



“This guy has only one leg to stand on!”



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Tom's case

Tom, 25, is brought to the ED after having his right leg crushed by a reversing forklift. He is alert and cooperative, but in significant pain. He is pale and diaphoretic.

Examination

A medical examination notes the following:

- BP: 90/40 mmHg
- Pulse: 132 bpm
- Respiratory rate: 24 breaths per minute

Paramedics are applying pressure to his lower leg and report a large amount of blood loss at the scene. They tell you that the leg wound is his only injury, but that there is a huge hole, with bone fragments easily visible, which you confirm when you remove the dressing (Figures 1 and 2).

Questions

1. What are the priorities in Tom's case?
2. What specific emergency interventions should be taken in cases of severe crush injury to an extremity?
3. Are there other issues to be addressed?

Read on to find out the answers to these questions.

Questions & Answers

1. What are the priorities in Tom's case?

The basic A, B, C principles (airway, breathing and circulation) of advanced trauma life support (ATLS™, American College of Surgeons) apply to any injured patient and an assessment of these take precedence, regardless of the particular presentation (*i.e.*, it may seem like isolated extremity trauma, but one should assume other injuries until a primary survey of the patient is complete). A primary survey, undertaken to rapidly identify and treat immediately life-threatening conditions, is usually conducted at the same time as a history (and past medical history) is solicited. The A, B, C phase is followed by an evaluation of Tom's neurologic status (*i.e.*, disability 'D') and his exposure for a thorough examination 'E.'

Ideally, as you perform the primary survey, other health-care providers are:

- applying high flow oxygen,
- securing two wide bore intravenous lines and
- connecting the patient to cardiac and pulse oximetry monitors.

A primary survey and, after addressing Tom's leg, a head-to-toe secondary survey reassures you that he does indeed have an isolated leg injury. We will accordingly not focus on airway management beyond reminding you that severe shock is an indication for definitive airway management and should be performed if the patient does not respond rapidly to aggressive fluid resuscitation. Ventilatory support, in shock, will maximize oxygen supply and reduce demand by removing the considerable work of breathing.



Figure 1. Medial view of the lower leg.



Figure 2. Antero-lateral view of the leg.

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2. What specific emergency interventions should be taken in cases of severe crush injury to an extremity?

In an otherwise healthy trauma victim such as Tom, hypotension and tachycardia suggest class III hemorrhagic shock (blood loss of 30% to 40%). In addition to aggressive fluid resuscitation (and blood transfusion if there is no rapid response), shock management in Tom includes stopping (or minimizing) his ongoing blood loss, which can usually be achieved by direct pressure on the wound with a clean dressing. Tourniquets are relatively contraindicated in all but extreme cases, as are attempts to clamp off bleeding vessels, as this is likely to damage associated nervous tissue and make vessels harder to repair. Further discussion on shock management is beyond the scope of this article.

Once immediate threats to life have been addressed, efforts to optimize outcome for the threatened limb should be instigated. Limb salvage will depend on simultaneous and timely attention to the following structures:

- Vascular
- Nervous
- Soft tissue
- Bony

Emergent surgical consultation is vital as any delay in therapy can lead to irreversible damage. Early recognition of an arterial injury is imperative and can be facilitated by careful evaluation of:

- distal pulses (presence and volume),
- distal pallor,
- temperature and
- capillary refill.

These can all be compared to those on the opposite limb. Note the presence of obvious arterial bleeding, or of expanding or pulsatile hematomas.

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Figure 3. Cutting the bag of normal saline to irrigate the wound.



Figure 4. Pinching the cut end while squeezing the bag can direct a steady flow of saline into the wound.

Injuries to nervous tissue can be diagnosed by a careful examination of distal sensation and motor function.

X-rays should include joints on both sides of any injury. Displaced bony injuries should be reduced as early as possible—urgently if there is evidence of distal neurovascular compromise, or skin tenting. Remember to consider compartment syndrome in any limb injury. This case must be discussed on an emergent basis with the consultant who will be carrying out definitive management and your concerns regarding the threatened limb should be communicated in a succinct and concise manner.

Any severe open injury carries a high risk of subsequent infection. Broad spectrum antibiotics (*e.g.*, 2 g of cefazolin intravenously) should be started as soon as possible, adding 6 mg/kg gentamicin if the wound is severely contaminated. If there is to be any delay to surgery, the wound should be thoroughly irrigated with normal saline. A useful trick to irrigate large wounds under pressure is to cut one of the tubes leading out of a 1 litre bag of intravenous saline and squeeze the bag between your forearm and flank, whilst directing the flow, pinching to increase pressure with the fingers of the other hand (Figures 3 and 4). After copious irrigation (at least 1 litre) the wound should be loosely covered with sterile saline-soaked gauze and the leg splinted in as anatomical a position as possible.

3. *Are there other issues to be addressed?*

Timely pain management is one of the most often forgotten, yet seminal, interventions in major trauma care. Pain should be managed with:

- intravenous, titrated narcotic analgesics,
- appropriate splinting and, if possible,
- elevation.

Tetanus immunization should be reviewed and tetanus immune globulin considered (passive immunization) if there is not a clear history of three prior doses of tetanus toxoid (active immunization). Remember to keep the patient nil per os (NPO). **Dx**

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