injury. In two cases we have seen it well marked within thirty-six hours, and in several others already extensive on the third and fourth day.

Several patients have died of it on the third day following that of the injury, and in other patients it has progressed so far that amputation has been performed on the third day.

Onset.

This is characterized by swelling of the injured part, and the gangrene seems especially liable to occur in connexion with that swelling of a limb which is due to extravasation of blood in the subcutaneous tissues and intermuscular planes. It seems to us that interference with the circulation either by extravasation of blood or by tight bandages has a marked influence.

In the early stages the patient complains of severe pain which is perhaps due to tension, the result of the swelling, but in the later stages the affected area becomes completely numbed and insensitive. The edges of the wound are generally ragged and sloughy, and a considerable quantity of blood-stained serum constantly exudes and soaks the dressings. This discharge emits a characteristic and most offensive odour which is so marked as to be almost diagnostic. The skin, if not previously discoloured by extravasated blood, assumes a dark purplish or slate-coloured hue.

In the vicinity of the wound it changes subsequently to a more green colour. The swelling extends coincidently with the change of colour, and a few hours later the skin becomes nearly black, and finally forms a black, leathery slough. Beyond the area of discoloration the limb is swollen with gas and fluid exudation, and an emphysematous crackling can be elicited on pressure with the hand. This may spread to a distance of as much as a foot above and below the actually gangrenous area, and so rapid is the extension of the gangrene that we have seen the whole of the lower extremity completely mortified before the end of the third day after the infliction of the wound.

Condition of Patient.

Temperature is not materially affected in many cases, and high fever is rare. A temperature of 99° to 100° is usual. Respiration is not materially quickened; headache is not complained of. The mind is perfectly clear till near the end. The pulse is not greatly quickened but rapidly loses power, so that several of the patients we have seen have had no perceptible radial pulse. The heart's action is greatly weakened so that its beat is quite difficult to feel.

Vomiting is common and in many cases is frequent; diarrhoea is rare; sweating is not generally present, and before death the skin is cold; the tongue is usually covered with a dirty fur, but the mouth is not exceptionally dry. Death appears to be due to cardiac failure, and we have been struck by the extraordinary clearness of the mind of a patient, almost pulseless, and within an hour or two of his death. In the worst cases the gangrene may spread with such rapidity that the whole limb may be cold, of a purple or black colour, immensely swollen and quite devoid of all sense of touch and power of motion within thirty-six hours of the onset of the gangrene. The smell of such a limb is overpowering, and almost precludes a careful *post-mortem* examination. If incisions are made before or after death gas and sanious fluid bubble up. Pus is confined to the edges of the wound, and is very little in proportion to the sanious discharge.

Practical Conclusions.

The practical conclusions we would draw from these observations are as follows:

1. All tight bandages and especially those applied at the first field dressing should be avoided. Shell wounds are so often followed by so much interstitial haemorrhage that the part swells and the bandage rapidly becomes tighter and interferes with the circulation. Consequently many bandages require to be cut within a few hours of their application.

2. In many cases the tension requires to be relieved by incisions and drainage, and the opportunity should be taken to wash the wounds thoroughly with an antiseptic. Hydrogen peroxide is one of the best. Great care should be taken to remove portions of clothing, as these

contain the infective agent. Shattered fragments of bone and pieces of shell or gravel should be taken out.

3. Amputation may often be successfully performed through tissues made emphysematous by gas but not yet gangrenous.

4. The group of anaerobes causing gangrene are spore-bearers, and spores (especially of this group of anaerobes) are especially difficult to kill by any antiseptic solution or even by boiling. Consequently, in order to sterilize instruments and other things that have been infected, other measures are required.

(a) Destruction of blankets and clothing soaked by the discharge.

(b) Heating in an autoclave at a temperature of 120° Centigrade.

(c) Boiling for an hour in a solution of 1 in 20 carbolic acid or lysol (1 in 10).

It should be remembered that the mud on the clothes of wounded soldiers is almost certainly infected, and care should be exercised to see that the area in which operations or dressing of wounds are performed should be kept free from possible contamination from such a source.

5. Where possible, it is advisable to isolate patients under treatment in hospitals, and this is all the more necessary on account of the bad smell which is inseparable from the condition.

The above is a copy of a report sent to the Director of Medical Services on November 9th, and is mainly the result of work done at the clearing hospitals at the front to which patients are taken within a few hours of being wounded. Many of the conclusions and practical recommendations, however, have been conveyed to the hospitals verbally or by official communication and attempts are being made at the Lister Institute to provide an antitoxin.

INJURIES TO THE BOWEL FROM SHELL AND BULLET WOUNDS.*

BY

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INJURIES to the rectum or pelvic colon, which occur in war, whether from bullet or shell wounds, must of necessity be very serious; and as a fact the statistics of previous wars show that injuries of this nature are attended by a higher mortality than injuries to other parts of the alimentary canal. Many of these cases must be fatal owing to concomitant injuries of the large vessels in the pelvis, or to resulting peritonitis. In the Boer war the mortality from wounds of the rectum was 30.7 per cent. of those so wounded, death being due to peritonitis, internal haemorrhage, or septicaemia. We have as yet no means of ascertaining the percentage of mortality from such wounds in the present war; but already there must have been a number of cases of wounds involving the large bowel under treatment in our home hospitals. It is to be hoped that, as the result of increased knowledge and improved technique, we shall be able during the present war to bring the percentage of mortality for wounds of this nature down to a much lower figure than in previous wars.

As these wounds present some unusual difficulties and require special treatment, it does not seem out of place to discuss them at this early stage of the war, if by so doing we can give any assistance to ourselves and other surgeons who may have to deal with such cases during the continuance of the war. In my position as surgeon to King Edward VII's Hospital for Officers I have seen several of these cases during the last three months.

The injuries vary from clean bullet wounds to large septic lacerated wounds due to fragments of shell. There can be no doubt that a high velocity Mauser bullet may pass straight through the abdomen, or across the pelvis, penetrating the large and small bowel, without causing a fatal or even very serious result, always provided that certain conditions are present. Of these conditions the

* Read before the Subsection of Proctology of the Section of Surgery, Royal Society of Medicine, November 11th, 1914.

chief are: the bullet must be travelling at a relatively high velocity, the intestines must be more or less empty of fluid contents, and the proper first-aid treatment must be administered. The Boer war taught us that, in the case of penetrating wounds of the abdomen, the best results were obtained by giving complete rest to the intestines for forty-eight hours after the injury, and that with a view to obtaining these conditions treatment should be confined to giving morphine in full doses, withholding all food, and providing as much rest as is compatible with the circumstances. It was found that such treatment allowed the small wounds in the bowel to seal themselves off, and prevented the risk of faecal leakage.

I should here like to express my unqualified admiration of those heroic members of our profession who, often at the risk of their lives, are so ably administering first aid to the wounded behind the firing line. I have now seen a considerable number of our wounded on their arrival in London, and have been much struck by the efficient treatment which they have in most cases received on the field. The good results which, I believe, are being obtained in the treatment of our wounded soldiers depend, above all, upon the efficiency of the medical treatment at the first dressing station.

The following case, which has recently come under my care, affords a good example of the comparative harmlessness of a clean bullet wound involving the bowel:

The patient was shot through the pelvis, the bullet entering at the external abdominal ring on the left side and passing out through the middle of the right buttock. Fortunately, the patient had urinated only a few minutes before he was struck, and consequently the bladder was not injured. The bullet must, however, have passed through the small intestines in the pelvis, and almost certainly through the upper part of the rectum. It emerged close to the sciatic nerve on the right side. The wound was kept aseptic, and the only inconvenience from which the patient has suffered so far has been severe neuritis in the sciatic nerve, with temporary paralysis of some of the muscles. There have been no bowel symptoms at all.

Wounds involving the large bowel are generally complicated by other injuries—such as fracture of the pelvis, injury to the bladder, or damage to the large nerve trunks. One or more of the nerve trunks may be cut, but more commonly they are only concussed. The symptoms in either case are at first the same—namely, motor and sensory paralysis, which is generally only partial. When the nerve is only concussed, the symptoms begin to pass off in a few days, although it may be some weeks before there is complete recovery. I have seen two cases in which the sciatic nerve was concussed at its point of exit from the pelvis. In both cases there was temporary complete loss of movement, followed by rapid recovery, but also by severe neuritis, which lasted for some time. One officer shot through the pelvis had apparently some injury of the sacral plexus. There was acute hyperaesthesia of the skin in the anal region, with resulting pain and tenesmus on defaecation, and retention of urine. These symptoms, however, passed off in a few days.

The most difficult cases are those associated with fracture of the pelvis and a septic wound.

One officer under my care was shot through the pelvis, the bullet entering at the symphysis and emerging close to the sciatic notch, between it and the acetabulum on the right side. The pelvis was extensively cracked, and the wound had become septic before the patient was admitted to the hospital. When the right leg was moved the sensation was rather like that of moving the parts of a broken basin. The bullet in this case had passed close to the rectum, although without injuring the mucous coat. With the finger in the rectum one could easily distinguish the track of the bullet as a firm elastic ridge passing along the left side of the bowel. Fortunately no faecal fistula developed. The case was treated by free drainage with tubes, and fixation of the patient in a Chappell splint.

Healing in such cases is likely, I am afraid, to be very slow, as considerable portions of bone must separate before healing can occur, and this is a long and tedious process, which cannot well be hastened by surgical means.

The worst cases are those in which a shell wound is complicated by a faecal fistula and fracture of the pelvis. The following case is one of the most serious that I have met with yet:

The officer was wounded at the battle of the Aisne by a shrapnel shell; there was very severe haemorrhage on the battlefield, and three days after he was injured a faecal fistula developed. On admission to the hospital there was a large lacerated wound, on the left side above the hip-joint. This led

down to a hole about the size of a two-shilling piece (diameter about 2.8 cm.) through the wing of the left ilium, and all faeces were being discharged through this opening. The patient was profoundly septic, and a secondary haemorrhage occurred soon after his admission. As it was impossible to deal with the wound while it was complicated by a faecal fistula, I decided to open the abdomen, and either to perform a temporary colotomy or if possible to close the wound in the bowel. On opening the abdomen I found that the sigmoid flexure had been injured on its mesenteric border, and that it was adherent to the inside of the ilium. I succeeded in separating it, and after trimming up the edges I closed the wound in the bowel with sutures. The abdomen was closed and the wound drained through the hole in the ilium, another opening being made above the ilium in the loin, through which drainage tubes were introduced into a large lacerated wound in the posterior abdominal muscles, where fragments of the shell had buried themselves. After this it was possible to deal properly with the wound. There was no further trouble from the faecal fistula, the bowels acting in the normal manner. The wound was exceedingly septic, as we had to deal with a compound septic fracture of the ilium complicated by *B. coli* infection. A rather alarming secondary haemorrhage from one of the lumbar arteries was, however, the only complication which occurred, and the patient, I am glad to say, is now making an excellent recovery.

In this case I was able to close the wound in the sigmoid successfully, and so to save the patient the discomfort of colotomy. But this must often be impossible, and I believe that, in most cases, the best way to deal with severe wounds, complicated by a faecal fistula, is to perform a temporary transverse colotomy, at the same time thoroughly opening up the wound and providing free drainage. After the wound in the bowel has healed, the colotomy can always be got rid of by a secondary operation. It is obviously impossible to deal satisfactorily with a serious wound of the pelvis if it is complicated by a faecal fistula, and I feel sure that the best treatment in such cases is a temporary colotomy. This must, of course, be done in such a way as to leave a good spur, so that there is no possibility of faeces passing on into the distal bowel. The old-fashioned colotomy would be quite inadequate to deal with such cases, and the best way of performing colotomy in these cases is by means of a glass rod placed under the bowel. The performance of a colotomy will, I think, be the best routine treatment in all cases in which there is a large or serious wound complicated by a faecal fistula into the rectum or pelvic colon.

In the case of a wound which is quite small and is not complicated by fractured bone, but is complicated by faecal leakage, an attempt may, I think, be justifiably made to get it to heal without resorting to a colotomy, provided that the patient has not developed a serious degree of sepsis. If such an attempt is to be made, the rectum should be drained by means of a tube introduced through the anus. Unfortunately, however, few patients can tolerate the presence of a tube through the anus for long, unless the sphincters have been divided. In the case of large lacerated wounds of the bowel, temporary colotomy is indicated as soon as possible. The closing of the colotomy is not a very easy matter, but, after all, this can be postponed until the patient is in the best possible circumstances as regards hospital accommodation and skill.

Finally, I should like to reiterate the view, which I hold most firmly, that wounds involving the bowel should not be treated by immediate operation, even if proper surgical facilities are available. I believe that very few exceptions should be made to this rule, and that the proper treatment is almost invariably complete rest, absence of food, and the administration of morphine; surgical treatment should be reserved till later for the treatment of secondary complications.

LIEUTENANT H. L. HOPKINS, R.A.M.C., who was killed in action, left estate valued at £169. An obituary notice of this officer appeared in the BRITISH MEDICAL JOURNAL of October 3rd.

At a meeting of the Académie de Médecine on November 10th, Dr. Langlet, professor in the Medical School of Rheims, of which he is director, was elected a member of that distinguished body. Dr. Langlet, who is Mayor of Rheims, showed the greatest courage and devotion to duty during the German occupation and the bombardment of that city. On November 8th, when M. Viviani, the Prime Minister of France, visited Rheims, he bestowed, in the name of the Government and the French nation, the cross of the Legion of Honour on Dr. Langlet.