Session Number 219

A BLUNT REVIEW OF THE PENETRATING ISSUES IN CHEST TRAUMA

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Content Description

This presentation is a review of Chest Trauma. This includes a review of the assessment, diagnosis and management of patients incurring blunt and penetrating trauma.

Learning Objectives
At the end of this session, the participant will be able to:

1. Discuss the physiologic affects of chest trauma
2. Identify the potential injuries sustained from blunt and penetrating chest trauma
3. Describe the nursing management of the patient with chest trauma

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References


Martin, M., Satterly, S., Inaba, K., & Blair, K. (2012). Does needle thoracostomy provide adequate and effective decompression of tension pneumothorax?. *Journal of Trauma and Acute Care Surgery*, 73, 1412-1417.


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A Blunt Review of the Penetrating Issues of Chest Trauma

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Trauma

- 5th leading cause of death overall
- Major cause of death and disability ages 16 to 44 years of age
- Often associated with drugs and alcohol
- Financial implications
  - Treatment
  - Rehabilitation
  - Disability

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Chest Trauma

- Trauma accounts for 20-25% of thoracic injuries
- Approximately 50% of trauma deaths are related to chest trauma
- Management of chest trauma dates back to Egyptians
- Literature review notes Homer describing chest injuries in the Iliad
- Romans treated chest injuries with ‘metal tubes’
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Chest Trauma: Advances in the Military

- World War I: Penetrating wounds had 60% mortality
- WWII: Advances in anesthesia, bronchoscopy, blood transfusions, & antibiotics
- Korean War: Standardization of Care
- Vietnam War: Decreased mortality r/t empyema, first description of ARDS and prolonged ventilatory support

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Levels of Trauma Care

- Level I—regional resource, state-of-the-science care, education, outreach, & research
- Level II—provides care for trauma patients and transfers to level I if needed
- Level III—community hospital where no level I or II exist
- Level IV—provides advanced trauma life support (ATLS) and transfer

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Prevention

- Primary prevention—prevent the event
  - Driving safety classes
  - Speed limits
  - Campaigns to not drink and drive
- Secondary prevention—minimize the impact of the traumatic event
  - Seatbelt use
  - Airbags
  - Car seats
  - Inflators
- Tertiary prevention—maximize patient outcomes after a traumatic event through emergency response systems, medical care, & rehabilitation
Mechanisms of Injury

- Knowledge helps to identify potential problems
- Uncontrolled source of energy
  - Kinetic, thermal, chemical, electrical, and radiation

Pre-hospital Care/Transport

- Emergency stabilization and quick transport
- ABCs (with cervical stabilization)
- IV access and fluid administration
- Control hemorrhaging
- Stabilize fractures

Chest Anatomy Overview

- Pleura
- Visceral Pleura
- Parietal Pleura
- Pleural Space
- Pleural Fluid
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Primary Survey

- Done in 1 to 2 minutes
  - Airway patency (with C-spine immobile)
  - Breathing effectiveness
  - Circulation, including hemorrhage and pulses
  - Disability (overview of neurological status)
- Identify life-threatening injuries accurately to establish priorities

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Secondary Survey

- Performed after life-threatening injuries are identified and treated
- Examination of all body systems: head-to-toe and front-to-back
- Maintain C-spine immobilization until cleared by x-ray
- X-ray studies (as determined by injury)
- Laboratory studies

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Diagnostic Studies

- STAT CXR
- Cat Scan
- MRI
- Aortography
- ECG
- Bronchoscopy
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Maintain Airway Patency

- Many factors affect the airway (e.g., facial fractures, bleeding, vomiting, decreased sensorium)
- Nasopharyngeal airways: used in spontaneously breathing patients
- Endotracheal intubation often required

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Ineffective Breathing

- Ongoing assessment is essential
  - Respiratory status
  - Arterial blood gases (ABG)
  - Chest x-rays
  - Computed tomography (CT) imaging
- Improve ventilation and gas exchange

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Ineffective Breathing (continued)

- Specific interventions:
  - Mechanical ventilation
  - Needle thoracotomy and chest tube insertion
  - Administration of fluids and blood products
  - Administration of sedation and analgesics
Impaired Gas Exchange

- Causes
  - Decrease in inspired air
  - Retained secretions
  - Lung collapse or compressed
  - Atelectasis
  - Accumulation of blood

Motor Vehicle Blunt Trauma

Blunt Chest Trauma

- Common causes:
  - Vehicular trauma
  - Explosions (IEDs in the military)
  - Assault with blunt objects
  - Falls
  - Sports

- Severity depends on kinetic energy dissipated to the body
Blunt Chest Trauma

- Injury from blunt trauma can be related to:
  - Acceleration
  - Deceleration
  - Shearing
  - Crushing
  - Compression

Pulmonary Contusion

- Most common internal injury after involvement in blunt trauma
- Results from direct compression and shearing forces
- Results in increased inflammation
- Often not seen on initial CXR

Pulmonary Contusion

- Bruising of lung tissue
- Can have associated rib fractures and flail chest
- Often results in pneumonia and acute respiratory distress syndrome (ARDS)
- May require long-term ventilatory support
- Pain relief
- Can become worse from excessive fluid resuscitation (CVP monitoring)
Fractures: Sternum & Ribs

- Seriousness varies; treatment also varies
- May result in flail chest
  - Paradoxical respirations result
- Treated with intubation, ventilation, and pain management
- May cause injury to the lung, causing pneumothorax or hemothorax

Flail Chest

- Three or more adjacent ribs fracture in more than one location
- Flail segment "floats" freely
- Paradoxical chest movement
- Treat with intubation, mechanical ventilation, pulmonary care, and pain management

Flail Chest

THE MECHANISM OF A FLAIL CHEST
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Physical Exam
- Chest wall symmetry
- Skin for color, temp & integrity
- Bilateral breath sounds
- Presence of subcutaneous emphysema
- Tracheal deviation
- JVD

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Pneumothorax
- Normal pressure in the lungs is greater than pressure in the pleural space. If air enters this space and the pressure becomes greater, then the lung will collapse.
- Collapse can be partial or complete
- Partial < 25% can be monitored
- Partial > 25% insertion of a chest tube

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Tension Pneumothorax
- Life-threatening
- Increased intrapleural and intrathoracic pressures cause compression of heart and great vessels
- Cardiovascular collapse
- Emergent treatment with needle thoracostomy
- Chest tube insertion
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Tension Pneumothorax

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Hemothorax
- Blood in pleural space
- Likely result of multiple rib fractures
- Chest tube insertion necessary
- May require immediate surgery

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Chest Tube Management
- Maintain appropriate suction setting
- Keep tubing free of kinks & secure all connections
- Observe for an air leak: bubbling in the water seal chamber
- Monitor & document quantity and color of output
- Chest tube output > 250 cc/hour for 3 consecutive hours is indication for surgery
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**Cardiac Contusion**

- Mild: causing cardiac dysrhythmias
- Moderate: interruption of cardiac valvular mechanisms
- Severe: cardiac rupture; shearing of cardiac vessels
- S/S can include:
  - dysrhythmia
  - chest pain
  - dyspnea
  - shock

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**Cardiac Tamponade**

- Bleeding into pericardial space
- Impairs pumping ability of heart
- May be difficult to diagnose
- Beck's triad
  - Hypotension
  - Muffled heart sounds
  - Elevated venous pressure

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**Cardiac Tamponade**

- Suspect in patient with symptoms of decreased cardiac output who does not respond to treatment
- Treated by pericardiocentesis
Commotio Cordis
- Sudden cardiac death
  - Healthy individual
  - Blunt force trauma directly to the chest (sports)
  - Direct chest force just before the T-wave, causing fatal ventricular fibrillation

Aortic Disruption
- Life-threatening injury requiring emergency surgical intervention
- Symptoms include weak pulses, pain, and hoarseness
- Chest x-ray shows widened mediastinum
- Confirmed by aortogram
- Results from shearing injury to aorta
- Can be repaired with endovascular stent grafts

Penetrating Trauma
- Impalement of foreign objects into the body
- Injuries depend on body part(s) involved and on the trajectory of the impaled (or sharp) object or bullet
- Stab wounds are low velocity injuries
- Gunshot wounds are high velocity injuries
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**Stab Wound**

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**Gunshot wound to Chest**

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**Injuries with Penetrating Chest Trauma**
- Wounds of the lung, heart and great vessels
- Damage to the trachea or large airways
- Thoracoabdominal injuries including: esophageal, diaphragmatic or aortic
- Hemothorax, hemopneumothorax
- Open sucking chest wound
Open Pneumothorax

- Air (pneumo) in pleural space
- Chest tube insertion needed
- Three-side occlusive dressing
  - Allow small amount of air to escape from occlusive dressing

Management of the Chest Trauma Patient can be a Shock

Hypovolemia

- Hypovolemic shock: Acute blood loss
  - External hemorrhage
  - Internal hemorrhage
- Ongoing assessment of vital signs, urine output, mental status, and hemodynamic parameters
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Treatment of Hypovolemia

- Stop bleeding
- Venous access—a large-bore IV; central line may be needed
- Administration of crystalloids and blood products
  - Ringer's lactate fluid of choice
  - Blood administration based on response to initial fluid resuscitation and laboratory values
  - Autotransfusion an option

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Response to Treatment

- Rapid responders
- Transient responders
  - Patient is still bleeding; surgery needed
- Minimal or no responders
  - Emergent surgical intervention needed to stop bleeding

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Ongoing S/S of Shock

- Falling hematocrit
- Falling PaO₂
- Decreasing urine output
- Increased serum lactate levels
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Massive Fluid Resuscitation

- Administration greater than 10 units of packed red blood cells (RBCs) in 24 hours
- Or replacement of patient’s total blood volume in 24 hours
- Restore oxygen transport to tissues
- Stop progress of shock
- Prevent complications

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Complications of Massive Fluid Resuscitation

- Acid-base abnormalities, metabolic acidosis
- Fluid-electrolyte imbalances
- Hypothermia
- Coagulopathies
- Organ dysfunction
- Volume overload
- Worsening of a pulmonary contusion

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ARDS

- Dyspnea, severe hypoxemia, decreased lung compliance, and infiltrates
- Identify patients at risk: flail chest, pulmonary contusion, prolonged hypovolemia, massive fluid resuscitation, aspiration, sepsis, burns, DIC, and shock
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ARDS (continued)
- Observe serial chest x-ray studies for infiltrates
- Treat underlying cause
- Maximize oxygen delivery
- Patient will require mechanical ventilation
- Fluid therapy often guided by hemodynamic monitoring

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Deep Vein Thrombosis (DVT)
- Complication of traumatic injury
- Assess risk factors
- Diagnosis:
  - Doppler flow studies
  - Duplex scanning

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Deep Venous Thrombosis (DVT)
- DVT prophylaxis
  - Early ambulation
  - Compression devices
  - Low-dose anticoagulant
  - Filter in inferior vena cava
Pulmonary Embolism
- Complication of a DVT
- New onset of dyspnea with:
  - Hemoptysis
  - Pleuritic pain
  - Fever
  - Changes in cerebral and tissue perfusion

- ABG results
- Hypoxemia
- Hypocapnia
- Alkalotic pH
- Tachycardia
- Electrocadiogram (ECG) changes
- Chest x-ray
- V/Q lung scan
- Pulmonary angiogram ("gold standard")

- Positioning of patient
- Supplemental oxygen
- Pain management
- Mechanical ventilation
- Anticoagulant or thrombolytic therapy
Infection

- Trauma predisposes patients to a wide variety of infections
  - Nosocomial pneumonia
  - Pulmonary infection
  - Catheter sepsis
  - Sinusitis
  - Wounds

Critical to Recovery

- Appropriate pain control throughout the continuum of care
- Emotional support for the patient and significant others
- Plan for post acute care
  - Rehab
  - Homecare
  - Outpatient PT/OT