

Hospital Preparation, Response & Management
ADVANCED EXPLOSIONS & BLAST INJURIES

Hospital Preparation

- External disaster plan
- Hospital Incident Command System
- Security
- Triage
- Decontamination and detection
- Surge capacity
- Supplies and resources

Resources-Staff

- | | |
|---|---|
| • Emergency Physicians | • Social workers |
| – Medical Toxicologists | • Chaplains |
| • Surgeons | • Psychiatrist and Psychologists |
| • Orthopedists | • Physician assistant and nurse practitioners |
| • Pulmonary and Critical care specialists | • Security officers |
| • Internal Medicine | |
| • Nephrologists | |

Resources-Supplies

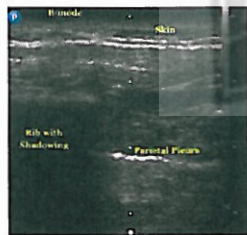
- IVF
- Blood
- Ventilators
- Tetanus toxoid
- Antibiotics
- Analgesics
- Bicarbonate
- Local anesthetics
- Splints
- Suture material
- Bandages and gauze
- Cyanide antidote
- Dialysis

Predictor of Injury Severity

- Triage at the hospital

Triage and Predictor of Injury Severity

- Sample entropy
- Extended-FAST used in Boston Marathon Bombing



Peev MP. Real-time sample entropy predicts life-saving interventions after the Boston Marathon bombing. J Crit Care. 2013 Oct 10.

Predictor of Injury Severity-Not for Triage

- Injury Severity Score (ISS)

- Each of the six body systems' injuries are given an Abbreviated Injury Scale (AIS) from 1-5

- The most severe injury in each body system is used for the Injury Severity Score

- $ISS = A^2 + B^2 + C^2$

- Major Trauma > 15

Baker S P (1974) "The Injury Severity Score: a method for describing patients with multiple injuries and evaluating emergency care" *The Journal of Trauma*

TM Perforation

- Keep dry

- Prophylactic topical antibiotic

- Gentamycin suspension

- Outcome is good

- Mixed frequency hearing loss with good subjective recovery

- High frequency sensorineural hearing loss may be more persistent

- Severity inversely proportional to distance from bombing

TM – Perforation

- Follow up is needed:

- Assess for middle-ear damage

- Audiometry

- Cholesteatoma

- Perilymphatic leak in patients with vertigo

Blast Lung Injury

- Should not rely on TM rupture to predict lung injury:
 - TM perforations are found in only 60% of patients with clinically significant injuries
 - Clinically significant injuries are present in less than 30% of patients with TM perforations

Blast Lung Injury

- Patients with normal CXR and ABGs, who have no complaints that would suggest BLI, may be discharged after a brief observation period

Ann Emerg Med 1999 Aug;34(2) 168-72

Blast Lung Injury

- Management similar to pulmonary contusions
- Complex fluid management
- Mechanical ventilation will increase the risk of air embolization

Management of Primary Visceral Injuries

- Surgical resection of contused or perforated segments of the intestine



Fig. 4. Access to the peritoneal cavity by laparotomy in the right and left lower quadrants for the repair of a blunt abdominal injury. A: Right upper abdomen; B: Right lower abdomen; C: Left upper abdomen; D: Left lower abdomen.

Management of Secondary Injuries- Tourniquet

- If not applied on the scene
- Shown to improve survival in combat casualties



Kragh JF Jr. *Ann Surg*. 2009; 249(1):1-7

Management of Secondary Injuries- Tourniquet Evidence

- Tourniquet application prevents shock which improves mortality
- Prehospital application better than ED application
- Potential complication: Nerve palsy in 1-2%
- No limb loss from tourniquet use

Kragh JF Jr. *Ann Surg*. 2009; 249(1):1-7
Survival with emergency tourniquet use to stop bleeding in major limb trauma

Management of Secondary Injuries

- Assess for vascular injuries.
- Solid organs or bone injuries
- Watch for unusual shrapnel such as nails and bolts
- Role of CT scan



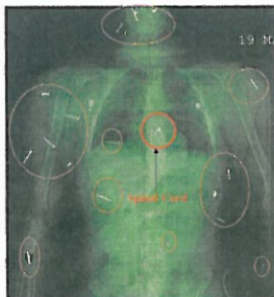
Decisions for Limb Salvage or Amputation

Table 1. Marginal Extremity Severity Score (MESS) (11)

Soft-tissue injury	
Low energy injury (eg, sprain, bone fractures)	- 1 point
Medium energy injury (eg, multiple bone fractures)	- 2 points
High energy injury (eg, car accidents)	- 3 points
Very high energy injury (eg, high speed trauma with severe contamination)	- 4 points
Limb ischemia	
Normal perfusion with redness or even absent pulse	- 1 point
Absent pulse, paresthesia, diminished capillary refill	- 2 points
Cool, paralyzed, insensate limb	- 3 points
Shock	
Systemic blood pressure < 90 mm Hg	0 points
Hypotensive transiently	1 point
Hypotensive persistent	2 points
Age	
< 44 years	0 points
30-50 years	1 point
> 50 years	2 points
*The scores obtained for ischemia + shock.	

MESS <= 6 – Limb salvageable

Bombing Victim



Management of Tertiary Injuries



Source: www.TheDenverClinic.com

Management of Tertiary injuries

- As per trauma protocols
- Look for crush syndrome especially in structural collapse:
 - Myoglobinuria
 - Renal failure
 - Hyperkalemia

Management of Crush Syndrome

- IVE:
 - Start in the field
- Urinary alkalization:
 - Myoglobinuria, Urine pH > 7
- Mannitol
- Hemodialysis:
 - Anuric patients, acidemic patients
 - Correction of electrolyte abnormalities
 - Advanced planning is needed for surge capacity

Management of Quaternary Injuries

- Inhalational injuries
- Carbon monoxide
- Hydrogen cyanide
- Chemical bombs or explosions
- Contamination with radionuclides and exposure to gamma radiation
- Mental health

Questions or Comments?

