year, for instance, I have seen herpes develop in several patients who were suffering from infective hepatitis.

Judging by the analogy of the affinity of the *Spirochaeta pallida* for nervous tissue even in the early stage of syphilis, it is not unreasonable to assume that the nervous system may also be affected by other spirochaetes, such as *L. ictero-haemorrhagiae*, during the course of its invasion.

If the association of nervous complications with infective hepatitis is kept in mind, it may be found that this combination, especially in cases in which the jaundice is not obvious, is not so uncommon as is at present supposed. Therefore, all cases of so-called "aseptic meningitis" of doubtful aetiology, or polyneuritis without obvious cause, should be carefully scrutinized for the presence of latent jaundice. The association of jaundice with nervous complications may possibly be further exemplified by such a condition as progressive lenticular degeneration (Wilson's disease), in which cirrhosis of the liver and a varying degree of jaundice occur together with involvement of certain parts of the brain, especially the corpus striatum.

Summary and Conclusions

The occurrence of nervous complications in Weil's disease and in epidemic hepatitis has been discussed.

Meningitis is the nervous complication most commonly met with in both diseases.

Disease of the nervous parenchyma, though it does occur, is rare in both infections.

Meningitis occurring in a patient suffering from Weil's disease has been described; also two cases of epidemic hepatitis, in one of which polyneuritis developed. In the other, hemiplegia, presumably due to an encephalitis, occurred within a few weeks of the attack of epidemic hepatitis.

While the possibility of coincidence has been kept in mind, the probability is that the hepatitis and the nervous complications are but two phases of the same disease.

This combination may be found to be not quite so uncommon as was formerly supposed, especially if the presence of latent jaundice is looked for in all cases of infective nervous disease of doubtful aetiology.

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speaking, and the line of approach determined by the wounding agent. The position of the wounded man at the time of injury and the type of missile may, however, modify this appreciably. Buttock wounds, in particular, demonstrate this fact, no less than 10 to 15% involving the peritoneal cavity. With regard to the type of missile, coincident blast is a complicating factor too easily forgotten, as that of the lower lobes of the lung in wounds of the upper abdomen. Gross external with less severe internal damage by mortar wounds is less likely to mislead than the converse with shell or rifle wounds. In all types, however, the through-and-through wound may well be the problem. This, *par excellence*, is the wound to be left alone, especially when of the "gutter" type in subcutaneous tissues. Wounds of the right upper quadrant of the abdomen, involving the liver only, may also fall into the same category.

The Abdomen

Abdominal wounds, in general, are still prognostically the worst, an all-in mortality of 50% being my experience and that of numerous surgical colleagues in the North African campaign. This is high, perhaps too high; but many of the factors determining it are beyond the surgeon's control. The interval between receipt of injury and operation is still the most important, and it is reasonable to suggest that every hour after six is more serious than two before it. Civilian figures for mortality of operations for perforated peptic ulcer provide a close parallel. (In the abdominal injuries dealt with by me in forward areas 10 to 12 hours was the average time between wounding and operation.)

Once the patient reaches the operating centre, however, many problems arise—perhaps more in the five or six days after operation than at the operation itself. Given blood instead of plasma, which is no substitute in cases with mesenteric bleeding, the decision and moment to operate are not, as a rule, difficult to determine. The approach then is in the line of the entry wound, and a buttock wound, for example, should be explored first before proceeding to deal with the intraperitoneal damage complicating it. At times, as a result, laparotomy will be found unnecessary; for abdominal rigidity with these, as with thoracic wounds, may easily be found misleading.

The importance of searching the alimentary canal from stomach to rectum has been stressed by numerous observers, and a patient too ill to stand this is too ill for operation. The exceptions are few enough to ignore. With this proviso, the plan should then be clear, and the task usually involved is exteriorization of the large gut and suture or resection of the small. The higher the lesion, of course, the better the prognosis. Even then, however, coincident injuries to other parts of the body may turn the scale, as it has been the exception rather than the rule to have to deal with a single wound. Too often, in fact, the wounded man provides an operation list in himself.

This raises the interesting subject of abdomino-thoracic wounds, which account for 20% of all wounds of the abdomen. These are more serious on the left than on the right side, but experience has shown that they are not necessarily graver than simple wounds of the abdomen. The abdominal injury in these cases is likely to be high and the bowel may be intact, the liver or spleen being the only viscus damaged. Simultaneous renal injury may occur—one notable case in the series under discussion necessitating nephrectomy, splenectomy, and closure of a large pleural defect, without untoward result. A successful cholecystectomy and duodenal repair has also been done for a right-sided abdomino-thoracic injury.

Post-operative continuous gastric suction and measures designed to prevent ileus repay all the care they demand; but a proportion of disappointing results remain which, at times, seem hard to explain. Why, for example, should pulmonary oedema have proved fatal in gunshot wounds of the spleen where no more than three pints of blood or plasma had been given in the 24 hours after operation? Why too, unless hypovitaminosis is the explanation in an army in the field, should a plastic peritonitis be the cause of death three weeks or more after operation? A typical example occurred in a man requiring resection of four feet of ileum and a colostomy for visceral injuries from a machine-gun, seen within five hours.

SURGICAL PROBLEMS IN FORWARD AREAS

BY

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The scope of surgery, in forward areas has advanced in recent times to more than life-saving measures and heroic ablations, often in vain. In their place there is, it is true, major surgery with a high proportion of amputations; but resuscitation, chemotherapy, and new views on after-treatment have altered the principles and results out of all recognition. Difficulties, of course, remain that experience alone can solve, and when not to operate and when not to evacuate are among the most striking. Evacuation, indeed, controls the whole problem; and familiarity with the mode of transport and distances involved should be an essential part of a forward surgeon's information. Many a successful technical procedure has been ruined by premature evacuation, many a wounded man set back further by a long ambulance ride than improved by the resuscitation not long preceding it. Cases of burns and thoracic and abdominal injuries illustrate this point well.

The surgeon in forward areas has admittedly the easiest task in one respect, for the field is new ground, surgically

Evacuation to a general hospital was delayed for more than a fortnight, and the patient died nearly three weeks after this.

The holding of patients for at least ten days after laparotomy has made a vast difference to results, and by this time the issue is usually clear. Even then, however, evacuation by air or by slow stages is the method of choice.

Chest Wounds

These are not, as a rule, difficult to deal with in forward areas, the minimum possible being done after closure of open wounds of the pleura. In a series of more than 60 cases only one required operation for bleeding from an intercostal vessel producing a haemothorax. Repeated aspiration in this instance failed to prevent displacement of the apex beat to the fifth right interspace three inches from the midline. Surgical emphysema likewise has necessitated intervention only once in the same series.

Limb Injuries

Sixty to eighty per cent. of all wounds involve the limbs, and the lower more often than the upper. Immobilization of a standard type simplifies the problem in these cases. Illustrative and valuable examples are the Tobruk plaster for fractures of the femur and thoraco-brachial plaster for the humerus. Plaster cuffs for amputation stumps have also proved useful. Coincident injuries, such as a Pott's fracture with a fractured femur, can complicate the picture appreciably.

Of all fractures perhaps those of the upper third of the femur must be regarded as the most dangerous, associated in dispatch riders, who are the commonest victims, with head injuries which may also be grave. The value of radiographs in these as in all fractures in forward areas has too often been exaggerated, as immobilization and not realignment is the surgeon's task. Excision of the wound is of course required, and difficulty is often experienced in distinguishing bone fragments from foreign bodies. The errors, however, can easily be rectified when definitive treatment is carried out after evacuation.

Amputations, as already stated, are numerous, and primary suture is no more admissible here than in any other site. Blood transfusion in these cases is usually vital, and for double amputations imperative. One such case did well although operated on 15 hours after injury with massive destruction of one leg below the knee and gas gangrene in the other.

Gas gangrene has been encountered more than a dozen times in 500 cases, and the interval since wounding has twice been less than eight hours. One case oddly enough presented coincident maggot infestation, and the wound was (as usual in these cases) very clean. Excision of the affected muscle group proved effective. The diagnosis in the majority of cases, however, is made not from an inspection of the wound but from the patient's general appearance—the sallow, vivid look, incipient delirium, and restlessness being characteristic features. The presence of gas in the wound is unusual and has been noted only once. Anaerobic gangrene, in fact, might be a more descriptive and apposite term. It may even be fair to say that the presence of gas in gas gangrene, so-called, is as useful in establishing the diagnosis as skeletal secondaries in carcinoma of the breast.

Chemotherapy in these infections is an adjunct to and not a substitute for radical surgery. Buttock, thigh (lateral aspect), and calf wounds, for anatomical reasons, are those most apt to develop gas gangrene, and prophylactic serum for all of them may well have reduced the incidence of this complication. There again postponement of evacuation for some while after operation is of the greatest value. In these cases, as in large wounds with gross sepsis, secondary haemorrhage is the real danger of the convalescent period. When it occurs nothing but ligation of the main vessel involved is likely to be effective.

Burns

Routine treatment with sulphanilamide and petroleum jelly gauze after gentle but thorough cleansing with saline is still the method of choice, and it is the anaesthetist rather than the surgeon whose task is difficult. General agreement will probably be expressed with the danger of pentothal in extensive burns as in head injuries. Intravenous morphine has, in fact, proved much more satisfactory, and can be used with advantage for subsequent dressings at five-day intervals.

Conclusions

Evacuation controls the problems of surgery in forward areas.

The number rather than the nature of wounds may be the most important prognostic feature.

The all-in mortality of abdominal wounds is 50% or thereabouts.

Abdomino-thoracic wounds are not necessarily more serious than abdominal.

No patient should be evacuated until ten days after a laparotomy.

Radiographs of fractures in forward areas are unnecessary in nearly all cases.

"Anaerobic gangrene" is suggested as an alternative to "gas gangrene." The presence of gas is a late manifestation.

Intravenous morphine is the anaesthetic of choice in the treatment of burns.

Medical Memoranda

Severe Granulocytopenia from Sulphaguanidine

A recent M.R.C. Memorandum (1943a) reports that sulphaguanidine has shown little toxicity to date, although nausea, drug-rash, and fever have occasionally been noted. The occurrence of severe granulocytopenia in a young adolescent treated for Sonne dysentery with moderate doses of this drug is therefore of some importance.

CASE RECORD

A girl aged 15 who had complained of headache, vomiting, and diarrhoea since the previous day was admitted to an E.M.S. hospital with a pyrexia of 101.2° and tenderness over the course of the colon. Her general condition was good and the frequent watery stools contained no blood or noticeable excess of mucus. Desoxycholate cultures produced a heavy growth of *B. dysenteriae* Sonne.

Sulphaguanidine was begun on the third day of the illness, 1.5 g. being given three times daily in the first three days. By this time the temperature had become normal and the stool cultures negative, and the dose was reduced to 1 g. three times daily, which was continued for four days. Thus a total of 25.5 g. of sulphaguanidine was given in seven days.

Six days after the drug had been discontinued the stools became relaxed and the cultures again became positive. A second course of sulphaguanidine was begun eight days after the conclusion of the first, 1.5 g. being given four times daily. After only two doses the temperature, previously normal, rose to 100.2° and there was complaint of a feeling of lassitude and slight headache. The temperature showed morning remissions to normal, but the malaise persisted, and on the third day, when a total of 15 g. had been given, the second course of sulphaguanidine was stopped. On this day the total leucocyte count was 5,500 per c.mm., of which 64% were polymorphs. The following day the temperature showed no morning remission and the leucocytes had fallen to 4,100 per c.mm., of which 38% were polymorphs. A day later the pyrexia reached 103.2° and the leucocyte count was 2,000 per c.mm., of which only 10% were granulocytes.

Sodium pentnucleotide was given in 10-c.cm. doses three times daily for four days, and twenty-four hours after starting it the leucocyte count had improved to 4,000 per c.mm. Of these 38% were of the granulocyte series, 4% being myeloblasts, 16% myelocytes, and 18% polymorphs. Thenceforth there was gradual improvement, but six days elapsed before primitive white cells ceased to be present in fair numbers and before the temperature became normal. The red cells were not affected. There were no necrotic lesions and no petechiae.

COMMENT

Sulphaguanidine is used in the treatment of bacillary dysentery because of the local bacteriostatic action of the proportion of the total dose given which reaches the colon unabsorbed and is finally excreted in the faeces. Attention has centred on this action, and it requires to be emphasized that approximately two-thirds of the amount administered by mouth is absorbed before the ileo-caecal valve is reached (M.R.C. Memo., 1943b). That relatively low blood concentrations occur with this sulphonamide is due in far greater measure to rapid elimination in the urine than to poor absorption from the intestine (Firor and Poth, 1941). The possibility of agranulocytosis resulting from the administration of sulphaguanidine therefore merits attention, especially as the drug is often given to large groups of cases in epidemics, when regular checking of the granulocyte count may be impracticable.