

War Wounds with Fractures: The ICRC Experience

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Historically, on a conventional battlefield, about 70% of the wounded present injuries to the limbs, the remaining 30% have central wounds involving head, chest or abdomen. The longer the delay in transport to hospital facilities, especially with inadequate first aid, the higher the death rate in the central injury group and the higher the percentage of those presenting with limb injuries. Most of these latter involve bones and/or joints. In a war situation, and especially in developing countries, high-technology facilities and skilled orthopaedic surgeons may not be available to deal with these wounds with particularly heavy tissue contamination. The experience of ICRC surgeons has led to an appropriate technology approach and the avoidance of sophisticated operations and equipment: “the simpler the better” has become our motto! Very important is the initial, extensive excision of all dead and devitalised tissues. The fractured bone is held by POP slabs, bridge POP, skeletal tractions and, in selected cases, external fixation. Internal fixation devices are never used due to the high risk of infection. Early and aggressive physiotherapy is of paramount importance. Good surgery without physiotherapy often results in a human catastrophe.

Introduction

A good deal of war surgery is orthopaedic surgery. In a conventional battlefield, some 50-75% of war injuries involve the limbs¹. While a high rate of patients with central (head, chest and abdomen) injuries dies in case of inadequate first aid and long delay before transport to hospital facilities, patients with limb wounds may survive longer and present to the hospital even days or weeks after injury with badly infected wounds. Most of these wounds involve bones and/or joints. As a result, in war-affected areas, surgeons will have to deal mainly with limb wounds with fractures. Many principles governing bone healing in civilian blunt trauma do not apply to war injuries. The excisional aspect of the surgery of war wounds with fractures is particularly important. Loose bone fragments, haematoma and surrounding dead tissues must be all excised. The method of fracture fixation is of secondary importance to the wound management. Multiaxial movement of the fractured fragments is a potent stimulator of secondary bone formation. Rigid fracture fixation reduces or eliminates callus formation. This happens commonly where external fixation is widely used by unsupervised surgeons who are unfamiliar with the technique and war wounds. Equipment for internal fixation should not be made available for early management of

war wounds: it is readily abused, with disastrous results². For any wound with a fracture, the advantages and disadvantages of each method of immobilization should be considered. Any method, if badly applied or unsupervised, can lead to poor results.

Preoperative Care

A sterile or clean dressing before application of splints should cover war wounds with fractures. Splints are intended to immobilize the limb so as to reduce pain and prevent further damage to soft tissues by the fractured bone.

Particular attention should be paid to vascular and nerve supply of the limb. A vascular and neurological assessment of the affected limb should be done. Tetanus serum and toxoid and antibiotics should be administered. X-rays should not be requested routinely.

Surgical Management

Tourniquet is very helpful in reducing blood loss and allowing a bloodless surgical field. It should not be left in situ for more than 90 minutes. Adequate exposure is mandatory. Surgical access should be through generous skin incisions.

Adequate decompression of compartments enclosed by fascia should be obtained through fasciotomy. Haematomas, devitalized muscle, debris and foreign materials should be excised (debridement).

Loose bone fragments without any periosteal attachment should be removed. Major blood vessels should be immediately repaired. Severed nerves should be marked and fixed to prevent retraction. They should be repaired only once the wound is clean and healing. Same procedure for damaged tendons. All wounds should be left open for delayed primary closure. A dressing made of dry, bulky, fluffed-up gauze should be applied and fixed with loose bandages. This dressing should not be changed until delayed primary closure. If signs of infection (increased oozing with offensive smelling, high fever) develop in the meantime, the wound should be checked earlier.

Major fracture fragments should be aligned and temporarily stabilized with back slabs or skeletal traction. The patient should be reviewed in the operation theatre, under anaesthesia, after about 5 days (3 to 7 days): if wound clean, the wound should be closed either by delayed primary closure or skin graft. Injured limb elevation is important in the postoperative phase to reduce oedema¹⁻³.

Methods For Fracture Immobilization^{2,3}

War wounds with fractures are, basically immobilized using plaster of Paris (POP), traction and, to a less extent, external fixators.

Plaster Splinting

In the forms of slabs, cylinder casts and bridge-POPs can provide adequate immobilization. Due to the post-traumatic oedema of the limb, cylinders should be avoided till oedema subsides. *Slabs* are the usual initial means of fracture stabilization. *Cylinder casts* can be applied once skin closure has been obtained or even on clean granulating wounds (Trueta method). They allow early patient mobilization. One disadvantage is the immobilization of proximal and distal joints.

Patients with hip or femur fracture can be managed with *hip spica* as alternative to traction. Spica, which can easily be fenestrated, is a good way of clearing beds in rush periods.

In case of relatively small wounds, *POP windows* allow dressing to be carried out. Larger wounds can be satisfactorily managed by *bridge POPs*. This particularly applies to wounds of the calf and heel. Two or three Kramer wires are secured to the plaster by circumferential turns at the end of the bridge, allowing the cast to be cut well away from the wound.

Traction

A simple and safe method for fracture holding, especially for the lower limb. It can be used for initial and definitive stabilization and allows easy wound access and joint mobilization. It gives a rapid callus formation. The disadvantages are long bed rest, difficult access to the buttock and posterior aspect of thigh and leg, and sometimes difficulties in getting a perfect alignment of the fracture. Traction can be applied in different forms: *gallows traction* for femur fractures in babies up to 3 years or 15 kg of body weight, *skin traction* for older children, *pin traction* for femur or tibia fracture.

For femur fractures a Steinmann's pin is inserted 2,5 cm below the tibial tubercle. Local anaesthesia is sufficient unless other surgical procedures have been planned. The leg is then rested on a Brown-Bohler frame. The standard 1 kg traction per 10 kg of body weight has to be adapted to each specific case (degree of muscular injury, bone gap). Pin care is essential. Infected pins must be removed.

Physiotherapy should be started as soon as possible, usually few days after delayed primary closure. After the first x-ray assessment, x-ray controls can be done on a monthly basis. Clinical evaluation gives a good picture of the fracture healing and avoids waste of x-rays.

External Fixators

External fixation is not the best way to treat all fractures in war surgery^{4,5}. It can give very good results when correctly applied for the correct indications. The main advantage of external fixators is the good access to the soft tissue wound. They also allow early mobilization of the patient

(quite important if we need beds or the patient has to be evacuated) and the joints adjacent to the fracture. They are very useful if we're planning a limb shortening to reduce a bone gap or to fix the fragments in case of bone graft.

The disadvantages are:

- Need of experience with the method.
- Cost of devices.
- Delay in callus formation, complications related to incorrect placing of the pins.
- Stiff joints.
- Muscle tethering.
- Nerves or vascular injuries, pin site infection.

The factors favouring their use are:

- Multiple limb injuries (amputation on one leg and tibial fracture on the other).
- Fracture plus vascular injury.
- Very large wound and unstable fracture.
- Need of evacuating and transporting the patient.

The factors against their use are:

- Fractures in children.
- Closed fractures.
- Single bone fracture in the forearm or leg.
- Absence of radiography.
- Lack of surgical follow up.

External fixators should be removed and replaced by a plaster cast as soon as soft tissues are healed.

Physiotherapy

The rehabilitation programme for patients with limb fractures involves 3 phases:

- **Phase I**, usually the first few days, when priority is given to soft tissue healing and the patient faces important pain. During this period we suggest limb elevation and gentle and passive movement of the joints close to the wound.

- **Phase II**, mobilization of the patient, may start immediately in case of upper limb fracture or be delayed and reduced to bed exercises in case of patients in traction.
- **Phase III**, which consists of active exercises of the fractured limb. It may be limited by the method of fracture immobilization.

The speed with which the patient can go through these phases depends on the site and size of injury, age of the patient, limb pain, rate of callus formation, method of fracture immobilization and multiplicity of wounds: this is why is not possible to give a physiotherapy schedule appropriate for all fractures².

References:

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