Trauma Care

- Includes:
  - Rapidly identifying injuries
  - Transporting patients to appropriate trauma center for definitive care
  - Providing scene safety
  - Performing trauma assessment in all cases

Newton's Laws of Motion

- Newton's First Law
  - "A body in motion remains in motion in a straight line unless acted upon by an outside force."
- Newton's Second Law
  - "Acceleration depends on the mass of the object and the force upon it."
- Newton's Third Law
  - "To every action, there is an equal and opposite reaction."

Types of Trauma (1 of 2)

- Blunt injuries
  - Energy exchange between an object and body without breaking skin
- Penetrating injuries
  - External force in which tissue is penetrated by an object

Types of Trauma (2 of 2)

- Deceleration injuries
  - Caused by a sudden stop of body's forward motion
- External force injuries
  - Caused by forces that violate body tissues
  - Injury depends on anatomic area, mass, and velocity of foreign object.

Factors That Might Require Trauma Center (1 of 2)

- Ejection from automobile
- Death in same passenger compartment
- Pedestrian thrown or run over, auto–pedestrian injury greater than 5 mph
- High-speed automobile crash
- Intrusion into passenger compartment of greater than 12”
- Major vehicle deformity greater than 20”

Factors That Might Require Trauma Center (2 of 2)

- Vehicle rollover with unrestrained passenger
- Extrication time greater than 20 minutes
- Falls of greater than 20’
- Motorcycle crash at greater than 20 mph or with separation of rider and bike

Triage

- Doing the greatest good for the greatest number
- Four common triage categories
  - Immediate (red)
  - Delayed (yellow)
  - Minimal (green)
  - Expectant (black)

Types of Triage

- START triage
  - Step 1: Identifies walking wounded
  - Step 2: Assesses nonwalking patients
  - Step 3: Assesses hemodynamic status by checking radial pulse
  - Step 4: Assesses neurologic status
- JumpSTART triage
  - Modifies process for pediatric patients under 8 years or weighing less than 100 lb

Trauma Scoring Systems (1 of 6)

- Glasgow Coma Scale (GCS)
  - Assesses level of consciousness: eye opening, verbal response, motor response
- Trauma score
  - Predicts likelihood of patient survival
  - Score ranges 1–16
  - Includes GCS
  - Not useful with severe head injuries

Trauma Scoring Systems (2 of 6)

GLASGOW COMA SCALE		
Eye Opening		
Spontaneous	4	
To voice	3	
To pain	2	
None	1	
Verbal Response		
Oriented	5	
Confused	4	
Inappropriate words	3	
Incomprehensible sounds	2	
None	1	
Motor Response		
Obeys command	6	
Localizes pain	5	
Withdraws (pain)	4	
Flexion (pain)	3	
Extension (pain)	2	
None	1	
Glasgow Coma Scale Maximum Score	**Total**	**15**
Glasgow Coma Scale Minimum Score	**Total**	**3**

Trauma Scoring Systems (3 of 6)

- Revised trauma score
  - Most commonly used scoring system to determine severity of injury
  - Measures respiratory rate, systolic blood pressure, GCS score
- Abbreviated Injury Scale (AIS)
  - Ranks severity of injury by reviewing six body regions

Trauma Scoring Systems (4 of 6)

TABLE 10-1 Components of the Revised Trauma Score

Revised Trauma Score	Components
4	GCS: 13-15 Systolic blood pressure: > 89 mm Hg Respiratory rate: 10-29 breaths/min
3	GCS: 9-12 Systolic blood pressure: 76-89 mm Hg Respiratory rate: > 29 breaths/min
2	GCS: 6-8 Systolic blood pressure: 50-75 mm Hg Respiratory rate: 6-9 breaths/min
1	GCS: 4-5 Systolic blood pressure: 1-49 mm Hg Respiratory rate: 1-5 breaths/min
0	GCS: 3 Systolic blood pressure: 0 mm Hg Respiratory rate: 0 breaths/min

Abbreviation: GCS, Glasgow Coma Scale.

Reproduced from Revised Trauma Score. © Trauma.org

Trauma Scoring Systems (5 of 6)

- Injury Severity Score (ISS)
  - Provides overall score for patients with multiple injuries
  - Incorporates AIS score
- Trauma injury severity score
  - Calculates survival probability of critically ill or injured patient
  - Not commonly used in transport setting

Levels of Trauma Care (1 of 2)

- Level I: Provides every aspect of trauma care from prevention through rehabilitation
- Level II: Provides initial definitive care
- Level III: Provides assessment, resuscitation, emergency care, stabilization
- Level IV: Provides advanced trauma life support prior to transfer

Levels of Trauma Care (2 of 2)

TABLE 10-3 American College of Surgeons Recommendations for a Level II Patient	
Patient characteristic/condition indicators	1. Glasgow Coma Scale score of < 14 when associated with trauma 2. Respiratory rate of < 10 or > 29 breaths/min (< 20 breaths/min in an infant younger than 1 year) when associated with trauma 3. Penetrating wounds (other than gunshot wounds) to the head, neck, torso, and extremities proximal to the elbow and knee 4. Flail chest 5. Combination of trauma with burns 6. Two or more proximal long bone fractures 7. Pelvic fractures 8. Limb paralysis and/or spinal cord injury 9. Amputation proximal to the wrist and/or ankle
Mechanism of injury indicators	1. High-speed automobile crash • Initial speed > 40 mph • Major automobile deformity • Intrusion into the passenger compartment 2. Ejection from the automobile 3. Death in same passenger compartment 4. Extrication time > 20 minutes 5. Falls > 20′ or significant falls in children or elderly 6. Automobile rollover 7. Automobile vs pedestrian or automobile vs bicycle impact > 5 mph 8. All-terrain vehicle or motorcycle crash > 20 mph or separation of rider from vehicle
Consider Level II classification with these preexisting conditions	1. Age younger than 5 years or older than 55 years 2. Cardiac or respiratory disease 3. Insulin-dependent diabetes mellitus, cirrhosis of the liver, or morbid obesity 4. Pregnancy 5. Immunosuppressed patients 6. Patients with a bleeding disorder or receiving anticoagulants

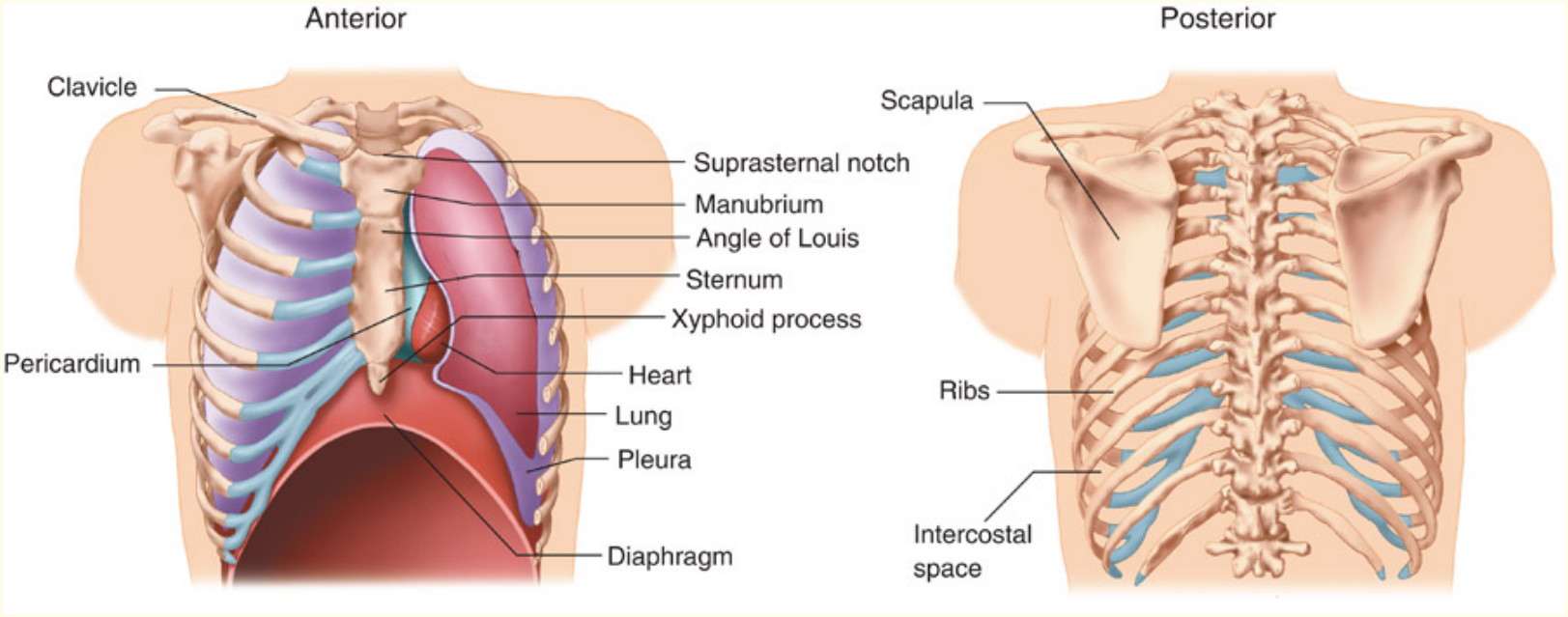
General Trauma Management

- Involves patients who are very ill and in need of close assessment
- Immediate attention directed at the ABCs
  - Assess placement of the endotracheal tube, presence of breath sounds, capnography waveform
  - Assess cardiovascular status

Effects of Hypothermia on Trauma Patients

TABLE 10-4 Effects of Hypothermia on Trauma Patients
Impaired cardiorespiratory function
Cardiac depression
Myocardial ischemia
Arrhythmias
Peripheral vasoconstriction
Impaired tissue oxygen delivery
Elevated oxygen consumption during rewarming
Blunted response to catecholamines
Increased blood viscosity
Metabolic acidosis
Bleeding diathesis
Decreased kinetics of coagulation factors
Reduced platelet function
Reduced clearance of drugs
Decreased hepatic blood flow
Decreased hepatic metabolism
Decreased renal blood flow
Increased risk of infection
Decreased white blood cell number and function
Impaired cellular immune response
Wound infection
• Thermoregulatory vasoconstriction
• Decreased subcutaneous oxygen tension
• Impaired oxidative killing by neutrophils
• Decreased collagen deposition
Pneumonia
Sepsis
Insulin resistance with hyperglycemia
Adapted from: Smith CE. Prevention and treatment of hypothermia in trauma patients. TraumaCare International ITACCS. Available at: http://www.itaccs.com/traumacare/archive/04_01_Spring_2004/prevention.pdf. Accessed April 23, 2009.

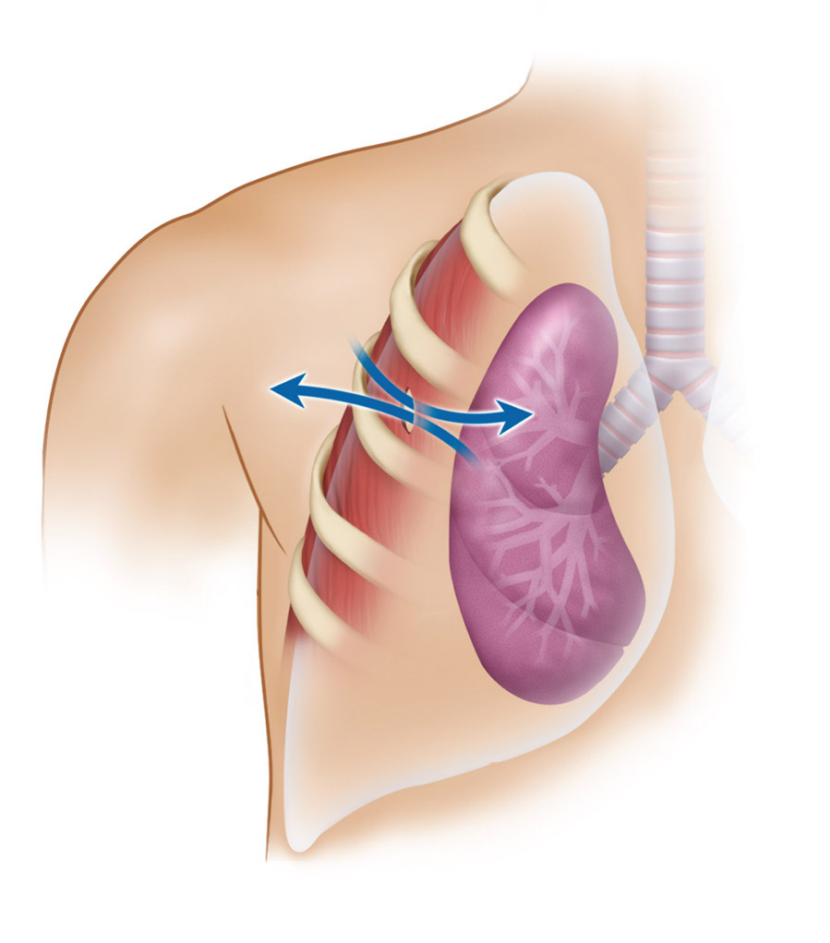
Anatomy of Thorax



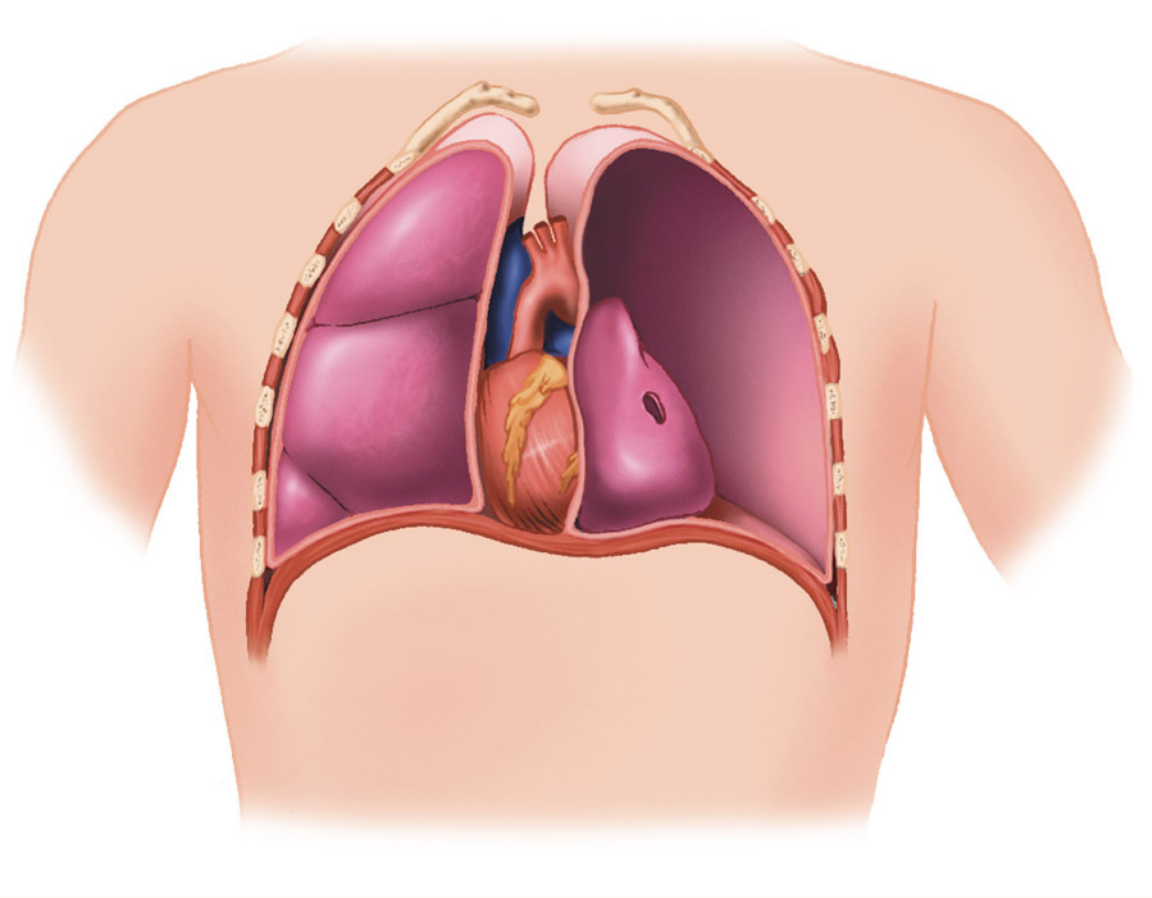
Types of Pneumothorax

- Open pneumothorax
  - Signs: “sucking chest wound,” dyspnea, tachypnea
- Simple pneumothorax
  - Often associated with closed chest injury
- Tension pneumothorax
  - Life-threatening, results from continual influx of air into pleural space

Open Pneumothorax



Tension Pneumothorax



Skill Drill 10-1: Managing an Open Pneumothorax (1 of 2)

Maintain an open airway and administer high-flow oxygen.

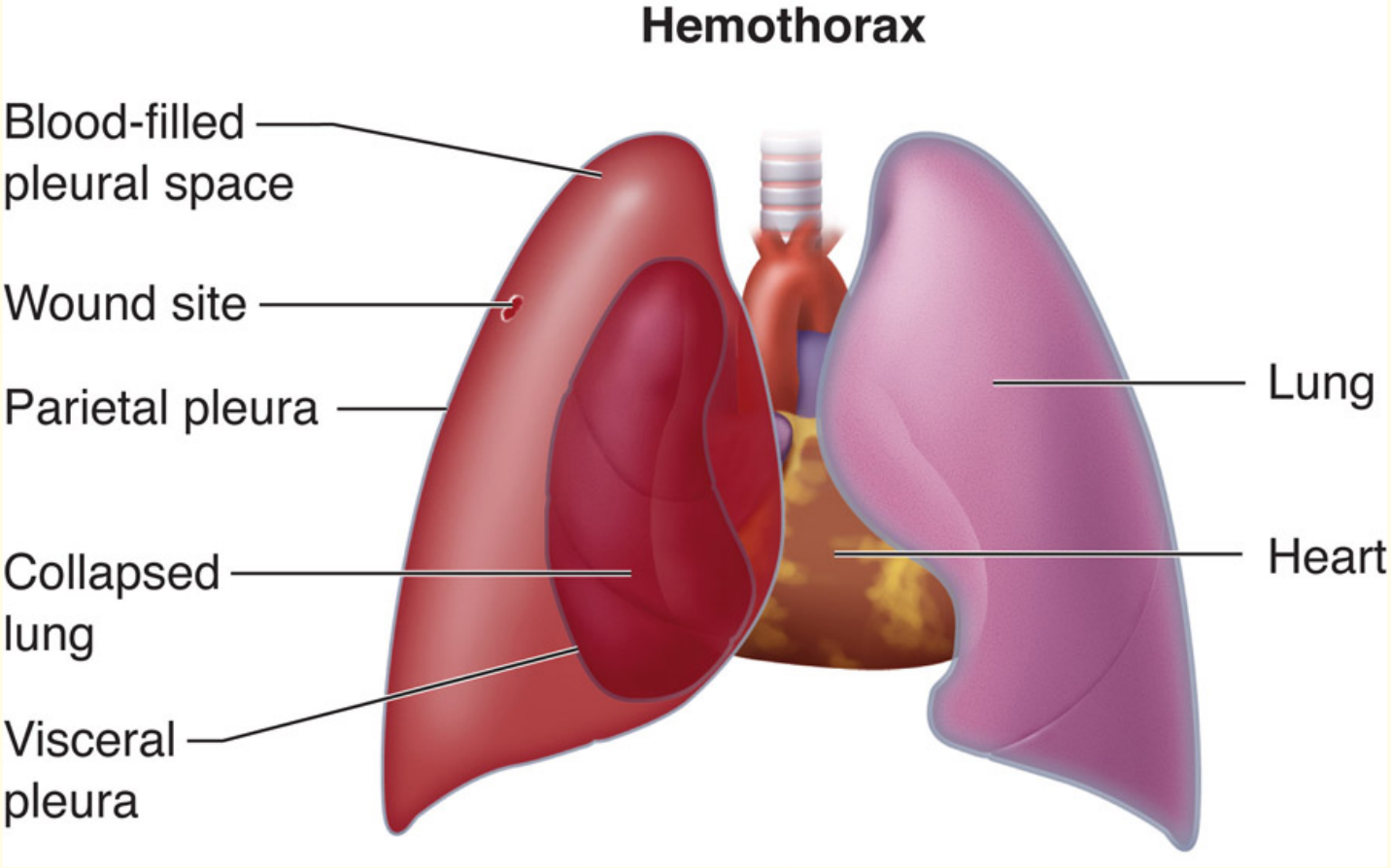
Immediately close the chest wound, initially with a gloved hand.

Apply an occlusive dressing, taped down on three sides.

Hemothorax (1 of 2)

- Blood in pleural space
- Causes
  - Hypovolemic shock
  - Harms lung function
- Caused by:
  - Penetrating and blunt trauma
  - Tumor

Hemothorax (2 of 2)



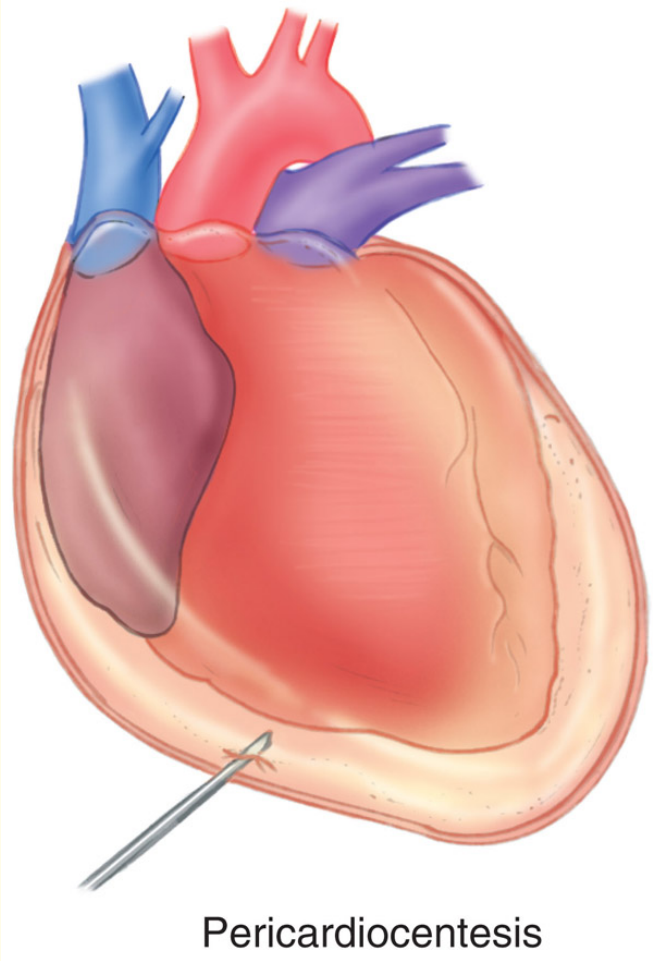
Chest Tube Insertion (1 of 2)

- Used to remove air, fluid, pus from pleural cavity
- Indicated for treatment of:
  - Pneumothorax, hemopneumothorax, empyema

Other Forms of Thoracic Trauma (1 of 5)

- Flail chest
  - Fracture in two or more places to two or more adjacent ribs; may initially go undetected
- Pericardial tamponade
  - Abundance of blood, fluid in pericardium; life-threatening; Beck's triad indicator; requires emergency pericardiocentesis

Other Forms of Thoracic Trauma (2 of 5)



Pericardiocentesis

Other Forms of Thoracic Trauma (3 of 5)

- Aortic dissection/transaction
  - Aortic rupture; most common cause of immediate death in MVCs
- Myocardial contusion
  - Caused by blunt chest trauma; signs similar to acute MI
- Diaphragmatic rupture
  - Caused by both blunt and penetrating trauma

Other Forms of Thoracic Trauma (4 of 5)

- Tracheobronchial disruption
  - Rare, life-threatening; can occur anywhere along tracheobronchial tree
- Pulmonary contusion
  - Tearing, lacerations to lungs can cause bleeding, plasma leakage into alveoli and interstitial spaces

Other Forms of Thoracic Trauma (5 of 5)

- Esophageal perforation
  - Usually caused by penetrating injuries like projectiles
- Traumatic asphyxia
  - Severe, sudden crushing injury to chest and abdomen
  - Not a form of asphyxia, but patient's head and neck turn cyanotic

Ear Injuries

- External ear injury
  - Local injury, no acute systemic implications
  - Perform halo test if fluid, blood leaking from auditory canal
- Ruptured tympanic membrane
  - Overpressure injury or failure to equalize middle ear pressure
  - Most heal spontaneously

Eye Injuries (1 of 2)

- Eyelid lacerations
  - Apply direct pressure; do not to push on globe; consider concomitant eye injuries
- Conjunctival and corneal injuries
  - Prevent eye and implanted object from moving during transport; patch unaffected eye
- Hyphema
  - Requires full ophthalmologic examination

Eye Injuries (2 of 2)

- Ocular globe rupture
  - Protect affected eye with rigid eye shield or cup
- Ocular avulsion
  - Protect affected eye with rigid eye shield or cup
- Traumatic retinal detachment
  - Avoid pressure to globe; protect eye with shield

Other Forms of Facial Trauma

- Mandibular fracture and dislocation
  - Provide for emergency airway during transfers when patient's jaw is wired shut
- Dental avulsion
  - Reimplantation possible if done within an hour
  - Follow ADA guidelines for transporting tooth

Neck Injuries

- Laryngotracheal injuries
  - Uncommon; provide airway management with careful endotracheal intubation
- Thyroid injuries
  - Consider thyrotoxicosis, prepare to manage
- Vascular neck injuries
  - Exsanguination, hematoma, air embolization

Abdominal Trauma (1 of 2)

- Difficult to recognize
- May cause life-threatening hemorrhage, serious organ damage
  - Grey-Turner's sign, Cullen's sign
- Requires assessment pretransport to determine blood loss
  - Inspect, auscultate, palpate

Abdominal Trauma (2 of 2)

- Signs and symptoms
  - Altered mental status
  - Tachycardia
  - Absence of palpable pulses
  - Pale, moist, and mottled skin
  - Poor peripheral perfusion
  - Hypotension

Hollow vs Solid Organs

- Hollow organs
  - Leak contents when injured (peritonitis)
  - Include stomach, intestines, gallbladder, urinary bladder, ureters, uterus, great vessels
- Solid organs
  - Bleed when injured
  - Include liver, spleen, pancreas, kidneys

Hollow vs Solid Organ Injury (1 of 3)

- Spleen
  - Most commonly injured abdominal organ; highly vascular; Kehr's sign
- Liver
  - Largest, most vascular organ; Kehr's sign
- Large and small intestines
  - Penetrating trauma most common; seatbelt injury from blunt trauma

Hollow vs Solid Organ Injury (2 of 3)

- Stomach
  - Damage from trauma rare
- Duodenum
  - Well-protected; may not produce symptoms of injury
- Jejunum and ileum
  - Frequently injured by gunshot and stab wounds

Hollow vs Solid Organ Injury (3 of 3)

- Vascular injuries
  - Usually life-threatening when a major vessel is injured
  - Vessels include: aorta, inferior vena cava, renal artery, mesenteric artery, iliac artery
  - Transfer immediately to trauma center for surgery

Pelvic Trauma

- Results from significant force
  - May involve additional injuries
- Can lead to catastrophic hemorrhage
- Includes open-book fracture
  - Pelvis separated at symphysis pubis

Extremity Trauma

- Rarely life threatening
- Include fractures, sprains, strains, dislocations, muscular contusions, compartment and crush syndromes
- Possible indicator of amount of energy transferred to body
- Assess for six Ps:
  - Pain, pallor, pulselessness, paresthesia, paralysis, pressure

Fractures

- Closed: Skin remains intact, less chance of infection
- Open: Skin over bone broken; infection possible
- Signs and symptoms: pain, swelling, deformity, rigidity, shortening, ecchymosis
- Management: Maintain airway, assess and reassess pulses, splint in anatomic position

Femur Fracture

- Largest bone in the body
- The slack muscle can provide a large space for the collection of blood.
- Contraindications
  - Hip and pelvic fractures
  - Knee injury
  - Ankle damage

Vertebral Fracture

- Trauma is the leading cause of injury.
- Can result in permanent devastating neurologic deficits
- Mechanism of injury includes:
  - Flexion
  - Flexion with rotation
  - Extension
  - Compression

Cervical Fracture

- Most devastating vertebral fractures occur in the seven cervical vertebrae
  - Control of the entire body descends here.
- May compromise respiratory effort

Thoracic Fracture

- Can lead to a loss of innervation of the intercostals muscles, leading to respiratory insufficiency
- “Spinal shock” can affect the thoracic area or higher.

Lumbar Spine Fracture

- Largest vertebrae
- Unsupported, so prone to injury
- Jackknifing injuries are the most common.

Humerus Fracture

- Vascular long bone
- May lose up to 750 mL of blood
- Mark the location of pulses that are found prior to transport with a skin marker.

Rib and Nasal Fractures

- Rib fracture
  - Rarely life threatening
  - May cause pneumothorax
  - Torn intercostal arteries can lead to significant blood loss or hemothorax.
- Nasal fracture
  - Cause concern for patency of the airway

Other Types of Extremity Trauma (1 of 2)

- Dislocations
  - Assume fracture also involved, consider emergency due to potential for neurovascular compromise
- Subluxations
  - Graded from I (sprain) to IV (dislocation)
- Amputation
  - Can be life threatening; locate missing part and transport

Other Types of Extremity Trauma (2 of 2)

- Compartment syndrome
  - Caused by burns, external compression, crushing injury; affects any extremity and buttocks; develops over period of hours
- Crush injury and rhabdomyolysis
  - Damage to sarcolemma from any cause resulting in influx of calcium and sodium; known as the smiling death

Management Techniques for Extremity Trauma

- Splinting
- Casting
- Reduction/realignment
- External fixation
- Internal fixation

Geriatric Trauma Considerations

- Presence of dentures, dental devices
- Kyphosis
- Reduced cough reflex
- Fragile nasal tissues
- Reduced vital capacity and tidal volume
- Capillary refill delays
- Medications, pacemakers
- Preexisting hypertension

Trauma During Pregnancy Considerations

- Maternal shock and death are the main causes of fetal demise.
- Pregnancy-related changes can mimic shock.
- Massive blood loss risk considerably increased with trauma to bony pelvis
- Abruptio placenta causes 70% fetal demise in blunt trauma

Flight Considerations

- Patients with severe trauma:
  - Are more likely to be transported by air instead of by ground
  - May not have time to wait for ground transport

Questions?