

# BLAST INJURIES

## Thermal Injuries



### Background

Thermal injuries from explosions of conventional weapons are classified as quaternary blast injuries. The rapidly expanding fireball from the explosion may cause flash burns over exposed body parts (e.g., hands, neck, and head). Confined space explosions can enhance thermal effects and increase the risk of inhalation injury. Effectively managing thermal injuries associated with primary blast injury, particularly blast lung injury, may be challenging due to conflicting fluid requirements.

### Clinical Presentation

- Most bomb-related burns cover <20% of the total body surface area (TBSA), but occur in combination with other blast injuries.
- Inhalation injury is relatively common (18%) among those who survive explosions in confined spaces.

### Initial Prehospital Management

- Stop the burning process; remove restrictive and smoldering clothing.
- Rapidly cooling the isolated burn (cool water irrigation, no ice) will reduce the zone of stasis associated with initial thermal injury; avoid hypothermia and freezing tissue.
- Apply simple dressings to limit secondary wound contamination.

### Initial Hospital Management

#### Immediate Steps

- Remove restrictive and smoldering clothing to stop burning, allow for a thorough examination, and prevent secondary fires in the presence of high flow oxygen.
- Irrigate thermal injuries with cool water to help reduce the area contained in the zone of stasis. Injuries in this area are potentially reversible. Do not use ice and be cognizant of the potential for hypothermia.

#### Airway/Inhalation Injuries

- Inhalation injury can result from the explosion's extinction of available oxygen and creation of particulate matter, smoke, superheated gases, and toxic by-products.
- Suspect an inhalation injury with a:
  - Closed space explosion;
  - Singed nasal vibrissae or carbonaceous sputum; or
  - Elevated CO or CN levels (obtain only if victim numbers are low— indiscriminant ordering will overwhelm the laboratory resources).
- If airway injury exists, intubate early. Inhalation injury can be fatal if a patient's airway is blocked due to mucosal swelling and progressive edema that obliterates normal airway structures.

### Initial Hospital Management *(continued)*

- At admission, consider evaluating the fiber optic airway to determine if subsequent airway intervention or aggressive pulmonary toilet is needed.
- Among patients with primary blast injury to the lung, mechanical ventilation and positive pressure may increase the risk of alveolar rupture and air embolism. Patients with inhalational injury may be at a higher risk of barotrauma.

### Fluid Resuscitation

- Fluid resuscitation is required for victims with burns that cover >15% of TBSA.
- The goal is to replace the loss of intravascular volume and to maintain tissue perfusion in the first 48 hours post-injury, when capillary leak and relative hypovolemia occur.
- Inadequate fluid resuscitation increases morbidity and mortality.
- Fluid resuscitation for significant thermal injury that is initiated more than four hours post-injury is associated with almost 100% mortality.
- Give Lactated Ringers (LR):
  - 4cc/kg/%TBSA in the first 24 hours
  - Give half in the first eight hours starting from the time of the burn insult itself, and the remaining half during the next 16 hours.
- Effective fluid resuscitation is demonstrated by adequate urine output.
- Take care when treating burn victims who have also suffered a blast lung injury. The risk of aggressive hydration to the blast injured lung must be balanced with the need to provide IV fluids to manage the burn.

### Pain Management

- Give narcotics for pain.
- Recognize when resources may be limited (e.g., a Rhode Island nightclub fire exhausted a three-month narcotic supply during the acute resuscitation phase at a Level I trauma and burn center).

### Other Considerations

- Administer tetanus toxoid if patient did not receive a booster in the last five years, or if date of booster is unknown.
- Full-thickness burns of thorax and extremities may cause the constriction of underlying structures and require an escharotomy.

### Disposition

- Inhalation injury is an independent predictor of prolonged ICU care and mortality.
- Burns covering >30% of TBSA are associated with increased death rates.
- Death from burns is dependent on: the percentage of TBSA affected, presence or absence of significant airway and lung involvement, and the age of the victim.
- Patients diagnosed with primary blast lung injury should be admitted to the hospital, regardless of the extent of any associated burn.

*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)**.