

# BLAST INJURIES

## Blast Extremity Injuries



### Background

The soft tissue and musculoskeletal systems have the highest incidence of bodily injury in survivors of bombings. The most extreme of these injuries, the traumatic amputation, is reported to occur in 1%–3% of blast victims.

### Clinical Presentation

Traumatic amputation from **primary blast injury** is often considered a marker for a lethal injury. Blast-induced amputations primarily occur through the bony shaft rather than joint disarticulations and may result from the combination of the blast wave and blast wind.

**Secondary blast injury** to the extremities is marked by penetrating trauma from the bomb casing fragments, materials implanted within the bomb (e.g., nails, screws), flying glass, or from local materials made airborne by proximity to the explosion.

- Wound contamination may occur from the traumatic implantation of biologic material (e.g., bone fragments) from the bomber or from victims in proximity to the explosion
- Irregular projectiles result in extensive tissue damage
- Even with small entrance wounds, surgeons should maintain a low threshold for performing a thorough debridement, as deep contamination and devitalized tissue can produce highly morbid infectious complications

**Tertiary and quaternary blast injury** to extremities more closely resembles civilian trauma. Victims suffer from blunt impact forces when propelled against surrounding structures.

Building collapse may produce crush injury and the potential for compartment syndrome. (For further information please refer to CDC's "Crush Injury and Crush Syndrome: What Clinicians Need to Know" fact sheet)

### Diagnostic Evaluation

- Document a systematic musculoskeletal, neurological, and vascular exam for each extremity
- Extremities should be thoroughly evaluated from a vascular perspective; physical examination is less reliable for detecting vascular injuries from blast than from routine civilian trauma
- Although diligence is warranted in assessing the vascular status of the blast-injured extremity, institutional protocols incorporating mandatory arteriogram have not been published
- Each open wound should be well documented—noting size, exposed bone, and type of contamination—and, ideally, photographed
- Radiological examination of injured extremities should be liberally utilized to identify deep foreign bodies and to characterize bony injuries
- The initial absence of plantar sensation in the blast-injured extremity is not predictive for amputation; 50% of patients will regain this protective sensation over time
- Lower extremity injury scores do not accurately predict the need for amputation

## Initial Management

- Even when blast victims have small entrance wounds, surgeons should maintain a low threshold for performing thorough debridement
- All open fractures are considered contaminated and should receive early antibiotic treatment (first generation cephalosporin and/or aminoglycoside, extended spectrum penicillin)
- Obviously contaminated wounds should be irrigated with sterile saline and dressed with iodophore (Betadine)-soaked sponges; once dressed, re-exposure should wait until operative exploration
- Tetanus prophylaxis should be administered unless immunization within five years can be documented
- Extremity fractures should be splinted to provide mechanical stability and relieve pain

## Surgical Management

- Initial debridement and bony stabilization should be done in the operating room to preserve life and limb; wounds should be enlarged with extensive longitudinal incisions and debrided in systematic fashion
- The zone of injury will extend well beyond initial skin wounds and fracture sites; aggressive debridement of necrotic and contaminated tissue is critical because there is a tendency to underestimate the soft tissue injury
- Following debridement, low-pressure pulsatile lavage may be employed to thoroughly irrigate the wound
- Bony stabilization is often provided by external fixation with secondary conversion to definitive plate or intramedullary fixation
- When treating vascular injuries, avoiding prosthetic grafts or repairs/reconstruction within contaminated zones of injury is important; where vessels may not be ligated, autologous vein grafts for critical reconstructions should be used
- Following debridement and bony stabilization, soft tissue injury is generally addressed with creation of an antibiotic bead pouch or application of a vacuum wound dressing
- Cultures are generally not useful during this acute injury management
- Repeat debridement is planned every 24–72 hours, depending on the injury extent, until a stable soft tissue bed is attained
- Literature on the management of small, imbedded foreign bodies is limited; it may be the case that small fragments involving soft tissue only, with small wounds and no active infection or gross contamination, may be treated expectantly
- Before and during each operative procedure, limb viability and feasibility of continued efforts to save the limb must be considered; the overall goal is to preserve potentially functional limbs without jeopardizing the patient's overall health

*This fact sheet is part of a series of materials developed by the Centers for Disease Control and Prevention (CDC) on blast injuries. For more information, visit CDC on the Web at: [www.emergency.cdc.gov/BlastInjuries](http://www.emergency.cdc.gov/BlastInjuries)*