"TRAUMATIC GASTRIC ULCERS."

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SURGICAL work with the army in France during the last six months has proved conclusively the value of early operation in gunshot wounds of the abdomen. In his admirable summary¹ of the experience gained by the careful observations of several workers in one army area, Colonel Cuthbert Wallace states the clear rule that a perforating wound of the intestine cannot be healed by spontaneous closure, and that such injuries of necessity must be treated by operative procedures at as early a moment as is possible. With regard to wounds of the stomach there is still doubt, because there are some grounds for the belief that such lesions are capable of cure by natural processes, and because it is certain that the wounds will often be found to lie in areas which are difficult for the surgeon to reach.

Surgeon-General Sir George Makins has discussed this latter question briefly,² and his conclusion is that on the whole it is unwise to open the abdomen in cases in which only the stomach is supposed to have been wounded. The advice is confessedly a conservative choice, in view of the lack of sufficient pathological evidence to justify a reasoned conclusion one way or the other. Colonel Cuthbert Wallace admits the probability that some stomach wounds may heal without operation, but none the less he decides that "it is wise to make no exception in the case of the stomach, but to operate on principle," the principle being that any gunshot wound of the intestinal tract is less likely to be fatal if repaired by immediate surgery than it is when left to rest and nature.

With perforations of the intestine the chief danger to life arises in the development of peritonitis. In the case of stomach wounds, peritonitis is perhaps rather less to be dreaded since there is undeniably a chance that the aperture may be sealed by adhesions, and since the gastric contents, which may leak out before such adhesions can be cemented, are not very septic. But here a fresh risk appears. The injured tissues are liable to be eroded by the gastric juice, and if a vessel is opened up in this process the wounded man may be in serious danger of losing his life by secondary haemorrhage from what is practically a traumatic gastric ulcer. It is this particular point of ulcer formation which the cases described in this paper have been chosen to illustrate.

Haematemesis and melaena are not often seen as an immediate result of wounds of the abdomen, for the early bleeding in these cases is chiefly from vessels which leak into the peritoneal cavity or into the retroperitoneal tissues. But these symptoms do occasionally appear about the second week, and at that date they are generally to be interpreted as evidence of an extending ulcer in the stomach or duodenum. This ulcer may be developed in a previously healthy mucous membrane as the result either of direct perforation or of contusion, or even, as in the rare case described by Captain Kelly, as the outcome of septic processes which are active at a considerable distance elsewhere in the body. To the naked eye such an ulcer looks very similar to the ordinary non-traumatic acute perforating ulcer of civil life. It commences in the internal mucous membrane, and may extend therein over a much wider area than is shown by the thin, sharply-cut edges of the external perforation. It may have the same

result in leading to perforative peritonitis, or to sudden haemorrhage when a vessel is eroded; but it is more liable than is the non-traumatic ulcer to form a gastric fistula, since it may open up the track of the injury first produced by the missile.

CASE I.

No. 229. Under the care of Captain A. Bradford. December 29th, 1915. Shell wound: a tiny hole over the seventh left intercostal space in the anterior axillary line. No abdominal pain or vomiting, and in consequence the patient was evacuated to the base as being simply wounded in the chest.

Third day: Arrived at base hospital in Boulogne. Vomiting of green fluid commenced and continued until the fifth day.

Sixth day: Melaena appeared with diarrhoea.

Seventh day: Very blanched and thirsty. Moribund and semi-delirious. Pleurisy in left axilla, and physical signs of left haemothorax of moderate size. Nothing abnormal found in abdomen, which was soft and moved freely. Gastric ulcer diagnosed, and food withheld. Patient too ill for operation.

Ninth day: Died.

Post-mortem Examination.

Left haemothorax containing 30 oz. of fluid defibrinated "blood"; lower lobe partly collapsed and coated with granular fibrin. Hole through left diaphragm 5 mm. in diameter. Some thin bile-stained fluid free in the peritoneal cavity, but no evidence of peritonitis.

On the anterior wall of the cardiac fundus of the stomach a round hole 2 cm. in diameter, and nearer to the pylorus on the posterior surface a much smaller hole about 8 mm. across. The stomach contained very little fluid, but a small flake of shell,

about 5 mm. long, was found within it, embedded in mucus. Between the stomach and the spleen was a localized collection of several ounces of viscid bile-stained fluid, which did not appear to be purulent and of which the reaction was not tested. This pool of fluid was contained by light adhesions springing from the anterior surface of the stomach, and an outlet from it appeared to be spreading forward by a narrow track along the anterior surface of the left lobe of the liver. The outer wall of the cardiac fundus, where it was submerged in the pool, had been partly digested away, but showed no evidence of gangrene or other injurious process. The perforating ulcer was circular in outline with smooth edges, and it was very much larger than the holes made in the chest wall or in the diaphragm, which corresponded roughly to the size of the piece of shell. All around it the peritoneal coat had vanished over an area nearly 10 cm. across, and the

FIG. 1.—Stomach showing traumatic gastric ulceration (Case I in text). A, The anterior perforation. B, The terraced edge limiting the spread of the external ulceration, which had denuded the peritoneal coat. C, The posterior perforating ulcer. (Specimen in War Office collection.)

circular muscle fibres of the stomach wall beneath were naked and transparent. A white terraced edge marked the transition from this external ulceration to the normal peritoneum at the attachment of the adhesions. (See drawings; specimen in War Office collection.) The posterior ulcer was closely limited by adhesions, and it did not display a similar external spread. Apparently the haemorrhage had been derived from vessels underlying this ulcer.

The patient died simply from gastric haemorrhage, which commenced about the sixth day. The anterior perforation, had time allowed, would doubtless have led to a subphrenic abscess. The posterior ulcer may have developed out of a perforation or only from an area of contusion in the stomach wall, for the momentum of the small shell fragment was spent when it reached the back of the abdomen. The destruction of the outer wall of the living stomach by the gastric juice, which had escaped from its interior, was a very remarkable fact in this case.

CASE II.

No. 16,502. Originally under the care of Captain R. Charles, who kindly transferred to us the full clinical notes of the case.

January 4th, 1916. Wounded by a bullet with slightly deformed nose, which entered the left epigastrium close to the subcostal triangle. Abdomen opened five hours later; free blood swabbed out of the peritoneal cavity; hole through left lobe of liver sutured and packed. The bullet had subsequently passed through the left sac, and it was found close to the duodeno-jejunal flexure, half in the less sac and half projecting through into the greater peritoneal cavity. Slight bleeding near tail of pancreas. A branch of the coronary artery on the less curvature of the stomach had been wounded by the missile, and this required ligature. At the time there was certainly no perforation of the stomach. Gauze drains were passed down to

the liver wounds, and also to the pancreas through a fresh hole in the mesocolon, while a tube was placed in Douglas's pouch.

Eighth day: Abscess opened in anterior abdominal wall, from which a considerable quantity of clear fluid and thin pus came away.

Tenth day: Again evacuation of pus and of at least one pint of clear fluid. An accident prevented the reaction of this fluid from being tested.

Twelfth day: Severe haematemesis and melaena.

Twenty-eighth day: Chest explored by needle but nothing found. Transferred to base hospital at Boulogne, since the general condition had improved.

Thirty-sixth day: Died.

Post-mortem Examination.

Empyema on left side and purulent pericarditis. Small collections of pus were loculated everywhere between the coils of intestine. No intestinal obstruction.

A blind fistula with yellow-stained walls led down from the anterior surface of the left lobe of the liver into its substance. Close to this a fistulous track ran below the lower edge of the liver and through the gastro-hepatic omentum to a gaping circular ulcer situated on the less curvature of the stomach, half-way between the pylorus and the cardiac orifice. There was no obvious inflammation around this, and no cicatricial deformation had been produced. Within the stomach the ulcer extended over a wider elliptical area along the less curvature, and was much larger than the perforation on the external serous surface. The silk ligature, which had been knotted around the bleeding vessel at the operation, lay in fibrous tissue on the outside of the stomach wall at the edge of the perforation. Bleeding had ceased, but the ulcer remained open and was presumably discharging gastric juice from the fistula. No evidence of fat necrosis was seen in the pancreas. (Specimen in War Office collection.)

In this case death was the result of a widespread and hopeless infection of the serous membranes. At the spot where the bullet had injured the stomach, whether by contusion or through interference with the blood vessels, an ulcer had formed and perforated some time before the sixth day, while its further spread was evidenced by haemorrhage on the twelfth day. The ulcer remained open and showed no signs of healing when death occurred on the thirty-sixth day.

CASE III.

No. 9,399. Under the care of Captain W. H. Oliver.

February 6th, 1915. Bullet wound high up in the left axilla and no exit. Slight haemoptysis, but no vomiting.

Tenth day: Vomiting suddenly began and about 1½ pints of blood were brought up. This was, by mistake, reported as haemoptysis.

Twelfth day: Abundant melaena. Signs of small effusion in left chest. No previous notes had been made of chest condition.

Sixteenth day: Melaena ceased.

Eighteenth day: Pain in epigastrium when food was swallowed. No rigidity over stomach. The patient stated that he had never suffered from indigestion before receiving this wound.

Thirty-first day: Temperature rising to 102°. Physical signs of large collection of air and fluid in left chest. Aspiration removed 35 oz. of yellowish grumous brown acid fluid, which smelt like bitter vomit, and also much air. The manometer readings proved that an open leak existed within the pleural cavity.

Thirty-third day: Rib resected. Acrid fluid and "coffee grounds" deposit of altered blood escaped.

Thirty-fifth day: Clotted milk seen to be discharged from the empyema tube shortly after food had been taken by the mouth.

Thirty-sixth day: Transferred to England in very bad condition. Later history unknown, but it seemed unlikely that he would recover except by the help of unusually successful plastic surgery.

Here the only certainty is that the man bled from a traumatic gastric ulcer on the tenth day, and that some time before the thirtieth day the extension of the ulcer established a direct fistula between the stomach and the pleural cavity. The exact path of the bullet was never determined.

CASE IV.

No. 1,226; T. Under the care of Captain A. Bradford.

May 16th, 1915. Wounded by shrapnel ball, which entered the left chest at the seventh space in the posterior axillary line, and finally lodged beneath the skin over the fifth right costal interspace just below and internal to the right nipple. Patient felt a "smack" in the epigastrium. No vomiting. Slight haemoptysis on the second day.

Seventh day: Fairly well. Slight epigastric pain. Left haemothorax of moderate size with pleural friction at its upper level and over the pericardium. Pleural friction also heard over the right base. Temperature 101°.

Fifteenth day: Profuse haematemesis, followed by melaena for two days. Patient states that he had never before suffered

from dyspepsia. The haematemesis came on abruptly with a feeling of nausea, as though he were "sea-sick." Very blanched. Temperature fell from 102° to 97°.

Seventeenth day: Septic haemothorax on left side, which was found to be infected with a streptococcus and a small bacillus, drained by resection of a rib. No evidence of gastric contents in this purulent blood, which was not acid in reaction. The presence of contralateral pleurisy on the seventh day makes it fair to conclude that the haemothorax had been infected at the time of the original wound.

Twenty-seventh day: Solid food allowed.

Forty-fourth day: No further gastric trouble and empyema cavity now very small. Transferred to England. Subsequent history unknown.

The course taken by this ball was so close to the stomach that it probably injured its wall by contusion, if not by actual perforation. The complete recovery from the ulcer that subsequently formed is the remarkable fact in this case, inasmuch as these injuries, so far as we have been able to observe them, have been generally fatal.

These particular cases illustrate the manner in which such traumatic gastric ulcers develop. In all four of them the missile either went through the stomach or so close to it as to cause direct injury to its wall, though it should be remarked that in Cases I and III there was no reason at first to believe from the position of the entry wound that the stomach would be likely to lie in the subsequent path of the missile. The ulcer revealed itself by haematemesis and melaena on the 6th, 10th, 12th, and 15th day respectively in each. One patient died directly from the haemorrhage; only one made a complete recovery. The cases suggest the clinical interpretation that must, with a slight reservation to be discussed later, be made of these symptoms of bleeding when they appear in the second week after a wound, and they also show the unfavourable course that may be taken by an injury of the stomach when it has not been repaired by the surgeon. But they are in themselves too few to serve as a basis for a forcible argument in favour of early operation on supposed wounds of this viscous.

A consideration of the general mass of statistics out of which these cases were chosen throws more light upon the disputed point. Taking the *post-mortem* records in the first place, examinations have been made by us on 100 consecutive cases of death at the base hospitals from wounds penetrating the chest wall. In 17 of these the missile, whatever its point of entry, had passed in its course through structures in the right base of the chest. Only eight examples were met with of a similar track through the left base. Therefore, since the incidence of wounds on either side of the chest is probably equal, it may be concluded that the left base is a more vital spot, and that the preponderance of fatal chest wounds on the right side met with at the base is due to the fact that men with wounds on the left side show grave symptoms early and die close to the fighting line. Kidney and colon are almost equally balanced on either side, so that the difference in fatality must depend on the contrast between the liver on the right and the heart, stomach, and spleen on the left.

Of the 17 fatal cases on the right side, 11 had haemothorax, and in 9 of these death was chiefly caused by the infection of this blood; 3 had wounds of the colon, and all 3 died from the resulting septicaemia; 12 had wounds of the liver, of whom 5 died of haemorrhage from the liver; there were 7 harmless liver wounds.

Of the 8 fatal cases on the left side, 5 had haemothorax with 3 septic deaths in consequence; 2 had liver injuries, of which one died from secondary haemorrhage. There were no cases of wound of the heart, and only two of actual wounds of the stomach. Of these two stomach injuries, one died of peritonitis consequent upon the perforation, and the other from gastric haemorrhage (Case 1). A third died of general peritonitis, and his stomach was full of blood, though no actual injury to this organ was found. So the only stomach wounds that were seen in this group were in themselves fatal, and no example was met with of a relatively harmless injury to the stomach, although this might have been fairly expected to occur in a series where chest wounds in general were being investigated. There were in the series, it should be remembered, seven examples of harmless liver wounds where death was due to other causes.

Post-mortem examinations at the base of fatal wounds penetrating the abdomen were not made by us as systematically as those of the chest. In a total of twenty-five

consecutive cases there were four instances of stomach wound, which gives six altogether when we include the two already referred to under wounds of the chest. Out of the entire six five had died as the direct result of the gastric lesion, three being from haemorrhage and two from peritonitis. The single exception died from general peritonitis caused by intestinal perforation, and in this there was discovered an actively spreading gastric ulcer in relation to a slight contusion of the stomach. Once more in the fatal abdominal, as in the fatal thoracic, wounds there was no example observed of a harmless wound of the stomach.

So far, then, as can be argued from *post-mortem* evidence derived from cases of death in men who survived long enough to be transferred to the base, a gastric wound is serious and likely to be fatal. The conclusions from the indirect evidence of survival cases is of a similar nature.

In dealing with wounded men who survive, it is rarely possible to be certain that any particular organ has been hit, even though the apparent path of the missile crosses the region in which this organ lies. *Post-mortem* evidence alone gives the sure knowledge. Still, it is permissible to make rough generalizations which depend on the assumption that the path of an in-and-out missile can be indicated by the straight line connecting the points of entry and of exit. In a series of 365 non-fatal chest wounds, recorded by one of us, the number of in-and-out wounds was tabulated. Survivors from such wounds in the upper two-thirds of the thorax were numerous. In the lower third they were relatively few. Excluding surface tangential wounds, there were twelve penetrating wounds of the right base through the liver area, and of these three actually developed biliary fistulae.³ Through the left base, on the other hand, there were only six survival cases noted. From this fact again emerges the same deduction as that already arrived at by *post-mortem* evidence—namely, that the left base is twice as fatal a target for a penetrating wound as is the right base of the chest.

Of the six survivors the details were as follows: Two showed no symptoms beyond those of a simple lung wound; one had a haemothorax infected with *Bacillus coli*, that may have come from the splenic colon; three exhibited symptoms of epigastric tenderness and vomiting or pain after food, which suggested injury to the stomach. All these three recovered, but one (Case iv) nearly lost his life from a spreading traumatic ulcer. The other two showed no development of other untoward symptoms while in France, and their subsequent history was not ascertained, though it was reported indirectly that one of them had developed a hernia of his stomach through the diaphragm into the pleural sac.

Summarizing the whole of these facts, one sees that wounds of the left base of the chest are twice as fatal as those of the right; that among men wounded in the thorax or abdomen who survived long enough to reach the base hospitals in France and there died, only six examples of gastric injury were found by us, while five of these injuries were the direct cause of death; and, finally, that in survival cases there were only three who showed symptoms which might be ascribed to stomach injuries, and that of these the only one who could unhesitatingly be accepted as a case of gastric injury nearly died from that injury. These figures were obtained from the study of a considerable number of wounds of the chest (total 465) and of the abdomen (total 25), and they demonstrate that the majority of men who have been shot in the region of the stomach die before they reach the base hospitals, and that those who do reach the base with stomach injuries generally succumb to their wounds. The conclusion seems clear, and it is this, that an operation at the earliest possible moment gives the best chance of recovery from a stomach wound, so that laparotomy should be undertaken when the track of the missile suggests the probability that this organ has been wounded. If abdominal exploration reveals a perforation or a bruise of the stomach, it may be judged by the surgeon that the best procedure is to invaginate the wall over all the area of injury, so as to lessen the chance of later perforation if an ulcer forms.

Secondary haemorrhage from a later erosion by the gastric juice will occur only in special areas where the larger vessels lie—that is, chiefly along the less curvature

and from the posterior wall if this becomes adherent to the underlying solid organs. Here it would be peculiarly difficult for the surgeon to gain access to the injury. We are not aware of any attempt that has been made in France to deal with such an ulcer by immediate operation during the bleeding. It is probably best at this later stage to treat the haemorrhage on expectant lines by the routine measures which are adopted for profuse bleeding from non-traumatic gastric ulcers in civil life. But the danger of ulceration should always be borne in mind where a stomach wound is suspected or known to exist; and the diet, even after operation, should be very strictly guarded in such a way as will both minimize the secretion of gastric juice, and soak up that which may be discharged into the stomach. It is most necessary to forbid categorically the use of meat extracts, such as bovril, for these, in the absence of explicit orders to the contrary, are likely to be given to the wounded man as an early restorative, and they will evoke an abundant and active secretion, which finds nothing but the half-dead gastric wall to feed upon.

At the outset of this paper we mentioned the possibility of gastric or duodenal ulcers occurring when the viscus was not directly injured by a missile, but where its mucous membrane had suffered some local devitalization through the indirect action by the blood stream of septic processes elsewhere in the body. The classical example of such a lesion is the duodenal ulcer that has occasionally been reported in civil practice as a consequence of widely-spread cutaneous burns. But in the last few years pathological work on the nature of ulcer formation has tended more and more to emphasize the probability that many acute gastric ulcers may have a similar origin in various poisonous and infective processes which affect the body in general and only indirectly injure the stomach.

With these views in our mind, we have repeatedly examined the inner surface of the stomach and duodenum at the autopsies of death from severe sepsis, and especially when the skin surface had been widely destroyed by multiple shell wounds. No examples of such acute ulceration were discovered. The sole instance we are able to relate is that for which we are indebted to the clinical diagnosis of Captain Kelly, who called our attention to the importance of the case (No. v). Nor have we observed in the wards, during an experience of sixteen months, any patient who showed, during the recovery from wounds, symptoms which could justify the diagnosis of such an ulcer formation. The very few cases of haemorrhage from acute gastric or duodenal ulcers that we have met with among unwounded soldiers were of the ordinary type seen in civil practice, and, with one exception, all recovered.

CASE V.

No. 5,884. Under the care of Captain Fitzmaurice Kelly, who had made a complete diagnosis of the nature of the lesion in the patient and kindly gave us his clinical notes of the case to complete the series of these ulcers.

January 18th, 1916. Severely injured by multiple shell wounds, in the left orbit, right upper and fore-arm, right groin close to the femoral vessels, left scrotum disorganizing the testicle, and in the right leg with compound fracture of the tibia.

Third day: Admitted to base hospital. General condition very good but groin and leg wounds suppurating with a very foul infection. Wounds cleaned under an anaesthetic, and left eye excised.

Sixth day: Left testicle removed, right groin opened more freely, and fragments of tibia partly removed.

Eighth day: Slight haematemesis occurred, and was followed by profuse melaena.

Tenth day: Patient died, after repeated haematemesis and melaena. The wounds remained in an intractably foul condition until the end. There was no extensive sloughing or destruction of skin surfaces.

Post-mortem Examination.

External wounds as described above, and extremely foul. The internal organs were all utterly blanched by the haemorrhage. Slight recent pleurisy over base of left lung. No endocarditis. Stomach dilated and its inner surface covered with a thick layer of inflammatory mucus. Just beyond the pylorus lay an acute duodenal ulcer, 2 cm. in diameter, with sharply cut clean edges, which had eroded one of the pancreaticoduodenal vessels. The intestines were filled with melaena. There was no peritonitis nor any evidence of injury to the abdominal organs. In connexion with the groin wounds there was some retroperitoneal haemorrhage which had extended up to the brim of the pelvis, but this was well drained, and its upper area was free from obvious sepsis.

Death was caused directly by the duodenal haemorrhage, commencing on the eighth day, and in this case the ulcer was certainly not caused by a wound near to the duodenum. Though the ulcer was large and deep, its appearance was that of a recently formed and acute one, and this opinion was confirmed by microscopic examination. There was no scarring or deformity around it, and the base was formed by soft pancreatic substance. Unfortunately the patient was too ill to be able to give any reliable answers on the question whether he had previously suffered from indigestion of such a nature as would have indicated the presence of an old ulcer. It is unlikely that he had been a dyspeptic, for he was a well-built soldier, 19 years old, enlisted a year back, and with four months' continuous service in France.

Summary.

1. The evidence related in this paper negatives the assumption that wounds of the stomach are less likely to be fatal than wounds of any other part of the intestinal tract.
2. A perforation or a contusion of the stomach wall by gunshot wounds is liable to be followed by the development of a spreading gastric ulcer, which in certain anatomical positions will erode vessels and determine a fatal issue from secondary haemorrhage.
3. Haematemesis and melaena occurring in the second week after a wound are generally to be regarded as the outcome of such a traumatic ulcer. These symptoms are very rarely due to haemorrhage from a non-traumatic ulcer produced indirectly as the result of septic wounds elsewhere in the body.
4. If a stomach wound has not been repaired by operation within the first twenty-four hours after the injury has been received, or if there is reason to suspect the possibility of such a wound being present, the diet should be rigidly controlled on such lines as will lessen the active secretion of free gastric juice.

REFERENCES.

¹ *Lancet*, December 18th, 1915. ² *Journal of the Royal Army Medical Corps*, January, 1916. ³ Cf. Elliott and Henry, *BRITISH MEDICAL JOURNAL*, January 1st, 1916.

Memoranda:

MEDICAL, SURGICAL, OBSTETRICAL.

INFECTIOUS JAUNDICE.

WE desire to call attention to some peculiar bodies, to which our laboratory assistant, Mr. Mann, drew our notice, in the urine of a case of jaundice with albuminuria, from Mudros.

On examination of the sediment with a low power the first thing that struck us was the presence of numerous light yellow-greenish bodies, circular or pear-shaped in outline, and of a markedly granular appearance. On examination with a $\frac{1}{2}$ in. it was seen that there was no marked differentiation of endoplasm or ectoplasm. The nucleus, usually relatively large, was easily seen. The size of the bodies varied from 8μ or less to 33μ or more, probably averaging about 20 to 25μ .

When carefully watched for some time, protrusion of a pseudopodium could be observed. This relatively clear protrusion contrasted markedly with the semi-opaque granular endoplasm. These bodies were totally unlike *Endamoeba coli* or *Endamoeba histolytica*.

No cystic forms were seen in the urine. In the faeces cysts of *Endamoeba coli* were seen.

We have named it provisionally *Amoeba urinae granulata*.

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THE late Dr. Isaac Ott, of Easton, Pennsylvania, left money for the endowment of a new chair of physiology at the University of Pennsylvania to be known by his name. Dr. Ott was known to the scientific world by his researches on the physiology and pathology of the nervous system.

Reviews.

SURGERY IN WAR.

WE have received within the last few weeks copies of two manuals of war surgery, the one in English and the other in French. They are, we believe, the first written in either language which are frankly based upon experience gained during this war. Some other handbooks which were published a year or more ago might be more properly described as attempts to apply opinions formed before the war to the new conditions. Such books are now out of date; their places will quickly be taken by such volumes as those now before us.

The English volume, *Surgery in War*,¹ is largely the work of Major HULL, who has seen the present campaign through from the beginning to the present time. He has been assisted by Colonel H. M. W. Gray and a number of other officers on active service, most or all of whom, it would appear, have been serving in France. The subject has therefore been dealt with more as regards surgical work there than in the other spheres in which our army has been and is now engaged.

In a preface which Sir Alfred Keogh has written for the book he states that "there comes a time in a long campaign like the present one when it is profitable to take stock, as it were, of the surgical position, to apportion values to various methods of treatment and to obtain some appreciation of their results." This, we venture to think, the present volume does in a very creditable manner. The circumstances of the present war have made necessary the reconsideration of most of our ideas on military surgery. The South African campaign was carried out in a country entirely different from that of France and Belgium; those who served there saw, as Major Hull states in his introduction, results which ill prepared them for a campaign fought in weather with a large preponderance of wet days, and upon a soil artificially sown with bacteria, mostly of faecal origin. The nature of the weapons employed also has exercised a potent influence upon the surgical treatment in this war. To surgeons it will be known as "the pointed bullet war," but attention is called to the increased proportion of wounds due to artillery fire and their greater liability to septic infection. Statistical results have had to be excluded at this stage of the campaign in deference to the wishes of the censor.

The chapter on bacteriology of wounds in war has been written by Lieutenant-Colonel Harrison. He urges that in dealing with tetanus "the administration of antitoxin must be supplemented by thorough eradication of the focus of infection." This may be possible where there is a single small wound, but can hardly be carried out where there are several wounds, some of which have involved joints and internal organs, so that it is not possible to say which was the focus. He suggests that 10 to 15 c.cm. of antitoxin should be injected into the lumbar sac and 100 c.cm. intravenously in one or two injections as soon as possible after the commencement of symptoms. For the mechanical removal of bacteria from the depths of the wound Colonel Harrison favours the use of eusol, since it adds to its lymph lavage properties that of being acid, an acid reaction of the medium being inimical to the production of toxin. The use of other strong antiseptics and pastes is condemned, for the aim should be to remove the anaerobes by setting up a free flow of discharge through a sufficient wound opening. This statement is sound common sense.

Dr. Greenfield has contributed a very useful chapter on the general condition of the wounded and their treatment. He emphasizes the importance of giving pituitary extract, condemns the use of strychnine, and recommends full doses of morphine in the treatment of shock; this is in agreement with Crile's teaching. Patients with severe bone injuries stand repeated manipulations of the limb very badly, even when under an anaesthetic. No major operation should, it is said, be attempted without infiltration anaesthesia. Novocain solution $\frac{1}{2}$ per cent. with adrenalin chloride had given good results, and if potassium sulphate gr. x be added to each ounce the effect is prolonged and pain after the operation is much lessened.

¹ *Surgery in War*. By A. J. Hull, F.R.C.S., Major R.A.M.C.; with a Preface by Sir Alfred Keogh, K.C.B., M.D. London: J. and A. Churchill, 1916. (Cr. 8vo, pp. 404; 24 plates, 55 figures. 10s. 6d. net.)