CASE XII.

Pte. D.; admitted October 10th, 1917. Shell fragment; entrance wound only, over eighth rib, left side; abdomen penetrated; general condition good; severe dyspnoea. Operation: Trans-diaphragmatic route—rib resected and blood swabbed from thorax; omentum found protruding through a wound in the diaphragm, size of a half a crown—enlarged this opening and found injury to spleen and kidney; foreign body removed from kidney, the wound being excised and sutured—no treatment of spleen; diaphragm closed; sudden cardiac failure then necessitated massage of the heart, which responded immediately; operation completed. Recovery uneventful. Base October 20th.

CASE XIII.

Lie.-Cpl. W.; admitted October 15th, 1917. Entrance wound close to spine, with exit wound at tenth rib in mid-axillary line, from which omentum protruded; patient badly shocked, but apparently had not lost much blood. After four hours' rest and treatment, operation: wound of exit (with omentum) excised and enlarged forwards and backwards; rib resected; wound laid widely open; rent in diaphragm sutured to chest wall above the wound; spleen found severely lacerated and therefore removed; no other visceral lesion present; wound closed. Died suddenly twenty-six hours later, when apparently doing well.

CASE XIV.

Gnr. G.; wounded October 26th, 1917. Shell fragment. On admission same day a large blowing wound in the chest wall at the level of the ninth rib, right side; x rays showed a very large foreign body in the liver. Operation: Trans-diaphragmatic route—rib resected, including excision of entrance wound; pleural opening further enlarged; blood removed from pleural cavity; foreign body removed from the liver through the rent in the diaphragm; edges of rent sutured to parietal pleura; wound of liver packed with gauze surrounded with rubber dam; rest of the wound carefully stitched. Following day, gauze removed and replaced by Carrel's tube. Dakin's solution used. Recovery. Base fourteen days later.

The table shows the results of 150 consecutive operations for penetrating wounds of the abdomen. As regards mortality, shock played the largest part, peritonitis was next in importance, and pulmonary complications accounted for several deaths.

Viscus Injured.	No. of Cases.	Recoveries.	Deaths.
Small intestine only: sutured ...	28	17	11
Small intestine only: resection ...	13	4	9
Small intestine and colon (2 resections of small intestine, 1 died)	28	16	12
Small intestine, colon, and stomach	1	0	1
Small intestine, colon, and liver (1 resection)	2	0	2
Small intestine, colon, and kidney...	1	0	1
Small intestine, colon, and bladder	1	0	1
Stomach	3	0	3
Stomach and liver	6	3	3
Stomach, liver, and pancreas ...	3	1	2
Stomach, colon, and kidney	1	0	1
Colon	10	5	5
Liver	14	6	8
Liver and colon	5	1	4
Spleen (2 splenectomies; both died)	6	3	3
Spleen and diaphragm	2	1	1
Spleen and kidney	1	1	0
<i>Abdomino-thoracic Wounds.</i>			
Thorax and diaphragm (missile in lesser sac, no visceral lesion)	1	0	1
Thorax, diaphragm, and stomach ...	2	2	0
Thorax, diaphragm, and spleen ...	1	0	1
Thorax, diaphragm, spleen, and kidney	1	1	0
Thorax, diaphragm, and liver (lung in two cases)	4	3	1
Kidney (3 nephrectomies, 1 death) ...	9	8	1
Intraperitoneal lesion, no viscus injured	5	4	1
Total	150	76	74

I take this opportunity to express my gratitude to Surgeon-General Sir Anthony Bowlby, K.C.M.G., for his encouragement and advice throughout this period. My best thanks are due to

Surgeon-General Cuthbert Wallace, C.M.G., and to Lieut.-Colonel H. Rogers, D.S.O., and Lieut.-Colonel W. D. Kelly, D.S.O., for permission to publish these cases.

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SHELL WOUND OF THE PANCREAS CAUSING PANCREATIC PSEUDO-CYST.

BY

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GUNSHOT wounds of the pancreas are less frequent, or less frequently recognized, than those of any other of the abdominal viscera, hollow or solid. The relations of the pancreas with the aorta and inferior vena cava, to say nothing of such vessels as the splenic artery and vein, are so intimate that perforation of the gland by a projectile involves the gravest risk of an immediate and fatal intraperitoneal haemorrhage, and but few cases are likely to survive the first few hours. Should a case escape this primary danger, peritonitis resulting from coincident perforation of the stomach or intestines will usually supervene, and will naturally tend to monopolize the surgeon's attention, should a laparotomy be performed.

The extensive literature concerning penetrating gunshot wounds of the abdomen that has arisen during the present war is remarkable for the rarity of cases of authenticated wounds of the pancreas. Thus Surgeon-General Cuthbert Wallace, in a total of 935 penetrating abdominal wounds, collected only 5 cases of wounds of the pancreas.¹ He remarks that there are no distinctive symptoms of these wounds, and mentions that the formation of Jordan Lloyd's pseudo-cysts, so frequent after civil confusions of the pancreas, has not been seen. Surgeon-General Sir G. H. Makins² states that wounds of the pancreas found during the performance of operations for intestinal injuries have usually proved fatal, while in the few cases in which apparent wounds of the pancreas have been seen at base hospitals it is difficult to exclude the possibility of a wound of the second or third part of the duodenum. He mentions one case, fatal on the eleventh day, in which *post mortem* a wound of the pancreas was found with fat necrosis of the omentum and mesentery, and two other probable cases which recovered but were not established as pancreatic lesions beyond doubt. Fraser and Drummond,³ in a series of 300 cases of perforating wounds of the abdomen, met with one case only involving the pancreas—a rifle bullet wound through the body of the gland, where recovery followed exploration and drainage.

The case described below, in which a penetrating shell fragment gave rise to a large collection of pancreatic juice in the lesser sac of the peritoneum, is not unique, for I have been able to find one reference to a similar case, which is reported in a Hungarian journal that is not accessible.⁴

Pte. M. was admitted to High Street Military Hospital, Manchester, under my care on August 14th, 1916, with the following history: He was hit in the back by a shell fragment on July 24th, three weeks before he came under my observation. Some aching pain in the epigastrium resulted, but there were no symptoms of peritonitis, and he was evacuated rapidly to England. After six days in a central hospital in Manchester he was considered well enough to be sent to an auxiliary hospital in the country. While in that hospital the aching pain in the epigastrium persisted, and a week before he came under my care it was noticed that a swelling had appeared in the epigastrium, and that he was rapidly losing flesh.

Condition on Admission.

He was thin and pale and the tongue was foul. The temperature was 99.4° F. and the pulse 100. There was an unhealed wound of entry in the back 1 in. to the right of the eleventh dorsal spine, and no wound of exit. In the centre of the epigastrium was an obvious swelling. It was large, tense, and rounded, and extended back to the left loin. It was dull on percussion and only moderately tender.

Operation.

The case was regarded as one of subphrenic abscess involving the lesser sac of peritoneum. Accordingly, under ether, a small vertical exploratory incision was made through the left rectus below the costal margin. On opening the peritoneum

the empty stomach was found to be flattened out over the front of a greatly distended lesser sac. This exploratory wound was therefore closed, and an incision was made in the back of the left loin immediately below the twelfth rib. On opening the lesser sac by this route four or five pints of clear fluid gushed out, followed by a little pus. On digital exploration of the lesser sac a fragment of the copper band of a shell, 1 in. in length, was found lying free in the cavity, and was easily removed. The loin wound was drained.

Captain G. E. Loveday, R.A.M.C.(T.), examined a specimen of the fluid and reported that it contained both trypsin and amylopsin.

After-History.

The patient made a somewhat slow recovery, and vomited for some ten days after operation. He then improved more rapidly, and after a change to an auxiliary hospital was discharged as fit for general service.

[I am indebted to Colonel F. H. Westmacott, A.M.S., Officer Commanding 2nd Western General Hospital, for permission to record this case.]

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THE TREATMENT OF INFECTED WAR WOUNDS BY MAGNESIUM SULPHATE.

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CAPTAIN W. J. TULLOCH and I have recently¹ described the treatment of infected war wounds by a concentrated solution of magnesium sulphate. In these articles we claimed as advantages for this dressing:

- (a) Its cheapness, ease of application, and infrequent and painless renewal.
- (b) That it is not easily absorbed and therefore gives rise to no constitutional disturbances.
- (c) That it induces the growth of firm, compact, bright red granulations, interferes with the proteolytic activities of the discharges, and stimulates the growth of epithelium.
- (d) That the magnesium ion has a decided inhibitory action on the growth of at least two of the organisms commonly present—namely, streptococci and *B. coli*—has also a less evident effect on the development of staphylococci, and a slightly inhibitory action on the propagation of the *B. pyocyaneus*.

General Principles of Wound Treatment.

The ideal method of wound treatment in military surgery has yet, I think, to be found, but, in order to discover it and to make it efficient, certain general principles must be considered.

1. The application must be easily carried out and readily applied.
2. Once dressed, it should be possible to leave the wound untouched for some time—that is, until the patient can receive more individual attention, or for such a period that he can be transferred from the field ambulance or casualty clearing station to a base hospital in France or England (about one to seven days).
3. Its action during this period should be continuous, and it should from the first exercise a beneficial effect upon the wound, so that on arrival at the base hospital sepsis should be either abolished or so inhibited that the health of the patient has not deteriorated, and so that further treatment may not be prolonged by dealing with conditions which were preventable.
4. As a necessary corollary to these principles it follows that all special apparatus used for flushing wounds should be abolished, thereby saving much time and labour to the members of the surgical and nursing staffs and much discomfort to the patients; special splints for the immobilization of each fracture would be unnecessary, and a return made to the simpler and more easily applied apparatus in general use for fractures, because the first dressing applied to the wound could remain untouched for several days.

Stages of Wounds.

In dealing with these wounds the two important stages through which they pass are to be borne in mind:

1. *Processes of disintegration* are set up immediately on receipt of the injury. As a result of trauma the wound

passes through various stages of molar or molecular gangrene, the tissues which have had their vitality too seriously sapped die and are cast off, and in so doing they become a medium for the development and growth of organisms. Treatment applied to the wound at this stage should have as its object cleansing the wound, getting rid of the sloughs, limiting sepsis, and preventing the proteolytic activities of the wound exudate as much as possible. This stage requires attention in the field ambulances and casualty clearing stations soon after the receipt of the injury and often under disadvantageous circumstances. When large numbers are passing through the surgeon's hands and accommodation is limited it is impossible to treat them on ordinary lines so thoroughly as is desirable. All that may be possible is to apply some dressing which will protect the wounds and diminish the chances of infection until greater individual time and attention can be given to them further behind the firing line.

The important point to remember is that if this part of the treatment is not carried out early, and with great efficiency, this first stage in the process of repair will be prolonged and rendered more serious.

2. *The phenomena of repair*, which begin when the processes of disintegration have been completed. Any substance applied to wounds at this stage which may interfere with the living leucocytes and prevent their phagocytic activities is to be avoided, and only those selected which will have a prohibitive effect on the proteolytic processes, and stimulate epithelialization of the wound. When this stage has been reached the patients should have arrived at the base hospitals, where more individual attention can be given. It is now, however, rarely that patients are transferred to the hospitals in England in this state. It more commonly happens that Stage 1 in the treatment of their wounds has to be continued on their arrival, and the condition of the wounds, if not worse because of increased infection, is quite as bad as when they were inflicted some days previously; they are discharging pus freely, and bacteriological examination immediately on arrival in the hospitals in England as a rule shows that all the pyogenic organisms usually found in infected wounds are present in abundance. The treatment of war wounds, therefore, resolves itself into two stages: (1) the cleaning of the wounds, (2) the encouragement of healing.

Antiseptics, and especially pure carbolic acid, have a limited scope. They may arrest sepsis so long as the organisms have not gained an entrance into the deeper tissues—that is, they must be applied very early after the infliction of the wound; they prevent the formation of toxins, but at the same time so affect the vitality of the tissues that a further field is provided for the development of organisms for whose destruction they had been employed.

The most satisfactory method of treatment during this stage is the employment of some form of more or less constant lymph lavage, or continuous irrigation with fluids that will prevent the absorption of toxic products while not interfering with phagocytosis. It is on these lines that most of the recent treatment is based—for example, Wright's hypertonic (salt) solution, eusol, Carrel-Dakin method, etc. These methods of irrigation not only get rid of the discharge by flushing, but, what is of equal or more importance, the wound is allowed to remain open, or is enlarged to allow of the free escape of the products of disintegration and sepsis.

Magnesium Sulphate Cream.

During the past year we have been using in our wards a preparation of magnesium sulphate, made of the consistency of cream, as soon as the patients arrive in hospital. To make the conditions as closely as possible resemble those that exist in a casualty clearing station, about a hundred cases were dealt with as follows:

The dressings with which the patients arrived in hospital, most of which were applied from two to five days previously, were removed. A culture was taken by Dr. Helen Clark of the organisms—aerobic and anaerobic—present in smears from the wound, and without any preliminary cleansing of the wound itself or of surrounding parts; magnesium sulphate cream was then applied to the wound under a suitable dressing. The dressing was left untouched for from three to ten days. Bacteriological and clinical examination was then made of the discharges and