

believe you will be more than satisfied with the result.

SOME OBSERVATIONS ON WAR SURGERY IN FRANCE.

BY W. IRVING CLARK, M.D., WORCESTER, MASS.

THIS paper is not a scientific contribution. It is an effort to put briefly before the members of this section the observations of the writer during six months in France.

Traumatic surgery as a whole has been unchanged by the war. The basic principles of asepsis in operating, irrigation in cases of infection, and extension in alignment of fragments in cases of fracture, are maintained and practised in every war hospital in France.

Many ideas have undergone modification, and there have been a multiplicity of methods for handling different types of injury, but the methods which are now becoming so generally used as to be almost standard are based on old and well-known surgical principles.

In order that you may see the general picture as I have seen it I will sketch the course of a wounded soldier from the trenches to the rear, indicating as he proceeds the most probable course of treatment he will receive, and endeavoring to sketch the new forms of treatment or modifications of old forms, as they present themselves.

In drawing this general picture it will be impossible to touch on the bizarre wounds, plastic surgery, or any special branch, and I shall confine myself to the more common types which are met in any war hospital service.

Wounds of war may be roughly divided into two great classes, the slight or flesh wounds (the *petits blesses* of the French) and the more severe wounds, fractures, wounds of one of the three body cavities and nerve injuries (the *grands blesses*).

From the point of view of the Army the former are the most important, for by prompt and effective treatment a man may be returned to the ranks in a month or six weeks, while in the latter his return at any time is problematical. According to most recent reports, 80% of the lightly wounded return to the ranks in four to five weeks. Moreover, the slight wounds, if not treated according to recently accepted methods, invariably become infected, endangering the limb and often the life of the soldier.

The primary treatment of all wounds on the battle field is practically the same. This treatment is given at the first dressing station and consists of a removal of any gross material projecting from the wound, painting the wound and skin with some form of iodine, usually the tincture, applying a sterile pad and bandage, and immobilizing the wounded part in case of fracture for transportation. For this immobilization some form of Thomas splint is usually preferred. The U. S. Army has adopted the Blake-Kellar modification, in which the hip ring is not complete, the anterior half being replaced by a strap and buckle. Traction is exerted by means of an anklet with lateral straps or by a clamp attached to the patient's shoe with traction straps depending from it. These straps are tied about the notch in the lower end of the splint and twisted taut with a pin, which by being partly withdrawn impinges on the side of the splint and prevents unwinding. All fractures of the leg in the American Army will probably be transported in these splints, while a smaller similar splint is used for the arm fractures.

The patient, having thus been prepared, is transported to the most active hospital in the war—the evacuation or front line hospital. These hospitals are supposed to be as close to the line as safe, safety being gauged entirely by shelling. When a hospital comes under regular shell fire it is evacuated to a point just out of reach of the usual shelling. The object of this close proximity to the line is to enable the surgeons to operate at the earliest possible moment after the wound has been received,—within six hours, if possible. All wounds at this hospital receive the same attention, but in most cases the more severely wounded are transported directly to base hospitals or hospitals further to the rear if their condition permits. Arrived at this first hospital after the regular cleaning, the patient is immediately given a general anesthetic, placed on the operating table, and the wound and surrounding skin washed with ether and painted with tincture of iodine. An elliptical incision is made around the wound. The outlined piece of skin with the wound in the center is raised and the dissection carried on along the tract of the piece of shell, the surgeon being guided by the appearance of the tissues, until the capote or piece of cloth and the fragment of shell are reached, the whole

tract including the foreign bodies, being removed like a tumor "en bloc." When this cannot be done, the wound tract is laid open and followed, all damaged and discolored tissue being dissected away.

All wounds more than ten hours old are left unsutured. Where bone is involved, the fragments unattached to periosteum are gently removed, all others being left in place. Compound fractures are not closed by primary suture.

After primary suture a patient is supposed to remain in the hospital for ten days under observation before being evacuated to a base.

If the foreign body cannot be located, the operation is transferred to the x-ray room, where the operator works with the aid of a fluoroscopic screen. The work done this way is very beautiful, neat and accurate.

Amputations are never done if they can be avoided. All amputations are guillotine type with no flaps, by order in the French Army.

Chest cases are usually treated expectantly, that is, beyond the excision and cleaning up of the wound of entry, no operative work is attempted.

Abdominal cases are treated very much as in civil surgery. The mortality in these cases is high.

Head cases are usually sent to a special hospital. I was unfortunate in not seeing any. I understand that the operating is conservative, pressure being removed and fragments of brain and foreign matter being irrigated or sucked out with a catheter, very gentle negative pressure being used.

In due time the patient, no matter what his type of wound, is transferred to a base hospital.

The base hospital is where the less spectacular but perhaps the most difficult, work is done. Among the French the wounded soldier remains at a base hospital until he is either entirely cured or until all operative treatment is completed.

The work consists principally of the treatment of: (a) infected wounds of the soft parts, (b) compound fractures, (c) amputations, (d) chest cases. Head, face and abdominal cases are usually treated at special hospitals.

The treatment of all infected wounds is divided into two classes:

(1) Those very slightly infected with a non-virulent organism.

(2) Those badly infected with many organisms or lightly infected with a virulent organism, especially streptococcus and b.a.c.

The treatment of Type 1 consists in either drawing the edges together with adhesive and treating as an aseptic wound or in placing a secondary suture. The determination is usually made quantitatively by the Carrel counting system and qualitatively by culture. Streptococci, even in small numbers, especially if in pure culture, are considered an absolute bar to secondary closure of any type. B.a.c. is not considered so unfavorably, and if not present in large numbers many surgeons unhesitatingly strap the wound. A large proportion of wounds seen at a base hospital are slightly infected with b.a.c.

In the majority of cases neither strapping nor secondary suture is done. The wound is left wide open and treated with Carrel tubes. Dakin solution is not used exclusively. In many cases a weak acetic acid solution, usually combined with quinine, is used, this being particularly valuable when the bacteria are those requiring an alkaline medium for growth, or where there is a tendency to secondary hemorrhage. In spite of the numerous solutions used, it is interesting to note that the Carrel method of administration is universally used, and that such leading surgeons in Paris as Chutro and Tuffier use Dakin's solution entirely, adhering exactly to the Carrel technic.

The management and dressing of these multiple infected wounds, usually complicated by fractures, tries all the ingenuity of the surgeons and nurses. That it is possible to do these dressings rapidly, effectively and without great pain is due largely to the suspension method of treatment, and partly to the number of assistants available in a war hospital. The means by which this is done will now be discussed, as it is the method most employed in caring for the most common of all the serious cases in base hospitals—compound fractures of the lower extremity. A compound fracture of the upper extremity is often treated in ambulatory apparatus, and the difficulty of dressing these cases is not great, but the compound fracture of the lower extremity, usually complicated by multiple wounds, is much more of a problem.

The basis of treatment is the Balkan frame, now modified and perfected into a very simple but invaluable structure.

The frame here described is that used at American Red Cross Military Hospital No. 2, and is standard for the U. S. Army.

The frame consists of a head frame and foot frame of wood united by longitudinal bars. The wood is white pine, $7/8 \times 2$ in. The head and foot frames consist of two uprights slightly slanted to form a truncated A. The cross bars which hold these uprights together are the width of the bed, at top extending beyond uprights on either side, while the lower joins the uprights at the level of the mattress.

The longitudinal bars are two in number, resting on the upper cross bars and retained in any desired position by reciprocal notches (mortise joint).

The two advantages presented by the frame are suspension and traction. Suspension is maintained by a Hodgen or Thomas splint, which supports the lower extremity as in a cradle, this being suspended by cords and counterweights, which are so arranged that they exactly balance the weight of the limb and splint. Toe drop is prevented by a special counter-weight, while traction is maintained by direct pull through extension bands glued to the skin, by a Steinman pin, or a Finocchetto stirrup. The principle of suspension allows the patient free movement in bed, makes for ease of dressing, and permits of motion in hip, knee and ankle. This change in treatment is due to the development of the theory that if the fragments of a fracture are kept in proper alignment, immobilization of the joints above and below the point of fracture is unnecessary.

The two great principles of treating compound fractures are:

- (1) Arranging the apparatus so that the lower fragment is in line with the upper fragment.

- (2) Making very strong traction for the first 24 to 48 hours, until all muscular pull has been overcome and then reducing the weight.

The wounds are treated as described above. Fractures about the joint frequently require resection. The Lyon School has developed resection of joints of the upper extremity to a remarkable degree. Using the sharp periosteal elevator, they carefully denude each fragment which is to be removed, taking the periosteum and a very thin shaving of bone. All fragments having been removed, the joint is immobilized with plaster for a short period of time, usually 7-10 days, and then active mo-

tion is started. The operated area is also exposed to the sun for a period of 15 minutes each day. New bone regenerates fairly rapidly and is shaped by the muscular pull on the periosteum so that a fairly serviceable joint results. The period of reconstruction is usually four to 6 months. The sunlight treatment of all open wounds is being advocated and tried largely throughout France.

Empyema of the chronic form is treated by wide opening, irrigation and the placement of Carrel tubes, which extend all through the cavity. As many as twenty or thirty tubes are used. Tuffier thus completely disinfects the cavities of old empyemas and then sutures tight by a plastic operation. His results are remarkable. I did not see the results of other surgeons employing the same method, and do not know if it is in general use.

At the French hospitals which I visited, bone plating was used in preference to bone grafts, though grafts were used in some cases. When grafts were used they were cut by chisel rather than electric saw. The French surgeons believe that the trauma caused by the saw is greater than that caused by the chisel, and that latent infection is more likely to be stirred up. It is considered inadvisable to graft previously infected bone sooner than three months after the wound has healed. Plates are often tried somewhat earlier, especially if the infection was not severe.

Compound fractures are very frequently complicated by severance or injury to a large nerve. In these cases no operation of suturing is considered advisable until four months after the wound has healed, because of secondary lighting up of infection; the same rule holds for tendon transplants or suture.

In nerve cases, supporting splints are used, as the Jones "cock-up" splint in radial paralysis. This allows the patient to use the hand and keeps up muscular tone. Massage is preferred to electrical stimulation previous to nerve suture.

The French use plaster very beautifully. Instead of employing the plaster bandage, forms are cut out of crinoline, 12-22 thicknesses being used. These forms are immersed in plaster cream, which is well rubbed into the form. The form is then applied directly to the affected limb, the skin of which has been coated with vaseline. A very fine dental plaster is employed, and there appears to be no irritation.

The cream is made by adding the plaster little by little to a basin holding about a quart of cold water, the water being gently but continuously agitated with the hand as the plaster is added. When the consistency is such that the withdrawn hand appears to be covered with a white cotton glove, the correct combination has been made. The form is immediately plunged in the plaster bouillon as described above. Many ingenious forms are used, especially the Delbet *appareil de marche* for fractures of the leg. Upon the completion of all operative work and the healing of all wounds the patient is sent to a physiotherapeutic center. Here he receives massage, mechano-therapy, electricity, heat and gymnastic training. Following this, if unable to return to the Army, he enters a re-educational school where, with the assistance of many ingenious types of apparatus, he is taught to adapt himself to his physical incapacity, and after from three to six months enters once more into civil life.

DISCUSSION.

DR. DAVID CHEEVER, Boston: I was very much interested in what Dr. Clark had to say, especially about the guillotine amputations. That was the method used in the British army in 1915-1916, but I note that lately in the British surgical literature there have been many protests against this method. They necessitated secondary amputations, which resulted in marked additional shortening of the limb, and in a certain number of cases secondary tetanus appeared. Of course that could, no doubt, be handled by additional prophylactic injections of tetanus serum, so that the latent and encapsulated organisms freed by the secondary operation would be destroyed. It would seem that flap amputations, with the tissues held widely apart by appropriate packing with gauze and protective tissue, would be as effective in preventing gas bacillus infection and give better stumps.

DISCUSSION ON EMPYEMA AND ITS TREATMENT IN MILITARY CANTONMENTS DURING THE WINTER OF 1917-1918.

By MAJOR HOMER GAGE, M.R.C., WORCESTER, MASS.

IN response to the invitation of your committee, I am very glad to say a few words about one of the camp problems that has both-

ered us all winter, and that is really one of the most interesting and one of the most important problems that has arisen during the winter's work among the new recruits.

Our problems are quite different from those encountered in the camps in 1898, a difference largely due to the elimination of typhoid fever and the so-called "typhoid malaria." The absence of these diseases is due chiefly to the triple inoculation with typhoid and paratyphoid vaccines; but the splendid work of the Medical Corps of the Army in improving camp sanitation, in the careful selection of camp sites, with reference to their natural soils and drainage, and eliminating the sources of malaria and other insect-borne diseases, has been an important contributing factor.

In spite of all possible care, the herding together in barrack life of large numbers of men, especially from the country districts, has favored the spread of certain other infections. To a lesser degree we have scarlet fever and diphtheria; to a greater degree mumps and cerebrospinal meningitis, although we have been very fortunate in having little of the latter in New England. And to a still greater degree we have had measles and pneumonia, which have taken the place to a considerable extent of typhoid and its allied diseases, as the most common and the most dangerous diseases incident to camp life. They are always present in our base hospitals in larger proportion than one sees in our civil hospitals; and at periods of great activity, as after the arrival of large numbers of new recruits, constitute a clinic the value of which cannot be appreciated by those not in the service. The clinic thus constituted is an exceedingly valuable post-graduate course for the general practitioner.

From a surgical point of view, the most interesting thing in connection with the epidemic of pneumonia and measles has been the study of the empyema with which they have been so frequently complicated. In our experience about twenty per cent. of all cases of pneumonia have been followed by empyema, fifteen per cent. of the straight lobar pneumonias, and twenty-one per cent. of the post-measles pneumonias. The empyema met with has been very different from the type which we have been accustomed to see in civil practice and in our local hospitals.

Ordinarily, if, after the crisis of the pneu-