

Special Article

[Simplified Wound Care/Management - Excerpts from 7th National Wound Care Workshop 2021]

Lower Limb Injuries

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Advanced trauma life support protocol is recommended for evaluating the injury in lower limb. Injury severity scoring determines the need of primary amputation. Debridement is needed for excision of the skin margin, generous extension of the wound, exploration through all layers, and excision of damaged muscle. In case of nerve injury, debridement is not recommended. The decision of replantation in lower limb depends on the hemodynamic stability and functionality. If the tibial nerve is completely transected and beyond repair, then immediate amputation is suggested.

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Key words : Amputation, Replantation, Severity scoring, Tibial nerve.

Trauma to the lower limbs occur frequently and commonly seen in emergency practice. Civilian lower extremity injuries are most commonly due to blunt mechanisms such as road traffic accidents (RTA), whereas combat injuries are predominantly due to penetrating or mixed mechanisms. In combat, extremity injuries are present in one half of all casualties.

Evaluation of Lower Extremity :

To evaluate the injury in lower limb, doctor suggested to follow advanced trauma life support (ATLS) protocol. As per the protocol, first evaluate person as a whole and check the vitals. Maintain the ABC protocol and then focus on particular limb. A brief lower extremity exam should be performed during the initial trauma assessment (primary survey); but should be repeated once life-threatening injuries have been

Editor's Comment :

- Pre-hospital care, compressive pad, elevation and sterile dressings are important in the management of lower limb wound.
- Debridement of non-bleeding muscle can be done; while healthy bleeding muscles should be conserved.
- Debridement and revascularization should be done within 6 h. However, if nerve injury exists do not debride.
- Replantation can be done if the injury is at a distal level while taking into consideration, the hemodynamic stability and functionality.
- If the tibial nerve is completely transected and beyond repair, amputate immediately.

addressed. The lower extremity evaluation should be structured to assess nerves, vessels, bones, soft tissues. The presence of injury should be evaluated in any one of the four sites or in all sites. Injury to three of these four elements constitutes a “mangled extremity.” This is the situation wherein most of the times patient undergoes amputation. Patients with extremity deformity, point tenderness, ecchymosis, laceration deep to the muscle fascia, joint laxity on primary trauma survey should undergo plain radiographs to rule out bone injury.

Factors that increase the risk of limb loss or amputation

- Lower extremity vascular injury
- Delayed revascularization
- Blunt or high-velocity mechanism
- Multiple additional injuries
- Advanced age and multiple comorbidities
- Shock and obvious limb ischemia
- Severe extremity injury sustained in a resource-limited environment or during a mass casualty event

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Injury severity scoring determines the need of primary amputation¹

- Mangled Extremity Severity Score (MESS)
- Limb Salvage Index (LSI)
- Predictive Salvage Index (PSI)
- Nerve Injury, Ischemia, Soft-Tissue Injury, Skeletal Injury, Shock, and Age of Patient Score (NISSA)
- Hannover Fracture Scale-97 (HFS-97)
- Gustilo-Anderson open fracture grading system

Wound Management (Fig 1):

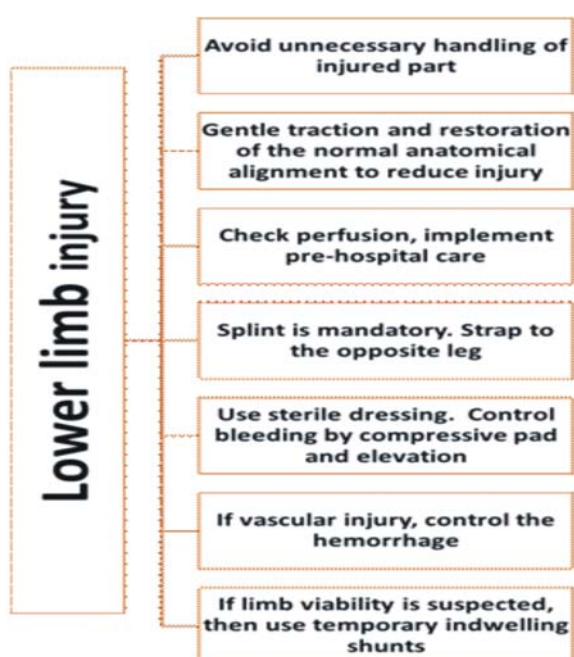


Fig 1 — Precautions during handling of lower limb injury

Debridement :

Debridement is needed for excision of the skin margin, generous extension of the wound, exploration through all layers, and excision of damaged muscle.

- The subcutaneous fat tissue in the lower limb, if undamaged, can be conserved; whereas if damaged, it should be removed.
- Debridement of non-bleeding muscle can be done; while healthy bleeding muscles should be conserved.
- A pneumatic tourniquet and magnification in the form of loupes enables limited blood loss.
- Wound cleaning using plentiful of saline before and after the procedure and post hemorrhage control is essential and later soft-tissue coverage by suturing, skin grafts, or flaps is recommended.²

Generally, dissection is done with sharp instruments, such as scissors, scalpels. In case of an acute injury, normal wound care such as larval therapy or enzymatic debridement can be used. Moreover, larva solution can be used with minimum pressure to gently irrigate and remove/ wash all the microscopic/dirt particles with copious amount of saline. All bleeding wounds can be stopped; but if there is major artery then it is difficult to repair due to lack of expertise or lack of facility to carry out vascular surgeries. In such circumstances tourniquet can be used to control bleeding and then send the patient to other center with desired facilities. If facilities including intraoperative ultrasound doppler and angiogram are available, vascular surgery such as direct arterial or autogenous or synthetic grafts can be conducted.

Panel Recommendations

- In case of contaminated tissue with muscular loss or dead, extend the skin incision generously above the wound to remove all dead necrotic tissues.
- Soft tissue like fascia can be removed while major structures, such as artery, should be preserved.
- Skin does not require to excise and access at the beginning and after 24-48 h, but skin can go for debridement.
- Wound care should follow a methodical order from superficial to deep layers (Osai fascia, muscles and then bone).
- Concerning about bone, remove only contaminated periosteum while preserving maximum bone.
- Be cautious while treating the children, because as children grow, there is a long limb-length discrepancy.
- In case of nerve injury, do not debride as patient may have injury in sciatic nerve or femoral nerves that can be repaired later and should only cover it. Tendons can be shortly debrided.

Role of Nanocrystalline Silver in Wound Care :

Nanocrystalline silver provides excellent antimicrobial barrier performance as graft/dermal replacement resulting in outstanding re-epithelialization in a healthier way. These are definitely beneficial for acute injuries, probably if used within 6 h of injury. Particularly, in cases of injuries with MRSA contamination, nanocrystalline silver prevents MRSA

infection and heals wound faster as compared to betadine.³

Salvage the Lower Extremity :

In circumstances where there is no strong indication of the need of amputation, the clinician should aspire to salvage the lower extremity. If patients with severe infection or polytrauma, multiple other injuries, actively bleeding elderly patient, then the principal responsibility of treating physician is to save patient’s life and then the limb. In majority of instances salvaging a mangled extremity is practical; nevertheless, patients with severe multisystem laceration and a mangled extremity, a primary amputation might be essential to save the patient’s life. Clinical scoring systems can indicate the chances of successful limb salvage, but these do not accurately determine the need for emergent primary amputation. It is the primary surgeon’s decision whether patient will undergo amputation or not. Following every initial limb salvage attempt, the extremity should be re-evaluated in the short term for signs of sensorimotor function and tissue viability.⁴

Replantation :

Distal reimplantation have better results of bulk survival than proximal one and might require subsequent surgeries and amputation in case of major infection and necrosis. Results of replantation is better in children compared to adults because of their growth, nerve regeneration, joint mobility and healing is better. Non-functional replanted limb vs. good prosthesis needs to be discussed with patients and decision should be taken by surgeons.

Panel Recommendations
<ul style="list-style-type: none"> • Replantation can be done if the injury is at a distal level while taking into consideration, the functional risks. • For the lower limb, decision of replantation depends on the hemodynamic stability and functionality. • Another important factor is the condition in which the injured distal part is brought to the hospital. If distal lower limb is brought covered in ice pack within 1-2 h of injury, it is possible to achieve successful replantation. • A team of multispecialty doctors, including microvascular surgeon, orthopedic surgeon, plastic surgeons and general surgeon, is very important and together can make a difference in the field of replantation surgeries.

Vascular Repair :

If facilities for vascular repair are not available, assessment of distal and proximal pulses is very helpful. In case of compound bone fracture, it is difficult to decide whether to proceed with vascular repair or not. As in most of the cases, amputation need to be done, but limb salvage should be the priority, if proper facilities are available. If appropriate facilities are not available, temporary stenting is recommended (Fig 2).

Managing Lower Limb injuries in Remote Areas :

The basic principles of wound care management are same whether it is primary, secondary or tertiary care. He/she should understand and learn the ways in which they need to manage with limited resources in terms of infrastructure, low man-power, etc (Fig 3).

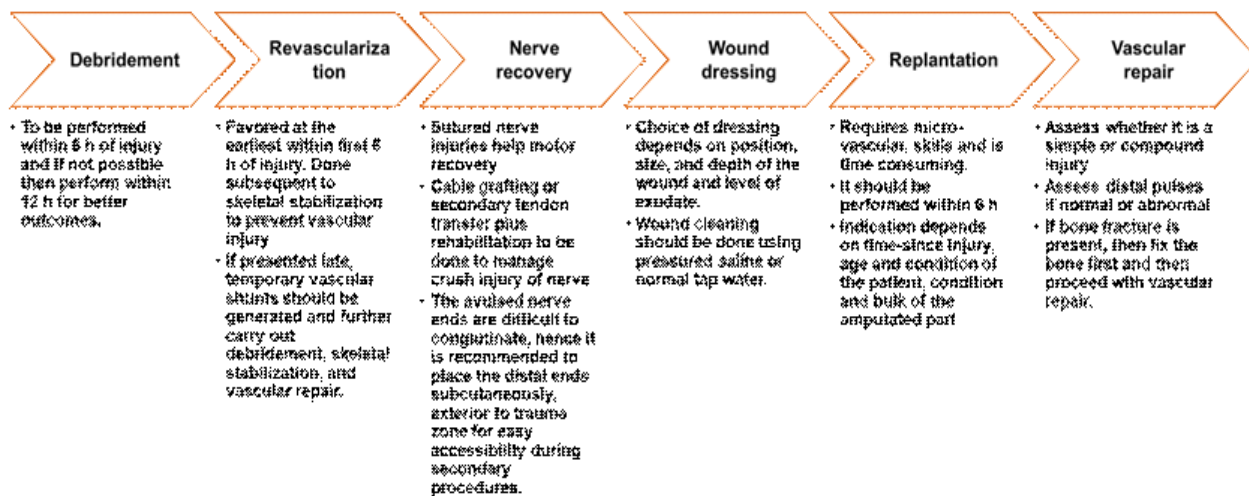


Fig 2 — Lower limb injury management

Lower limb injuries in remote settings				
Rule out single/polytrauma, follow ABC protocol	Minor vessels- maintain homeostasis with the available resources. Major vessels- compression bandage or put stent for perfusion	If revascularization is not possible, refer patient to the tertiary care hospital within 6 h.	If no vascular or nerve injury then check for bone injury. If bone injury is present, put a splint on limb with adequate analgesics	Perform saline dressing and sent to better care facility. If possible layer-wise primary closure of the wound could be done.

Fig 3 — Management of lower limb injury in remote settings

Need for Amputation :

Immediate amputation is required if the tibial nerve is completely transected and beyond repair. If warm ischemia time is more than 6 h, primary amputation is recommended. However, panel recommended to consider age and hemodynamic stability of the patients before proceeding with amputation.

Skin Grafting in Degloving Injuries :

Degloving injuries are severe and mishandling or delayed management leads to necrosis of avulsed skin or loss of limb. In absence of contamination and presence of actually degloving injury, particularly with large flap of skin, Panel prefer to proceed with primary skin grafting. However, in presence of contamination, it is recommended to avoid skin grafting.

Management of Compartment Syndrome :

Increase in pressure due to internal bleeding or tissue swelling in lower leg results in a painful condition called compartment syndrome.

Management

- Usually in lower extremity trauma during revascularization, if ischemia time is higher, primary fasciotomy followed by revascularization is the best strategy for managing compartment syndrome. However, if ischemia time is <3 h, then revascularization is recommended.
- If fasciotomy is not performed, close the wound and frequently open the wound and monitor the patient for edema, toe movements and sensation. This will help in early identification of compartment syndrome and fasciotomy can be done.
- Non-surgical therapy encompassing physical therapy, orthotics (inserts for shoes), and anti-inflammatory medications are implemented in few cases.⁵

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