

# Basic Surgical Management of war wounds: The ICRC Experience.

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According to WHO statistics, war injuries are the first surgical cause of death and the first cause of surgical disease in the Africa Region. The International Committee of the Red Cross is an impartial, neutral and independent organization whose humanitarian mission includes the assistance to war wounded. During the last 30 years ICRC surgeons have gained a wide experience in the management of war wounded patients under difficult conditions, more than 40,000 have been registered in the ICRC surgical database. In additions, hundreds of thousands of operations for the wounded of war have been performed in ICRC supported hospitals. The authors present the basic principles for a correct understanding and treatment of war wounds. Attention is focused on ballistics, triage, pre hospital care, antibiotic prophylaxis, early physiotherapy and rehabilitation, and wound surgery: large debridements, wound left open with no unnecessary dressing changes, delayed primary closure.

## Introduction

War wounds are an important cause of morbidity and mortality worldwide. According to WHO<sup>1</sup> in Africa, they represent the first surgical cause of death and the first surgical cause of disease. **The International Committee of the Red Cross (ICRC)** is an impartial, neutral and independent institution created in 1863 in Switzerland whose humanitarian mission is to protect the life and dignity of the victims of war and internal violence and to provide them with assistance. During the last 30 years the ICRC surgeons have gained a huge experience in the management of war wounded patients under difficult conditions. Hundreds of thousands of operations have been performed in the ICRC supported hospitals to treat war injured patients and more than 40,000 cases have been registered in the ICRC surgical database.

During the last year (2001) ICRC gave substantial assistance to 134 hospitals in 22 countries where 18,189 war-wounded patients have been treated. ICRC surgical teams worked in 8 hospitals (4 in Afghanistan, 1 in Kenya, 1 in Sudan, 1 in Sierra Leone, 1 in East Timor) performing more than 13,500 operations on 10,500 patients and treating also 69,850 outpatients.

## The usual scenario

The usual scenario where war surgeons work is quite peculiar. Most of the conventional wars take place, nowadays, in developing countries, where the health system might have already been weak before the conflict started and might be almost non functioning during the conflict. Water and electricity supplies can be unreliable, trained staff often leave the area, drugs and disposable equipments cannot be replaced, buildings can be destroyed. Security is always a major

concern. The influx of patients is not regular and depends on active fights and the possibility of transporting the wounded. As a result war surgeons have to face sudden large influxes of patients.

## The Triage<sup>2,3</sup>

To be able to cope with large numbers of wounded arriving within a short space of time at a facility with limited resources triage is needed. Triage is the process of sorting wounded into categories of priority for the treatment. The underlying principle is “do the best for the most”.

### Triage categories:

- **Category I: serious wounds**  
– resuscitation and immediate surgery (vascular injuries, abdominal and thoracic penetrating wounds).

#### Category II: second priority wounds

– can wait for surgery (mainly limb wounds).

- **Category III: superficial wounds**

– ambulatory management (do not require hospitalization).

- **Category IV: severe wounds**

– supportive treatment (patients likely to die or survive with very poor quality of life. Es: comatose and moribund patients).

## Patterns of injury<sup>4</sup>

War wounds are caused by bullets, metallic fragments from bombs, mines, rockets and grenades or as a direct result of blast and/or heat waves into tissues (mines, bombs). Tissue damage is the result of energy transfer from the missile to tissues that interfere with its progress, according to the formula:

$$E_t = \frac{M(V_1^2 - V_2^2)}{2}$$

Where  $E_t$  is the energy transfer;  $M$  is the mass of the missile;  $V_1$  is the entry speed;  $V_2$  is the exit speed.

### Bullets:

While handgun bullets have low speed (below 300 m/sec) and cause a damage that corresponds to the simple bullet tract, war rifles shoot high speed (more than 800 m/sec) bullets that can transfer a much higher amount of energy to the tissues resulting in a large volume of dead tissue.

## Metallic fragments

Tracts produced by fragments have a consistent pattern. The energy transfer is maximal at entry and reduces progressively as the fragment passes through the tissues. The wounds are conical in shape with the entry usually larger than the exit.

## Mine injury

Antipersonnel mines are made either to produce multiple fragment injury or to cause the damage through the blast wave. Pressure-detonated blast mines blow off the foot or the lower leg with considerable damage to the other leg, perineum and upper limbs. The particular danger and difficulty in treating these wounds is earth, mud and debris are blown into the tissues and into the intermuscular planes. Fragmentation mines spray around small metallic fragments that can be deadly as far as 30 metres away.

## Pre-hospital care

First aid can be provided in or closed to the battlefield, usually by military nurses or doctors. Essentially their aim is to prevent death and to avoid further injury. The basic trauma-life-support rules applied in civilian traumatology (Airway, Breathing, Circulation) applies also in the first aid of war wounded. Most deaths are caused by loss of cardio-respiratory function and from haemorrhage. If these 2 problems are controlled, the patient has excellent chances of surviving the evacuation to the hospital.

In some situations a system is set up to stabilize the war wounded before transferring them to the hospital (long routes, unstable patients, immediate transport not possible for security reasons, etc.). Dispensaries and other health facilities are individuated to be used as “first aid posts”. Here wounds are dressed, bleeding is stopped, fractures are stabilized, IV fluids, blood, antibiotics tetanus serum and vaccination are administered, according to the needs.

## Antibiotic prophylaxis<sup>5</sup>

All war wounds are contaminated with bacteria and will inevitably become infected unless treated quickly and correctly. In case of mine blast, contamination is massive. The role of antibiotics is to prevent spreading of infection from the contaminated wound. Locally, the main role is played by surgery: wound excision should be performed, ideally, within 6 hours from injury. The major bacterial contaminants in war wounds are: Gram-positive pyogenic cocci (staphylococci and streptococci),

Gram-negative bacilli (Escherichia coli, Proteus, Klebsiella, Pseudomonas, Bacterioides), Gram-positive bacilli (Clostridia, demonstrated in about 30% of war wounds). The major threats to a patient with a war wound are gas gangrene and tetanus. Here is the ICRC antibiotic protocol for war wounded:

### **Soft tissue wounds, with/without fracture, less than 3 days old:**

Benzyl penicillin 5 M i-v 6 hourly for 48 hours then penicillin V orally 6 hourly for 3 days.

### **Soft tissue wounds older than 3 days, antipersonnel mine injuries:-**

- Benzyl penicillin 5 M i-v 6 hourly for 48 hours then penicillin V orally 6 hourly for 3 days.
- Metronidazole 500 mg i-v 8 hourly for 48 hours followed by 500 mg orally 8 hourly for 3 days.

### **Penetrating cranio-cerebral and eye injuries: -**

- Benzyl penicillin 5 Mega i-v for at least 3 days, then orally for 7 more days+
- Chloramphenicol 1 Gm i-v 8 hourly for at least 3 days, then orally for 7 more days. In case of brain abscess add metronidazole 500 mg 8 hourly i-v for at least 3 days, then orally for 7 more days.

### **Maxillo-facial and oral cavity wounds:**

- Ampicillin 1 Gm i-v 6 hourly for 2 days then orally for 3 more days
- Metronidazole 500 mg IV 8 hourly for 2 days then orally for 3 more days.

### **Penetrating chest wounds:**

- Ampicillin 1 Gm i-v 6 hourly for 2 days then orally till 2 days after removal of chest drain or 5 days.

### **Penetrating abdominal wounds:**

*if only liver, spleen, kidney or bladder are injured:-*

- Benzyl penicillin 5 M i-v 6 hourly for 48 hours then penicillin V orally 6 hourly for 3 days (depending on possibility of oral intake).

### **Stomach, small bowel injury:-**

- Ampicillin 1 Gm i-v 6 hourly for 3-5 days.
- Metronidazole 500 mg i-v 8 hourly for 3-5 days

## **Colon, rectum, anus injury or peritonitis:**

- Ampicillin 1 Gm i-v 6 hourly for 3-5 days.
- Metronidazole 500 mg i-v 8 hourly for 3-5 days.
- Gentamycin 80 mg i-v 8 hourly for 3-5 days.

If metronidazole or gentamycin are not available, give chloramphenicol.

## **Wound surgery<sup>6</sup>**

The surgery for war victims is different from the type of surgery practiced for civilian injuries. War wounds are always extremely contaminated and missiles may cause massive destruction of soft tissues, bones and other structures. Strangely, the principles of treatment of war wounds have been known for decades but need to be re-learned by each new generation of surgeons facing war situations. War surgeons work following basic priorities: save life, save limbs, avoid infectious complications, minimize residual disability. There is no room for fancy, high technology surgery. Time, human resources, material, hospital beds are never enough and need to be optimized.

War wounds are often multiple and tricky, a chest wound may enter the abdomen, a wound in the perineum or buttocks may be hidden and ignored due to the patient position, a penetrating brain injury may go unrecognized as masked by hairs: the entire patient should be thoroughly examined, paying particular attention to back and buttocks. Soft tissue wound treatment is a 2 stages procedure consisting of excision of the wound and delayed primary closure.

### **Wound excision**

is the process whereby dead and damaged tissue, which is grossly contaminated with bacteria and debris, is completely cut away. The commonest mistakes are inadequate exposure and insufficient excision. Fascial compartments may need decompression by fasciotomy to avoid muscle ischemia. All muscle that is not healthy and red, does not contract when pinched or bleed when cut must be excised. Foreign bodies: explore the wound with the fingers to identify foreign bodies or unexpected extensions of the wound. Do not open fresh planes in healthy tissue. If metallic foreign bodies are not found in the wound while performing the debridement, don't extend the exploration unnecessarily, they can be left in situ. Look for metallic foreign bodies under the sole of the foot and inside joints: if left here they cause important disability. Do not attempt primary repair of tendons,

nerves or bones, as success is unlikely in these grossly contaminated wounds. Injuries to major arteries of the limbs should be either repaired or replaced by saphenous graft immediately if the limb is to survive. Delay of more than 6-12 hours from injury usually prevent successful repair.

### **Delayed primary closure**

Following excision, the wound should be irrigated thoroughly, left open without any suture of skin or deep structures. It is then covered with a bulky absorbent dressing made of dry fluffed-up gauze and held in place with loose crepe bandage. The aim is to avoid any tension in the tissues and to draw inflammatory fluid out of the wound, into the dressing. Exceptions to delayed primary closure include wounds of the face, neck, scalp, genitals and open chest wall injuries (muscular layer has to be airtight closed). Vaseline gauze should not be used and wounds should not be packed in a way that would form a plug that would prevent free outflow of fluid. This dressing should normally not be changed until formal closure. Limb wounds should be elevated to reduce edema. Delayed primary closure is usually performed after 5 days.

### **Physiotherapy and rehabilitation**

Physiotherapy is of paramount importance. Perfect war surgery not followed by appropriate physiotherapy often results in a disaster. Physiotherapy often starts on the first post-operative day with patient mobilization and few days after wound closure, with passive joints mobilization in the affected limb. As soon as the wound situation allows, active limb mobilization also starts. In case of limb amputation, rehabilitation means prosthetic replacement. This is usually done about 2 months after the amputation to give enough time for the wound to heal and for the stump to acquire the definitive shape.

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