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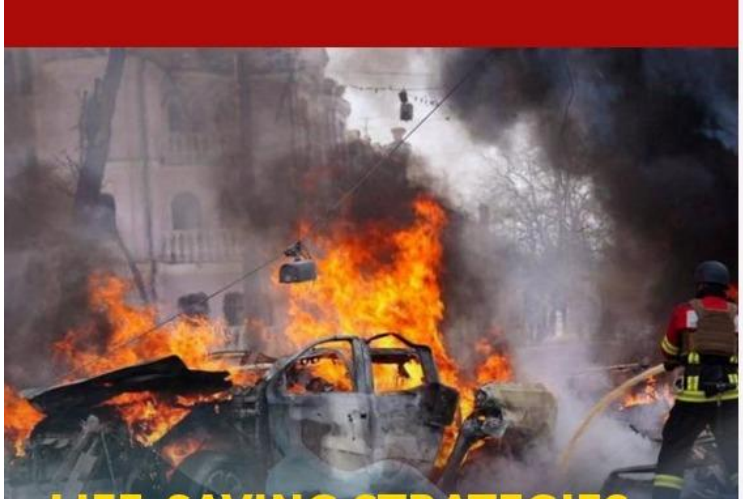

LIFE-SAVING STRATEGIES FOR BLAST AND BALLISTIC INJURIES.

EXPERTS

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Session Chair:
Dr. Anna Meridah Kaguna,
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This session will delve into areas such as;

1.Key history in a patient with blast/ballistic injuries
2.On-scene assessment, triage, care & transportation of a patient with blast/ballistic injuries
3.ED handover, assessment & investigations for a patient with blast/ballistic injuries
4.Nursing Care for a patient with blast/ballistic injuries
5.ED management & disposition plan for a patient with blasts/ballistic injuries

scan to register

FRIDAY
27th March 2026
2-4pm EAT

Use link;
https://shorturl.at/sVgGE

Case Presenter
Dr Paul Sekate
EM Resident at MakCHS

Chat Questions
Dr Obwapus Robert,
Surgeon & Commanding officer, Level II Field Hospital Mogadishu

ECAU EMERGENCY CARE ASSOCIATION OF UGANDA

Brief History

A.K, 35/M, soldier serving as a deminer while sweeping a suspected IED route ahead of a foot patrol in a high-risk major transport route, triggered an anti-personnel IED.

Reportedly thrown in a trench ~6m following a loud blast, had a brief loss of consciousness (1-2mins), then he woke up confused and screaming in pain, bleeding from both LL & Patient now complaining of severe chest pain, shortness of breath, inability to hear

Primary Survey (Emergency Assessment)

A	Speaking in short sentences, had soot visible around the mouth and nares, no stridor
B	Marked respiratory distress, RR-32/min, SPO2-86% on room air, asymmetrical chest , tracheal deviation to the right, left chest is hyper-resonant with reduced air entry

Primary Survey (Emergency Assessment)

C	Cold extremities, diaphoretic, CRT>3sec, HR-130b/min, BP-80/52mmHg, HS I and II loud, bleeding amputated bilateral LL
D	GCS-14/15(E-4,V-4,M-6), Pupils equal and reactive to light (3mm), no FNDs, RBS-6.8mmol
E	Bilateral traumatic LL amputation(R- above knee, L - below knee), stable pelvis, multiple shrapnel wounds on abdomen, upper limbs, thighs, superficial flash burns to the face and hands. Bleeding from both ears.Temp-35.3, no step-off lesions along the vertebrae

POLL 1

From the history and primary survey, what are the imminent emergencies in this patient?

What are the emergency Conditions?

THREATS	*PRIORITY*	*Findings*	*Associated Risk*
A	Inhalation burns	Visible soot around the mouth and nares	Airway obstruction
B	Respiratory distress	Chest asymmetry, RR-32B/MIN, SPO2-86%, hyperresonance & reduced air entry to the left	Tension pneumothorax-Hypoxia- cardiac arrest
C	Catastrophic bleeding	Diaphoresis, cold extremities, CRT>3secs, HR-130b/min, BP-80/52mmhg. Torniquets already applied	Hypovolemic shock-death

POLL 2

What are the emergency lifesaving interventions for this patient?

What are the emergency Conditions?

THREATS	*PRIORITY*	*Findings*	*Associated Risk*	*Immediate Action Taken*
A	Inhalation burns	Visible soot around the mouth and nares	Airway obstruction	Dexamethasone Secure airway
B	Respiratory distress	Chest asymmetry, RR-32/min, SPO2-86%, hyperresonance + reduced air entry to the left	Tension pneumothorax Hypoxia-cardiac arrest	High flow 02 via non – rebreather mask Immediate needle +finger thoracostomy
C	Catastrophic bleeding from the amputated limbs	Diaphoresis, cold extremities, CRT>3secs, HR-130b/min, BP-80/52mmhg	Hypovolemic shock-death	Tourniquets insitu & timed, 2 large bore cannulas inserted- IV RL started, IV TXA 1g bolus + 1g infusion, planned BT

And always reassess to monitor response to treatments

Interventions to stabilize the patient

Great!

We have started to stabilize the patient
…let's gather more details!

SAMPLE History

Signs & Symptoms	Bilateral traumatic lower limb amputation, shortness of breath, bilateral hearing loss and severe pain with multiple shrapnel injuries
Allergies	None known
Medications	None

SAMPLE History

Past Medical History	Previously healthy, no known chronic illnesses
Last Oral Intake	4 hours ago(breakfast ration)
Events Leading Up to presentation	Stepped on anti-personnel IED while sweeping route for foot patrol

Secondary Survey (Head-to-toe examination)

RELEVANT POSITIVES	RELEVANT NEGATIVES
- **Head & Neck**: soot on the lips/ tongue bleeding from both ears, autoscopy reveal TM rapture, superficial flash burns to the cheeks and forehead - **Chest**: Decreased chest expansion and breath sounds on the left - **Abdomen**: multiple small shrapnel wounds on anterior abdominal wall. - **Extremities**: traumatic amputation of both LL, tourniquets insitu. Multiple shrapnel wounds on both thighs, forearms and hands, superficial flash burns to both hands - Skin: superficial burns on the anterior	Head - no scalp lacerations, depressions or fractures. No epistaxis or septal haematoma Neck-no penetrating wounds , no JVD Pelvis- stable on gentle compression, no obvious deformity, no pain, no blood at urethral meatus Extremities-, both upper limbs were active Back- no step offs , tenderness or deformity along entire spine

Poll 3

What are all the possible differentials *and* what would you be looking for on examination to support these?

Differential Diagnoses?

Differential
- Blast lung injuries with tension pneumothorax - TM rupture - Mild TBI
- Penetrating shrapnel (chest, abdomen, limbs) - Hemorrhagic shock (Bilateral lower limb amputation)
-Blunt abdominal injuries secondary to a fall
- Flash burns, inhalation

Poll 4

What are the priority investigations for this patient?

Investigations

Investigation	Result
E.FAST	Absent lung sliding
otoscopy	tympanic membrane rupture
Blood Grouping + cross matching	Blood group O+, massive transfusion protocol activated
Point of care labs	RBS-6.8mmol, HB- (iSTAT) -8.2g/dl
CT scan (trauma series), abdominal uss,	
ECG	
ABGS, cbc, lfts, rfts,extended electrolytes	

Diagnoses

- Hemorrhagic shock
- Tension pneumothorax
- Bilateral LL Amputation
- Tympanic membrane rupture

Supportive Management

I. Oxygen therapy- 15l by non-rebreather mask to achieve spo2 above 94%
II. Needle decompression , 2nd intercostal space, mid clavicular.
III. Iv fluids (crystalloids), blood transfusion, permissive hypotension (sbp-90mmhg),
IV. Txa-1g iv then 1g in infusion for the next 8hrs
V. Analgesia, iv paracetamol, iv fentanyl and femoral nerve blocks
VI. Warmth
VII. Stump dressing,
VIII. Tetanus shot
IX. Antibiotics

Specific Management

Tension pneumothorax	➢ High flow o2 therapy 15l by non-rebreather mask ➢ Chest tube insertion upon arrival to level two field hospital ➢ Avoid excessive positive pressure ventilation
Mild TBI	➢ Neuro- critical care bundle ➢ Monitor GCS
Bilateral traumatic amputations	➢ Keep tourniquet in place, dress stumps with saline – soaked gauze + occlusive plastic wrap, elevate stumps ➢ Bilateral femoral nerve blocks for pain control
Tympanic membrane rupture	➢ Hospital ENT review
Haemorrhagic shock	➢ Permissive hypotension ➢ Massive transfusion(1:1:1) ➢ TXA infusion for the next 8 hours ➢ Continue iv fluids, consider early vasopressor use ➢ Surgical consult

Disposition Plan

Notify receiving hospital – blast amputation, blast lung –needs immediate theatre

Rapid evacuation by road/ air ambulance to nearest level II facility with surgical capability

Continue monitoring ABCs, repeat primary survey every 5 minutesen-route. Prepare vasopressor infusion foruse in casethere is need

Handover using MIST format

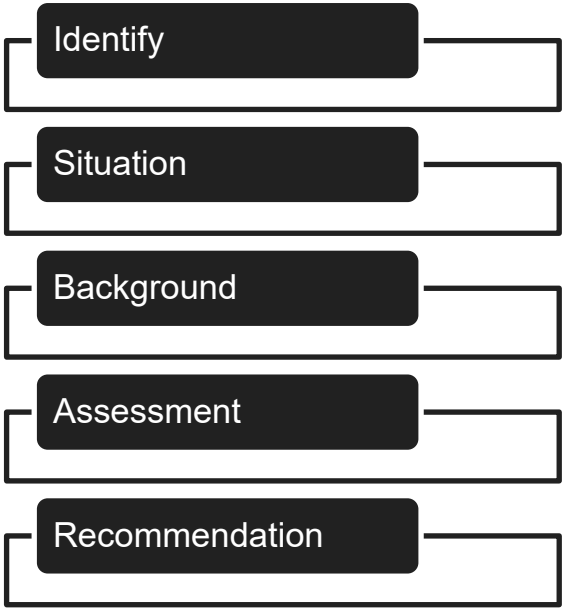
Thank you

And now for the pre-hospital care perspective…

Prehospital team:

What do you need to prepare for pre-hospital care for this patient?

- Staff
- Patient
- Equipment / Medications
- Mode of transport
- Documentation/Handover



Primary Survey

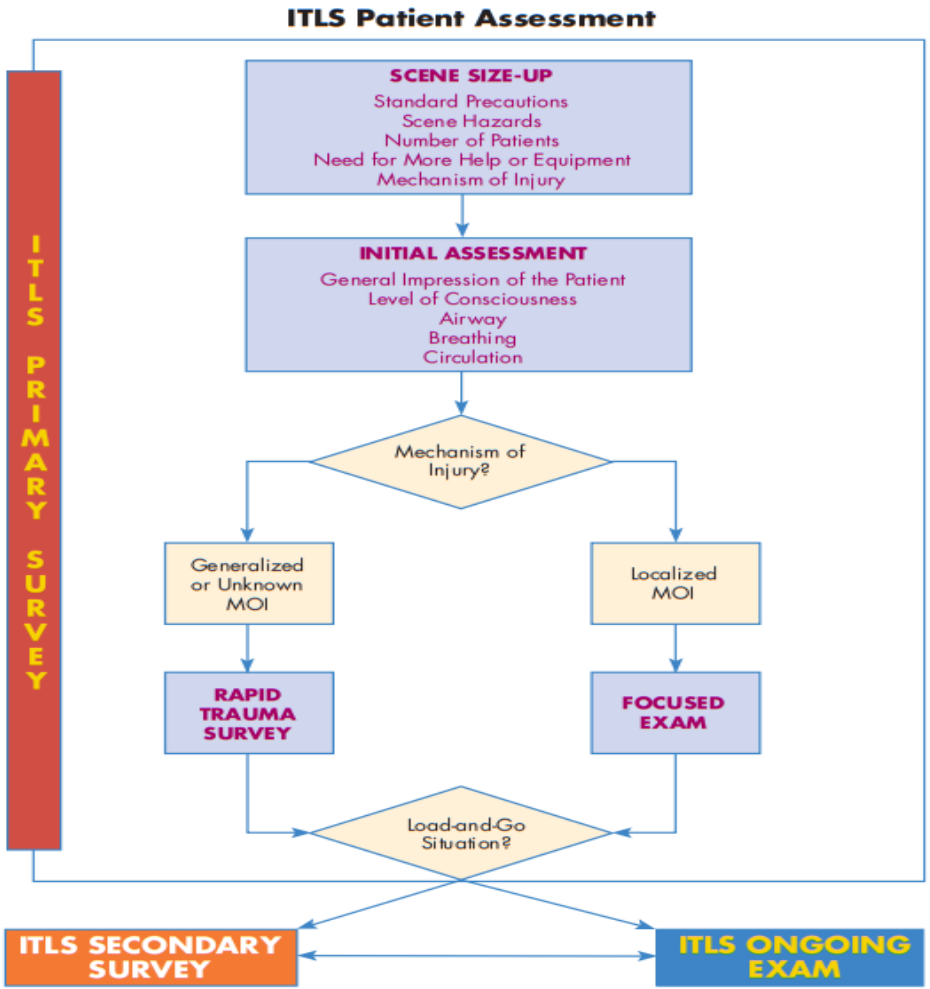


Figure 3-1 Steps in the assessment of the trauma patient.

Reference

Nursing team:

Is there anything else you would like to know now?

What are the **nursing priorities**
for this patient during their inpatient stay?

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Nursing Priorities for blast and ballistic injury Casulity

By Lt. Jackson Gutagwa

Introduction

Nursing theories considered for case management

Grand Theory

- Nursing need theory by Virginia Henderson

Middle range theory

- Theory of deliberative Nursing Process DNP (Intergrative)
- Balance between analgesia & Side Effects (Physiological)
- Chronic Sorrow CS (Psychological)

Tenets of Theories

- Need theory- Emphasizes the importance of increasing pt independence and focus on basic human needs so that progress after hospitalization would not be delayed.
- DNP- Meet immediate pt needs when pt is unable to do so without help
- BBA&SE- Pt satisfaction with relief of pain and relief or absence of side effects
- Chronic Sorrow- Ongoing loss or a Single event causing long time grief

Nursing Concerns

- Chemical Biological Radiological and Nuclear and High yield Explosives (CBRNe)
- Risk for shock
- Compromised tissue perfusion
- Pain
- Ineffective thermoregulation
- Altered skin integrity (Shrapnel abdominal wounds and flash burns)
- Loss of hearing
- Chronic sorrow
- Disturbed body image/ altered body image

Assessment	Nursing Diagnosis	Goal/Desired Outcome	Intervention	Rationale	Evaluation
Bp-80/52mmhg PR-130b/min Cold Extremities Diaphoresis Temp. 35.3 RR 32/min SPO2 86%	Risk for shock related to severe hemorrhage.	Stop progressive bleeding instantly.	Check tourniquet. Apply counter tourniquet if implied. Apply pressure bandages.	Ensure effectiveness. Stop progressive hemorrhage. Stop bleeding.	No evidence of progressive hemorrhage from stamps.
		Return blood pressure to near normal in 3hrs.	Secure IV access with large bore cannulas Administer prescribed fluids	Optimize IV access Increase circulating volume	Bp and temperature improve from baseline readings to near normal.

Assessment	Nursing Diagnosis	Goal/Desired Outcome	Intervention	Rationale	Evaluation
SPO2 86% RR 32/min Temp. 35.3 CR >3 Sec.	Ineffective peripheral tissue perfusion related to severe bleeding and compromised chest evidenced by low circulations.	Maintain oxygenation and ventilation	Assist into high fowler's position. Attach pulse oximeter Log roll	Reduce weight on chest cavity. Monitor circulation Rule out other body injuries.	Patient's circulation improves to 90-95%
		Maintain optimum body temperature.	Cover patient with warm beddings Apply patient warmer.	Provide optimum environment for circulation	Patient's body temperature improves to 36.0-36.8

Assessment	Nursing Diagnosis	Goal/Desired Outcome	Intervention	Rationale	Evaluation
Diaphoresis Facial expression Visible wounds on thighs and abdomen	Acute pain related to traumatic tissue damage and physical damages evidenced by diaphoresis and facial expression.	Patient feels no or reduced pain through admission	Administer prescribed analgesics Keep a quite cool room	To reduce pain perception To provide a conducive environment for pain control	Patient indicates reduction in pain by facial and body expression.
		Patient shows interest in getting care	Assess residual pain	Helps step up pain control interventions	Patient indicates reduction in pain.

Assessment	Nursing Diagnosis	Goal/Desired Outcome	Intervention	Rationale	Evaluation
Bilateral traumatic lower limb amputation. Hearing loss in both ears.	Disturbed body image related to absence of body parts evidenced by bilateral traumatic lower limb amputation.	Allow the patient go through normal grief.	Provide a clean quite environment Allow organized visiting hours from friends	To provide the patient time to reflect upon the loss. To minimized destruction during meditation	Patient indicates interest in rehabilitation activities.
		Avoid chronic sorrow	Routine counseling Referral for rehabilitation	Allay anxiety Access to prothesis and improve mobility	Patient shows interest in living Pt is referred to rehab center

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- Sandra J Peterson & Timothy S. Bredow 2012 *Middle Range Theories Application to nursing research (*3rd ed.) Lippincott Williams & Wilkins
- Nanda International, Inc. 2018 *Nursing Diagnoses Definitions and classification (11th ed.) Thieme publishers New York*
- Purola, j., & Makela, k., 2024 The experience and challenges of registered nurse to manage a penetrating injury patient after a mass casualty incident

Thank you


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Now, let's Dive into Emergency Department Care for a patient with Blast & Ballistic Injuries

Dr Prisca M. Kizito, Emergency Physician & Lecturer, Chair Dep't of EM, MUST/MRRH, Director ITLS and ALS Programs

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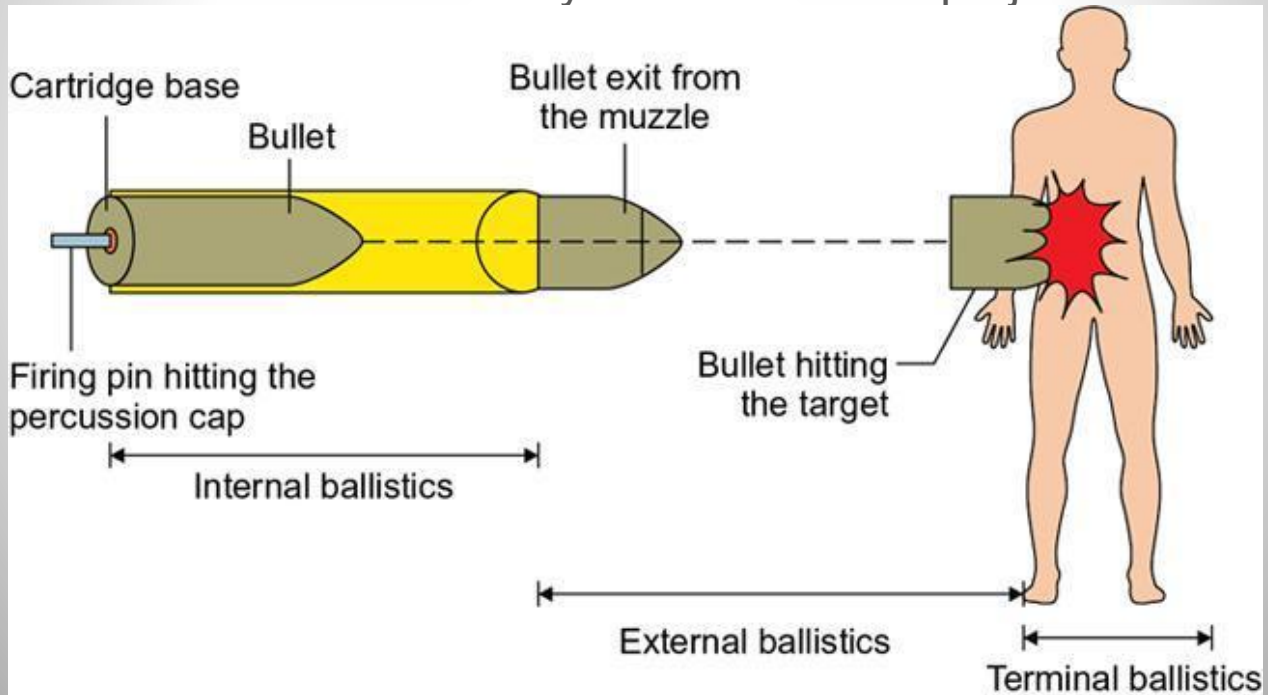
Ballistic and Blast Injuries in the ED: Assessment, Management & Disposition

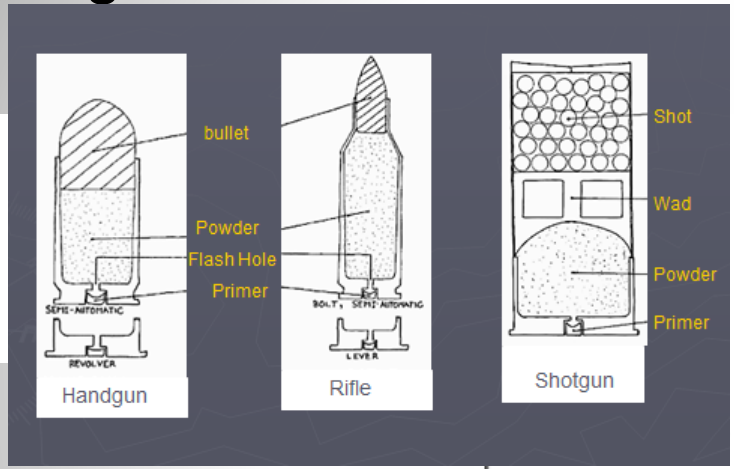
Prisca Kizito
Emergency Physician/Lecturer,
Chair, Emergency Medicine, MUST/MRRH

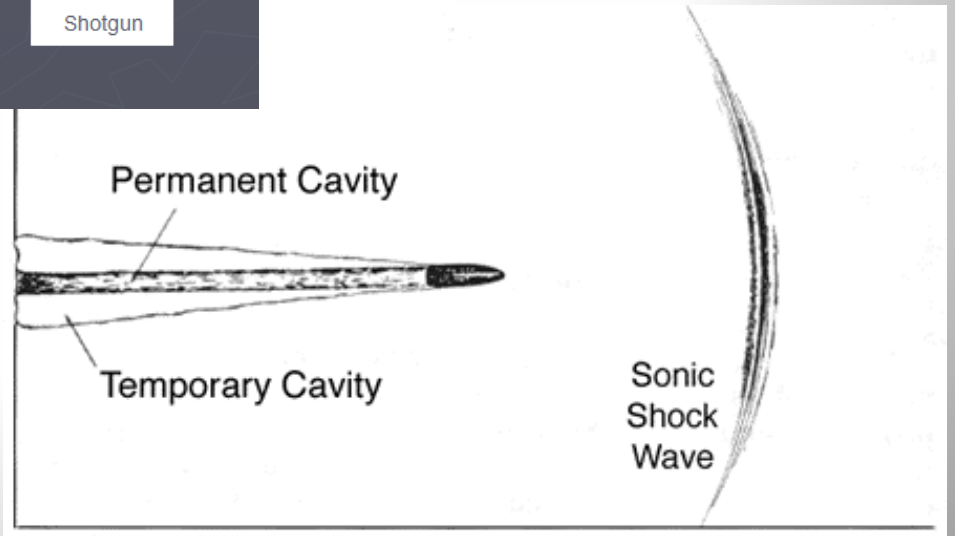
Overview of ballistic injuries

- Ballistics is the study of the motion of projectiles.



Wounding mechanism



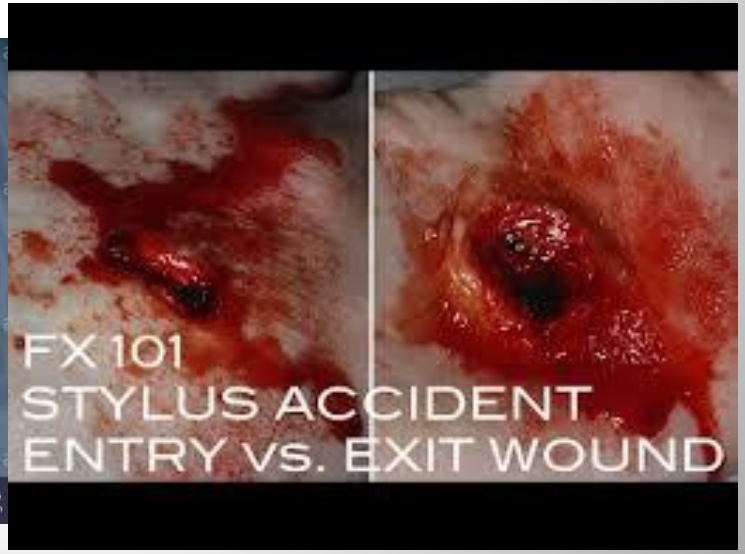


Approach in summary

Feature	Primary Survey	Secondary Survey	Tertiary Survey
Primary Goal	Identify/treat life threats	Identify all injuries	Identify missed injuries
Timing	Arrival (Immediate)	After stabilization	Within 24 hours
Scope	ABCDE focus	Head-to-toe + AMPLE	Comprehensive re-evaluation with diagnostics done
Key Output	Resuscitation	Definitive diagnosis	Completion of injury list

Entrance vs exit

Trajectory predicts injury and not all bullets exit. Cavitation means there is hidden damage. Recent



Critical Questions that Guide Management

In addition to SAMPLE History, ask for:

- Weapon type - Low vs high velocity
- Distance & angle of shot → Estimate trajectory and likely organs
- No. of shots heard - May indicate multiple retained bullets.
- Circumstances of injury (e.g., assault)- relevant later (e.g., self-inflicted for psychiatric follow-up)

Collateral history is often helpful

Blast injuries

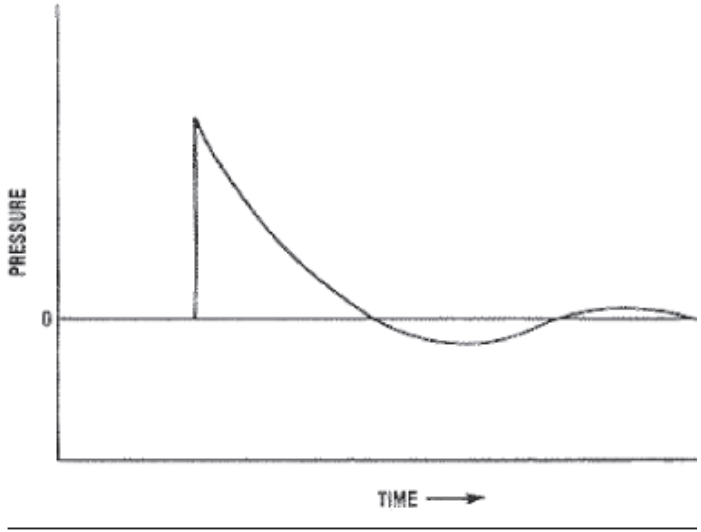
Overview

- A blast wave: Intense rise in pressure (overpressure) that is created by high-order explosives* → longer negative pressure → push-pull effect on organs/objects

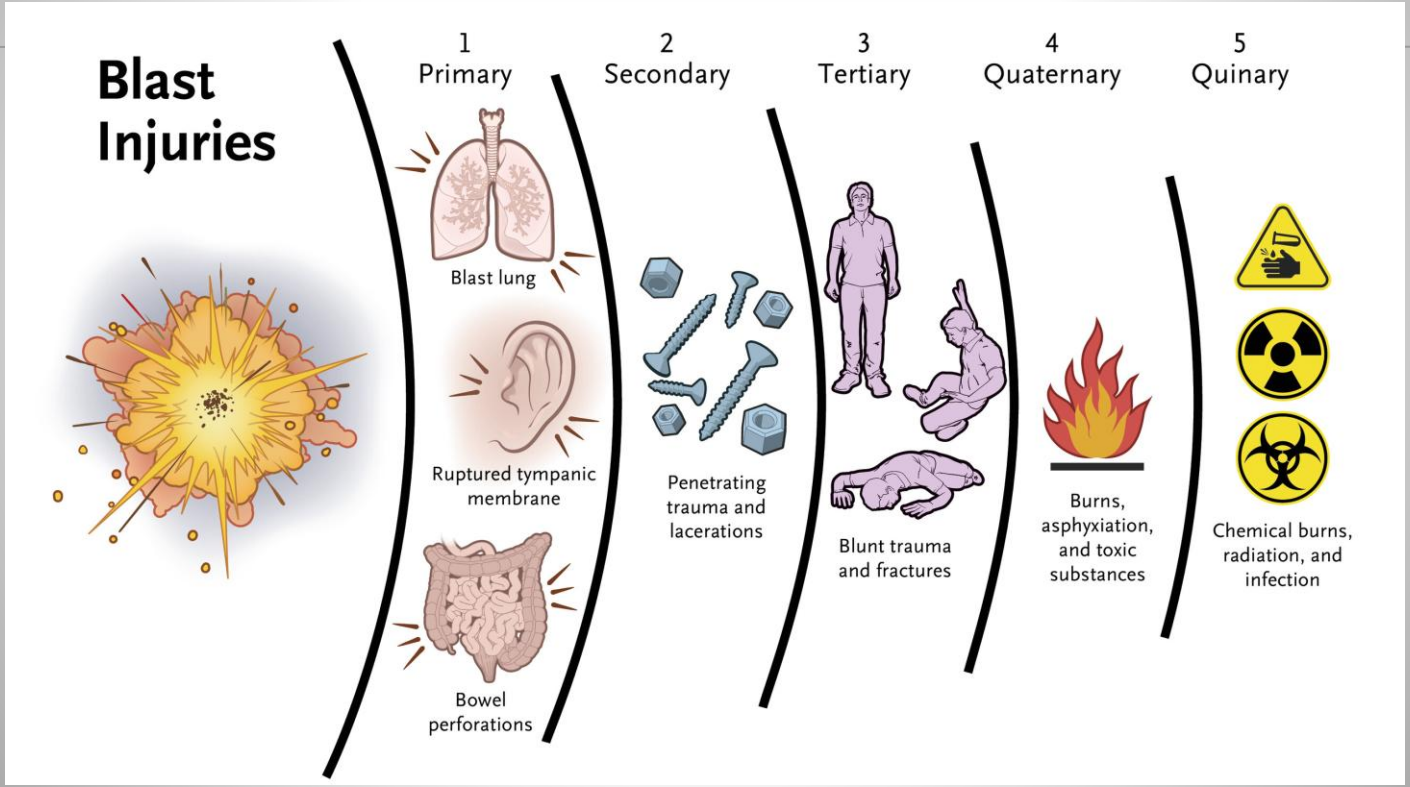
- Multisystem injuries in multiple patients simultaneously.

Figure 4. Pressure-time graph of blast wa

Idealized representation of pressure-time history of an exp
sion in air.



Categories of blast injuries



Blast Injury	Cause	Typical Examples
Primary	Blast wave affecting air-filled organs	Lung injury (blast lung), eardrum rupture, bowel injury
Secondary	Flying debris causing penetrating trauma	Shrapnel wounds, eye injuries
Tertiary	Body displacement from blast wind or collapse	Head injury, fractures, blunt trauma
Quaternary	Other explosion-related effects	Burns, inhalation injury (cyanide, CO, OPPs-like), crush injuries
Quinary	Contaminants from the explosion environment	Chemical exposure, radiation, infection

What influences extent of injury and death?

Explosive agent
- Size
- Nature
- Container

Response System
- Triage
- Time to care
- Resources

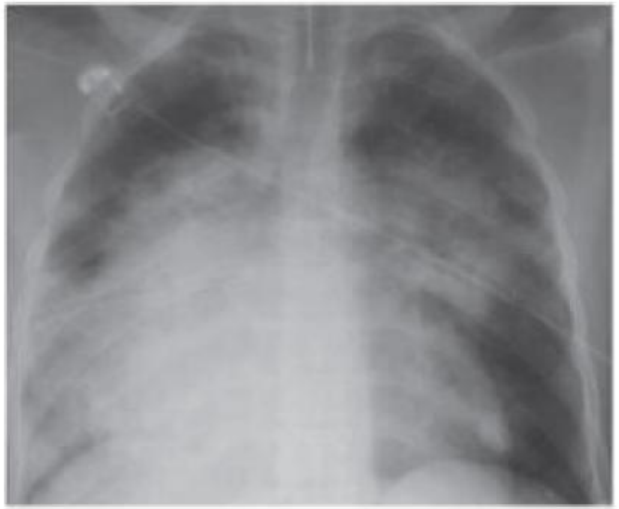
Patient
- Position
- Injury pattern
- Exposure

Environment
- Distance
- Enclosed space
- Barriers

Common primary Injuries

- Lethality of about 7.8% in open air; 49% in a confined space (US)
- 70% minor soft tissue injuries, traumatic amputations in 11%
- Ear: haemorrhage, ear drum perforation/rupture, dislocation of ossicles
- Pulmonary: commonest cause of death- contusions and/or barotrauma
- GIT: perforation > colon; mesentery, testes, solid organs
- Myocardial contusion, brain injuries (concussion, penetrating), eye (10%)

Figure 10. Radiograph of blast lung.



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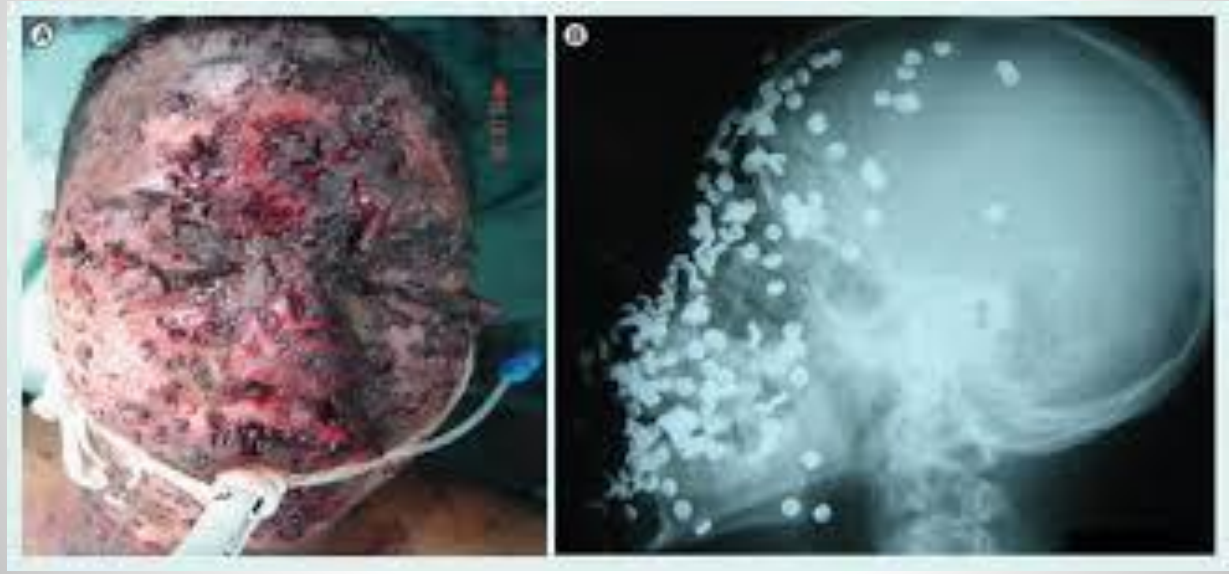

A
B

Secondary injuries

By bomb fragments and other debris pr

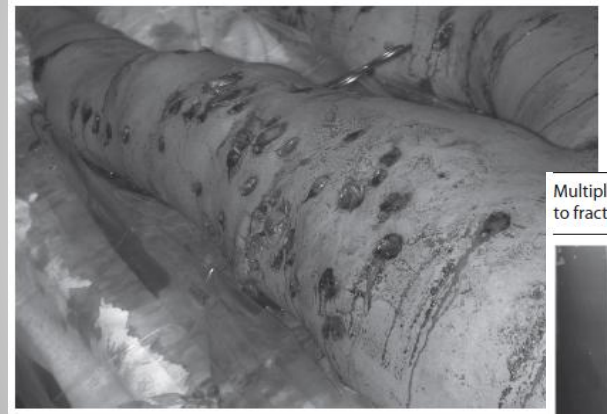
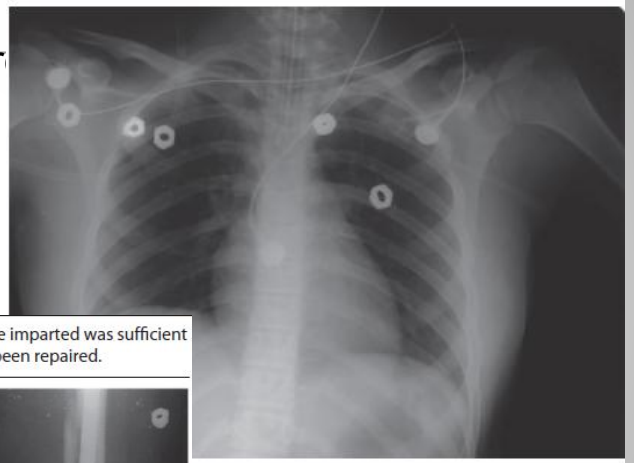
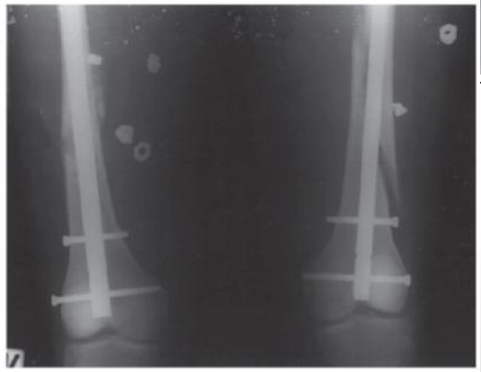


Figure 11. Multiple fragment wounds from blast injury.





Multiple nuts in both thighs. The force imparted was sufficient to fracture both femurs, which have been repaired.

Table 6. Clinical Signs/Symptoms Of Significant Explosion-Related Injuries.*

System	Injury or Condition
Auditory System	Blood oozing from the mouth, nose, or ears Eardrum hyperemia, hemorrhage, or rupture Deafness (may persist) Tinnitus Earache
Cardiovascular	Tachycardia (stress, hemorrhage, hypoxia, exertion, or dehydration) Bradycardia (may be transient due to blast-induced vasovagal reaction) Delayed capillary refill Fall of mean arterial blood pressure (hemorrhage, AGE, vasovagal reaction) Arrhythmia (cardiac irritability due to shock or coronary AGE)
Gastrointestinal	Nausea Vomiting Abdominal tenderness (particularly progressive tenderness) Abdominal rigidity Hematochezia Hematemesis
Neurologic System	Vertigo (vertigo is *not* usually due to auditory trauma) Coma Altered mental status (may be due to head trauma, shock, or cerebral AGE) Focal numbness Paresthesias Seizures Retrograde amnesia Apathy

Ocular Injury	Eye irritation Difficulty focusing Blindness Funduscopic findings of retinal artery air embolism Loss of red reflex on funduscopic examination
Respiratory System	Cyanosis Ecchymosis or petechiae in hypopharynx Asymmetric breath sounds Cough (often dry) Tachypnea (often preceded by a short period of apnea) (Rapid shallow respirations are common after blast exposure) Dyspnea (respiratory difficulty) Hemoptysis Rales or moist crepitation in lung fields Wheezes Chest pain Asymmetric chest movement Subcutaneous emphysema (open wound or rupture of air-containing internal structure)
Miscellaneous	Tongue blanching (may indicate AGE) Mottling of nondependent skin (may indicate AGE or hypotension) Subcutaneous emphysema (open wound) Pharyngeal petechiae (this has a better predictive value for blast lung than tympanic rupture) Abrasions

*Dark gray shading indicates most common findings; light gray shading indicates common findings.

Management: Using ATLS principles and MCI planning

- Safety- Scene and Personal: beware of secondary devices, contaminated patients, and terrorists as patients

- Activate the hospital's external or internal disaster plan (ICS)
- Clear the ED, cancel electives, clear the ICU
- Notify the lab/blood bank & radiology units

- Triage and assessment of life support needs: Mobilize resources
    - Two waves of medical demand – Low acuity victims arrive via private vehicles vs most critical patients arrive later via EMS

Management-ATLS principles

Primary Survey + Resuscitation

- **C** – Control bleeding (tourniquet/packing)
- **A** – Airway management + C-spine
- **B** – Breathing: Treat pneumothorax / consider blast lung
- **C** – Circulation: Blood products, control internal bleeding
- **D** – Disability: GCS, pupils, blood sugar, pain relief
- **E** – Exposure: Fully examine, prevent hypothermia*

Secondary Survey

- AMPLE history and head-to-toe exam
- Identify entry/exit wounds
- Assess for missed injuries

Special Considerations

- Hidden injuries are common so reassess frequently
- Blast lung may deteriorate later
- Multiple injuries likely (mixed patterns)

Most urgent actions in the ED

- Intubate inhalational injuries early.
- Oxygen, needle decompression
- Bleeding control, early blood, TXA (3Hrs). ?Permissive hypotension
- Appropriate antidotes. Tetanus toxoid. Reassess frequently

- Antibiotic prophylaxis: Cefazolin 1 g IV 8 hourly Ideal
  - Cephalexin, Amoxicillin/clavunate, Cef, Gentamycin

- Surgical consult for: Damage Control Surgery (DCS)
  - Staged exploration and delayed primary wound closure at 24h and 48 h

Specific evidence updates on Mgt

- Short-course antibiotics for uncomplicated civilian extremity GSWs- SD or brief (≤24 hours) 1st gen cephalosporin
- Initial DCS → Delayed 1^0 closure if no signs of infection (at 48–72HRs, or 4–7 days in austere settings)
  - 1^0 closure safe for clean, superficial entrance wounds
- Multiphase CTA- standard for suspected penetrating vascular injuries

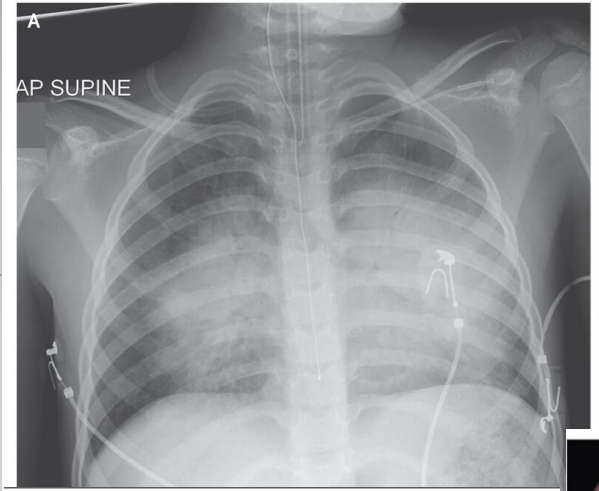
Specific Mgt in Blast Injuries

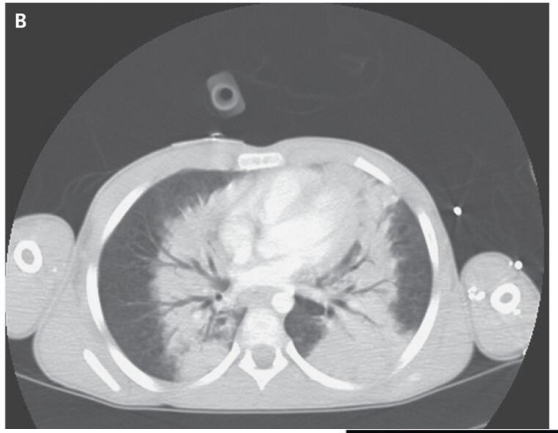
- **PBLI**- Use lung-protective ventilation (ARDS-type). Avoid high pressures. Monitor frequently for delayed compromise
- **MCI planning:** Update hospital disaster plans to reflect triage, surge capacity, and coordination with regional responders.
- Have protocols for decontamination, PPE, secondary surge (ICU)

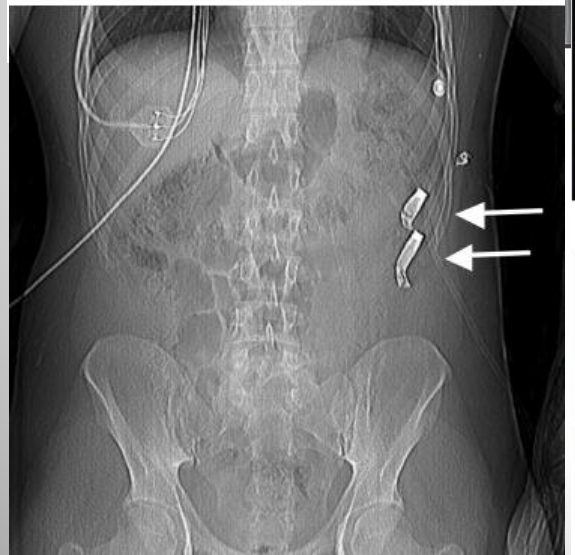
Admission Criteria

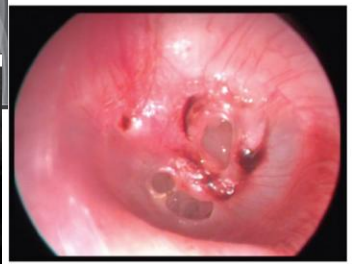
High-risk patients such as those with the following:

- Significant burns (>10% TBSA)
- Upper airway burns
- Suspected air embolism
- Radiation
- Shrapnel contamination
- Abnormal vital signs
- Abnormal lung examination findings
- Clinical or radiological evidence of pulmonary contusion or pneumothorax
- Abdominal pain or vomiting
- Penetrating injuries to the thorax, abdomen, neck or cranial cavity
- Reduced GCS

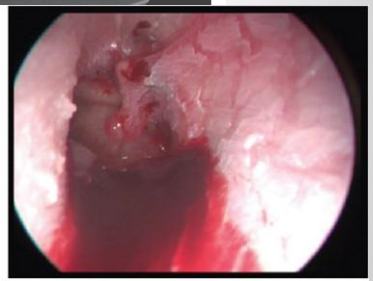




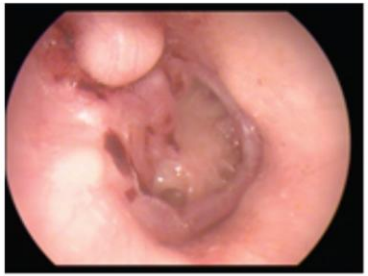




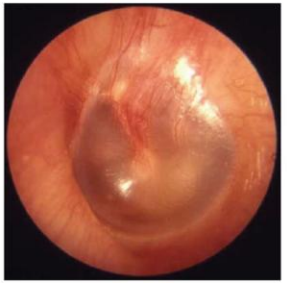
Multiple perforations



Subtotal perforation



Reversal of the edges of the tympanic membrane



Hyperhemia

How do GSW and Blast injuries differ in ED approach

Domain	Ballistic (Gunshot)	Blast Injury
Mechanism	Bullet trajectory	Pressure wave + debris
Key risk	Hidden tissue damage (cavitation)	Multisystem + delayed effects
Pattern	Localized (along path)	Polytrauma
Red flag	Vascular injury, internal bleeding	Blast lung, delayed deterioration
ED focus	Where did it go?	What am I missing?

Pearls and Pitfalls

Pearls	Pitfalls
Control bleeding first	Missing internal bleeding
Mechanism → predicts injury	Assuming entry = exit
Reassess often (blast!)	Premature discharge
Use blood, limit fluids	Fluid overload (worsens lung injury)
Suspect hidden injuries	Tunnel vision on obvious wounds Missing antibiotics (avoid myths)

References

- Eb Medicine
- CDC
- Rosens textbook of Emergency Medicine
- Core EM
- WHO