METASTATIC GAS GANGRENE: FIVE CASES, WITH RECOVERY IN THREE.

BY

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MICRO-ORGANISMS, in cases of gas gangrene, gain entrance to the blood stream and produce lesions in distant parts of the body, perhaps more frequently than is generally supposed.

This in the majority of cases is a terminal phenomenon and readily escapes notice. Colonel Cuthbert Wallace¹ has mentioned two cases in which metastatic lesions were manifest shortly before death, and two similar cases are recorded by Kenneth Taylor.² Mullally and McNee³ describe a remarkable case in which the bacillus of malignant oedema, circulating in the blood, became localized at the sites of injections of antitetanic serum and pituitrin.

During the past five months five cases of metastatic gas gangrene have occurred in No. 8 General Hospital, and three of these are of special interest, inasmuch as each made a satisfactory recovery.

The records of the five cases are as follows:

CASE I.

Cpl. A. (under the care of Captain W. F. Neil, R.A.M.C., T.C.) was admitted on September 9th suffering from gunshot wound of the right upper arm. The humerus was comminuted and the wound very foul and septic.

On December 6th an operation was performed, drainage was improved, and fragments of bone removed.

On December 9th the arm below the wound became cold and areas of discoloration and bullae appeared on the forearm and hand. The patient was pallid, complained of thirst, and vomited. The pulse was soft and running.

The arm was amputated at the shoulder-joint, the flaps being left unsutured. The same evening crepitation was noticed in the left buttock. The extremities were cold, and the pulse barely perceptible; 100 c.cm. of eusol were injected into the median basilic vein. Shortly afterwards the pulse improved, and he began to perspire profusely.

The improvement was very transitory; he rapidly grew worse, and died at 2 p.m. on December 10th.

An autopsy was made soon after death, and the gluteal muscles of the left buttock were found to be greyish, soft, and crepitant. A bacteriological examination demonstrated the presence of *B. aerogenes capsulatus* in large numbers.

CASE II.

Cpl. B. (under the care of Captain W. F. Neil, R.A.M.C., T.C.) was admitted on September 17th with a gunshot wound of the abdomen. An operation had been performed at the casualty clearing station, and the ascending colon had been found injured. On his arrival at the base there was a faecal fistula and swelling and crepitation over the right deltoid. There were also the usual toxic symptoms associated with gas gangrene—a soft rapid pulse, intense thirst, and marked pallor. The same day an incision was made over the right deltoid; the whole of the muscle was greyish-brown in colour, crepitant, and spongy. A free excision was made, and 70 c.cm. of eusol given intravenously. The patient rapidly grew worse, and died the next day.

CASE III.

Pte. L., aged 22, was admitted September 5th with gunshot wound of the right arm. The missile had traversed the upper arm a short distance above the elbow and comminuted the humerus. The entrance and exit wounds were large, and the brachial artery lay exposed. The forearm and hand were cold, and presented a bluish mottling and numerous bullae. Crepitation was detected, and bubbles of gas and a sanious fluid could be pressed from below into the wounds. The patient was pallid, had a dry, foul tongue, and vomited.

The arm was amputated a little above the insertion of the deltoid, a flap being taken from the outer aspect.

On September 6th he was extremely ill. Pulse 140, respirations 32, temperature 103°; stimulants were freely administered, and 100 c.cm. of eusol injected into the left median basilic vein. On September 9th the general condition was slightly better, although there was extreme pallor and an insatiable thirst. Pulse 110, temperature 101° to 103°, respirations 30. The flap had become necrotic, otherwise the stump was satisfactory. Pain was complained of in the right buttock, where there was found to be some swelling and a suspicion of deep crepitation. On September 10th the crepitation was very distinct, and extended over the sacral and right iliac regions and down the back of the thigh to within a handbreadth of the knee. The right buttock was definitely tympanitic, and over the most prominent part there was a small area of bluish discoloration.

Under a general anaesthetic an incision was made to the right of the sacrum. Gas was present in the subcutaneous tissue, and gas and sanious fluid could be expressed from the right buttock.

A small circular slough of skin formed at the site of the bluish discoloration; on September 16th the slough was gently removed, and along with it was extracted a greyish necrotic

mass of muscle, measuring 4 in. by 2 in. The patient was decidedly better. There was no longer thirst, and he was now able to enjoy food. The temperature was falling by lysis. Pulse 96, respirations 24. On September 20th the arm stump and wounds of buttock were covered with healthy granulations. The patient was rapidly gaining colour and strength, and was this day transferred to England.

CASE IV.

Pte. W., aged 21, was admitted November 23rd suffering from trench feet. The toes were bluish-black and cold. There were bluish patches and bullae on the dorsal and lateral aspects of the feet and oedema of the legs extending as high as the knees. The blisters were snipped, the feet washed with methylated spirits, and boric powder and dry gauze applied.

On December 6th the feet had become sodden and foul smelling. The bluish patches had become confluent and an indefinite line of demarcation had formed at the level of the ankle-joints. There was pallor and thirst, and the temperature rose to 103° and the pulse to 120.

The left leg was amputated midway between the ankle and knee. The right leg was amputated a handbreadth above the ankle, and as there was a suspicion of gas in the intermuscular planes, the lateral incisions were extended upwards and the short flaps left unsutured. The patient's general condition was so critical that the operation had to be hurriedly completed. Before he left the table a mixture of 100 c.cm. of eusol and 200 c.cm. normal saline was injected into the median basilic vein.

On December 7th the oedema of the legs was subsiding and the stumps were satisfactory. The patient, however, was extremely ill, mildly delirious, and passing urine involuntarily. There was a bluish pallor of the face. Respirations 46, pulse 140. There was no dyspnoea and nothing abnormal to be found in the chest. One pint of saline and 1 c.cm. of pituitrin given subcutaneously.

On December 8th he was still delirious. Respirations 48, pulse 120, temperature 101°. Next day he was no longer delirious, but very weak and pallid. He complained of pain in the buttocks, and a small serous blister was discovered on the left buttock. On December 12th there was slight improvement and the stumps were satisfactory, but the sclerotics had a marked icteric tint. On December 13th he was still complaining of pain in the buttocks and both gluteal eminences were found to be tympanitic. The skin over the sacral and lumbar regions was oedematous and over the posterior superior spine there was an area of bluish-red discoloration. This state of affairs was remarkable, as the patient's general condition was decidedly better. There was still the waxy pallor, but the patient was feeling better and the tongue was clean and moist.

Under a general anaesthetic incisions were made downwards and outwards from the posterior superior spine. The subcutaneous tissue was slightly oedematous. On incising the deep fascia bubbles of gas and a thin yellowish blood-stained fluid escaped. The finger was inserted, and greyish crepitant masses of necrotic muscle extracted. The wounds were lightly packed with dry gauze. Buttock wounds douched daily with hydrogen peroxide and eusol gauze applied. Small greyish tags of muscle slough were separating on December 16th, and exposing early granulating tissue. Portions of the flaps of the right stump had necrosed, otherwise the stumps were satisfactory, the patient feeling stronger, enjoying food, and sleeping well. On January 2nd the temperature had been normal for a week. The buttock wounds and stumps were clean. The patient had been allowed up in a chair for several days, and on this day was transferred to England.

Bacteriological Examination.—A fragment of slough was examined by Captain W. E. M. Armstrong, R.A.M.C. (T.C.), and was found to contain *B. aerogenes capsulatus* in large numbers.

CASE V.

Cpl. P. (under the care of Captain G. Whittington, R.A.M.C., T.C.) was wounded in the right buttock, right arm, and right shoulder by shell fragments on December 10th. On December 12th the buttock wound was enlarged at the casualty clearing station, and a small piece of shell removed from the bone close to the right acetabulum. When admitted to the base hospital on December 14th he was not markedly pallid, but complained of thirst. Pulse 92, temperature 99.5°. The wound in the right buttock was about three inches long, and lay a little above and behind the great trochanter. There was a moderate amount of sepsis, which, however, was localized to the immediate neighbourhood of the wound. Accidentally it was found that deep crepitation could be made out in the opposite buttock. There was no discoloration of the skin.

An incision was made downwards and outwards from the left posterior superior spine of the ilium, and gas and a thin blood-stained fluid escaped. A portion of the gluteus maximus, measuring 2 in. by 3 in., was greyish and crepitant, and was excised. The wound was lightly packed with dry gauze.

On December 18th there was still a small amount of thin purulent discharge from the left buttock. The discharge contained fragments of muscle slough and had a characteristic anaerobic smell. General condition much improved. For more than a week there was irregular pyrexia, and this was in part due to the septic state of the wounds of the left arm, but on January 3rd all the wounds were clean and granulating, and his general condition was such as to allow of his being transferred to England.

Bacteriological Examination.—Captain W. E. M. Armstrong, R.A.M.C. (T.C.) reported on the gluteal discharge that *B. aerogenes capsulatus* was present in large numbers, and that in aerobic culture a coliform bacillus had been isolated.

It will be observed that in all of the three cases in which a bacteriological examination was made, the causal organism of the metastatic infection was the *B. aerogenes capsulatus*. Four of the secondary lesions occurred in the buttocks, and it would seem—as Kenneth Taylor pointed out in his two cases—that continuous pressure, due to the patients' posture, was an important factor in the localizing of the metastatic infection. Whether the intravenous injection of eusol in Cases III and IV was contributory to their recovery it is impossible to say. In Case V there was recovery without the injection of eusol, but the remarkable feature of this case was that, despite the evidence of a systemic infection with the *B. aerogenes capsulatus*, there was an absence of marked toxæmic symptoms.

It will be noted that in the fatal cases, I and II, the intravenous injection of eusol was given when the secondary lesions were already manifest and the patient obviously moribund.

In the successful cases III and IV the intravenous injection of eusol was given early. The metastases occurred late, and recovery followed with the minimum of surgical intervention. In Case III the extensive gas gangrene in the right buttock and thigh occurred five days after amputation of the right arm. Only a small incision was made for the secondary lesion, yet the infection became localized, and a muscle slough separated spontaneously. In Case IV the metastatic infection in both buttocks developed a week after the amputation of the gangrenous feet. Here again the operation for the secondary lesion was limited, and no attempt was made to extirpate the infected muscles. It can only be suggested that in these two cases the intravenous injection of eusol delayed metastasis, and that prior to the secondary lesions the patient had time to acquire an immunity sufficiently powerful to overcome the disease.

I wish to express my thanks to Captain Max Page, R.A.M.C.(S.R.), for his help and advice, and also to Lieutenant-Colonel S. G. Butler, D.S.O., R.A.M.C., for his kind permission to publish these cases.

REFERENCES.

¹ BRITISH MEDICAL JOURNAL, September 16th, 1916. ² *Lancet*, December 23rd, 1916. ³ *Journal of the Royal Army Medical Corps*, December, 1916.

A NOTE ON SKIN GRAFTING.

BY

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SEVERAL successful cases of skin grafting during the past few weeks have prompted the writing of this note. Four large wounds have been treated by the method described. In three the wounds have been covered by firmly-growing skin at the end of a fortnight. In one only a few small islands of skin grew.

Failure follows many cases of skin grafting owing to the loosening of the grafts by excessive discharge, or to their displacement by the shifting of a dressing or its removal. The employment of oiled silk, celluloid or foil next the grafts only lessens the liability. The absence of a dressing does away with the second risk and minimizes the former, since much less discharge occurs when the wound is open to the air. There may be some greater risk of sepsis, but the other advantages outweigh this. A gauze cage can be made to keep off flies if the part is not covered by bedclothes. Several procedures recommended in skin grafting are open to criticism. It is said that grafts should overlap each other and the margin of the wound. Epithelium will adhere to a granulating surface, but not to epithelium. Consequently, the overlapping edges die from lack of nourishment. There being no spaces between the grafts there is a greater risk of the discharge floating the grafts off. It is often recommended to shave down granulations before applying grafts. This I regard as most undesirable, since it increases the discharge. If the surface is flabby and unhealthy, it is much better to wait till firm new granulations appear before applying the grafts. It may, however, be advisable to shave down the edge of the wound if it be raised and hard. The details of the method used are as follows:

1. The skin from which the grafts are to be cut is cleaned with ether soap. The best site is, I think, over

the ileo-tibial band, as the surface is flat and the skin is not easily moved on the subjacent tissues. Grafts of a uniform thickness are cut easily.

2. The granulations are swabbed with saline solution and dried with aseptic gauze.

3. Under a general anaesthetic a graft about the size of two or three postage stamps is cut with a wet razor. In thickness it should be sufficiently transparent to allow the blueness of the razor to be seen through it. On its removal pin points of bleeding should appear.

4. The graft is slipped from the razor on to the wound, slightly stretched with two fingers, and pressed firmly on. About one-eighth of an inch is left between the grafts.

5. No dressing is applied to the grafts. The patient should be in a position in which he can lie comfortably and the contact of the bedclothes avoided by a cradle.

6. Aseptic gauze is stretched firmly over the surfaces from which the skin was cut. This should be left till it peels off readily. If aseptic, the areas are dry. If any sepsis is present, the pus will soon loosen the gauze. It is difficult to avoid the infection of the skin in some cases.

After the operation discharge accumulates between the grafts and forms in some cases an unpleasant-looking scab. This should not be touched before the lapse of a week, when gentle bathing or fomentations will easily remove it. One reads of grafts which disappear entirely for a few days, after which a fine growth of epithelium can be seen over the surface. This suggests to me failure of all but a few fragments to "take," as happened in one of my cases.

The grafts in the presence of discharge may pucker slightly. This is the reason why I think slight stretching of them in application is useful. If there is any blistering of a graft a day or two after operation it is advisable to snip a small button-hole with a pair of sharp curved scissors. In future, except in a very clean dry wound, I would make such a small opening in any graft above the size of a postage stamp at the time of operation. There is nothing novel in the method used, but it is one which has much to recommend it.

ANOTHER WANDERING SHRAPNEL BALL.

BY

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PROFESSOR ARTHUR KEITH's letter in your issue of February 24th prompts me to record the following case, in which a shrapnel ball entered the body between two ribs and was removed from the common iliac vein:

The sequence of events was, baldly, as follows:

January 9th. Wounded between ninth and tenth ribs, anterior axillary line, right side.
January 9th to 14th. X-rayed at casualty clearing station. Bullet seen in chest.
January 14th. Admitted to No. 26 General Hospital. Bullet seen in chest by x rays.
January 15th. Right hæmorrhax diagnosed.
January 17th. Explored with needle and found sterile.
January 18th. Aspirated. A pint of fluid blood; much cough followed.
January 20th. X-rayed again. Bullet not in chest, but seen in abdomen.
January 25th. X-rayed again. Bullet in same position. Bismuth meal.
January 26th. Pain in right iliac fossa, suggesting appendicitis.
January 27th. Pain and tenderness increasing. Swelling above Poupart's ligament.
January 28th. Operation. Appendix removed; bullet removed from vein.
January 29th to 31st. Increasing pain, distension, and vomiting, followed by death.

There was a gash wound in the front of the arm, which possibly took a little "way" off the bullet. When the patient was admitted the breathing was distressed, necessitating the upright position, and there was frequent cough with fairly copious greenish sputum. There were signs of pleural effusion—dullness, diminished breath sounds, vocal fremitus, and resonance, with displacement of the apex beat to the left. There was ægophony on both sides.

The x rays showed the bullet near the middle line at the level of the anterior end of the sixth rib. It moved obliquely upwards and inwards with respiration, and now and then oscillated quite violently through a distance of about an inch.

Captain D., radiographer to the hospital, suggested that it might be in a bronchus, and it seemed very possible that this was so, thus accounting for the cough and sputum and respiratory distress, though there had never been any hæmoptysis. The x ray, of course, showed the hæmorrhax, which rather obscured the outline of the liver and diaphragm.