A Lecture

ON

TREATMENT OF THE WOUNDED IN THE AID POSTS AND FIELD AMBULANCES.

GIVEN TO THE MEDICAL OFFICERS OF AN AMERICAN DIVISION,

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IMPORTANCE OF FIRST-AID WORK.

It is perhaps natural that articles in the medical journals should have dealt almost entirely with the comparatively finished surgery of the clearing stations and base hospitals. The surgery of first aid is not a subject in which the profession generally has interested itself. Abdominal and chest surgery, for instance, lend themselves more to literature than the efforts of the regimental or field ambulance officer. At one time there was a real danger that insufficient effort might be given to developing and encouraging the surgical work of the fighting line. But the keenness and devotion of many officers with divisions has saved the situation, and the improvement effected in the surgery of the forward units is just as striking a feature of the medical history of the war as that which has taken place in the clearing stations and base hospitals abroad and in England. The improvement in forward work is strikingly reflected in the condition in which the wounded reach the clearing stations. My attention was drawn at a unit at home to the fact that whereas at one time the arrival of a double leg amputation was a rarity, now there were a large number of such cases awaiting artificial limbs. Improvement in the treatment of shock, and surgical treatment generally, has, of course, much to do with this, but I am inclined to attribute a large share of the credit to the work of the regimental and field ambulance officer. In many a case the question whether a wounded man can have a chance of survival has been settled by the treatment adopted before the ambulance convoy deposits him at the clearing station. In all that follows I am telling you methods which have for the most part been devised by officers who have spent their service in forward units, and what I shall say is largely what I have learnt in visiting those units.

GENERAL PRINCIPLES.

In surgical work at forward units it is necessary to have clearly in mind what surgical aims one has in view; what it is possible to do in dealing with a wound; what is impossible, and therefore waste of time to attempt. In laying down the general principles which govern the treatment of wounded at the aid posts and field ambulances, it is essential to consider briefly the whole question of the treatment of the wounded as it now stands.

In the conditions of warfare existing on the western front the great majority of the wounds met with are severely lacerated, the soft tissues are extensively crushed and devitalized. Such wounds are heavily infected, not only with the ordinary pathogenic organisms but also with the anaerobes of gas gangrene and gas cellulitis. Fragments of shell or bomb and pieces of clothing, or masses of mud, carried in by the missile, are frequently present in the wound. Varying in proportion with the character of the fighting, clean through-and-through bullet wounds are met with. Even bullets, especially when striking bones at short range or when splitting into myriads of fragments through hitting accoutrements or ricochetting from hard objects, produce wounds which possess all the grave characteristics of those caused by large fragments of shell.

The results in the early days of the war of treating wounds of this nature by simple aseptic or antiseptic dressings, on the lines adopted in South Africa, caused a rude awakening. In the first place tetanus was rife; the routine administration of antitetanic serum had an immediate effect in controlling the incidence of this disease. In the second place, anaerobic infections of the nature of gas cellulitis and gas gangrene—conditions almost unknown to us in civil practice—were nearly universal complications of bad wounds. The measures first adopted, of free opening and drainage, and the avoidance of constriction and undue pressure, had but little effect in the prevention of gaseous

infections. Attempts at disinfection in the forward area by pastes and strong chemical antiseptics were notoriously unsuccessful. Almost all severe wounds became infected and foul. Deaths were frequent, and prolonged and painful convalescence the rule.

Excision of Damaged Tissue.

Not much progress was made until it became recognized that all but trivial superficial wounds or clean through-and-through bullet wounds need an early and complete cleansing operation—an operation which involves the free exposure of all the recesses of the wound; the removal of all missiles, clothing, dirt, and debris; the methodical excision of damaged muscle and fascia and the paring of damaged skin edges. This operation must be performed with surroundings permitting of care and thoroughness, with proper aseptic ritual, by surgeons experienced in the technique, and in places where patients, if necessary, may be retained for a short period. It was found that when this operation had been efficiently performed wounds ran a course free from complications; that secondary suture was possible in many at an early date; and finally that, under certain circumstances, many wounds could be sewn up right away, and would heal much as the clean operation wound of civil practice. It is now everywhere recognized that this operation is the factor in deciding between severe infection, prolonged illness, and eventual crippling on the one hand, and an aseptic course, rapid convalescence, and a minimum of disablement on the other. This operation may conveniently be termed the excision of the wound. When is it to be performed? Certainly as soon after the infliction of the wound as possible. The longer the delay the greater the chance of established infection. Where? You have not the necessary appliances, theatres, personnel, and accommodation in the forward units. Special hospitals are provided for the purpose, as near the line as possible. We call them Casualty Clearing Stations. Your work, then, will consist in getting your wounded back as soon as possible, and as fit as possible for the further treatment necessary.

Summary of General Principles.

Having these facts in mind, one may now summarize the general principles which govern forward unit work as follows:

1. Get the wounded back to the clearing station as soon as you can.
2. Dress the wound once carefully; afterwards do not disturb the dressings unless they have slipped or unless there is bleeding.
3. Take measures to avoid shock; if it has already supervened, take measures to treat it.
4. Efficiently splint all fractures.
5. Arrest haemorrhage.
6. Take any special measures needed in special cases.

Rapid Evacuation.

This calls for qualities of organization, endurance, devotion, and courage. It is not a surgical problem. Yet perhaps I may be allowed to say these words: Success in regimental and field ambulance work depends at least as much on what is done to meet the rush beforehand as on the actual conduct of affairs at the time. Forethought and organization are all-important. Every man in a unit should know what is expected of him, and should be trained to carry out his particular job. A wounded man passes through one of the larger units in much the way that a piece of metal passes from department to department of a factory till it emerges the finished article. Records have to be taken, antitetanic serum given, food or drink administered, the wound dressed, splints applied, the patient warmed and packed up for transport. Often this has to be done under circumstances of almost intolerable difficulty. The difficulties can only be surmounted by organization of the machine beforehand, so that each man does his job and confusion is avoided. "Team work" is essential. To see a Thomas's splint applied to a fractured femur by a well-drilled team is a revelation to the inexperienced.

Dressing the Wound.

Dressings must be ready beforehand. Gauze should be cut up into 6-inch squares and sterilized. The best way, I think, of doing this is to boil the gauze in a marmite. The excess water is drained away, and, when cool, the

gauze is covered with eusol. When needed for use the eusol is drained off, and the gauze is ready for use. Roller bandages are laid out ready to hand. The triangular bandage is of great value, and all your orderlies should be trained in its application.

The field or shell dressing will have been applied usually by unskilled hands. It is liable to be dirty and tight. You should therefore remove it and do one careful dressing. It is not possible for you to have clean hands. Rubber gloves are out of the question, but if you will practise sufficiently you will find that forceps can do the whole work without your hands having to touch either the wound or the dressings which are to be in immediate contact with it. Pairs of sterilized forceps standing in glasses of antiseptic should be at each dressing "dump." The wound itself is temporarily covered with gauze; the skin around is then washed and painted with picric acid (3 per cent.) in spirit. (Iodine is liable to blister, and when combined with cyanide gauze causes serious burns.) The wound is then uncovered, obvious dirt or foreign bodies are removed, and the surface of the wound swabbed over with eusol. No attempt should be made to clean out the depths of the wound or to syringe or irrigate. Attempts to delay or avoid infection by the injection into wounds of fluids or pastes are futile. You are more likely to spread infection to previously uncontaminated areas. You will waste valuable time. You will disturb clots and restart bleeding. You only need to see a few wounds opened up at the clearing station to realize how impossible of realization is the first-aid disinfection of lacerated shell wounds. The wound is finally covered with gauze and wool and bandaged.

Shock.

I can do no more than touch on the practical aspect of this wide subject as far as it affects your forward work. It is convenient to speak of primary and secondary shock.

Primary shock ensues practically immediately on the receipt of a severe wound. It is not possible for you to avoid its occurrence. If adequate means be taken to combat it, the patient may recover from it and secondary shock may not follow. In the worst cases, or where no treatment has been available, it passes into a condition of secondary shock, with or without a period of rallying and partial recovery.

Secondary shock comes on later. It may be a sequel to primary shock or come on *de novo*. It is produced by various factors, which will be spoken of, and to a considerable extent may be avoided if adequate treatment is possible.

The factors which cause primary shock to pass into secondary shock, and those which cause secondary shock, are largely identical. They are—cold and exposure, lack of food and drink, haemorrhage, pain and disturbance. The onset of sepsis aggravates and perpetuates the condition. A condition of acidosis is often present, and further research on this point is being carried out. Cold and exposure are, of course, in part inevitable, but much can be done to avoid them. The warm stretcher is well known in our service, and is used even in many aid posts. (A demonstration was given of this and a practical method of warming blankets at a field ambulance shown.) Improvised hot-water bottles are widely employed, and our ambulance cars are warmed by the exhaust pipe. When circumstances allow, and it is possible to do it in reasonable warmth and shelter, the wet clothes may be changed. During one severe action every one of the badly wounded in a certain division were sent down in dry warm clothing with hot-water bottles applied, without delaying evacuation. The circumstances were exceptional, but I quote this as an example of what can be done when determination exists to get as near the ideal as the military situation permits. Hot drinks should be given. Hot tea is the favourite with our men. With a view to combating acidosis, a teaspoonful of bicarbonate of soda is sometimes added. Of all factors concerned in shock perhaps haemorrhage is the most potent. Every effort must be made to reduce it to a minimum. Remember that every change of dressing starts oozing afresh. In the avoidance of pain, the importance of efficient splinting cannot be overrated. Not only fractures, but also extensive lacerated flesh wounds of the extremities should be splinted. Morphine is of great value. It should not, however, be given indiscriminately, and the dose needs careful regulation. A good deal of

difference of opinion has existed on this point, but the view of those best qualified to judge is becoming unanimous, that a dose of $\frac{1}{4}$ grain should seldom be exceeded. The question of the more active treatment of shock, in the forward area, by intravenous injections has been studied for a long time. Injection of normal saline is generally held to be too transitory in its effect to be of much value in helping a badly shocked man over his journey back. We are now investigating the effect of a solution of gum and sodium bicarbonate in the forward units. As might have been expected, it is in cases where there has been much haemorrhage that the effects have been most favourable. Since the technique is rapid and easy it may be that intravenous injections will become a recognized feature of field ambulance work. Transfusion of blood, the most effective form of treatment we have at present, I am not discussing, as its employment in front of a clearing station is hardly ever a practicable matter. Attempts have recently, however, been made to employ preserved blood for the purpose.

Fractures.

Allusion has already been made to the shock produced in fractures of the larger bones. Transport with fractures imperfectly splinted is a great feature in increasing and producing shock. The condition of a man with a fractured femur at the end of a journey without a splint is pitiable. One of the most striking things in war surgery is the improvement in the condition of fractured femurs arriving at the clearing stations since the adoption of the Thomas splint in front line work. Every fracture should be immobilized as far forward as possible. This is very often possible at the aid post. Failing this, it should be done at the advanced dressing station. The fewer and simpler the varieties of splints used the better.

For all fractures of the femur, serious fractures involving the knee-joint, and fractures of the upper part of the tibia, the Thomas splint should be used, with an extension applied over the boot, which should not be removed. (A demonstration was given of the first-aid application of the Thomas splint.) In those rare cases where the ring of the Thomas would press on the wound, a long outside splint must be substituted.

For fractures of the middle and lower third of the leg, and for those of the ankle and tarsus, a back splint with footpiece is efficient, provided always that side splints are used with it. Otherwise the heel slips out, and the splint becomes useless.

Fractures of the humerus are not easy to splint effectually. If the lower end of the bone is broken, an internal angular splint, or the variety of this with a posterior splint fixed on like a shutter, is efficient and simple. If the fracture is in the middle or upper third no internal angular splint can come high enough into the axilla to get any useful grip on the top fragment. After much trial and discussion with front line officers I have come to the conclusion that the best method is to use the thorax as a splint for the arm. A wool pad is placed in the axilla, the whole upper arm is then bandaged to the chest, a piece of Gooch's splinting being applied to the outer side of the arm, reaching from the acromion to the outer condyle. The wrist is supported by a sling. Of course you will understand that I am dealing only with transport as far as the clearing station.

For fractures of the radius and ulna the internal angular splint is used, with a straight splint for the back of the forearm. For those close to the wrist straight splints to the front and back of the forearm suffice. In all these fractures the sling should reach as far as the fingers, so as to support the hand.

Haemorrhage.

The Tourniquet.—In speaking of haemorrhage one is at once up against the much-discussed question of the tourniquet. Properly used, the tourniquet at times saves a life. Improperly used, it is a frequent cause of loss of life and limb. Its use is seldom justifiable, and then only as a temporary measure for the arrest of serious bleeding until the wounded man can be got to a place where the arrest of haemorrhage by the recognized surgical methods can be carried out. You should remember that some form of emergency tourniquet may have been applied by a comrade or stretcher-bearer. In the rush of heavy fighting it is easy to miss such a tourniquet hidden by the man's clothing or the corner of a blanket. Being warned of the

possibility, one should not do so. In patients getting back as far as the clearing station with tourniquets applied, death of the limb from interruption of the circulation is almost invariable. Even if this does not occur, the cutting off of the blood supply from an area of smashed muscle provides all the ideal conditions for the development of gas gangrene.

Other measures than the tourniquet should therefore be adopted, and if for some reason a tourniquet has been applied it is the duty of every medical officer through whose hands the case passes to remove it. In most cases there will be no bleeding. If, however, bleeding recommences, then the following methods should be employed:

1. In many cases the obvious source is exposed in the wound and may be seized with pressure forceps and ligatured. This is the ideal.

2. In other cases blood may be seen welling from a deep recess of the wound. Pressure forceps are applied in that area and the bleeding ceases. To apply a ligature over the forceps may need a free opening up and present difficulties. In this case it is best to leave the forceps on and pack round with gauze. The patient is sent on with the forceps *in situ*.

3. If neither of these methods is applicable pressure must be obtained by packing the wound. But it is essential that the pack really presses on the bleeding point. It is no use packing gauze through a small aperture into a big lacerated cavity. The pack must be cone-shaped, with its apex at the source of haemorrhage. If the wound aperture be small it must be enlarged by slitting up the skin and fascia. No anaesthetic should be used. The pain caused is not great, particularly if the incision be made in a distal direction where the nerve supply has been interrupted by the injury. Gauze is then packed firmly into the wound and a pad placed over it. Firm pressure is made with a bandage, but a wide wooden splint should always be applied to the opposite side of the limb before the bandage is applied, in order to avoid constriction of the extremity.

Special Cases.

Penetrating Abdominal Wounds.—These should be sent by the shortest route to the clearing station. The mortality varies directly with the number of hours which intervenes between the receipt of the wound and operation. It is important to realize that not only wounds with their entrances in the abdominal wall, but also wounds of the back, buttock, hip, groin, and lower chest, are potential "perforating abdomens." Shock, out of proportion to the external appearance of the wound, pain in the abdomen, rigidity—especially in regions remote from the wound—and vomiting, point to the likelihood of an abdominal lesion. Any case in which suspicion exists should be sent on at once.

Penetrating Chest Wounds.—An injection of morphine should be given. This lessens the respiratory distress. The patient should be placed in the position of greatest comfort, which is usually the semi-recumbent posture. While it may be an advantage to keep a bad case for a time to allow him to tide over his initial shock, the general rule is to send cases back as soon as they are fit to travel. In dressing the wound, it is important to avoid the interference with the free play of the uninjured side of the chest caused by an encircling bandage. Use strapping when possible. There is one class of chest wound that needs special attention. The wound in the parietes may remain open so that air is sucked in and out with respiration, or the blood collected in the pleural cavity may be leaking away through the external aperture. "Sucking pneumothorax" and "leaking haemothorax" are convenient terms for these conditions. In the first the respiratory embarrassment is extreme, and the patient's condition desperate from the start. In the latter, so long as there is a free external leak, internal bleeding is likely to continue. In both infection is certain if the condition continues. In both types of case the wound should be closed before the patient is sent on. Stout sutures inserted with large curved needles are used. A good grip should be obtained of skin and muscle. If the gap be large, a piece of gauze should be laid in the wound and the stitches tied over this. When for any reason suture of the wound is impracticable, the wound should be plugged with gauze, and strapping applied over it in the manner employed in strapping a broken rib.

It should be practicable thus to render the wound airtight. The improvement in a patient's condition brought about by suturing a sucking pneumothorax is immediate and dramatic.

Penetrating Wounds of the Knee-joint.—Great care must be taken to splint all cases in which joint injury is suspected. It is easy to diagnose a wound of the knee-joint when the synovial cavity is distended with blood or effusion. It is very easy to miss such a case at an early stage, when there is nothing to see but a small entry wound in the lower part of the thigh. The matter is, however, of great moment. A knee-joint into which a missile has carried infection, is much less likely to run an aseptic course after operation if distension of the synovial cavity has opened up all its recesses to the scattering of infected material. Failure to splint favours bleeding, effusion, and distension. The unrecognized knee case sent down "walking" does badly. It is a safe rule to splint all penetrating wounds near the knee.

The Field Medical Cards.—In conclusion I should like to say a word about this card. It forms the means by which you are enabled to communicate to the unit behind you any information which may be useful in the further treatment of the case. Look at it from this point of view: "If I were in the unit behind, what information should I like to have about the previous history of this case?" Put that down on the field medical card. In most cases nothing is needed but your diagnosis. Above all write legibly. Put the important wound or wounds first and be precise. "G.S.W. abdomen, arm, both legs," may mean anything. It may mean "G.S.W. abdomen perforating, also arm, right thigh, left leg." It may mean "G.S.W. fracture right femur also abdominal wall, left arm, left leg"; or again, "G.S.W. fracture left tibia, right knee-joint, also abdominal wall, arm." Note the occurrence of serious bleeding and the means taken to arrest it. Note such a thing as a sucking pneumothorax. Note the dose of morphine in the special space, and the administration of antitetanic serum. In short, try to help the man behind you. He will be grateful, although perhaps, at times, he may seem to lack exuberance in showing it.

ON GUNSHOT WOUNDS OF THE HEAD.*

BY

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DURING ten months' experience at a general hospital nearly 500 cases of gunshot wounds of the head have passed through my hands. Whilst very encouraging results have been obtained in many instances in which extensive damage to cranium and brain had occurred, I have to admit that in about 50 per cent. of those cases in which the dura was opened by depressed or indriven fragments of bone, by the missile, or subsequently opened at operation, death ensued; but, so far as I have been able to ascertain, my results compare favourably as regards mortality with those obtained by others engaged in operating on head injuries of war.

Cranial injuries may be classed in two main categories, according as the dura remains intact or is opened and penetrated.

In my series of 500 cases in which trephining had to be resorted to, the mortality was less than 10 per cent. where the dura was intact, and just over 50 per cent. in those in which the dura was penetrated.

ANAESTHESIA.

It has become my practice to operate under local anaesthesia in nearly all cases. Two-thirds of a grain of omnopon is injected hypodermically half an hour before operation. When the patient is on the operating table, 2 per cent. novocain and adrenalin is injected into the scalp in a complete circle of infiltration all around the area to be operated on. In this way a circumferential zone of "blocked" nerves is produced. The conscious patient feels no pain either while excising the infected scalp wound, trephining or nibbling away the bone, incising the dura,

* Being a paper read at the Boulogne Base Medical Society, August 24th, 1917.