

Injury to Nerves

An injury (transection) of a major nerve is NEVER in itself an indication for a primary amputation.

The nerve should be marked with a suture through the nerve sheath, the wound debrided and treated according to the usual guidelines, and the injury documented in the patient's record.

Once the patient is stable, he can be referred to a tertiary centre for final treatment of the nerve injury.

Fracture Fixation

Method will depend on the available facilities and expertise at each level of care.

The following options are available/suggested.

Tibia

- Plaster of Paris
- Calcaneal pin traction with plaster backslab
- External fixator

External fixation is an excellent method of managing open fractures of the tibia. It will be necessary to pass 2 pins through each part of the broken tibia to hold their positions firmly. If a commercial fixator is not available, an external fixator may be improvised from:

Use any rigid metal or wooden bar (Steinman pins or old K-nails are excellent).

1. Lay the bar along the leg in contact with the pins that transfix the bone ends.
2. With the bone carefully aligned, attach the points of contact to the bar using either Plaster of Paris or commercial Epoxy cement or fillers.

Denham pins are preferable to Steinman pins, but the latter are adequate if nothing else is available. If using Steinman pins, they should be inserted through the tibia from medial to lateral and a quadrilateral frame built, using a rod on either side of the limb fixed to the ends of the protruding pins.

If there is insufficient distal tibia present to sustain the distal pins, one can place pins through either the calcaneum or the talus (or both of these) in order to quadrangulate the frame.

Open Joint Injuries

Articular cartilage does not tolerate prolonged exposure to the atmosphere, as it will very rapidly dry out and die. Any joint which is open should therefore be covered by a minimum of tissue such as synovium or muscle after having been debrided and washed out. If the overlying skin is damaged or absent that may safely be left open provided that the cartilage is not exposed.

Femur

- Skeletal Traction with Steinman pin through Proximal Tibia/Distal femur
- Plating
- Locked Intra-medullary nails

Upper Limb

In the case of the upper limb and hand one should exercise particular caution before amputations are performed. Hand injuries should be washed, minimally debrided and referred early for specialist management.

Fasciotomy in the upper limb is as important as in the leg, and the same indications apply. Below the elbow the compartment most at risk is the flexor compartment and a single incision into this compartment is usually sufficient, as the inter-muscular septa are not as rigid here as in the lower limb.

WOUND CARE

Here the aim is to create a clean wound with best chance of repair and an eventual good function for the patient.

The Wound

A landmine explosion produces both high velocity missiles (>1000m/sec) and low velocity missiles. They cause a variety of wounds depending on the form of the missile, its speed, and what part of the body is entered. Some are sharp, some blunt; most are contaminated.

The processes which cause injury are direct penetration, cavitation (the effect of blast causing an open space under the surface in the deeper tissues), yaw (the to and fro movement of the missile as it moves forward, creating a wider track of injury) and contamination which goes on to infection. Air, cloth, soil, grass, and dead tissues from the person's own body are all forced into the wound.

A low-velocity missile makes a narrow track as it passes through the body.

The action of an irregular piece of metal or plastic travelling at high velocity is to transfer energy to the tissues and create an instantaneous cavity which then collapses.

CAUTION:

Do not fear taking too much;
fear leaving any dead tissue
behind!

1. The dead tissue in the cavity must be removed. The hole may be quite small, but underneath there is a ball of mashed tissues.
2. Clean this out, and give a final forced irrigation forcing water into the cavity with a syringe to remove any pieces that have been picked off with forceps but remain there.
3. Establish control of any bleeding, tying off bleeders if necessary, then pack the wound with long strips of gauze (for example, vaginal packing gauze). Do not pack very tightly — this may cause loss of blood flow to the area. Do not use hydrogen peroxide — it is destructive of tissue. Caution: a pack must be carefully observed — if bleeding continues into the pack, and the wound is left undisturbed for some days, there is a very real risk of infection.
4. Apply a pressure dressing and elevate the part. Keep the dressing under observation for any oozing of blood and serum. A dressing which become wet with serum must be changed.

Examination of the Wound

1. Exposure of all the patient's skin surface is essential — look and look and look! Use heavy duty scissors to cut away any clothing (If you open trousers along the seam of the leg they can easily be mended!). Do not neglect vaginal and rectal examination in association with careful examination of the perineum. That is very likely to be damaged by the force of an explosion from below.
2. Describe and record your findings, using also a body diagram.
Site, size, and what tissues are involved in each wound — skin, muscle, blood vessels, nerves, bones, etc. — taking a separate paragraph for each major wound.
3. X-rays are a part of examination — both plain and contrast. Consider taking X-rays of chest, head, abdomen, limbs if there is any evidence of injury. Contrast may be necessary to demonstrate foreign body embolism in a damaged major vein. A CT head (if available) is most valuable for head injuries. ECG may reveal a pericardial injury with haemo-pericardium (raised ST segments over the precordium and low voltage).

NOTE:

The best antibiotic is a properly completed debridement.

Debridement

This must be done very, very thoroughly — leaving no dead tissue or foreign material.

1. Enlarge the wound, extending its opening along the line of the limb and watching that you do not cause any further damage to vital structures — nerves or arteries.
2. Wash out foreign material with copious irrigation with water. The use of a big syringe (as for ear or bladder use) is helpful in bringing a good jet of water into corners of the wound.
3. All dead tissue must be removed, step by step. Excise as little skin as possible; it is essential for covering the wound later on, and if small areas do not survive they are less likely to cause trouble than dead muscle tissue.

In white skin, blue edges are excised; in dark skin, make sure the cut edge bleeds freely. Excise dead fascia, and cut away dead muscle until it bleeds. Watch for the colour (pink), the consistency (firm) and its ability to contract when touched. Muscle that will not contract is dead. If the tissues are heavily contaminated, with particles of foreign material driven deep into them, you will have to cut tissue away or pick at it with forceps.

Junior and inexperienced staff must realize that it may be necessary to cut away the whole of an affected muscle. Particularly if it will not be possible to explore the wound again soon, you must be radical and remove any tissue that is doubtful.

Do not fear taking too much; fear leaving any dead tissue behind!

Look carefully for blood vessels and repair any major vessels if possible, where necessary using a shunt (see earlier).

4. Do not try to repair cut nerves; mark the cut ends with a small suture of black silk so that they can be found later on.

The best antibiotic is a properly completed debridement.

Do not suture the wound; plan for delayed primary closure. Cover the wound with copious absorbent dressing and bandage firmly. This will keep the wound moist until reviewed.

CAUTION:

Indications to visit the wound earlier than 48 hours are:

Fever, rapid pulse, hypotension, patient obviously unwell, excessive wound pain, bad smell.

Revisit the Wound

The time to take down a dressing, remove a pack, and inspect the wound again will depend on whether it is already infected or fresh and merely contaminated.

Infected Wounds

If the injury occurred more than six hours before it was first cleaned, it will definitely be infected. This wound may need to be revisited within 48 hours — never longer.

1. Remove the dressing in the operating theatre under an anaesthetic.
2. Re-excite any dead and infected tissues as you identify them.
3. Thoroughly irrigate and redress the injury, and cover again with copious absorbent dressing and bandage.

Do not suture until the infection is clearly controlled.

Continue antibiotics until the wound is healed.

Re-visit again after 2–3 days and close the skin only when clean.

Indications to visit the wound earlier than 48 hours are:

Fever, rapid pulse, hypotension, patient obviously unwell, excessive wound pain, bad smell.

If in any doubt, remove the dressing in the operating theatre under an anaesthetic.

Contaminated (Not Infected) Wounds

If the initial wound excision was carried out by an experienced surgeon and less than 6 hours after the injury, then plan to revisit the wound after a longer period — 3–5 days. But take heed of the same indications as above for earlier re-exploration.

Continue antibiotic therapy until the wound is healed.

If the wound is clean when it is re-visited, close it with sutures or with a partial thickness skin graft. If major skin loss has occurred, which exposes bone, tendons or joints, it will need to be covered with vascularised muscle flaps and full thickness skin flaps. Seek appropriate assistance or transfer to a Provincial Hospital.

Management of Open Bone Fractures

1. During debridement remove any bone fragments which have lost their periosteal attachments.

Use this rule: **For Bone :** **Be Conservative — save what you can**

For Muscle: **Be Radical — remove anything doubtful**

With bone you can afford to wait and see what is viable. If there is an unattached fragment less than 2.5cm in width, take it out; if larger than 2.5cm, leave it in and refer on to a surgeon.

It is from the periosteum that the bone derives its blood supply; and without blood supply, tissues will die. For bone, this is a relative term, since it has been shown that free bone chips can be used in reconstruction procedures.

2. After debridement, cover the bone. Exposed bone quickly becomes dead bone.
3. Splint the fracture. At District level, this will usually mean a Plaster of Paris slab.

For injury to the bones of the face or maxilla, leave fragments of bone in the wound.

SPECIAL AREAS

Skull

For any penetrating wound of the skull or an open wound of the head:

1. Open the wound to see whether there is a fracture or if the dura membrane covering over the brain has been opened.
2. If so, debride, close the wound and refer on for specialized care.
3. If there is no fracture, debride and close the wound.

Face

The major worry is the airway, because the soft tissues swell rapidly, and may obstruct.

1. Debride;
2. Close what can be closed readily; and
3. Refer if it seems complex.

The main aims in managing facial injuries are to preserve sight, to restore function, to address aesthetics, and to minimize the psychological effect of damage to the individual. Facial injuries usually need further reconstruction and repair.