgeon and developed gas gangrene with amputation of the arm and death; another one was possibly treated by an outside doctor when the ambulance was sent for, and came into the hospital and developed gas gangrene.

With three such dire complications from hypodermic injections, it would seem advisable to warn the hospitals to inspect their hospital bags to see that their hypodermic solutions are kept sterile. Oddly enough it was a solution of digitalis that was responsible for two of the above cases.

DR. KELLOGG SPEED, of Chicago, Ill., said that during the war in 1916 while working in the No. 18 General Hospital, B. E. F. France, Davis of Chicago first made these discoveries about the finding of gas bubbles in the X-ray examination of incipient stages of gas gangrene.

Sometime later the speaker treated and reported a series of cases thus infected by a method of muscle group excision. That saves amputation. One may have to take off a whole group of muscles, such as the extensor groups in the arms or legs because the infection spreads through and along the fascial planes, through the muscle itself not via the lymphatics in the early stages. It does not spread by the blood stream in the early stages. Consequently, if the diagnosis is made early the area traumatized with resulting gas infection, the soft parts which were penetrated, involving only a certain portion of the limb, one or two muscles, may be completely removed, or the area of infection may be completely removed simply by taking out that muscle from origin to insertion and leaving the wound wide open and treating it with the Carrel-Dakin method.

DR. URBAN MAES, of New Orleans, La., remarked that Doctor Boland had referred to some work done by Doctor Gage in the speaker's service in New Orleans. He would supplement that by recounting several things that he followed in regard to the prophylaxis of gas gangrene.

A very interesting observation has been made—it has a seasonal incidence in the South. It occurred only at a certain time of the year in people who were wearing woolen clothing at the time they were injured. In the summer, when linen clothes are worn, he had never seen a patient afflicted with gas gangrene who was hurt while he was dressed in linens; always it has been woolen clothing.

He wished also to record in line with what Doctor Bancroft had said, the fact that he had lost two patients from infection such as the type he speaks of, one from a hypodermic injection and another from an infected burn in which the blister broke and the patient was between woolen blankets. In both instances he cultured the wool from the blankets and in both instances recovered the gas bacillus.

It is interesting to bring out the fact that prophylaxis, which is the only

safe thing to consider, has largely to do with the matter of contamination with wool in the form of clothing or blankets or other such commodities.

DR. HENRY H. M. LYLE, of New York City, said that in 1916 he reported a case of general gas gangrene without local manifestations. A French soldier was wounded in the thigh by a shell fragment. The fragment could not be found in the wound. The wound was treated by the Carrel method and remained sterile. X-ray examination of the upper thigh and lower abdomen showed no shell fragment. It was then assumed that the fragment had been extracted at the dressing station or had fallen out during transportation. On the third day the patient developed symptoms of generalized gas gangrene and he died on the afternoon of the fifth day. At autopsy the following conditions were found: A perforating wound of the left thigh, a penetrating wound of the right femoral vein, migration of a shell fragment to the right ventricle of the heart. Generalized gas bacillus infection. No local infection of the wound. The shell fragment when found in the ventricle had attached to it a portion of the uniform which was undoubtedly the source of the infection. The cardiac muscle was riddled with gas bubbles.

DR. SAMUEL C. PLUMMER, of Chicago, Ill., stressed the point in diagnosis, that the sense of smell is one that surgeons do not use very much in making diagnoses, but it can be used to great advantage in the diagnosis of gas gangrene. The number of these cases which one sees in civil practice is very small, but a short time before the war he had two cases within a few months of each other. The first of these cases was a compound fracture of the thigh with severe injury to the soft parts. This patient died after an amputation of the hip. The next one was a crushing injury of the upper arm. The arm was practically amputated by the accident. A trimming up was done and the stump left wide open and treated with a wet dressing. On the second day the speaker noticed an odor which was familiar to him from the previous case of gas gangrene. The ends of the crushed muscles which remained were partly devitalized. There was a dark, rather disagreeable color and the odor was that of rotting meat. A smear taken at once showed the presence of the Welch bacillus. An amputation was done promptly only about two inches above the amputation which was already there. This brought them into good, live tissues with good circulation and the man never developed any further symptoms of gas gangrene. He suggested where one has cases of injuries where gas gangrene is likely to occur that one does not overlook the sense of smell in making an early diagnosis.

DR. ASTLEY P. C. ASHHURST, of Philadelphia, confirmed what Doctor Plummer had said about the sense of smell. It is a good thing when you know what the smell of gas gangrene is like. It smells somewhat like a mouse.

During the second battle of the Marne he was in the American Ambulance in Paris. Patients had been coming in so fast and the staff was so small that the patients had accumulated in great numbers. It became his habit

whenever he got a spare moment between operations to wander around the corridors and smell the patients. Those that smelled like mice he operated on right away because they had gas gangrene. The rest of them could wait awhile.

One more point: When he was a student his father lectured to his students on surgery of all kinds. He described eloquently the Erysipèle bronzé of Velpeau; but the speaker had to wait twenty years before he saw a case, though he knew that it must exist because his father had described it. Over in France with the French army, in the early part of the war, he operated on a patient with a compound fracture of the femur, and it was there that he saw the *Erysipèle bronzé* of *Velpeau.* There were no blisters but it was an erysipelas nevertheless. The disease was in the skin, and perhaps in the subcutaneous tissues a little bit. There was a distinct raised margin next the surrounding unaffected tissues. Under conservative treatment the patient recovered.

In his service at the Episcopal Hospital of Philadelphia a few years ago was a young woman with a compound fracture of the upper extremity. She developed gas gangrene, and along with it the typical bronzed erysipelas of Velpeau. The limb was so rotten that amputation was required. She recovered. That was the only manifestation of gas gangrene of that type he had ever seen in civil life.

Formerly these clinical states were classified as separate diseases, but it is much simpler not to divide them, but to class them all as gas gangrene, whether they be the acute mephitic gangrene of bone of Liddell, or the acute purulent œdema of Pirogoff, or the bronzed erysipelas of Velpeau.