Chapter 26
Thoracic Trauma

Objectives

- Discuss epidemiology and mechanism of injury of thoracic trauma
- Describe mechanism of injury, signs and symptoms, and management of:
  - Skeletal injuries to the chest
  - Pulmonary trauma
  - Injuries to the heart and great vessels
  - Esophageal and tracheobronchial injury and diaphragmatic rupture

Scenario

Your frightened 20-year-old male patient was shot in the chest. A pool of blood encircles his torso, and blood and air bubble out of a small wound to the right of his fourth rib. You place a gloved hand over the wound and call for an occlusive dressing as you continue your assessment. He is anxious, tachypneic and has a very rapid, weak radial pulse. The occlusive dressing and oxygen are applied, and the patient is secured to a spine board. As you load him into the ambulance, the patient has increasing shortness of breath and an increased heart rate. You secure the cot and continue your care en route to the trauma center.
Discussion

- What additional assessments are critical for this patient?
- Describe your treatment priorities in this situation
- List internal structures at risk for injury in this situation
- Discuss the significance of his new signs and symptoms

Chest Injuries

- 16,000 deaths per year

Classifications:
- Skeletal injury
- Pulmonary injury
- Heart and great vessel injury
- Diaphragmatic injury

Mechanism of Injury

- Blunt thoracic injuries
  - Forces distributed over large area

- Penetrating thoracic injuries
  - Forces distributed over small area
  - Organs injured usually those that lie along path of penetrating object
The Thorax

- Skin

- Bones
  - Thoracic cage
  - Sternum
  - Thoracic spine

- Muscles

Anatomy

- Lungs
  - Parenchyma
  - Alveoli
  - Alveolar-capillary interface

- Pleura
  - Visceral
  - Parietal
  - Serous fluid

- Lobes

Vessels

- Arteries
  - Aorta
  - Carotid
  - Subclavian
  - Intercostal
  - Innominate
  - Internal mammary
  - Pulmonary

- Veins
  - Superior vena cava
  - Inferior vena cava
  - Subclavian
  - Internal jugular
  - Pulmonary
Anatomy

- Heart
- Esophagus
  - Thoracic inlet
  - Esophageal foramen through diaphragm
- Mediastinum

Ventilation

- Mechanical process moving air into and out of lungs
  - Bellows system
- Musculoskeletal structure
  - Intercostal muscles
  - Diaphragm
  - Accessory muscles
  - Changes in intrathoracic pressure

Respiration

- Exchange of oxygen and carbon dioxide between atmosphere and cells
- Neurochemical control
- Gas exchange
  - Alveolar-capillary interface
  - Capillary-cellular interface
- Pulmonary circulation
- Cardiac circulation
Respiration

Clavicular Fractures
- Clavicle most frequently fractured bone
- Common in kids
- Pain, tenderness, deformity
- Sling and swathe

Rib Fractures
- Often ribs 3 to 8
- Simple fx painful not life threatening
- Atelectasis from splinting
- Analgesics
- Assess for underlying injuries

Fracture of left clavicle seen from above left shoulder

Chest wall asymmetry caused by rib fractures
Flail Chest
- 2 or more adjacent rib fractures in ≥2 places
- May be paradoxical chest movement
- Pulmonary contusion
- Oxygenate
- If respiratory failure assist ventilations
- PEEP
Flail Chest During Expiration

Sternal Fractures
- Uncommon
- Very painful
- May be unstable chest wall, heart injury, cardiac tamponade
- Oxygenate
- Assess underlying injuries

Pulmonary Injury
- Closed pneumothorax
- Tension pneumothorax
- Open pneumothorax
- Hemothorax
- Pulmonary contusion
- Traumatic asphyxia
Closed (Simple) Pneumothorax

- Air in pleural space
- Part or total lung collapse
  - Rib fx
  - Paper bag effect
- Chest pain, dyspnea, tachypnea
- Oxygen, ventilate

Open Pneumothorax (Sucking Chest Wound)

- Disrupts air flow
- Dyspnea, pain, sucking sound
- Seal on three sides
- Oxygenate
- Ventilate

Open Pneumothorax

Air enters pleural cavity during inspiration; air exits pleural cavity during expiration
Open Pneumothorax

- Sealing a chest wound

Tension Pneumothorax

- Air trapped in pleural space
  - Anxiety, cyanosis
  - Dyspnea increases
  - Tracheal deviation
  - Hypotension, tachycardia
  - Distended neck veins
  - Unequal chest expansion
  - Subcutaneous emphysema

May occur after open pneumothorax is sealed with occlusive dressing

- Momentarily remove dressing:
  - Air escapes with audible release of air
  - After release of pressure, reseal wound

- Relieve through thoracic decompression with:
  - Large-bore needle or
  - Commercially available thoracic decompression kit
**Needle Decompression**

- Insert hollow needle or catheter into affected pleural space
- After needle insertion, note audible rush of air as pressure escapes
- Secure catheter and prevent reentry of air into pleural space
- Monitor patient’s respiratory status

**Hemothorax**

- Blood in pleural space
  - May be 2 L blood loss
- Hypovolemia
- Hypoxemia
- Oxygenate
- Fluid resuscitate
Hemopneumothorax
- Pneumothorax with bleeding in pleural space
- Findings: Same as with hemothorax
- Management: Same as for hemothorax

Pulmonary Contusion
- Rapid deceleration forces
- Alveoli rupture
  - Hemorrhage
  - Interstitial edema
- Oxygenate
- Ventilate if needed
- Tachypnea
- Tachycardia
- Cough
- Hemoptysis
- Apprehension
- Dyspnea
- Cyanosis
- Blunt chest trauma

Traumatic Asphyxia
- Severe crush to chest, abdomen
- Increased intrathoracic pressure
- Facial discoloration
- JVD
- Conjunctival hemorrhage
- Manage airway, breathing
**Myocardial Contusion (Blunt Myocardial Injury)**

- Often MVC
- Sternal or rib fx common
- May have chest pain
- Dysrhythmias, palpitations, murmur
- Oxygenate, monitor ECG
  - Treat rhythm disturbance

**Pericardial Tamponade**

- Blood leakage into pericardial space
- Heart cannot refill
  - Decreased stroke volume, cardiac output
- Beck’s triad
  - Elevated CVP (JVD)
  - Muffled Heart sounds
  - Hypotension

**Pericardial Tamponade**

- Other
  - Tachycardia
  - Dyspnea
  - Narrow pulse pressure
  - Upper body cyanosis
  - ECG changes
- Pericardiocentesis
Myocardial Rupture

- Heart muscle ruptures
- Usually immediate death
- MVC common cause
- Signs and symptoms
  - CHF, cardiac tamponade
- Supportive care

Traumatic Aortic Rupture

- Shearing forces
- Most die at scene
- Hypertensive upper extremities
- Decreased femoral pulse
- Systolic murmur
- Paraplegia
- Rapid transport

Penetrating Great Vessel Wounds

- Injuries to chest, abdomen, neck
- Associated with hemothorax, shock, cardiac tamponade, hematomas
- Airway and ventilation support
- Fluid therapy
- Transport to appropriate hospital
**Esophageal Injuries**

- Usually penetrating trauma
- Pain, fever, hoarseness, dysphagia, respiratory distress, shock
- Esophageal perforation—cervical
  - Tenderness, SQ emphysema, mediastinitis


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**Tracheobronchial Injuries**

- Rare but high mortality
- Airway, ventilatory, circulatory support
- Rapid transport
- Hypoxia
- Tachypnea
- Tachycardia
- SQ emphysema
- Dyspnea
- Hemoptysis


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**Diaphragmatic Rupture**

- Abdominal pain
- Shortness of breath
- Rapid abdominal compression
- Often on left
- Abdomen flat
- Bowel sounds in chest
- Positive-pressure ventilation may worsen condition

Conclusion

Chest injuries are directly responsible for more than 20% of all traumatic deaths (regardless of mechanism) and account for about 16,000 deaths per year in the United States. The risk of death can be reduced by early recognition of serious signs and symptoms and rapid transport to a trauma center.

Questions?