mitter of the subtertian parasite; but probably under natural conditions it is not a significant factor in this respect.

On the other hand only three specimens of Anopheles (Myzomyia) turkhudi survived after the third day, and only one to the tenth day after its first feed. On dissection the latter specimen showed an extensive development of pigmented oocysts in the stomach, no less than ninety-six being counted with a \( \frac{1}{2} \) inch lens in a permanent specimen stained with Giemsa. They measured on an average twenty-four microns in diameter.

I have submitted specimens of Anopheles of each batch I experimented with to Mr. G. Storey, B.A., F.E.S., of the Entomological Section, Ministry of Agriculture, Egypt, and I am indebted to him for the confirmatory identification of the species.

CONCLUSIONS ON EXPERIMENTAL GROUNDS.

(1) Anopheles (Myzomyia) turkhudi is an efficient definitive host of the subtertian malaria parasite in Egypt.

(2) Anopheles (Cellia) pharoensis can act as an inefficient and occasional definitive host for the subtertian parasite. This fact is of interest in view of the prevalence of its congener Anopheles (Cellia) pulcherrima in Mesopotamia where it is regarded as a probable carrier.

REFERENCES.


THE SUCCESSFUL CONSERVATIVE TREATMENT OF EARLY GAS GANGRENE IN LIMBS BY THE RESECTION OF INFECTED MUSCLES.

By Lieuténant-Colonel C. H. S. Frankau,
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And

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Among the points brought forward by Colonel Cuthbert Wallace in an article on "Gas Gangrene," some months ago were the following:—

(1) It is rare to meet gas gangrene without muscle injury.

(2) It is chiefly a disease of muscles, and is rarely dangerous unless muscle is involved.

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(3) The lesion in its early stages may be described as a longitudinal one, running up and down the wounded muscles from the seat of the lesion. Muscles and groups of muscles are involved while others escape.

(4) It is rare to find all the muscles of a segment of a limb involved, save in a segment distal to one in which the main blood supply has been cut off. Thus the whole leg dies and becomes gaseous when the femoral artery has been blocked in the thigh.

(5) There is little tendency for the infection to pass from one muscle to another. This is well shown in amputation stumps where one muscle dies and becomes gaseous, while the rest of the cut muscles remain healthy.

From our own observations in clearing stations over a period ranging up to twenty-one months, it is abundantly clear that these points cannot be controverted. In no case have we seen gas gangrene commencing as a subcutaneous infection; injured muscle is in all cases the initial focus—the appearance of cracking in the subcutaneous tissues being a secondary phenomenon due to extravasation of gas from the infected muscles below.

In view of this it has been our aim to model our treatment on the following lines: to explore the primary focus with a view to attempting to arrest the infection in the muscle or group of muscles involved by resection of the infected areas. Such resection may, as will be seen from the cases, involve a part or the whole of single muscles or groups of muscles.

Resection should be limited to cases in which the main vessel of the limb is intact and should be replaced by amputation where the operation must be so extensive as to be likely to give a limb which would be of less value than an artificial limb. Extensive resections however may be performed regardless of the ultimate utility of the limb, as a life-saving operation, it having been quite clear in some of the cases recorded below that an amputation as in Case 13, or a further amputation in Cases 7 and 9 could not have been carried out without very grave risk to life.

Resection should extend until muscle is reached, which has the following characteristics: (1) The colour is unchanged; (2) the contractility is normal; (3) a good blood supply is present, as indicated by free bleeding from the cut surface. Experience has shown that even if such muscles are, as they may be, slightly infected, free drainage and an open wound will arrest further development of the condition.

The treatment of cases after resection is carried out on the following lines: (1) The dressings are reduced to the absolute minimum, i.e., one or two layers of gauze only being placed over the wound so as to allow free access of air and if possible sunshine to the wound region; (2) constant or intermittent irrigation of the wound by some modification of the Carrel method—eusol, saline or peroxide of hydrogen being used as the irrigating fluid.

In connexion with the cases described below, the point must be specially emphasized that gas gangrene had already developed in some of the patients, though they were admitted a very short time after being wounded. In fact in units at the front established gas gangrene has to be treated ab initio in addition to gas gangrene developing at a later stage.

We are indebted to Colonel Cuthbert Wallace, consulting surgeon to this Army, for advice and assistance in the treatment of these cases, and to Captain
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J. W. McNe and Lieutenant J. S. Dunn, of No. 3 Mobile Laboratory, Royal Army Medical Corps, for the bacteriological and pathological investigations they have made in the cases.

Case 1.—Lieutenant F., wounded 4 p.m., on November 2, 1916, by rifle grenade fragment; admitted at 7.15 p.m., the same day, i.e., three and a quarter hours after being wounded. When admitted he was clearly very ill, although he arrived as a walking case; his pulse was 120, of poor quality and irregular, his tongue was furred and his features pinched and worn. There was an irregular wound the size of a threepenny-piece on the posterior aspect of the right arm, just above the internal condyle of the humerus—there was no exit. The whole upper arm appeared swollen; it was crepitant to the touch and gave a tympanitic note on percussion. The crackling was most marked on the inner aspect of the arm and extended as high as the anterior axillary fold above in front but to not quite so high a level behind. He was given a general anesthetic at 8 p.m. The wound, of entry was first excised, much damage to the triceps was found locally and the projectile could be felt in the inner side of the vessels in the front of the arm at the junction of the lower and middle thirds; a second incision was made over this when the subcutaneous tissues were found to be edematous and the biceps muscle showed evidence of gas infection. A further incision was accordingly made along the whole length of the biceps muscle from its origin to attachment; this showed the following conditions: some bruising of the inner border of the muscle at the situation of the projectile; discoloration of the inner half of the muscle varying from a dull red colour at either end to a deep plum colour in the centre. Over the discoloured area bubbles of gas were present under the fascia covering the muscle. This half of the muscle did not react to tap stimulation, whereas the outer half was normal in colour and contracted sharply on stimulation. As this appeared to be an infection localized to the inner half of the muscle, the latter portion was resected in its entirety. A tube drain was inserted into the posterior wound; the anterior wounds were left open, small tubes being inserted for continuous eusol irrigation, which was commenced immediately after the operation was completed. The pulse dropped to 88 six hours afterwards, and never rose above this again; the wounds remained clean without pus formation, and on November 9, 1916, were closed by secondary suture, and the eusol irrigation was discontinued. The wounds remained healthy and were practically healed when he was evacuated to the base on November 17, 1916. He had already very fair power in his arm, and the remaining portion of the biceps could be felt contracting.

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An anaerobic gas-forming organism was grown from the excised muscle, which on histological examination showed hyaline degeneration of groups of fibres with separation. This condition represents a very early stage in the process of gangrene. Long bacilli could be recognized between the muscle fibres, but were very scanty.

Note.—The extreme rapidity of the infection in this case is remarkable, occurring as it did within three and a quarter hours of the time of injury, in fact it is the earliest case that we have ever seen. There is no doubt that if any delay had occurred in the treatment the consequences would have been disastrous owing to the virulence of the infection, and the patient would have lost his limb if not
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his life. The treatment by resection of half of the muscle rather than the whole, which at first sight would seem to have been the better course, was due to the fact that the infection is known to spread longitudinally along the length of the fibres, and that transverse spread is a late phenomenon occurring in the more advanced stages. The differentiation between living and dead portions of the muscle was made from the presence or absence of contractility, it being well established that heavily infected muscle is non-contractile. (C. H. S. F.)

Case 2.—Lance-Cpl. D., wounded by shell fragment on July 2, 1916, admitted twenty-four hours later, when the following condition was found. Temperature 102.5°F, pulse 118; there was a through-and-through wound in the middle of the left upper arm; the arm was greatly swollen in the neighbourhood and tender on palpation. Subcutaneous crepitation was present. At the operation, which was performed at once, the biceps muscle at the site of the wound was found to be in a state of "black death," and was full of gas; for two inches above and below this the muscle was not contractile, and in the "red death" stage. A long incision was made over the whole length of the biceps and the entire muscular portion was excised. The wound was dressed with gauze soaked in peroxide until all oozing had ceased and then was left exposed to the air and sun under a single layer of gauze. The patient vomited a good deal for two days after the operation, but on the third day this ceased and his temperature and pulse dropped to normal and remained so. No other muscle was affected, and the resection was entirely curative and conserved his limb. He was sent to the base on July 11, 1916, with a healthy granulating wound, and a satisfactory report on his condition was received from England on July 26, 1916. (G. E. N.)

Case 3.—Pte. O., admitted at 7.30 p.m., on October 29, 1916, suffering from multiple shell wounds received the same afternoon. His general condition was good; there was a penetrating wound of the right chest, an in-and-out wound of the right calf and a penetrating wound of the right biceps muscle. The next day he was given a spinal anaesthetic and the wound in the leg was incised and drained. The next day his condition was not so good and he complained of pain in the right arm; pulse 106, temperature 101.8°F. The wound in his arm was the size of a sixpence and was situated over the centre of the biceps muscle. The arm was swollen and the skin was tense and slightly discoloured in the region of the wound. On gentle pressure a small amount of dirty serum with gas bubbles in it escaped from the wound. A general anaesthetic was given and the biceps muscle exposed by a long incision. In the middle third of the muscle deeply situated there was a small cavity containing a fragment of shell; above and below this for a distance of two inches was an area of dead crepitant muscle. The whole necrotic area was excised until healthy muscle was reached which bled on section. The wound was left freely open and dressed with a eusol gauze. He made a straightforward recovery and was evacuated to the base on November 12, 1916. The wound in his arm was then healthy and ready for secondary suture.

(Note.—In this case immediate improvement followed resection of the infected muscle.—H. D.)

Case 4.—Pte. G., wounded July 24, 1916, admitted the same day. Shell wounds right buttock, right calf and skull. Immediate operation, trephining, wound of buttock and calf drained and piece of metal removed from soleus...
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muscle. Twenty-four hours later the calf was very swollen and tender and gas bubbled from the wound on pressure. Temperature 102° F., pulse 112. A second anaesthetic was given and the calf opened up from the lower part of the popliteal space to three inches from the ankle. The gastrocnemius was split down the mid-line and found to be healthy and contractile; the soleus beneath along the track of the projectile was found to be in the black death stage of gangrene, it was crepitant and no part of the muscle was contractile. As much as possible of the muscle was cut away and the wound was flushed out with peroxide and left open to the air, the limb being slung in a cradle for this purpose. The patient was given 100 cubic centimetres of five per cent eusol solution intravenously at the end of the operation. Rapid improvement followed; the temperature and pulse dropped to normal on the next day and he was evacuated to the base on July 30, 1916, with a normal temperature and pulse. The head wound had healed and the other wounds were clean. A note from the Base Hospital stated that he was sent to England on August 5, 1916, having made an uninterrupted recovery.—G. E. N.

Case 5.—Second-Lieutenant G., wounded in the left leg by a rifle bullet at close range at 2.30 a.m., on October 11, 1916, admitted at 9.0 a.m., and operated on immediately. There was a through-and-through wound in the upper and outer part of the left calf—the wound of entry and exit being of about the same size and just large enough to admit the tip of the finger. The wounds were excised and the wound freely drained by means of two large tubes after irrigation with eusol; the wound appeared to be a comparatively trivial one. Eighteen hours later his pulse which had been previously normal ran up to 120, and the patient showed signs of a profound toxemia; the upper part of the leg was swollen and tender and the skin was glazed; there was no subcutaneous crackling. A further anaesthetic was given and the entire track of the wound, which was about three inches long, was laid open by division of skin and intervening muscles. The peroneus longus and brevis muscles were found to be considerably lacerated, they were altered in colour, crepitant and non-contractile. The dead portions were cut away until healthy bleeding muscle was reached which contracted on stimulation. The wound was left open and treated with continuous eusol drip irrigation. Immediate improvement followed, the pulse dropping to normal within a few hours. He was evacuated to the base nine days later with a healthy granulating wound. Anaerobic gas-forming organisms found in the dead muscle removed.

Note.—This case is of interest as the infection commenced in spite of free and early drainage. Resection of the infected area cut the process completely short.—C. H. S. F.

Case 6.—Cpl. E., was admitted to the station at 5.30 p.m., on August 27, 1916, having been wounded by a shell fragment at 7 p.m. the previous day. On admission he looked flushed, his tongue was dry and his pulse 120, temperature 103° F. There was an entry wound the size of a shilling over the anterior tibial group of muscles at the junction of the middle and lower thirds of the leg; the wound of exit was two inches above the ankle-joint on the posterior aspect of the limb in the middle line. The missile had passed between the two bones of the leg. The limb was very swollen in its lower half and the skin had a white tense glazed appearance; there was considerable pain on palpation. No
subcutaneous crackling was elicited. Under the anaesthetic on raising the limb gas bubbles escaped from the anterior wound with some foul stinking serum. The skin wound was excised and the anterior tibial group of muscles were explored by a six-inch incision. The extensor longus digitorum muscle was exposed—this had been divided across by the missile; the retracted ends showed an opaque sheath with underlying dead non-contractile muscle for an inch on either side of the wound. The dead portions were cut away until normal vascular muscle was reached at either end. About two and a half inches in all were cut away from either end; the anterior tibial artery was exposed at the bottom of the wound but was uninjured. The extensor longus hallucis looked healthy and contracted well. The posterior muscles were not markedly damaged and were not interfered with. The wound was drained and drip irrigation with eusol commenced. The patient made an uninterrupted recovery and was evacuated to the base on September 3, 1816; his pulse was then 90 and his temperature 99° F.; the wounds were granulating.

An anaerobic gas-forming organism was isolated from the removed muscle which on section showed necrosis and irregular fragmentation of muscle fibres; there was oedematous thickening and leucocytic infiltration of the interstitial connective tissue; large bacilli were present in considerable numbers between the dead fibres.

Note.—This case clearly shows the longitudinal spread of the infection in the muscles and how free resection of the diseased muscle arrests any further spread of the infection.—H. D.

Case 7.—Pte. C. was wounded at 4 p.m., on July 29, 1916, by a shell fragment in the region of the left knee. On admission five hours later his condition was very bad owing to loss of blood, pulse 150. Six hours later after warmth and stimulation he was fit for operation and the wound was explored. There were two lacerated wounds on each side of the popliteal space which had evidently been traversed from within outwards; examination showed an extensive fracture of the head of the tibia involving the knee-joint. The pulsations of the main vessel could not be felt; gastrocnemius and soleus muscles were extensively lacerated. The wound was freely drained after irrigation with eusol. The next day his condition was satisfactory until 8 p.m., when his pulse was 120 and his temperature 103.4° F. The region of the wound was more swollen and the skin over the calf had the appearance of a bruise which was fading; percussion gave a tympanitic note over this area; there was no subcutaneous crackling. The knee-joint was also resonant from the presence of gas. The lower third of the leg was cold and there were several light purple patches over the dorsum of the foot. The leg was removed by disarticulation at the knee-joint; examination of the limb showed occlusion of the popliteal artery from a bruise wound and a large hole in the popliteal vein, the gastrocnemius and soleus muscles showed marked gas gangrene. He was much improved the next day, but on the following day his pulse was 120, and his temperature 101.4° F.; the lower third of the thigh was swollen, tender to the touch and resonant to percussion; it was evident that the infection was spreading up the muscles of his thigh. Under chloroform an incision was made up the back of the thigh and the semi-membranous muscle was found to be gaseous and stinking. It was followed up to the middle of the thigh and resected at this point as the fibres were found to be healthy there.
The anterior aspect of the thigh was then explored and the sartorius muscle was found to be similarly infected in its lower part; the distal four inches were resected through healthy muscle. The wounds were left exposed to the air, being covered by one layer of gauze only; the wound was kept irrigated by a constant eusol drip. The thigh was slung so as to take the weight off the muscles of the back of the limb; suspension was effected by means of a gauze band attached to the exposed condyles of the femur. From this time on he commenced to improve, on the following day his pulse was 96 and temperature 101° F. On August 3, the stump of the popliteal artery, which was lying in a bed of sloughing muscle, commenced to ooze; in order to avoid a secondary hemorrhage the femoral artery was ligated in Hunter's canal under local anesthesia. After this he continued to improve and was evacuated to the base on August 15. The muscles were infected with a pure culture of Bacillus perfringens.

Note.—It was impossible even to attempt to save the limb in this case by resection of muscle in the first instance owing to the occlusion of the popliteal artery. When the secondary spread of infection occurred into the thigh muscles after the amputation his general condition became rapidly so bad that a further amputation would have been inevitably fatal. Resection of the infected muscle was the only satisfactory course to adopt, as proved to be the case.—H. D.

Case 8.—Pte. P., wounded August 28, 1916, admitted the same day. Through-and-through wound of left thigh with compound fracture of the femur in the upper third. He had had much hemorrhage before admission and was very collapsed on admission—pulse 140, temperature subnormal. Twelve hours later he had improved sufficiently for operation, both wounds were freely opened up, lacerated muscle, fragments of bone and the case of a bullet being removed. The outer wound was kept open with a silver retractor and both were lightly packed with eusol gauze. The limb was immobilized on a Wallace-Maybury splint and the wounds were syringed every two hours with eusol. Patient had a good night but next morning his temperature and pulse began to rise, he complained of pain in the limb and of great thirst. His tongue became dry and brown. On examination the limb was found to be swollen, tense and had a characteristic odor. There was no skin crepitation and no gas-bubbles from the wound. An immediate "chaff cutter" amputation just below the trochanters was performed and the adductor muscles were found, to be in the red stage of gas gangrene, so they were completely excised from the stump. The wound was dressed for twenty-four hours in gauze soaked in peroxide and then left exposed to the air under one layer of gauze. Within two days the temperature dropped to normal and the pulse to 90; none of the other muscles in the stump showed any sign of being infected and he was evacuated to the base on September 15, 1916, with a granulating wound. A laboratory report confirmed the diagnosis of gas gangrene. This method of removing a group of infected muscle was also carried out in another case five days after amputation; the adductors here being also removed—no spread occurred in the other muscles.—G. E. N.

Case 9.—Lieutenant B., wounded at 1 a.m. on September 13, 1916, by shell, right leg shattered in lower third. Admitted at 3.30 a.m. the same day. Primary amputation by equal lateral flaps at the middle of the leg was performed at 4 a.m.; at the operation it was noticed that the anterior tibial artery was occluded, there was no change in the muscles which were contractile and
apparently healthy. The wound was freely irrigated with eusol and the flaps which were free were united loosely with three sutures. Free drainage was provided for by means of two tubes which also served for constant eusol irrigation which was started at once. The pulse before the operation was 90, at the end of the operation it was 88. Twenty-six hours later the pulse ran to 120, tongue became furred and dry and the patient was drowsy and obviously very ill. Examination of the wound showed mottling of the skin over the front of the leg, together with a tympanic note on percussion over the same area; there was no crackling of the subcutaneous tissues. The wound was at once opened up, when it was found that the entire anterior tibial group of muscles were a brick red colour, non-contractile and quite dead. They were removed en masse and the wound was left open under constant eusol drip irrigation. The general condition remained bad for twenty-four hours with rapid pulse, drowsiness and persistent vomiting. Steady improvement then followed and the patient was sent to the Base on September 23, 1916, with a healthy granulating wound.

The removed muscles were found to be heavily infected with _B. perfringens_ and other gas-forming organisms on culture.

**Note.**—The only other alternative in this case would have been a further amputation through the thigh, which it is doubtful if the patient would have survived; resection of the muscles avoided this additional danger and gave the patient a much more serviceable stump as the knee-joint was saved.—C. H. S. F.

**Case 10.**—Pte. P. was wounded by shell fragment on July 23, 1916; admitted July 24, 1916. On admission—temperature 103·6° F., pulse 120. There was a through and through wound of the left thigh, the entry being on the inner side three inches above the patella and the exit two inches higher up on the outer side. The exit wound was swollen, tense and tender, but did not crepitate. Both wounds were excised and united by incising the skin. There was some laceration of the edge of vastus internus; this was cut away, the muscle looked normal and was contractile. The rectus femoris was grooved on its under surface but appeared otherwise normal. The exposed inner edge of vastus externus was brick red and non-contractile and smelt strongly of gas gangrene. An area of four inches by two in the muscle showed signs of red death, the parts beyond were normal and contractile. A free skin incision was made and a piece of muscle eight inches by three enclosing the affected area was excised; the wound was dressed in gauze soaked in p eroxide and later exposed to sun and air. The temperature and pulse steadily fell and by July 30, 1916, were 99° F. and 76 respectively. He was sent to the Base on July 30, 1916; the wound then was healthy and granulating and there was no sign of further gas infection. A report from the mobile laboratory stated that the infection was due to an anaerobic gas-forming organism.—G. E. N.

**Case 11.**—Pte. M., wounded on August 29, 1915, by shell fragment in the left groin: there had been much haemorrhage at first, necessitating saline infusion in the Field Ambulance, where he was retained until mid-day on August 31, 1915. On admission his condition was grave: tongue brown and dry, pulse 130. There was a ragged wound of entry the size of a shilling, an inch and a half below Poupart's ligament and just to the inner side of the femoral vessels; the skin over the upper third of the thigh and for a hand's breadth above the wound was mottled and discoloured, and showed marked subcutaneous crackling. An
anesthetic was immediately given and the wound opened up; it was found to extend upwards and outwards towards the anterior superior spine where a fragment of metal and khaki was found in the sartorius muscle. The muscle in this situation was dead and the upper third was cut away. The discoloured and crepitant areas were incised down to deep fascia and freely injected with hydrogen peroxide. No dressing was applied and the wound was kept constantly irrigated with hydrogen peroxide and left exposed to the air and sun. Rapid improvement took place and the man was evacuated to the base with a granulating wound twelve days later. No bacteriological examination was made, but there is no doubt about the condition.

Note.—At the time when this case came under treatment the significance of the muscle resection was not realized, but it seems at least probable that it cut short the process by removing the main focus of infection.—C. H. S. F.

Case 12.—Lance-Cpl. C., wounded in the left thigh by a shell fragment at 3.0 p.m. on March 13, 1916; admitted into hospital at 2.30 p.m. the following day. On admission he looked flushed; temperature 102°F., pulse 130. There was a jagged wound two inches in length on the outer aspect of the lower third of the left thigh, No exit wound. The lower part of the left thigh was swollen and tense and the overlying skin was shiny. There was tenderness on palpation and a tympanitic note was obtained on percussion; there was no subcutaneous crackling. Operation 5.30 p.m. the same day. A long incision down the outer aspect of the thigh exposed the vastus externus muscle, of which the lower half was markedly affected with gas gangrene. A portion of the muscle near the wound of entry was black in colour and the muscle fibres were diffusent. The lower part of the muscle was resected up to the middle of the thigh where healthy contractile muscle was found. As the muscle planes were separated by gas up to the level of the great trochanter the skin incision was carried up to this level. The whole wound was left wide open and dressed with eusol gauze. At 9.0 p.m. the same evening he was given an intravenous injection of eusol 100 cubic centimetres. His pulse dropped the next day and he showed a great improvement; this was maintained and he was evacuated to the Base six days later. Information was received from England a week later that he was progressing well. An anaerobic gas-forming organism was obtained on cultivation from the muscle removed.—H. D.

Case 13.—Pte. B., wounded September 1, 1916, admitted the same day. Shell fragment. Through and through wound of thigh, the entrance being on the inner side two inches below Poupart’s ligament and the exit at a corresponding point on the outer side. Under an anesthetic the skin wounds were excised and the track syringed with eusol and drained. Fifteen hours later the patient complained of great pain in his thigh and of great thirst. Temperature 101°F., pulse 110. On examination the wound was found to be tender, crepitant, and gassy. A further anesthetic was given and the whole tract of the missile laid open; the sartorius, rectus femoris and inner edge of vastus externus were found to be in the “black death” stage of gas gangrene. An incision was made from the anterior superior iliac spine to the knee and another along the inner side of the thigh; these were stitched back to healthy skin so as to fully expose the wound. All three muscles showed the “black death” stage of gangrene at the site of the wound, toning down through the “red death” stage to normal muscle as the muscles were traced
down the thigh. The muscular part of the rectus femoris was removed and also the sartorius from its origin to just above the knee. A strip of the vastus externus for nearly its entire length and for a width of three inches was also excised. No other muscles appeared to be affected; the wound was dressed with gauze soaked in peroxide and afterwards exposed to the sun and air. For three days he was very ill with a rapid feeble pulse, constant hiccough and persistent vomiting; he however slowly improved, and on September 5, 1916, his pulse was 88 and temperature 100°F.; the hiccough still persisted. Two days later a part of the skin flap sloughed, after which he improved steadily and was evacuated on September 11, 1916, with a healthy granulating wound which was skin grafted at the Base hospital. The diagnosis of gas gangrene was confirmed by the mobile laboratory.—G. E. N.

Case 14.—Cpl. V., wounded in the left thigh by a shell fragment at 5.30 p.m. on September 19, 1916: admitted into the station five hours later. General condition was then good; pulse 100, temperature 99°F. There was an entry wound the size of half-a-crown on the inner and posterior aspect of the thigh at the junction of the middle and upper thirds. The exit wound was at the outer side of the thigh in the middle third—it was very large, admitting the whole hand and the muscles were greatly lacerated. He was operated on immediately after admission; the missile had passed through the vastus externus and biceps muscles close to the femur and had partially divided the sciatic nerve. The wound was freely drained after irrigation with eusol. He continued to do well for two days; when the evening pulse rose from 104 to 132 and the temperature to 103°F. The skin over the exit wound was now a dirty-brown colour and the area in the neighbourhood was swollen and tender; there was no subcutaneous crackling. The skin discoloration extended to the popliteal space. A further anæsthetic was given and the large exit wound was freely laid open. In the lower part of the wound the vastus externus muscle was found to be gangrenous; it was non-contractile and gaseous. The infected portion of the muscle was resected until healthy muscle was exposed. In the upper part of the wound the vastus externus was pale and contracted feebly; with clean instruments a piece was removed for examination and the skin was laid freely open over the muscle. Eusol dressings were applied. Immediately improvement followed and he was evacuated to the base on September 20, 1916, with a normal temperature and pulse. Anaerobic gas-forming organisms were cultivated from the dead muscle and were also obtained on culture from the portion of muscle removed from the upper part of the wound.

Note.—This case shows the immediate improvement after resection of the infecting focus, and also that muscle may look healthy and be contractile and yet be infected.—H. D.