

TRAUMA

40% are preventable
Leading cause of death in ages 1-45 yo

↑ **MORTALITY** → hemorrhage, multi-system organ failure, & cardiopulmonary arrest

Trimodal Distribution of Death

GOLDEN HOUR → increased risk of death. Need rapid intervention

- within minutes → 50%
- within hours → 30%
- days-weeks → 20%

5 Levels of Trauma Care:

Level 1: 24hr in-house staffing of **board-certified trauma surgeon** and supporting team

Level 2: 24hr in-house staffing of **general surgeons**, EM and critical care and **on-call** of supporting team

Level 3: 24hr in-house **EM**, others on-call

Level 4: 24hr **ED**; **ATLS** and **transfer** to higher level of care

Level 5: ED **not always open** 24hrs. Can do **ATLS**, **transfer** to higher level

Preparing for TRAUMA PT

- **Designated leader** clearly established rules
- **Communication** closed loop, plan clearly conveyed
- **Teamwork**

PRIMARY survey

Airway stridor, gurgling? foreign body, hematoma, fracture?

Interventions: **supplement O₂**, suction, chin lift/jaw thrust, oral/nasal airways, definitive

Breathing patent airway ≠ adequate gas exchange. crepitus, deformity, paradoxical movements?

Interventions: **100% FiO₂**, vent assistance, imaging, ETT positioning

Circulation adequate organ perfusion? Feel pulses, skin temp.

Interventions: **pressure to bleeding site**, volume, foley cath, PIVs, hemodynamic monitoring

Disability abbreviated neuro exam, LOC, "thumbs up, wiggle toes", pupil size/reactivity

Interventions: **consider transfer to higher level neurologic care**

Exposure examine all skin surfaces, logroll

SECONDARY survey AFTER primary survey complete

History allergies, meds, PMH, last meal, events/MoA

Physical exam

Reassess

Labs → CBC, CMP, coags, UTOX, blood alc, blood gas, UA, lactate

Imaging → CXR, pelvic Xray, CT, EFAST

Procedures → peritoneal lavage, laparoscopy, laparotomy

SHOCK

Hypovolemic: reduction in intravascular volume

Cardiogenic: reduced cardiac output

Neurogenic: disruption of autonomic pathways

Distributive: severe vasodilation, septic, anaphylactic

HEMORRHAGIC

Class I: <15% blood loss → monitor

Class II: 15-30% blood loss → possible blood products

Class III: 31-40% blood loss → blood products

Class IV: >40% blood loss → massive transfusion protocol

MANAGEMENT

gas exchange, bleeding, resuscitation, coagulopathy, hypothermia

Blood products: control bleeding, minimize IV fluids, blood products in 1:1:1 ratio

• Indications - ↑ oxygen-carrying capacity, coagulopathy, thrombocytopenia

• Products - packed RBCs, platelets, fresh frozen plasma, cryoprecipitate

consider → Vitamin K, PCC, TXA, factor 7

Massive Transfusion Protocol needed for replacement of:

• at least 1 blood volume (5 liters) in 12-24 hrs

• pts requiring more than 4 units of blood in first hour of resuscitation

• high likelihood of needing >10 units of blood in first 12 hours

Indications: pulse ≥ 120bpm, SBP ≤ 90, penetrating torso injury, +FAST

6-6-1 → 6 RBCs, 6 FFM, 1 "6-pack" of Platelets

• Cryotherapy in rounds 2 and 4

Lethal Triad sequelae of Hemorrhage

① **HYPOTHERMIA** core temp < 35°

Independent predictor of mortality in major trauma

• enhanced fibrinolysis, altered platelet function, inhibition of coagulation factors

Causes: scene, exposure, operating room, effects of anesthesia

② **COAGULOPATHY** dilutional loss from crystalloid fluids

Hypoperfusion → hyperfibrinolysis

• worsened by hypothermia and acidosis

• decreased platelet function

③ **ACIDOSIS** pH < 7.2. Related to tissue injury and shock

• lactemia and hyperchloremia

DAMAGE CONTROL

1. **Hemostatic Resuscitation** - early transfusion, minimize crystalloid, reduce coagulopathy, environment control, manage acidemia

2. **Permissive hypotension** - decrease volume of hemorrhage. Contraindicated in head trauma.

3. **Damage control surgery** - goal to achieve homeostasis and damage control ONLY

Phase 0 - presurgery. Rapid transport and triage

Phase 1 - damage control surgery. Stop hemorrhage, limit contamination, organ perfusion

Phase 2 - resuscitation w/ IV fluids. Warm. Normalize O₂ delivery. Resolve acidosis/coags

Phase 3 - definitive repair. Timing dependent on pt status. May be staged.

Phase 4 - closure. Reconstructive surgery. Delayed until after complete recovery.

Indications: severe physiologic insult, uncontrollable bleeding, hemodynamically unstable

FLAIL CHEST 2+ fractures in 3+ contiguous ribs

Chest wall segment does not have continuity w/ rest of thoracic cage
→ disruption in negative pressure ventilatory mechanics → paradoxical movements
Treatment: oxygen, ventilation, analgesia. Consider mechanical vent.
Definitive = surgical plating

HEMOTHORAX blood in pleural space

Causes: aortic rupture, myocardial rupture, lung parenchymal injury, intercostal injury
minimal: < 350 mL
moderate: 350-1500 mL
massive: > 1500 mL → urgent thoracotomy (or if > 200 mL/hr)
Evaluate w/ CXR or eFAST. Manage w/ large bore chest tube
• factor blood loss into resuscitation efforts

TENSION PNEUMOTHORAX air in pleural space due to lung injury

↑ intrapleural pressure → lung collapse and shifting of intrathoracic viscera →
Cardiovascular collapse due to lack of preload and filling
Causes: positive pressure ventilation in patients w/ visceral pleural injury
Diagnosis: Clinical - hypotension, tachy, tracheal deviation, JVD, absent breath sounds

Needle decompression w/ large bore (18g+) into 2nd ICS at midclavicular line
↳ chest tube follows

PENETRATING NECK INJURIES surgical consult

Zone 1: cricoid cartilage to clavicles (thoracic outlet)

Zone 2: cricoid cartilage to angle of mandible

Zone 3: angle of mandible to base of skull

Management: unstable/hard signs → OR. Stable → imaging
airway compromise → definitive airway

TRACHEOBRONCHIAL INJURIES Penetrating injuries lead to disruption

of larynx or trachea → airway obstruction and/or bleeding into tracheobronchial tree

Air escaping from penetrating neck wound → pathognomonic

• significant air leak despite tube thoracostomy

Management: ASA airway disruption algorithm - use of flexible bronchoscope to guide intubation. Associated w/ high mortality

HEMOPERITONEUM blood in peritoneal cavity due to abdominal trauma

Diagnosed on CT, FAST, exploratory laparoscopy

If unstable → emergent laparotomy

If stable → abdominal CT for more info

Splenic injury most common injured organ in blunt abdominal trauma

FAST → hypoechoic rim around spleen. Fluid in Morison's pouch

If unstable → emergent abdominal exploration. If stable (low-grade injuries) → observation

Hepatic injury

Fast → hypoechoic rim of subscapular fluid, intraperitoneal fluid around liver or in Morison's

If unstable → emergent abdominal exploration. If stable → nonoperative

operative: control hemorrhage. If severe, may require hepatic artery ligation + resection