THE VALUE OF HYPOCHLOROUS ACID IN THE TREATMENT OF CASES OF GAS GANGRENE.

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(Report to the Medical Research Committee.)*

In June of this year I was interested to learn that the professor of pathology and the staff in the Department of Pathology at Edinburgh University were investigating the value of hypochlorous acid as an antiseptic. This information came to my notice before any publication had been made. I was anxious to test the value of the application in the treatment of recent and infected wounds, and Professor Drennan was good enough to place a quantity of the material at my disposal; and, further, he gave me very useful directions as regards its preparation and properties.

Since that date I have given the treatment a very thorough trial, and its value in the special class of case herein noted has so impressed me that I have decided to publish a brief account of the results.

This paper, therefore, deals only with the value of hypochlorous acid as an application in cases of gas gangrene. And it is well at the outset to make clear what is meant by the term. It is applied to cases in which the wound has become infected with a gas-producing organism; the further progress of the infection is associated with local tissue necrosis, and ultimately with general collapse and death. The affection has been attributed to various organisms. According to Fleming,[1] it would appear that the most common occurrence is a combined infection by the *Bacillus aerogenes capsulatus* with the streptococcus.

Granting that infection with these or other organisms is the chief etiological factor, there are also certain important accessory conditions. The situation of the wound is important; I have never seen a gas infection follow a wound of the scalp or face, and only on one occasion have I seen it follow a wound of the trunk. The lower extremity is a more common site than the upper, and in the lower limb the seat of election for an infection is certainly below the knee.

The nature of the wound is the second consideration. The infection pre-eminently occurs in a punctured wound, and more especially in a wound which has been associated with extensive extravasation of blood into the tissues. There are other subsidiary etiological factors, but those mentioned are of outstanding importance.

It is possible in this paper to refer to the pathology of the condition only in the briefest terms. From the wound opening a scanty, foul-smelling discharge appears; it is largely composed of broken down blood clot; it is of a brownish colour, and mixed with it there are bubbles of gas. The skin around the wound becomes of a faint purplish colour. In the subcutaneous tissues there is an accumulation of lymph-like fluid. There is a similar infiltration throughout the intermuscular septa and connective tissue planes. Muscular tissue rapidly loses its healthy red appearance; it becomes pallid and avascular, and disintegrates into a foul-smelling necrotic mass; it is always extensively infiltrated with gas; if the muscle is exposed to the air its surface becomes dry, brown, and leather-like. In consequence of the muscle changes bands of fascia stand out prominently, and they undergo early necrosis. Throughout the precincts of the wound there is an infiltration of gas, and it extends to further limits along certain lines—the subcutaneous tissues, the perivascular tissues, and the planes of intermuscular connective tissue. In addition to these local changes there have been found alterations in the brain, the suprarenals, and the liver: the cortical cells of the brain disintegrate; chromaffin substance disappears from the cells of the suprarenal; and in the liver there is actual destruction of the cells.

I shall refer to particular clinical features in describing individual cases. Locally there are the changes which have been mentioned above. The general effects are the phenomena of fever, rapid pulse, increased respirations, restlessness, sweating, delirium, unconsciousness, and death. Ultimate death would appear to depend upon the structural changes which are found in the brain, the suprarenals, and the liver.

These elementary facts have been stated as an introduction to the account of the method which I have employed in the treatment of these cases. The method has been the application of the 0.5 per cent. solution of hypochlorous acid known as eusol, occasionally intermitted with one of two other procedures—the application of the powder known as eupad (bleaching powder and boric acid) and the use of baths of hypertonic salt solution. For details regarding the composition and experimental value of eusol and eupad the reader is referred to the paper by Professor Lorrain Smith and others in the British Medical Journal of July 24th. Briefly the method of preparation was as follows:

> Into a Winchester quart bottle 27 grams of dry bleaching powder were placed, and to this 1 litre of water was added, the mixture was shaken, and 27 grams of boric acid were added; the bottle was now filled with water, the solution was thoroughly shaken, allowed to stand for a few hours, and then filtered through cotton-wool. The clear solution is eusol; it is slightly alkaline to litmus and contains approximately 0.5 per cent. hypochlorous acid. Eupad was made by finely grinding the dry bleaching powder and adding an equal weight of boric acid powder. Both eusol and eupad were stocked in airtight black bottles.

Whenever a case of gas gangrene was recognized as such the eusol treatment was immediately begun. The local wound from which the infection had apparently commenced was opened up thoroughly, and as far as possible all free blood clot was removed. Whenever an emphysematous sensation could be detected an incision about 2 in. long was made, but such an incision was never carried deeper than the subcutaneous tissues. Each wound was now thoroughly irrigated with eusol, and if the wound was of any depth irrigation was carried out under considerable pressure by means of a Higginson's syringe; frequently the nozzle of the syringe was forcibly inserted through a superficial wound and a small quantity of the eusol injected into the subcutaneous tissues all around the wound. From the last procedure was seen no ill result, but, on the other hand, considerable benefit has repeatedly accrued.

Grossly infected muscle or skin was cut away. Gauze soaked in eusol (0.5 per cent.) was lightly packed into the wound and as far as possible into all the crevices. If the wound was of considerable depth, it was found advantageous to insert a medium-sized drainage tube provided with numerous large lateral openings; around the tube gauze wrung out of eusol was lightly packed. This procedure had the advantage that the gauze packing could be easily resoaked by injecting a quantity of fluid along the rubber tube from which it escaped by the lateral openings into the dressing. Over the surface of the wound and covering a large area of the surrounding skin gauze wrung out of eusol was laid; this was covered with a layer of dry gauze, wool, and bandage. The end aimed at was to make the dressing as light and airy as possible. In only two instances could it be said that the dressing had produced any irritation of the surrounding skin. In both cases the slight irritation which appeared occurred around the edge of the dressing; it was easily counteracted and speedily alleviated by the application of a thick layer of zinc ointment. During the first forty-eight hours an attempt was made, where possible, to change the dressing every four hours; after that period it was found sufficient to change the dressing every eight hours. On the fourth day of treatment experience taught one that granulation tissue was improved and the separation of the slough stimulated by the application of eupad to the wound; this was dusted on from a dredger in a thin layer, and the dressing with gauze eusol continued as before. This modification was followed throughout the fourth, fifth, and sixth days; it was not adopted earlier because observations seemed to show that in the earlier stages of treatment the application of a solid tended to retard the wound secretion. On the seventh and subsequent days, until granulation was complete, the treatment was further modified by immersing the part for four hours each day in a bath of hypertonic salt solution; a double

* The report was illustrated by coloured drawings, not here reproduced, showing the underlying sloughing tissue exposed in two cases by incisions made on the patients' admission, and the healthy granulating tissue after applications of eusol, or eusol and eupad, for five and ten days respectively.

purpose was answered—the granulations were further stimulated and any remaining slough separated, and the surrounding skin, which had become very dirty after repeated eusol dressing, was thoroughly and efficiently cleaned.

Observations of the wound from day to day show some interesting features. During the first twenty-four hours the foul smell of the wound entirely disappears; the discharge as such also disappears, but is replaced by a lymph-like secretion, which soaks the dressings with a glairy, gelatinous looking fluid. After the third day this lymph-like discharge tends to cease, granulation tissue begins to make its appearance, and slightly blood-stained serum escapes from the wound. Sloughs separate with extraordinary rapidity, and the healthy granulation tissue which remains completes the process of healing at a more rapid rate than I have previously observed.

At no time was any complaint made of pain or irritation being produced by the eusol. This could not be said of the eupad; its application was always followed by a stinging, burning sensation, which lasted usually for about thirty minutes.

Details are added of nine cases of undoubted infection with a gas-producing organism, ending in tissue necrosis, which were treated successfully with eusol. Many of the cases were of intense severity. These cases have not been selected, but form a consecutive series coming under my care. It was interesting to note that the general condition of the patient responded and improved synchronously with the improvement in the local condition.

CASE I.

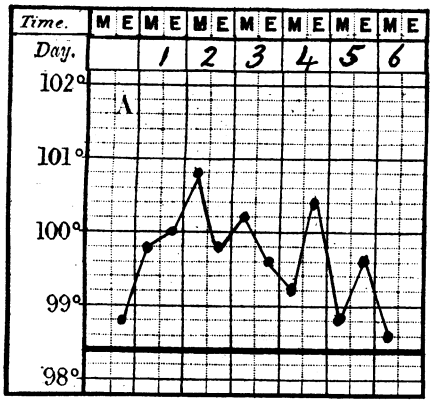
Private, admitted June 23rd, 1915.

History and Operation.

As a result of a shell explosion the right foot was blown off, and there was a deep lacerated wound of the left thigh. In regard to the wound of the right foot, the edges were trimmed and converted into flaps, the surfaces were washed with eusol, and the stump was partially closed with interrupted silkworm gut sutures. The wound of the left thigh was dressed with a warm solution of hydrogen peroxide.

Progress.

The amputation did well, and proceeded to heal without further complication; the wound of the left thigh developed the clinical features which are associated with a moderate gas infection—that is to say, the general condition altered by a rise in temperature, pulse and respiration-rate. The patient complained of general debility and restlessness, and had the facial appearance of undoubted illness.



Case I.—A, Date of admission.

Locally the wound had altered: the surface appeared to be covered with coagulated albuminous substance; the exposed muscle had a brown leathery appearance; the surrounding skin was beginning to be discoloured with a faint purplish tinge. When the fingers were gently laid on the part, the typical emphysematous crackling could be detected in the surrounding tissues, and also in the exposed muscle. On light percussion a faintly resonant note could be detected.

With the discovery of the development of these features the treatment was altered: generally stimulants were pressed as thoroughly as possible; locally several incisions were made into the subcutaneous tissue around the wound; the wound itself was loosely packed through all its interstices with gauze wrung out of eusol. Over the wound and the surrounding tissues gauze saturated with eusol was laid. The dressing was changed at intervals of eight hours, and after the primary eusol dressing the wound was thoroughly syringed out with eusol. Twenty-four hours after the original application of eusol no gas could be detected in the surrounding tissues. The exposed muscle still crackled on pressure, and from it bubbles of gas could be expelled, but there was no suspicion of any spread of the infection. On the fifth day the greater part of the necrotic muscle came away as a slough, leaving behind it clusters of red and healthy granulation.

After-History.

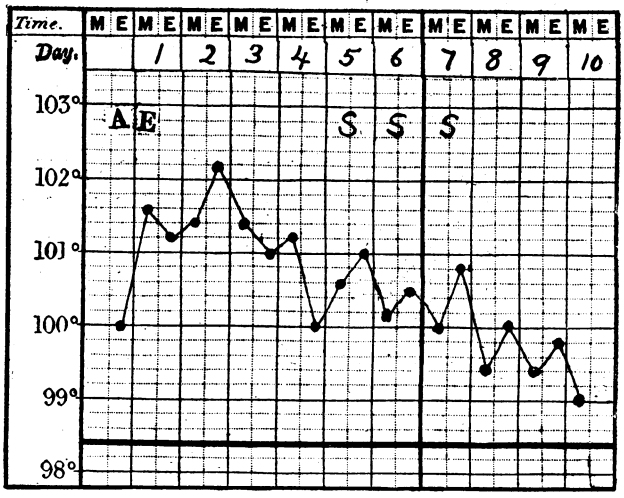
Both general and local conditions were so thoroughly improved that we were able to send the patient to the base on the sixth day (June 29th). We followed the principle of keeping as far as possible in touch with the patients who passed through our hands. Thus we were able to ascertain their ultimate condition, and we received from this patient a letter written from Chichester on July 27th. Special interest centres around the following remark: "The thigh wound is got on wonderful, the hole has fill right up and the skin 'as grown about half an inch all round it and it 'as gone so small."

CASE II.

Sergeant, admitted August 30th, 1915.

History.

This man was wounded in a bomb explosion. The chief injuries were localized to the right leg below the knee. There was an extensive wound, which passed through the leg, associated with a compound fracture just below the knee-joint. On the outer aspect of the leg there were several more superficial wounds of varying size and depth. On the anterior aspect of the leg there were several small punctured wounds.



Case II.—A, Date of admission; E, eusol dressing; S, saline bath.

On admission the patient was found to be suffering considerably from collapse; the pulse was 120, small and irregular; the temperature reached 100°. The various wounds were dressed with a eusol dressing; they were dirty and sloughy, but at this, their first examination, they showed no evidence of a gas infection.

The following morning, August 31st, the general condition of the patient gave rise to some anxiety; the pulse-rate had increased, but more alarming were the restlessness and air of impending collapse. On examining the limb the source of the change was evident—there was an extensive infection with a gas-producing organism throughout the leg from the knee to the ankle. There was considerable swelling; the limb was tense and resonant on percussion; there was crackling on palpation all over, but especially marked on the anterior surface of the limb.

Gas Gangrene: Treatment.

Free incisions were made all over the limb into the subcutaneous tissues. With each incision there was a distinct escape of gas; the incisions into the front of the leg showed that the muscles and subcutaneous tissues were of a greenish-black colour, very foul-smelling and crackling with gas; there was, in fact, an acute infection of emphysematous gangrene. The limb was treated with eusol; gauze soaked in it was loosely packed into all the crevices of the wounds and incisions.

After-History.

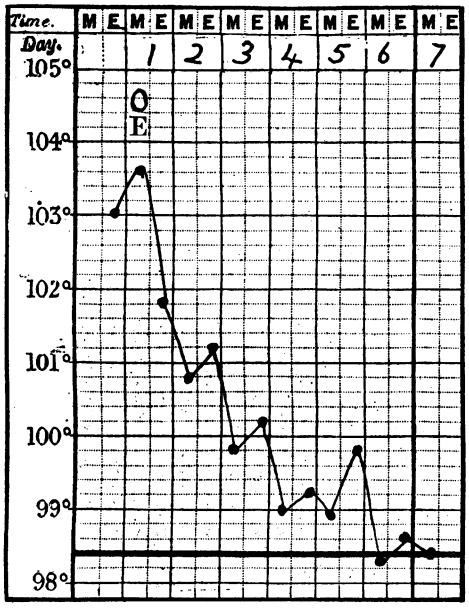
The further progress of the case need not be entered into in detail; briefly it was as follows: The eusol dressing was changed at intervals of four hours. From the date of operation there was no further spread of the gas infection. Emphysema remained in the muscle until the muscle separated as a slough. Sloughing occurred in the entire group of anterior tibial muscles, leaving exposed the tibia, fibula, and interosseous membrane; the slough extended from the upper attachments of the muscles to the upper border of the anterior annular ligament. The treatment throughout consisted in the application of eusol; from this there were two divergences—during the third and fourth days of treatment dry eupad was powdered over the area in addition to the eusol dressing; during the fifth, sixth, and seventh days, while the slough was separating, the limb was immersed in a bath of hypertonic saline for intervals of eight hours in the twenty-four.

The patient was discharged on the tenth day with the leg wounds in a healthy granulating condition.

CASE III.
Private, admitted August 10th, 1915.

History.
This man had been wounded three days previously by a rifle bullet through the right thigh. Military exigencies had prevented his transfer to the clearing hospital until this date.

Condition on Admission.
His condition was such as to give rise to considerable anxiety. He was restless and, to some degree, collapsed; there was profuse perspiration; the temperature was 103.2°, the pulse 120, and the respirations 30. The right thigh was swollen. For an extent of 3 in. around the wound there was distinct emphysema; from the wound some brown haemorrhagic material was escaping; it was very foul smelling and mixed with it were bubbles of gas. It was obvious that some radical treatment was necessary, and that as quickly as possible.



Case III.—E, Eusol dressing; O, operation.

Treatment.
Under a general anaesthetic the wound was opened up for an extent of about 9 in.; a quantity of foul-smelling blood clot was removed, and also several portions of clothing which had been dragged in by the projectile. The bullet had passed through the substance of the semimembranosus muscle, and this muscle was apparently the main site of the gangrenous process; its surface, when exposed, was perfectly dry and of a greenish-brown appearance; when handled it crackled in the fingers. When cut into it did not bleed and the cut surface was of a salmon pink colour, quite different from the red of a healthy muscle; moreover, it was a foul-smelling mass. By enlarging the incision the muscle was followed throughout the greater part of its course; it was severed at its origin and at its insertion and entirely removed. It was interesting to note that the necrotic process was so closely limited to the position of the muscle. The wound was syringed out with eusol, and afterwards lightly, but thoroughly, packed with gauze wrung out of eusol.

Thereafter the wound was dressed at intervals of eight hours. After the second application of eusol all foul smell disappeared, and actually on the third day healthy red granulation tissue became apparent in the wound.

CASE IV.
Private, admitted August 24th, 1915.

History.
This man was wounded through the soft tissues of the right calf five days before admission to hospital.

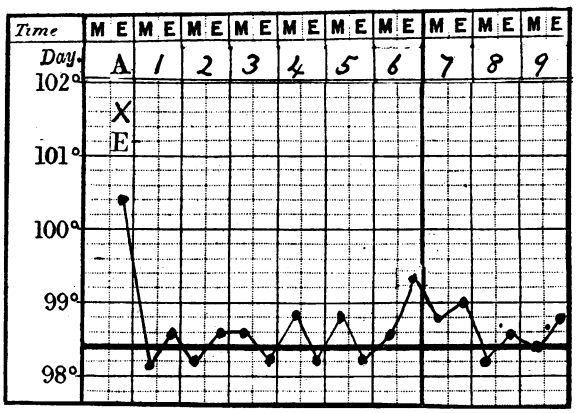
Condition on Admission.
His condition was found to be extremely serious. He was restless, collapsed, and occasionally delirious; his temperature was 100.4°, his pulse 120, and his respirations 30; he had the appearance which is associated with an intense toxaemia.

The local condition was even more alarming than the general condition.

The right leg below the knee was swollen to almost twice its natural size. The skin showed the purplish-red discoloration of moist gangrene. Up to within 3 in. of the knee-joint there were several large superficial vesicles containing foul-smelling blood-stained fluid; the surface temperature of the limb below the knee was stone cold; no trace of a pulse could be detected in either anterior or posterior tibial vessels. From the bullet wounds a quantity of foul-smelling blood clot was protruding; the entire limb below the knee crackled with emphysema. From the knee to the groin, although the skin temperature was maintained, and there was no discoloration, yet the presence of gas could be detected by palpation and percussion.

The treatment of such a case presented a great problem; one was faced with three possibilities of treatment:

1. To adopt no greater operative interference than that of simple incision, risking the very remote possibility of the gangrene becoming localized.
2. To disarticulate the limb at the hip-joint by a flapless amputation, and thus get above the infected tissue.
3. To amputate through the centre of the thigh—in other words through the less infected gas area—in this way getting rid of the actual necrotic part, and trusting to localize



Case IV.—A, Date of admission; E, eusol dressing; X, amputation.

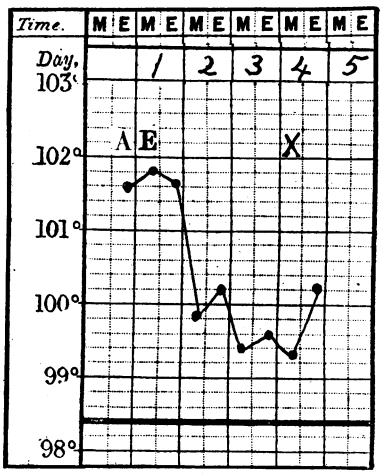
and counteract the less infected part by free incision and the application of some antiseptic. After due deliberation the last course was adopted.

Operation and After-History.
The operation was performed under spinal anaesthesia. The amputation was carried out in the middle of the thigh and anterior and posterior flaps were formed. The cut surfaces were thoroughly washed with eusol and a few sutures were inserted to bring the surfaces together. Above the site of amputation a number of incisions were made into the subcutaneous tissues.

The further progress of the case was one to uninterrupted recovery. No further evidence of a gas infection appeared; the stump surfaces quickly granulated, and on the fifth day it was found possible to insert additional sutures, and so facilitate the healing and closure of the stump.

CASE V.
Private, admitted August 26th, 1915.

History and Condition on Admission.
Twenty-four hours before admission to hospital this man had been wounded by a rifle bullet. It had passed through the left thigh, producing a compound fracture of the junction of upper and middle thirds of the bone. It had then passed across the front of the right thigh immediately below the groin. In its passage it had torn away the coverings so completely as to leave Scarpa's triangle exposed in its entirety, as though by a dissection; in the floor of the triangle the pulsating femoral vessels were lying clearly visible. From its origin the wound had been grossly infected. There was a mass of adductor muscle at the inner side of the wound in a condition of necrosis and infected throughout with a gas-producing organism; there was a similar mass of necrotic and gas-infected muscle—portions of the sartorius and rectus femoris muscles—lying at the outer edge of the wound. The surface had the coagulated, gelatinous-looking appearance which one had by this time begun to associate with gas-infected wounds.



Case V.—A, Date of admission; E, eusol dressing; X, amputation.

Treatment.
The question was considered whether it would not be advisable to amputate the limb immediately; it was decided to

vail, as any immediate amputation would certainly result in infection of the stump surfaces. The wound was carefully cleaned up, syringed, and afterwards lightly packed with gauze wrung out of eusol; the dressing was changed at six-hourly intervals. For three days repeated dressing with eusol solution was persisted in. During that time the gangrenous process was entirely mastered, the infection disappeared from the subcutaneous tissues; the emphysematous crackling remained in the necrotic muscles until these separated as sloughs.

On the fourth day the continued exposure of the femoral vessels apparently led to a coagulation of the blood stream, and gangrene appeared in the tissues of the foot. It was therefore necessary to perform amputation in the upper part of the thigh.

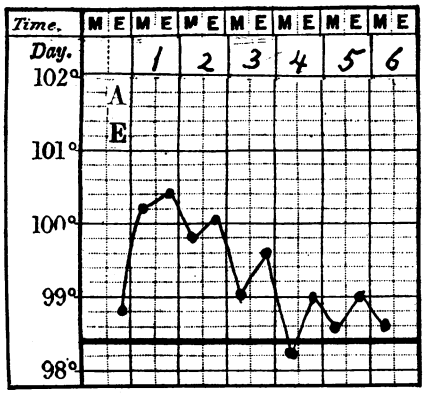
In performing this amputation one had an opportunity of observing in the tissues of the stump how completely the original necrotic process had been localized. It had not extended into the posterior thigh muscles, and it had not infected the tissues of the thigh above the wound. It was our opinion that the remarkable localization of the infection was the result of the action of the eusol application.

CASE VI.

Sergeant, admitted August 4th, 1915.

History and Condition on Admission.

There was a bullet wound of the right thigh. The injury had been sustained some forty-eight hours before, and there had been a considerable amount of bleeding into the deep tissues of the thigh. The bullet had entered the centre of the thigh posteriorly, and it remained just beneath the skin anteriorly; the bone of the leg was not damaged. From the wound fluid and discoloured blood were escaping; it was distinctly foul smelling. Around the wound the typical crackling associated with infection by a gas-producing organism could be detected; the outline of the thigh was considerably swollen. Small bubbles of gas could be expelled with the blood from the bullet wound. As regards the general condition, the temperature was 100°, the pulse 90, and there was a distinct degree of general illness.



CASE VI.—A, Date of admission; E, eusol dressing.

Obviously one was dealing with a case in which, if there was not a tissue necrosis due to the gas-producing organism, there was at least the infection which is preliminary to such a change.

Progress.

The wound was thoroughly opened up and drainage established. Among the tissues of the thigh a quantity of blood clot had accumulated; this was removed. The cavity was syringed out with eusol. A drainage tube was inserted, and the space around the drainage tube was loosely packed with gauze wrung out of eusol. In about eight hours the wound was dressed. The packing was removed; it still retained a trace of the foul smell possessed by the discharge the evening before; the cavity was again syringed out. There was no evidence of any gas infection of the surrounding tissue. At the third dressing the foul odour had entirely disappeared; the interior of the cavity was covered with a thin brownish slough. In about four days the slough had separated, leaving a cavity lined with healthy granulation tissue.

CASE VII.

Sapper, admitted September 2nd, 1915.

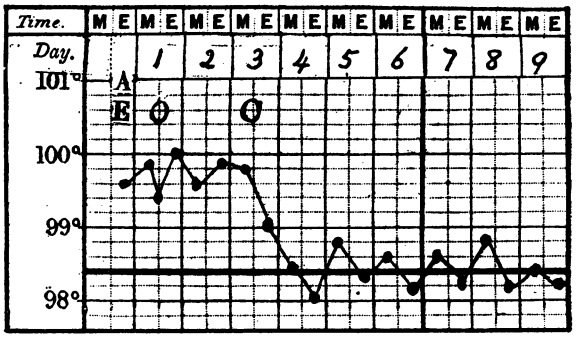
History and Treatment.

The patient was admitted on the afternoon of September 2nd with a bullet wound through the calf of the left leg. On examination the wound appeared sloughy and gas was found to be present in the surrounding tissues extending upwards to the knee-joint and downwards as far as the ankle-joint. The wound was enlarged under a general anaesthetic and syringed and dressed with eusol; the dressing was changed every six hours.

Progress.

On the following day (September 3rd) the swelling had diminished, and only the faintest traces of gas could be detected.

On September 4th there was a considerable extension of the infection, gas could be detected throughout the greater part of the leg between the knee and the ankle. Fresh incisions were made into the leg; the original wounds were further opened up and some blood clot removed. The wounds were thoroughly syringed out with eusol and eusol wet dressings were applied and changed at four-hourly intervals as before.



CASE VII.—A, Date of admission; E, eusol dressing; O, operation.

On September 5th no gas was detectable, the wounds were perfectly "sweet"; the patient generally was much improved.

On September 7th, locally the wounds were clean and beginning to granulate; the pulse and temperature were normal, and the general condition was thoroughly satisfactory.

On September 10th, the improvement being maintained, the patient was discharged to the base.

CASE VIII.

Sergeant, admitted August 30th, 1915.

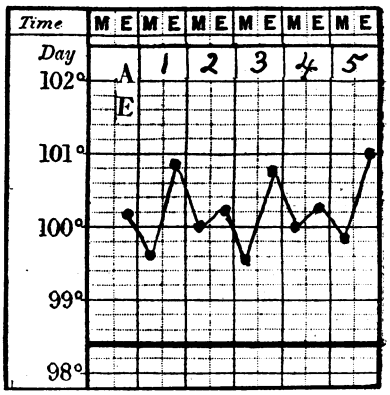
History and Condition on Admission.

This man was wounded in a bomb explosion about two days before admission. On admission he was scarcely conscious; he was delirious, and after a short period of delirium and talking nonsense he lapsed into complete unconsciousness. On the outer side of the left thigh there was a deep lacerated wound; it had all the appearances of a wound infected by a gas-producing organism. The tissues in the floor and side of the wound were brown and sloughy in appearance; there was a scanty foul-smelling discharge. The skin at the edges of the wound was faintly discoloured with a purplish-red discoloration; throughout the muscles exposed in the wound and throughout the surrounding tissues there was the distinctive crackling of a gas infection.

Other wounds present were superficial and not affected with gas gangrene.

Treatment and Progress.

The local treatment consisted in freely opening up the infected wound. As much as possible of the necrotic muscle was cut away. The wound was washed out with eusol, and later it was loosely packed with gauze saturated in the same solution.



CASE VIII.—A, Date of admission; E, eusol dressing.

The further progress of the case, as far as the infected wound was concerned, was one of progressive recovery—the gas infection was entirely arrested, the sloughs of necrotic muscle had begun to separate, and healthy granulations were beginning to appear. The general condition of the patient was unfortunately not so favourable. Complete consciousness was never regained; the features were all those of a progressive oedema cerebri, and after lingering for five days he died.

Post-mortem examination showed that he was the victim of a specific leptomeningitis, which apparently was responsible for the fatal oedema cerebri.

CASE IX.

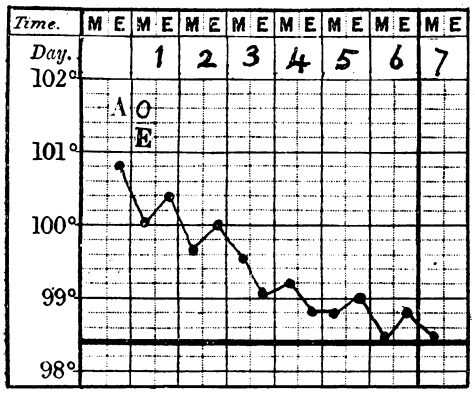
Private, admitted August 25th, 1915.

History and Condition on Admission.

A rifle bullet had passed through the soft tissues of the back. On admission the general condition was satisfactory; the wounds were dressed, and, while they were undoubtedly infected, nothing unusual was noticed.

Operation.

On the morning after admission the general condition was less reassuring; the temperature remained high—100°; the pulse-rate had increased; there was a complaint of pain in the wound and general restlessness. On dressing the wound, the cause of the change was apparent—the wound was infected with a gas-producing organism; there was the typical emphysematous crackling of the surrounding parts; gas could be displaced from the entrance and exit wounds; and the discharge was foul smelling.



Case IX.—A, Date of admission; E, eusol dressing; O, operation.

Under a general anaesthetic the wound was thoroughly opened up. The subcutaneous tissues had a dry gelatinous-looking appearance, as though infiltrated with coagulated lymph; gas could be displaced from this situation. The depth of the wound contained foul-smelling blood clot; the muscles which were cut in the opening up of the wound had the pale avascular appearance of commencing necrosis. Gas originating in the wound had infiltrated downwards in the retroperitoneal tissues as far as the anterior superior spine of the ilium. The wound was syringed out with eusol; its interstices were lightly packed with gauze wrung out of eusol; drainage was secured by means of two large rubber tubes passing downwards into the depths of the wound.

Progress.

As regards the subsequent progress of the case, the dressing was changed at intervals of six hours for two days and thereafter at intervals of eight hours. From the date of operation the condition improved and the improvement was progressive. After the first twenty-four hours all trace of foul smell disappeared and no further evidence of gas could be found. On the fourth day healthy granulations had already made their appearance.

REFERENCE.
[1] *Lancet*, August 21st, 1915.

A HOSPITAL SHIP IN THE MEDITERRANEAN.

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THIS article is somewhat discursive. My aim has been simply to give a description of the kind of work with which a hospital ship is called upon to deal, and of the conditions under which this work is carried out.

The ship is extremely well fitted, and is capable of carrying, without undue crowding, 350 cot cases, and an equal number of "walkers."

There are two excellent theatres—the one large and containing two operating tables, the other smaller and provided with one table. Our medical staff at present consists of a fleet surgeon, a consultant surgeon, and nine surgeons. One of the last belongs to the R.N., the remainder are drawn from the R.N.V.R., or hold temporary commissions. We carry four nursing sisters. There is also a sufficiency of sick bay ratings, and of St. John Ambulance men.

Fortunately our work has been carried out in security. It has never been hampered by any disregard, on the part of the enemy, of the Geneva Convention. The Turks are, from all accounts, remarkably clean fighters. They certainly respect hospitals and hospital ships, and they never put any impediment in the way of the rapid evacuation of our wounded from the shore. Hospital ships are allowed to anchor quite close to the land, and embark their cases unmolested. Of course if they get in the line of fire shells may burst unpleasantly near them, and they may have to clear out. Similarly, in certain situations, spent bullets from the nearest trenches create a certain element of danger. Shrapnel fired at aeroplanes occasionally falls on board, or a floating mine may prove a menace. These are, however, unavoidable incidents of warfare, and no fault of the Turks.

Having anchored, then, in a convenient spot, the ship is ready to take in wounded. Cases are usually brought off from the shore in barges towed by picket boats. When these come alongside, the walking cases are first taken off; the cot cases are then placed, stretcher and all, in "cot-carriers" and are hoisted on board. As a rule the majority of the "walkers" are only received for a few hours. They are fed, dressed, and then taken off in trawlers to the shore hospitals. Those of them who are likely to require lengthy treatment are, however, retained on board.

The more severely wounded men are nursed in swing beds and service cots. Any requiring immediate operation or dressing under an anaesthetic first pass through the theatre.

When as many cot cases as possible have been taken on board, the ship may complete her complement with walking cases, or she may proceed to one of the nearest hospitals and fill up there. The ship then goes on to Alexandria, Malta, or England, discharges her patients, takes in stores, coals, cleans ship, and returns to the scene of action.

When there is much activity ashore, and casualties are heavy, every available ship may be required on the spot. In these circumstances the routine may be modified, and all the cases discharged at the nearest hospital. This enables the hospital ship to return to the scene of action within a short time of leaving it. When things are quiet a ship of our size may take four or five days or even longer to fill up. On the other hand, we have taken in our full complement in eighteen hours, while during that time more than four hundred additional walking cases were dressed, fed, and sent away. Between seventy and eighty of these patients passed through the theatres, many of whom required multiple operations.

The condition in which the wounded arrive on board depends almost entirely upon the distance of the firing line from the beach, and upon the nature of the intervening terrain. Where the front trenches are within easy reach of the shore the wounded are received within a few hours of their having been injured. In these circumstances wounds when irrigated and, if necessary, freely opened up and drained, do quite as well as similar injuries treated in a civil hospital at home. Severe sepsis is the exception and spreading gangrene practically unknown. On the other hand, where the trenches are some miles from the shore, there is inevitably considerable delay in evacuating the wounded. Often this cannot be effected for twenty-four hours or more. When this is the case septic infection in a very large proportion of the wounds is firmly established, and has spread widely. Amongst such patients spreading gangrene, both with and without gas formation, is common, and many of the wounds are maggoty. Flies are incredibly numerous, especially at the southern end of the peninsula. Immediately a trace of blood is spilt down they come in swarms. In a moment a wound, unless protected, is lost to sight beneath a black crawling mass of these insects, and the same applies to a soiled dressing. One can only hope that things may improve with the advent of the cooler weather.

I feel considerable diffidence in speaking of individual injuries and their treatment, as so much has been written on the surgery of the war by more competent pens than mine. I will touch, however, lightly upon a few classes of injury, mentioning any points which have appealed to me personally. In military surgery every medical man suffers from the disadvantage of being unable to follow his cases up. In a hospital ship the cases upon which one individual operates may get scattered through several wards, and lost to his sight. On the other hand, he may have to undertake the after-treatment of cases originally under the care of his colleagues. At best the cases are seldom under his supervision for more than a few days before they are transferred to a shore hospital.

In spite of this I will endeavour to give a brief account of some injuries as they appear during the short time they remain on board.

Of the different kinds of wound, those inflicted by shell are comparatively rare except at Cape Helles. Shrapnel and bullet wounds largely preponderate everywhere. Injuries inflicted by bombs are very common where the