Thoracic Trauma

A PowerPage Presented By

Vehicular trauma is a commonly presenting emergency situation, especially in more heavily populated areas. Injuries can range from minor to life-threatening depending on the location, force and speed of impact. This PowerPage will focus primarily on thoracic trauma which occurs in 40-60% of all vehicular trauma patients.

Key Points

- **Pneumothorax and pulmonary contusions** most common
- Diaphragmatic hernia and rib fractures/flail segment also possible but less common
- Clinical signs will vary depending on the nature and severity of the injury
- **Supplemental oxygen**, analgesia almost always indicated during initial stabilization
- **Thoracocentesis** most important intervention for pneumothorax

Pathophysiology

Pneumothorax

- Blunt force trauma and increased intrathoracic pressure against a **closed glottis** resulting in alveolar rupture and accumulation of air in the pleural space
  - **Tension pneumothorax** - one-way valve allows air into pleural space with no means of escape
- Pneumothorax leads to progressive collapse of the lungs - **hypoventilation and hypoxemia**
- With severe pneumothorax can have collapse of the vena cava leading to decreased venous return, impairment of cardiac output, and shock

Pulmonary contusions

- Impact causes compression of thoracic wall and lungs, **elastic recoil** causes **shearing forces** on the blood vessels and hemorrhage into the alveoli and pulmonary interstitium
- Results in **ventilation/perfusion mismatch and hypoxemia**

Diaphragmatic hernia

- Abdominal trauma leading to increased pressure directed and transmitted across the diaphragm
- **Open glottis** – low intrapleural pressure, large peritoneal-pleural pressure gradient resulting in diaphragmatic rupture at the weakest point
- Movement of viscera into the thorax is dependent on the size and location of the rent
  - **Liver most common**, spleen, small intestine, stomach, and greater omentum also possible
  - Herniation of stomach most concerning/life-threatening due to risk of severe distention
- Presence of viscera in the pleural space leads to decreased lung capacity – **hypoventilation, ventilation/perfusion mismatch and hypoxemia**

Rib fracture/flail segment

- Excess force will result in rib fracture
  - Interestingly thoracic compliance results in an increase in the amount of force necessary to fracture ribs compared to other long bones
- **Flail segment** involves ribs fractured in **two places** resulting in independent movement of segment

- Hypoxia secondary to pulmonary contusions (which often associated with rib fractures) and hypoventilation from pain

Clinical signs

Pneumothorax

- May have dyspnea and tachypnea (rapid and shallow breathing)
- **Muffled or diminished lung sounds, especially dorsally**

Pulmonary contusions

- Dyspnea, tachypnea, increased lung sounds/crackles
- **May not be apparent initially**. **May take up to 24 hours** for contusions to fully manifest

Diaphragmatic hernia

- Respiratory distress, rapid and shallow breathing, **may worsen when patient is laying down**
- Muffled lung sounds, especially unilateral, **borborygmi** my be heard in thorax if intestines herniated

Rib fractures/flail segment

- Rapid/shallow breathing pattern, pain on palpation of chest wall
- Flail segment - **paradoxical movement of the chest wall** (e.g. segment moves in as chest expands)

Diagnosis

Thoracic radiographs

- **Only when stable!** A dyspneic and distressed patient should not be taken to radiology
- Pneumothorax
  - May see **retraction of the lungs from the chest wall**, **sternal elevation of the heart**
- Pulmonary contusions
  - Can be normal initially, progress to patchy/diffuse distribution of interstitial to alveolar pattern
- Diaphragmatic hernia
  - Soft-tissue or air-filled structures in pleural space, lateral displacement of heart, lungs and trachea, absence of distinguishable diaphragmatic contour
- Rib fractures

Thoracocentesis

- **Diagnostic procedure of choice for suspected pneumothorax**

Arterial blood gas

- Hypoxemia, hyper or hypocapnea reflecting pulmonary function and ventilation status

Treatment

General supportive care

- Supplemental oxygen, sedation/analgesia indicated for (almost) all thoracic trauma patients
- Stabilize patients in shock with (cautious) fluid resuscitation

Injury-specific treatment

- Pneumothorax
  - THORACOCENTESIS – 7th – 9th intercostal space, cranial to rib, dorsal 1/3 of chest
  - May need thoracostomy tube if continuous/recurrent pneumothorax
- Pulmonary contusions
  - Time and supplemental oxygen. May need mechanical ventilation if contusions severe
- Diaphragmatic hernia
  - Thoracocentesis/trocarization if stomach herniated
  - Surgical intervention to replace viscera and repair diaphragmatic defect
- Rib fractures/flail segment

- **Surgery not typically required**, appropriate/aggressive **analgesia most important**
  - Opioid +/- lidocaine +/- ketamine CRI, intercostal nerve block with local anesthetic