cal Corps, from general to private, is being systematically trained to improve military and medical knowledge, and is studying the new experiences which have been gained. For this purpose all medical units in institutions run planned courses of instruction; short courses for medical personnel are arranged to improve their knowledge of special branches; and numerous conferences of surgeons, physicians, epidemiologists, and workers in other specialties are held at which the experiences of the most progressive specialists and institutions are studied, summarized, and popularized.

Conclusion

The organization of the Red Army medical service does not stand still, but by the correlation of war experiences and study of the latest achievements in war medicine, its personnel and their distribution, the forms and methods of work are constantly being perfected. This is a guarantee that the Red Army Medical Corps will in the future be able to cope with the tasks with which it is faced.

TREATMENT OF GUNSHOT FRACTURES OF THE EXTREMITIES IN EVACUATION HOSPITALS OF THE U.S.S.R.

BY

Prof. NIKOLAI N. PRIOROV

In wartime the treatment of bone injuries has exceptional significance. According to data from Soviet hospitals fractures of the extremities constitute 38% of all wounds encountered during the present war. If fractures of the skull, face, spine, and ribs are added to this figure the total reaches 45 to 47%, or almost half of all wounds incurred at the front. Correct fracture treatment must involve not only restoration of lost function but restoration of fighting capacity as well and the return of an experienced and tried soldier to the Army.

Wartime gunshot fractures have these features:

1. They are open, compound, and complicated by infection.
2. Like closed fractures, they are accompanied by displacement of bone fragments.
3. They are associated with extensive destruction of soft tissue, not observed in closed fractures.
4. They are often encountered as comminuted fractures, with a large number of splinters scattered throughout the area surrounding the wound.
5. Wounded men with bone fractures are unavoidably subject to many-staged treatment in various stations and centres, beginning with field hospitals and ending in the deep rear.
6. Treatment is protracted and the results are less satisfactory than in treatment of closed fractures.

Principles of Treatment

Treatment of gunshot fractures in the U.S.S.R. is based upon the following principles: (1) First aid is administered on the battlefield at the spot where the wound is incurred, either by sanitary instructors or occasionally by other soldiers. (2) An aseptic dressing is applied to the wound and the limb is immobilized with splints made of plywood, bark, or wire netting. (3) Surgical débridement is performed at the first field medical stations.

Through-and-through wounds, with perforations of soft tissue at the sites of entry and exit, are always treated with antiseptics. The wound is always excised if there is extensive destruction of soft tissue. All devitalized and necrotic tissue is excised. Supplementary excision is performed in the presence of pockets or if an outpouring of lymph into spaces is likely. When the wounded man has not been treated for 24 hours after injury the wound is merely incised, and excision of devitalized tissue is carried out if necessary.

In treating the wound free bone splinters are removed and the periosteum is preserved; the wound is never sutured. Sulpha drugs and, more recently, penicillin are utilized. Reduction of the fracture is considered obligatory.

The following rules are observed in fracture reduction:

- (1) The fracture must be reduced at the earliest possible

moment. (2) Reduction must be performed under general or local anaesthesia. (3) Reduction must be by manipulation or with the help of special orthopaedic tables and traction apparatus. (4) After reduction the position of the fragments must be verified by radiographs or by comparative measurements of the extremities. Plaster cast, Cramer, and Thomas splints and the Dieterich wooden splint are used for fixation of the extremities after surgical treatment. Cramer splints are preferable for injuries of the upper extremities; plaster cast or Thomas splints for injuries of the lower extremities.

Plaster casts are most often used, and are applied without cotton inner padding. Practice has shown not only that they effectively immobilize the fracture but that they are very effective in draining wound seepage. They keep the wound undisturbed and prevent secondary infection. The patient wearing a plaster cast must receive careful attention. High temperature, complaints of illness, pains in the extremities, all stress the necessity for examination and observation of the wound either by means of cutting a window in the cast or, occasionally, by removing the cast completely. Closed plaster casts must not be used if the presence of gas infection is suspected or if there is a possibility of haemorrhage.

Blood transfusion is widely used in treating shock and loss of blood. All wounded men receive antitetanus serum, and anti-gas-gangrene serum is also given in the presence of extensive and severe injuries to the tissue. The wounded, if transportable, are evacuated to rear hospitals by ambulance, hospital train, and aeroplane.

A network of special hospitals has been established for treatment of gunshot bone fractures. Distribution of the wounded among these hospitals is based upon the severity and location of their wounds. For those with slight injuries of the fingers, wrist, forearm, and foot there is a special hospital where they can simultaneously receive surgical treatment, physiotherapy, gymnastics, and occupational therapy. A separate hospital also exists for patients with injuries of the thigh, lower leg, and upper arm. This system makes possible correct allocation of requisite apparatus to the various hospitals, and also facilitates the assignment of cadres of specialists. It enables doctors and nurses working with a uniform contingent of wounded men to master more speedily the correct methods and technique of treatment.

Treatment in Base Hospitals

Patients arriving in base hospitals are subject to careful observation, which includes x rays, laboratory analysis of blood and urine, and bacteriological examination if necessary. If phlegmon or inflammatory processes exist in the region of the injury, especially when primary débridement has for some reason been omitted, secondary excision of the wound is performed. A wide incision is made and foreign matter, free bone splinters, and necrotic tissue are removed. Reduction is carried out simultaneously if the condition of the patient permits, the fragments being brought into juxtaposition and occasionally even fixed by suturing. Such delayed reductions are performed as late as four and even five months after injury if there is extensive displacement of bone fragments and union has not been secured. The wound is not sutured after secondary surgical débridement and late reduction; it is tamponed and commonly treated with antiseptics (including sulpha drugs and penicillin). Our observations enable us to recommend delayed reduction to surgeons with sufficient experience. In most cases extremely good results have been noted after these operations. A flare-up of infection occurs as a rare complication in individual cases.

Two methods are used for the treatment of gunshot wounds in rear hospitals: (1) the plaster cast and (2) skeletal traction. The plaster cast is employed in treating fractures of the upper arm, forearm, foot, and lower leg, and in all cases in which complications occur during the course of illness. In most instances closed plaster casts, in which openings have been made as a precautionary measure, are employed. Skeletal traction is used in fractures of bones of the thigh, lower leg, and upper arm, in the presence of displacement, and when complications are absent or have already been overcome, as well as in closed fractures. Thus, plaster cast and skeletal traction are not mutually exclusive but, on the contrary, supple-

ment each other. In certain cases treatment begins with the closed plaster cast and concludes with skeletal traction; in others it begins with skeletal traction and concludes with the closed plaster cast.

In gunshot wounds union is protracted. To stimulate this process we make wide use of physical therapy, quartz, paraffin, and ozocerite, as well as the antireticular cytotoxic serum of Prof. Bogomoletz and the tissue therapy of Prof. Filatov.

Considerable importance is attached to good nutrition and the prescription of vitamins. At the earliest moment that the patient's health permits, general and specialized physiotherapy (gymnastics) are used in order to improve his general condition and prevent muscle debility, contractures, and limitation of joint mobility.

Complications

A variety of complications may occur in the treatment of bone injuries. These include: (1) abscess, phlegmon, pus pockets; (2) osteomyelitis; (3) haemorrhage; (4) delayed consolidation, non-union, and pseudarthrosis; (5) malunion; (6) contractures, limitation of mobility, and ankylosis of joints; (7) sepsis. Each of these complications demands timely discovery, diagnosis, and special treatment.

Conclusion

We consider that considerable success has been achieved in our treatment of gunshot fractures. More than 50% of our wounded with bone injuries are returned to the Army. Complications in wounds of the thigh and lower leg have sharply decreased and the number of amputations considerably diminished.

AMPUTATION OF THE EXTREMITIES, AND PROSTHESIS, IN THE U.S.S.R.

BY

Prof. NIKOLAI N. PRIOROV

In gunshot wounds, amputation of the extremities is in many cases the sole means of saving life. In comparison with previous wars the number of amputations in the present war, both in the rear and at the front, has diminished by half. The reasons for this decrease are as follows: (1) approximation of surgical aid to the wounded; (2) application of first aid soon after injury; (3) radical excision of the wound in medical sanitary stations near the front and in field hospitals; (4) the use of antitetanus serum in all cases of trauma and of anti-gangrene serum in cases of severe trauma; (5) wide use of sulphonamide preparations; (6) employment of blood transfusion, without exception, where indicated; (7) the possibility of retaining patients with severe wounds of the extremities in front-line hospitals until their condition becomes less grave; (8) complete immobilization of the injured parts.

We consider the plaster cast the best method of immobilization. The majority of amputations are performed at the front, and only an insignificant number—approximately one-fifth of all amputations—are carried out at hospitals in the rear.

Reasons for Amputation

The first and chief reason for amputation (up to 40%) is severe destruction and crushing of soft tissue, bones, and joints, with acute disturbance to nutriment of the extremities. The second reason is the tearing away of an extremity by shell fragments, bombs, etc., the remaining part being connected to the body by a mere patch of skin, thus necessitating only completion of amputation. Third, the presence of sudden and rapidly developing gas infection, when other methods of controlling it are unsuccessful. Fourth, gangrene of the extremities, after injury to the blood vessels, burn, freezing, etc.: amputations of this type are not numerous (from 1 to 2% of the total). Fifth, the septic condition of the patient after trauma of the extremities, in the presence of phlegmon and purulent pockets, and in acute osteomyelitis, when all methods of treatment prove unsuccessful and it becomes necessary to sacrifice the injured part. Amputations as a result of these conditions constitute, according to our data, 7 to 9% of the total. They are performed in hospitals close to the rear.

Methods of Amputation

We use both chop and guillotine methods, but greatly prefer the latter because enough skin is saved to allow of a later skin graft. In individual cases we cut out one or two skin flaps, which, if conditions are favourable, can later be used to close the amputation wound. In order to protect the flap from infection it is rolled into tube form and sutured. Primary amputations are never sutured.

We consider the following safeguards obligatory in amputation: (1) To prevent the patient from becoming chilled during the operation and to provide him with heat (warm blankets, heat pads, etc.). (2) To give blood transfusions before and after operation. In primary amputation blood is transfused in large quantities; in secondary amputation it is transfused in small quantities. (3) To apply a tourniquet during the operation and not to lose a single drop of blood. (4) To operate under anaesthesia. We commonly use inhalation, intravenous, and local anaesthesia, and also freezing. (5) Observation and care, in the field hospitals where the amputation is performed, for a period of two or three days after operation.

Treatment of Stump

The reason for amputation, and the methods of amputation just indicated, determine subsequent treatment of the stump. An infected stump is never sutured. When it progresses favourably we recommend an initial dressing on the eighth or tenth day, preferably under anaesthesia. In such cases the amputation site is usually clean and covered with fresh granulation tissue, and inflammation is absent. Secondary suture, preferably with the use of plastic buttons, is possible, the edges of the wound being gradually approximated by tightening the suture. These measures guarantee a good stump for prosthesis and preclude the necessity for re-amputation.

When the stump does not progress favourably, owing to the presence of infection—phlegmon, osteomyelitis, phlebitis, etc.—the wound is treated by the usual surgical measures: supplementary excision, antiseptics (sulphonamide preparations, penicillin, gramicidin, bacteriophage, and others), and also by physiotherapeutic methods. The stump wound is treated with the aid of a Thomas brace in order to prevent the development of contractures.

A significant number (up to 80%) of amputation stumps are diseased or defective. Diseases of the stump comprise non-healing wounds, ulcers, osteomyelitis, ligature fistula, exostosis, neuritis, pains in the stump, phlebitis, disorders of the skin, and contracture. Defects of the stump consist of excessively long or short stumps, disarticulated stumps of the knee-joint, ankle-joint, wrist, and shoulder, stump scars with bone adhesions, conical stumps, ankylosis, and defects following osteoplastic operations.

In treating diseases of the stump and to remove defects, physiotherapy, heat, mud, tar, paraffin, and ozocerite are extensively used. Cases that do not respond to conservative treatment are dealt with as follows: (a) by skin grafting; (b) by grafting adjacent tissue; (c) by excision of scar tissue, with skin grafting; (d) by removal of adhesions and ligatures; (e) by removal of neuromas and neurolysis; (f) by sequestrectomy; (g) by re-amputation.

Re-amputations form from 40 to 60% of all operations on the amputation stump and need special attention. The three chief points arising with regard to re-amputation are: (1) indications for re-amputation; (2) time of re-amputation; (3) method of re-amputation. According to data compiled during the war by Soviet hospitals, indications for re-amputation have occurred in the following proportions: non-healing wounds, up to 60%; osteomyelitis, from 17 to 20%; extensive scars with bone adhesions, 10%; exostosis, pains, etc., 10%.

The time for re-amputation can never be a matter of indifference. From a wide experience we have reached the conclusion that the ideal time is the third month after primary amputation, when good granulation tissue exists, inflammation and oedema have disappeared, and dense scars are not present. In cases of gas infection re-amputation is delayed until the six to tenth month.