

Parke Weber (1932), in a discussion on the subject, suggested that the primary factor was not a local infection but rather some condition of the mucous membranes analogous to epidermolysis bullosa, which is not necessarily hereditary. The familial incidence of the condition in 6 of my cases favours such an interesting idea.

In view of the occurrence of mucosal ulceration in agranulocytosis the possibility of such a condition in these patients has to be remembered. No investigated case has had a neutropenia. Embleton (1937) described the interesting case of a girl who had ulceration of the mouth regularly every seventeen to nineteen days, the attacks always being coincident with a marked neutropenia, the leucocyte count being normal between the paroxysms. Embleton states: "There is no relationship between the swing of the rhythm and the menstrual periods." But unless the menstrual cycle was extremely irregular it is difficult to understand how this could have been the case.

I suspect that cyclical mucosal ulceration, at any rate as a partial syndrome, is far commoner than is generally believed. Possibly many girls who have genital ulceration do not seek medical advice because of false modesty, especially if they are single. In cases of stomal ulceration the relation to menstruation may not be volunteered by the patient even if present or be asked about by the doctor, who is probably unaware of such an association. Almost all previously published cases have been severe, but some of mine were mild and lead me to suppose that frequently the condition does not trouble the patients enough to make them consult a doctor, and Case 7 of my series indicates that spontaneous cure does apparently occur.

I wish to emphasize that none of the 8 cases described above has ever been an in-patient of any hospital.

Summary

Eight cases of cyclical mucosal ulceration are described, six of the patients being near relatives. The ulceration affected the mouth in all cases, and in two the genital tract was also involved.

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SOME RECENT AIR-RAID CASUALTIES

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The treatment of air-raid casualties at this hospital during the past few weeks is here recorded because a few points have arisen which may be of value in the conduct of further cases.

First Series of Cases

Twenty-three casualties were brought to hospital; the injuries were due mostly to the direct action of the explosive, the distribution of the fragments being such that nearly all the lesions were in the lower limbs. Of the 23 patients 6 were dead or died within a few minutes of admission. Of the remainder, 8 died within twelve hours and 9 survived. These 17 patients were admitted to the receiving ward within thirty minutes of the time of injury, and resuscitative treatment was started immediately. They were all between the ages of 19 and 30; their lesions were lacerations or compound fractures of one or both lower limbs, with shock and local injury roughly in proportion. It was found that they could be put into one of two groups with reference to severity of the shock and treatment (and, one might add, prognosis also, as was unfortunately confirmed by the poor results of resuscitative treatment). One group, containing 9 cases, were all suffering from severe shock and had comminuted compound fractures of one or both lower limbs. The other group, consisting of 8 cases, only slightly shocked, had multiple lacerations, some also with compound fracture of one limb.

The former group were from the start too ill to allow of immediate operation; they were all in the clinically recognizable state of severe shock and had to be resuscitated before operation could be considered. They were given morphine and blood or plasma transfusions. In not one case was there bleeding from a large artery. The results of resuscitation treatment were extremely disappointing. Of these 9 patients 8 progressively became worse, and they died in $\frac{1}{2}$, $3\frac{1}{4}$, 4, $6\frac{1}{2}$, $6\frac{1}{2}$, $6\frac{1}{2}$, 8, and 11 hours. The other patient improved sufficiently for operation to be performed after six hours, and after much anxiety he survived. The second group never really gave rise to any doubt about their treatment and immediate prognosis. All 8 were operated on within six hours, mostly by excision and plaster, and have done extremely well.

It is not proposed to describe the general organization or the routine treatment, which was on generally accepted lines, as frequently described in recent articles (Cohen and Schulenburg, 1940; Hodgson and McKee, 1940). The operative technique was that described by Cohen and Schulenburg in their excellent paper, except that in their cases "no attempt at excision or trimming of muscle was made," whereas in our cases excision of damaged muscle was regarded as an important step in the procedure. A few cases only will be detailed, as they were of uniform type in the two groups. Of the 9 patients with severe shock the following case was typical:

A man aged 22. Compound comminuted fracture of upper end of left tibia and fibula with much destruction of tissue and the limb almost completely severed; a tourniquet had been applied just above the knee. This patient was suffer-

ing from extreme shock, and the pulse was imperceptible. He was given morphine grain 1/3 and a transfusion of 500 c.cm. of blood, followed by 800 c.cm. of plasma (4.5% protein). He improved slightly after two hours, his pulse then being 120 and of poor volume; but he subsequently deteriorated, and died seven hours after the injury. He was never in a condition to allow of operation.

Seven other cases, with unilateral or bilateral fractures, were very similar in their injuries and course. The remaining case of this first group of 9 survived:

A man aged 20. Compound comminuted fracture of upper end of right tibia and fibula and a severe laceration of the calf muscles of the left leg; a tourniquet had been applied just above the right knee. This patient was in a state of very severe shock—pulse 152, just palpable. He was given morphine grain 1/3 subcutaneously, 3,000 units of A.T.S., and a transfusion of 450 c.cm. of blood followed by 650 c.cm. of plasma (4.5% protein). His condition remained extremely poor for five hours, after which he improved enough for operation to be undertaken; his pulse was then 150, of fair volume. Amputation through the lower third of the right thigh was performed under gas-and-oxygen anaesthesia, the wound being closed, with drainage. His condition became so poor again during the operation that no excision was undertaken for the laceration of the left leg, a flavine dressing being applied and the transfusion continued post-operatively with 900 c.cm. of blood. The outcome was in doubt for a further twenty-four hours, after which he gradually improved. His subsequent progress was good, the wounds healing well.

The results of treatment of shock in these 9 cases were very disappointing. The transfusions were all started within half an hour of admission; blood or plasma (4.5% protein), or both, were used. The first 500 c.cm. was run in as rapidly as it would drip, and the rest at about 40 drops a minute. In none was there any substantial rise in blood pressure or fall in pulse rate. No cases developed rigors or signs of incompatibility. Several of the patients remained mentally alert until a few minutes before death, and appeared to gain little relief of pain from subcutaneous morphine: perhaps with a poor circulation intravenous administration would be preferable. The results obtained in these cases therefore indicate that replacement of fluid is not sufficient by itself to overcome severe shock.

The other group of 8 less-shocked patients consisted of 5 with multiple lacerations of the lower limbs, and 3 with compound fractures, in addition, of femur, of tibia and fibula, and of tibia respectively. The wounds were excised and packed with dry gauze, and the limbs immobilized in plaster-of-Paris. One such case is typical:

A man aged 23. Multiple lacerations of both lower limbs; general condition good. There were perforating injuries of the right thigh and calf, with entry and exit wounds in each, and penetrating injuries of the left thigh and calf, with small entry wounds. He was operated upon an hour after admission; the wounds were excised—there being a certain amount of muscle damage in each—packed with dry gauze, and immobilized in a bilateral plaster-of-Paris hip spica down to the toes. He was given 14 grammes of sulphapyridine during the next four days, and was transferred to the base hospital on the fourth day. His temperature chart was normal throughout convalescence, and the plaster was replaced on the eleventh day, when the wounds were found to be clean and granulating well. The plaster was renewed twice subsequently at intervals of ten and twelve days, and the wounds have remained clean and are nearly healed.

Second Series

In a second convoy of 43 cases there were also 11 cases in which the subject was dead on admission or died within a few minutes. The 43 cases consisted of 25 less seriously injured, comprising mostly one or more lacerations, and 18 severe cases, in which the site of the

major injury was: abdomen, 6; chest, 1; head, 3; and limb, 8.

The abdominal wounds were all fatal. Two cases with evisceration were too bad for operation to be attempted. The other 4 were operated upon: their lesions included perforation of large and small intestine, bladder, liver, and mesentery. All 4 patients died in from seven hours to seven days after operation. The patient with the chest injury had a compound fracture of the right twelfth rib without damage to the pleura. The wound was excised and sutured and the case did well. The 3 patients with severe head injuries had compound fracture with laceration of the brain; all died within a few hours.

The 8 limb injuries comprised 6 cases of compound fracture and 2 of lesions of main arteries. Three of these cases developed gas gangrene. Notes about some of this series are given below.

A woman aged 35. Compound fracture of lower end of right tibia and fibula involving ankle-joint; lacerations of right arm and of left thigh, leg, and foot; general condition fairly good. She was fit enough to be operated upon within two hours. Amputation through the upper third of the right leg was performed, with closure and drainage, and the lacerations were excised and sutured, with drainage. She was given 14 grammes of sulphapyridine in four days. There was a little sloughing of the anterior skin edge of the amputation stump, but the general convalescence was normal.

Particulars of the 3 cases that developed gas gangrene are as follows:

A girl aged 16. Compound fracture of left tibia and fibula; the left leg was severely crushed and almost completely severed below the knee, and there were a few small lacerations of the face, scalp, and right leg. General condition fairly good. The patient was given morphine grain 1/3, 3,000 units of A.T.S., and transfusion of 500 c.cm. of blood; operation under gas-and-oxygen and ether anaesthesia was undertaken two hours after admission. Amputation through the lower third of the femur was performed, with closure and drainage by two corrugated rubber strips at the ends of the wound. The lacerations were excised and sutured. The patient's condition deteriorated somewhat during the operation, the pulse being raised and of poor volume, and a further blood transfusion of 500 c.cm. was given, being continued post-operatively. She received 2 grammes of sulphapyridine intramuscularly, followed by 1 gramme four-hourly. Her condition improved, and eight hours later her pulse was 100 and temperature 103°. The following morning the pulse rate was still raised—130, and of poor volume—and the temperature was 101°; a further 500 c.cm. of blood was given. There was no complaint of pain and the amputation stump looked satisfactory. Towards the evening—that is, about thirty-six hours after injury—the temperature was 100° and pulse 130, and inspection of the amputation stump showed swelling with crepitus, with the typical musty odour of gas gangrene. The patient had had up to that time 8 grammes of sulphapyridine but no anti-gas-gangrene serum. The wound was opened up, packed with gauze and Carrel tubes, and hydrogen peroxide irrigation instituted; 40,000 units of serum was given, but she died in seven hours.

A man aged 42. Perforating wound of the left thigh with small entry and exit wounds on the anterior and posterior surfaces of the upper third. The thigh was swollen and tense, suggesting a haematoma. There was a small laceration about three inches long on the lateral side of the left calf. The general condition was good on admission. Owing to the large number of urgent theatre cases in the convoy this patient was not operated on until seven hours after admission. Exploration of the wound showed that the femoral artery had been punctured at about the junction of the upper and middle thirds of the thigh, and it was ligated at this point. The entry and exit wounds were excised and packed with flavine gauze. The laceration in the calf was explored, when it was found that a few muscle fibres of the gastrocnemius were damaged. There was no foreign body present, and this wound was also excised and packed with flavine gauze. The condition throughout operation—which was not a severe one, lasting only thirty

minutes—was extremely poor, and 500 c.cm. of blood was transfused in the theatre. The patient was given 2 grammes of sulphapyridine intramuscularly, followed by 1 gramme at four-hourly intervals. His condition the next morning was still poor, with temperature 102° and pulse 120, of poor volume, and there was some discoloration of the toes, but no gas and no discoloration around the leg wound. His pulse improved in the afternoon and he had slight haematuria, but made no complaint of pain in the wounds. Inspection of the leg at this time—i.e., thirty hours after the injury—showed discoloration around the small laceration of the calf, with crepitus under the skin and the typical musty odour of gas gangrene. This discoloration spread very rapidly, so that by the time the patient reached the theatre—within thirty minutes—it had spread several inches further up and down the leg. Lateral and medial incisions were made into the calf, when it was found that the dead muscle extended up to the knee, and formal amputation was therefore performed through the lower third of the thigh. Subsequent progress was good, the stump healing well in spite of the wounds in the upper third of the thigh. The two important predisposing factors in this case no doubt were the diminished blood supply to the leg and delayed operation: the patient's poor condition during operation strongly suggests that gas infection was already present at that time, and had probably started within a few minutes of the injury, the diminution of blood supply being sufficient to determine the rapid onset of gas gangrene in the presence of infection even in such a trivial muscle injury.

A man aged 26. Multiple lacerations of face, chest, right arm and forearm, and both legs. All these injuries were slight and the general condition was good; he had in fact been admitted to the first-aid post as a walking casualty. The right arm had a small laceration on the medial side three inches above the elbow, and a tourniquet had been applied just above this point. There was another small laceration on the front of the middle of the right forearm; the radial artery was impalpable; the right hand was cold, with patchy anaesthesia up to the wrist, and active movements of fingers and wrist could not be obtained. A radiograph showed a small foreign body (probably bomb fragment) in the lower part of the arm. The wounds of the legs were slight, the largest being a laceration about four inches long on the posterior surface of the left calf, penetrating into the calf muscles. There were two small foreign bodies (glass) in the superficial layers of the chest wall. Owing to the large number of urgent theatre cases this patient was not operated on until seven and a half hours after admission. Exploration of the arm showed that the brachial artery had been completely severed and the ends had retracted and were thrombosed. There were no nerve injuries. This wound and the laceration of the forearm were excised and sutured, with drainage. The laceration of the left leg showed a certain amount of damaged muscle, which was excised and sutured, with drainage. A few other small lacerations, mostly due to glass, were cleaned and sutured, and the foreign bodies were removed from the chest wall. He was given 2 grammes of sulphapyridine intramuscularly, followed by 1 gramme at four-hourly intervals, and 20,000 units of anti-gas-gangrene serum, followed by three more such doses during the next forty-eight hours. The right hand remained cold and paralysed, and subsequently the forearm and hand showed the changes of severe ischaemia. The electrical reactions taken the next day showed no excitability of any kind in the forearm muscles. The hand and forearm swelled considerably during the next three days, causing severe pain, and the wound of the forearm eventually broke down to show a sloughing of some of the flexor muscles. The terminal phalanges of the second, third, and fourth digits became discoloured and developed dry gangrene with good demarcation. The radial pulse reappeared in about two and a half weeks. In addition the left leg developed gas gangrene, noted clinically about fifty-four hours after the injury, and amputation through the lower third of the left thigh was performed; the subsequent progress of this limb was satisfactory. The patient had had 10 grammes of sulphapyridine up to the time of onset of gas gangrene as well as 80,000 units of anti-gas-gangrene serum. The wound in the leg giving rise to gas gangrene was small, and the deciding factor in this case must have been its delayed local treatment.

Summary of Conclusions

In the survey of these cases the following are among the points to be noted.

1. The results of the treatment of severe shock by the replacement of fluid with blood and plasma were disappointing. So much was this so that one could almost give an accurate prognosis as regards immediate mortality on first seeing the patient.

2. Most of the limb cases that have been seen had tourniquets applied before admission. In the majority these were applied badly, resulting in some cases in a slow steady ooze of blood. It was obvious that if a large artery had been injured the haemostasis would have been inadequate. We are inclined to agree with Delisle Gray (1940) that application of the tourniquet by first-aid workers should be discouraged, a firm dressing applied to the wound being of more value for routine use.

3. Routine radiographs of limbs were not taken as, although desirable, they were not regarded as absolutely essential: in the excision of wounds only the larger and accessible foreign bodies are removed, so that the previous localization of all foreign bodies is not essential, and in any case important contaminants like cloth, etc., do not of course show. Fractures and joint lesions or doubtful cases were radiographed.

4. Routine treatment by excision and closed plaster as recommended by Trueta and others gave excellent results.

5. The development of gas gangrene in three cases was a serious complication. In two of these delayed operation was an important factor; in one, diminished blood supply was no doubt even more important. In the third case early operation and administration of a standard dose of sulphapyridine did not prevent its occurrence. The development of gas gangrene being so important, arising in comparatively small wounds and depending so much for its diagnosis on local examination, one would recommend routine inspection of all wounds two or three times a day in the early post-operative period in cases in which delayed treatment or doubtful blood supply is a factor.

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The British Standards Institution (28, Victoria Street, S.W.1) has issued a British standard method for the biological assay of vitamin D₃ by the chick method, B.S.911. At the second Conference on Vitamin Standardization, held in London in June, 1934, it was recognized that amounts of cod-liver oil and irradiated ergosterol which contain an equal number of vitamin D units, as determined by tests on rats, may not possess equal antirachitic activity when tested on certain other species—for example, poultry. From other work carried out it is obvious that the antirachitic efficiency of substances containing vitamin D as measured by the rat method cannot be relied upon with any certainty when applied to the chick, except for cod-liver oil—that is, the liver oil produced from the fish of the *Gadus* species. This reliance no longer holds if the definition of "cod-liver oil" is extended to include all members of the family Gadidae. The committee consequently decided that a method of testing the antirachitic efficiency of compounds using the chick as an experimental animal was necessary if such compounds are intended for poultry use, and it has drawn up a method of test in which the substance under test would be compared with known dosages of the standard preparation of vitamin D₃, the method being carried out in such a way as to enable the results to be subject to statistical analysis.