repeated paracentesis. Such cases may get well with no special treatment after running a prolonged course of several weeks' duration. Their explanation is difficult, but it may be that the pyrexia in such cases is dependent upon the inflammatory process in the wound track, and more especially in that in the lung, and that the layer of fibrin coating the pleural surfaces prevents the infection reaching the pleural fluid. Care must always be taken in considering the diagnostic significance of pyrexia that it is not due to some associated complication, such as purulent bronchitis, contralateral pleurisy, pneumonia, or pericarditis, although all such complications are much more liable to occur in infected than in sterile haemothorax. The rarity of pulmonary inflammation in the compressed lung on the side of the haemothorax should always suggest, if symptoms are urgent, that infection of the fluid is present rather than pneumonia, although the physical signs may be such as to render diagnosis difficult. In all such cases there should be no delay in making an exploratory puncture, as it is essential for the successful treatment of infected haemothorax that the cases should be recognized as early as possible.

TREATMENT.

In sterile haemothorax, if the amount of the bloody effusion is small, there is no need for any special active treatment; such cases do well, although their progress may sometimes be slow. If the effusion is at all large in amount—that is, the dullness reaching above the angle of the scapula—the fluid should be removed by aspiration about the end of the first week after the wound. In a few cases earlier aspiration may be required to relieve distress arising mechanically from the amount of fluid present. Aspiration with oxygen replacement is better than simple aspiration, since by this method, with suitable local anaesthetics, the operation can be carried out without discomfort to the patient and without any of the symptoms that so commonly occur in ordinary aspiration, and not infrequently prevented by their urgency the completion of the procedure. Further, with oxygen replacement practically all the fluid present in the chest can be removed at one sitting; this is rarely feasible with ordinary aspiration, where the development of such symptoms as a sense of constriction, distress, cough, etc., occurs before all the fluid has been removed. These unpleasant symptoms develop as a consequence of a too sudden change in the intrapleural pressure resulting from the rapid removal of fluid, together with incomplete adjustment owing to incomplete expansion of the lung. Different patients vary considerably in the degree of their tolerance of pleural pressure changes, and these are necessarily much influenced by the degree and rapidity with which the lung re-expands. With an oxygen replacement apparatus a measured quantity of oxygen at any desired pressure can be introduced, and thus violent and sudden changes in the intrapleural pressure are avoided.

For practical purposes it is not necessary to measure accurately the intrapleural pressure; it is sufficient to regulate the introduction of oxygen by the presence or absence of symptoms. The aspiration of the fluid should be temporarily stopped when distress or a sense of constriction is first noticed by the patient; if the symptoms do not subside at once, a small quantity of oxygen from the oxygen replacement apparatus (Parry Morgan or other) should be allowed to flow into the pleural cavity. Then with the relief of all distress, a further quantity of the fluid can be aspirated and the process continued until the operation is completed. The patient is left at the end of the aspiration with a small quantity of oxygen in the pleura—for example, 200 to 500 c.cm. at a pressure considerably less than the pressure of the haemothorax, but still appreciably above the normal pleural pressure. The oxygen is gradually absorbed in the course of the following week, but it is remarkable that many days are required for the pleura to absorb even small quantities of gas, and this slow absorption is probably due to the coating of the parietal and visceral pleura with fibrin, as it is in remarkable contrast to the rapid absorption of air that is known to occur after opening the normal pleura.

Free drainage is required in all cases of infected haemothorax, and it is of the utmost importance that this should be provided as early as possible, as the organization of the deposit of lymph on the visceral pleura produces a great impediment to the rapid expansion of the lung after the

removal of the fluid, and this organization proceeds rapidly in cases where delay in operating takes place. Removal of the infected fluid by free drainage is, however, not sufficient treatment in all cases; the inflammation in the pleural sac and the septic clots must be treated by the local application of some efficient antiseptic, applied either by periodical washing out of the cavity or else by the instillation method and the Carrel-Dakin technique that is now so much used. If the cavity is treated by washing out, care must be taken to avoid raising the intrapleural pressure. Septic clots, often of considerable size, can be removed with success by this method. Recently the Carrel-Dakin technique has been applied with success to cases of infected haemothorax, and a few cases have already been so successfully treated that the operation would required for the excision of the rib has been closed by secondary suture before the evacuation of the patient to England.

Two difficulties are met with in practice in cases of haemothorax. In one group of cases, although the pyrexia and the patient's general condition suggests the presence of infection, bacteriological examination does not confirm this. In another series of cases organisms are detected in the fluid, but there is little or no pyrexia, and the patient does not seem to be very ill. It is probable that some of the cases falling into this second group recover after simple aspiration, but their convalescence is often very slow, and certainly in some instances such cases develop serious and even urgent symptoms. For these reasons it is advisable to excise a portion of rib and procure free drainage in all cases of haemothorax where the bacteriological examination reveals the presence of pathogenic organisms, even if the clinical condition of the patient is not such as to suggest infection. As regards the first group, the position is more difficult, but it is probably wiser to delay opening the pleura until proof of infection in the fluid is obtained, as the pyrexia and even the other symptoms may have some other origin; it is a serious matter to open a sterile haemothorax in view of the possibility of secondary infection.

Care must be taken in selecting the site for excision of a portion of rib to provide really efficient drainage, and the fact that the diaphragm is abnormally high in these cases must be borne in mind, as otherwise the opening will be made too low down.

In some instances the wound of entry or exit communicates more or less directly with the pleural cavity and fluid in variable quantity drains from it; this drainage is rarely satisfactory or sufficient, and such cases require a counter opening in a suitable situation to really drain the effusion.

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FACTORS IN FIELD AMBULANCE WORK WHICH HELP THE WORK IN CASUALTY CLEARING STATIONS.*

BY CAPTAIN K. M. WALKER, R.A.M.C.

In spite of its necessary limitations, the surgery of the field ambulance is of the greatest importance. The treatment that a shattered limb receives during the first four or five hours may alter the whole future history of the case.

The surgery of the aid post and the dressing station is necessarily a surgery of emergency. Collection of the wounded, and rapid evacuation, must always be recognized as the most important functions of the field ambulance units; and when it is possible to do so, anything in the way of operative treatment must be postponed until the arrival of the wounded man at the casualty clearing station.

Haemorrhage.

In this surgery of emergency the treatment of haemorrhage takes first place, and there is a certain type of case in this connexion to which I should like to call attention. I refer to those cases in which there is a slow, continuous oozing that is at no time sufficiently rapid to be regarded

* Paper read at a meeting of medical officers of an army in the field.

as severe haemorrhage, but which in the long run may cause more loss to the patient than a brisker haemorrhage that has received prompt treatment. The danger of these cases is, of course, that they may not be recognized. A wounded man passes through many hands before he reaches the casualty clearing station, and although his dressings may have been changed on several occasions because they have "come through," no one may have been in a position to realize how much blood he has lost and how urgent is the call for prompt treatment. Such a case may not, indeed, be in danger of death from haemorrhage, but he will start his fight against *sepsis* severely handicapped. Every ounce of blood is of value to a wounded man, and the more efficient the work of an ambulance the less will be this avoidable loss. The wounds which are most likely to result in loss of blood in the above manner are compound fractures of the tibia and fibula, and wounds around the ankle-joint. Therefore, before dispatching such injuries from the dressing station, great care should be exercised in making certain that no oozing is taking place. The application of large quantities of gauze and wool to such cases is an "ostrich" policy as well as a wasteful one.

I have purposely dwelt on the less profuse forms of bleeding, for true arterial haemorrhage is not only rarer, but is so dramatic that there is no chance of its being overlooked. It is scarcely necessary to add that the application of a tourniquet to any case of haemorrhage must always be regarded as a purely temporary expedient. No case ought ever to leave a field ambulance with a tourniquet.

Splinting of Compound Fractures.

Another branch of field ambulance surgery that exercises a great influence on the future history of a case is the splinting of compound fractures, and especially of compound fractures of the femur.

It is during the first five or six hours after wounding that the danger of moving an unsplinted femur is greatest. When men with compound fractures of the femur die before reaching a casualty clearing station they almost invariably die of shock; and if anything is likely to aggravate shock, it is a long journey with a fracture that is imperfectly immobilized. I am aware of the difficulties that attend the use of a "Thomas" splint so far forward as an aid post, but one is stimulated to continue urging that something more should be attempted for these cases.

As the result of discussing these difficulties with various regimental and ambulance officers, I submit the following suggestions:

1. That nothing further should be attempted at an aid post than the simplest possible adjustment of a Thomas splint—that is to say, that it should merely be placed in position, traction made by a clove hitch round the ankle, and a sling tied behind the thigh.
2. That time be saved and exposure avoided by applying the splint over the clothes and without even removing the boots. Thus used, a Thomas splint should take less time to adjust than a Liston, and the task can be undertaken by any orderly.
3. That the more elaborate technique for completing the adjustment of the splint should only be attempted when the patient reaches more convenient surroundings.
4. That the Thomas splints supplied to the more advanced stations be rendered more portable by making the ring detachable. A dozen rings and a dozen bars could then be packed into the space now occupied by two Thomas splints.
5. That some exchange system between the ambulance advanced or main dressing stations and the aid posts should be maintained in order to ensure the supply of "Trench Thomas," in the same way as rules with stretchers and blankets.

I do not flatter myself that these suggestions entirely eliminate the difficulties that attend, and must always attend, any attempt to deal more efficiently with compound fractures of the femur at an early stage. They are offered tentatively, and if they do nothing else than stimulate discussion, and thereby assist at arriving at some practical solution of a difficult problem, they will not have been made in vain. The difficulty may be great, but the

necessity for improvement in dealing with these injuries is even greater.

Emergency Amputations.

Hopelessly shattered limbs should be amputated on arrival at the dressing station, if for no other reason than to relieve the wounded man of needless pain on his journey down the line. The operation is not a formal amputation; it is merely the completion of the work that the explosive has all but effected.

Chest.

It is often wiser to allow a chest case to remain quiet in the field ambulance rather than to subject him too soon to the dangers of a journey. When, therefore, it is possible to do so, perforated wounds of the chest should be retained in the ambulance until the dangers of shock and of haemorrhage have been weathered. Beyond the usual treatment there are only two points to be borne in mind. The first is that the sudden appearance of alarming symptoms in a case of haemothorax may be due to an anaerobic infection, requiring the immediate adoption of drastic measures—that is, drainage by resection of a portion of a rib. The second is that in the event of any likelihood of a gas attack, all chest cases must immediately be evacuated. Chest injuries and box respirators do not harmonize.

Head and Abdomen.

The more quickly head and abdominal injuries are evacuated the better. Owing to the difficulties of accurate diagnosis in abdominal wounds, it is better to err on the side of excessive caution, and to regard all wounds of the abdomen, back, and buttocks as potentially penetrating, unless there is clear evidence to the contrary. There is only one type of penetrating abdominal wound whose retention in a field ambulance is justifiable—namely, perforating bullet wounds of solid organs like the liver or kidney, in which it is certain that no hollow viscera are implicated, and in which there are reasons for suspecting haemorrhage. Such cases may be retained until the danger of haemorrhage is past, but to do this the diagnosis must be absolutely certain.

Shock.

In addition to these injuries, severe cases of shock should be retained until some reaction has taken place. Superficial and extensive lacerations often produce a disproportionate amount of shock like superficial and extensive burns. Such wounds are in no urgent need of surgical treatment, but are immediately dangerous only on account of the shock produced. For this reason the evacuation of such cases may be delayed until reaction has begun.

The improvement of the ambulance dressing stations and the increased facilities for surgical work that now exist should result in an improvement of the work performed there, rather than in an enlargement of its range.

Discussions as to the best type of dressing to employ in field ambulances are not, to my mind, very profitable. When the interior of a wound is full of dirt, cloth, shell fragments, and destroyed tissues, it matters little whether eusol gauze or cyanide be employed to the mouth of the wound. An alcoholic solution of picric acid is, however, more satisfactory than tincture of iodine, in that it is less irritating to the skin and at the same time more lasting in its effect.

I have avoided launching out into new ideas on the subject of ambulance surgery, and have merely selected a few points that seemed worthy of consideration. The casualty clearing station and the field ambulance are so closely connected, that anything that assists in bringing the work of the two into line must contribute towards efficiency.

THE Caledonian Hospital was opened recently in Brooklyn, New York. It is the first Scottish hospital established in the United States. Dr. William J. Cruikshank is president of the medical and surgical staff, and is head of the department of medicine. There are also departments of surgery, obstetrics and gynaecology, genito-urinary surgery, neurology, paediatrics, ophthalmology, laryngology, otology, roentgenology, and anaesthesia.