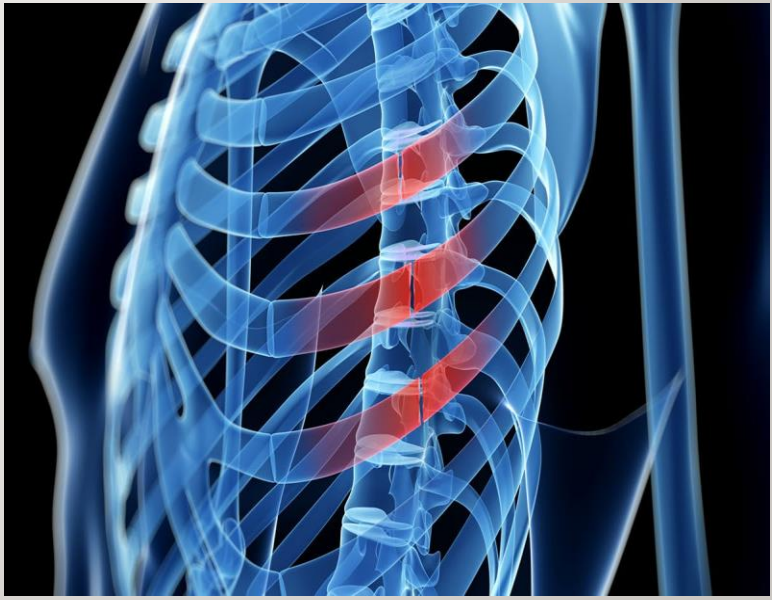
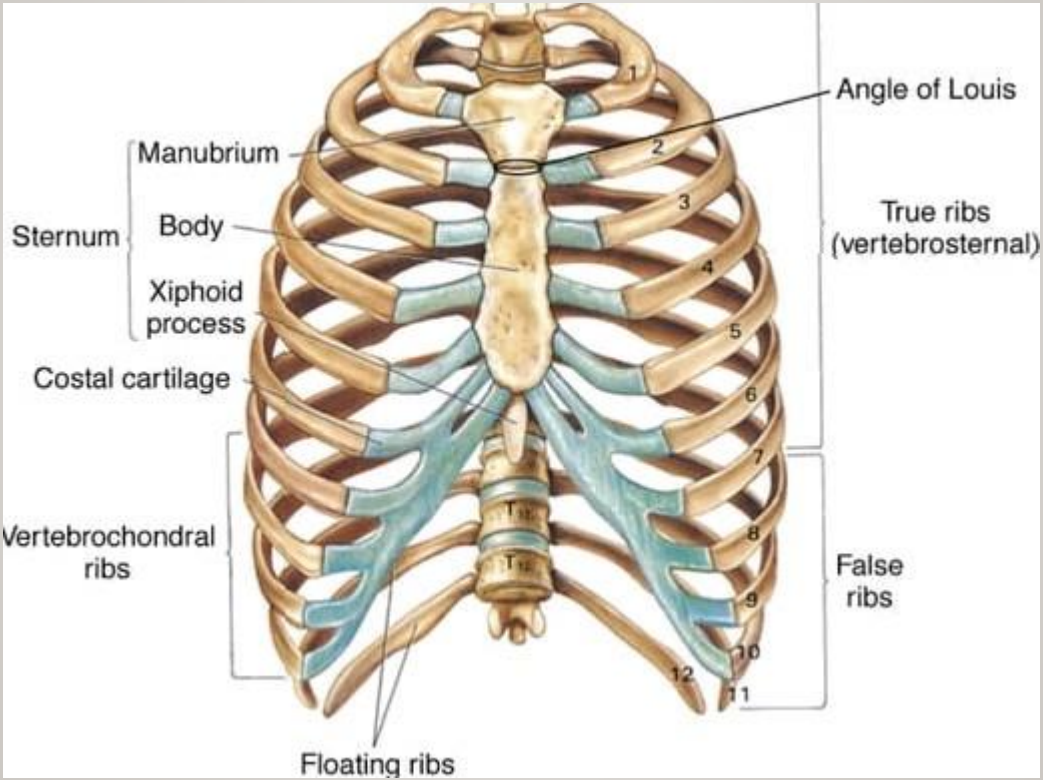
THORACIC TRAUMA



CHEST WALL


Angle of Louis
Manubrium
Sternum
Body
Xiphoid process
Costal cartilage
True ribs (vertebrosternal)
False ribs
Vertebrochondral ribs
Floating ribs
1
2
3
4
5
6
7
8
9
10
11
12

RIB FRACTURES

- Pathophysiology
  - Ribs break at point of impact or posterior angle (weakest structural poinl)
  - Ribs 1-3 = Relatively protected = Higher association with severe intrathoracic injury
  - Ribs 9-12 = More mobile = Higher association with intra-abdominal injury
    - Right sided rib fractures = 3K as likely to have hepatic injury
    - teft sided rib fractures = 4X as likely to have spJeniC injury
  - Fractures more common in adults due to inelasticity of the chest wall
  - 8ib fractures = High potential for penetrating injury to pJeura, lung, liver or spleen
  - Elderly patients with multiple rib fractures: XS mortality

RIB FRACTURES

- Clinical Course
  - Rib fractures heal in 3-6 weeks
  - Gradual decrease in pain over time with analgesia needed for first 1-3 weeks

- Management
  - Pain control
  - Maintenance of pulmonary function
  - Elderly patients may require admission for treatment with IV pain control and monitoring of respiratory status
  - Displaced rib fractures should be monitored and repeat CXR at 3 hours after presentation to evaluate for delayed pneumothorax development

FLAIL CHEST

- Epidemiology
  - Occurs in 1/3 of major trauma patients with major chest injuries
- Pathophysiology
  - Three of more adjacent ribs are fractured at two points, resulting in a Paradoxical movement of chest wall
  - Association with underlying pulmonary contusion
  - Severe pain associated with injury results in muscular splinting and resultant atelectasis and hypoxemia
- Management

Flail Chest – Management

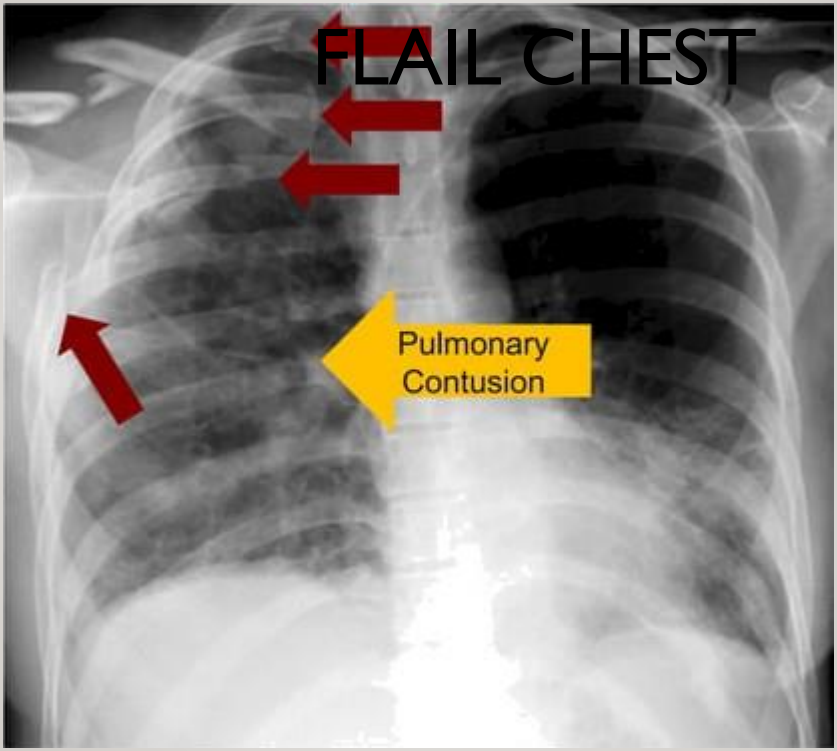
Analgesia.

- Mainstay
- Opioid Analgesics (*risk of respiratory depression*)
- NSAIDs
- Thoracic or high lumbar Epidurals with or without Opioid additives.
- Posterior rib blocks (*lasts upto 24 hours*)
- Instillation of L.A. into pleural space through ICD (*controversial*)

Flail Chest – Management

Intubation & Ventilation.

- Rarely indicated
- Indicated for hypoxia due to pulm. contusions.
- Double lumen tracheal tube.
- each lumen connected to a different ventilator.
- each lung may require drastically different pressures and flows to adequately ventilate.


FLAIL CHEST
Pulmonary
Contusion

STERNAL FRACTURE

- Epidemiology
  - Primarily, the result of anterior blunt trauma
  - Rapid deceleration injury from a frontal impact results in sternal fracture at site of seatbelt
  - Isolated sternal fractures are relatively benign with low mortality (0.79a)
  - Complications
    - Myocardial Contusion (1.5-6% of cases)
    - Spinal Fractures (« 10K of cases)
    - Rib Fractures (21% of cases)
    - No association between eternal fracture and blunt aortic injury

STERNAL FRACTURE

- Pathophysiology

  Associated mediastinal injuries should be considered including

  mediastinal hematoma from injury to underlying proximal great

  vessels

- Diagnostic Management
  - — Lateral radiograph is most helpful with diagnosis
  - — Patients with eternal fracture should be screened for myocardial contusion with EKG and serial cardiac enzymes
- Management
  - — Analgesia

PULMONARY INJURIES

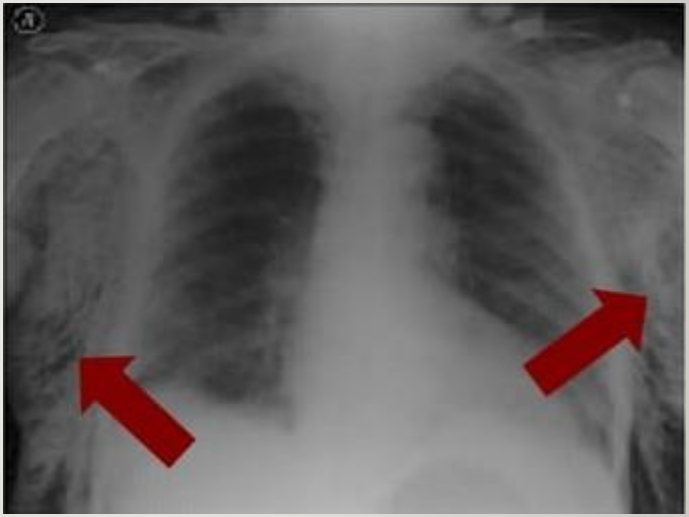
- Subcutaneous Emphysema
  Pulmonary Contusion
- Pneumothorax
- Hemothorax
- Tracheobronchial Injury

SUBCUTANEOUS EMPHYSEMA

- Pathophysiology
  - Subcutaneous emphysema in the presence of the chest wall is indicative of a more serious thoracic injury
  - Location
    - Adjacent to penetrating wound
    - Localized subcutaneous air over chest wall
      - Indicates presence of traumatic pneomoth0rax
    - Localized over supraclavicular area and anterior neck
      - Typi¢ally indicades pneumomediastin um
    - Massive subcutaneous air of the face and neck
      - TypiCally the result of rupture d bro«¢hus

- Management
  - Mostly subcutaneous air is benign and self limited and can be treated with high flow oxygen

SUBCUTANEOUS EMPHYSEMA



PULMONARY CONTUSION

- Epidemiology
  - — Present in 30-75% of patients with significant blunt chest trauma
  - — Most common significant chest injury in children
- Pathophysiology
  - Direct pulmonary parenchyma injury with associated alveolar edema and hemorrhage
- Clinical features
  - — Dyspnea, Tachypnea, Cyanosis, Tachycardia, Hypotension, Chest wall 6roising
  - Hemoptysis may be present in 50% of patients
  - — Associated with flail chest
- Diagnosis
  - — Radiographic findings appear within minutes of an injury
  - — Patchy irregular alveolar infiltrates to frank consolidation
  - — Always present within 6 hours of injury
  - Differentiate from ARDS by time course
    - Pulmonary contusion < 6 hours present, resolves in 4B-72 houre
    - ARD5 onse£is 24 72 hours after injury

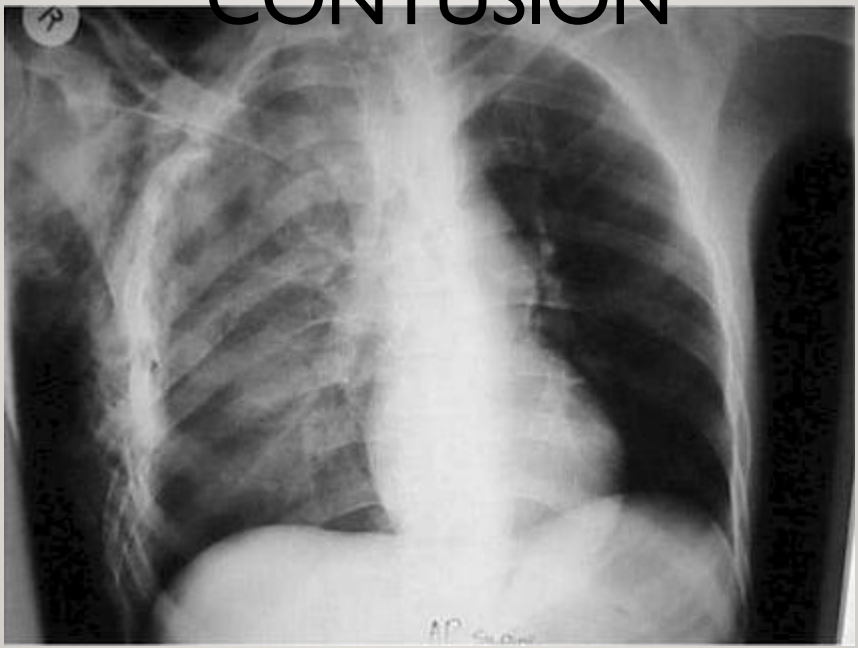
PULMONARY CONTUSION

- Management
  - Restriction of fluid administration
  - Pain Control

    Judicious use of respiratory support with endotracheal intubation and mechanical ventilation
- Complication = Pneumonia

  Prophylactic antibiotics are not recommended
- Prognosis
  - Morta|ity of isolated pulmonary contusion is 5 -16%

PULMONARY CONTUSION



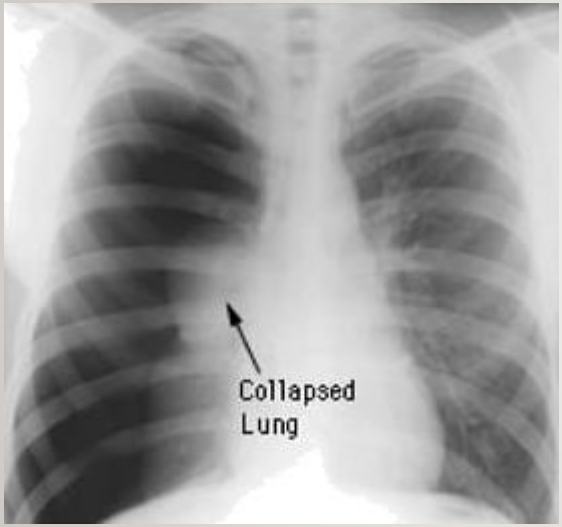
PNEUMOTHORAX

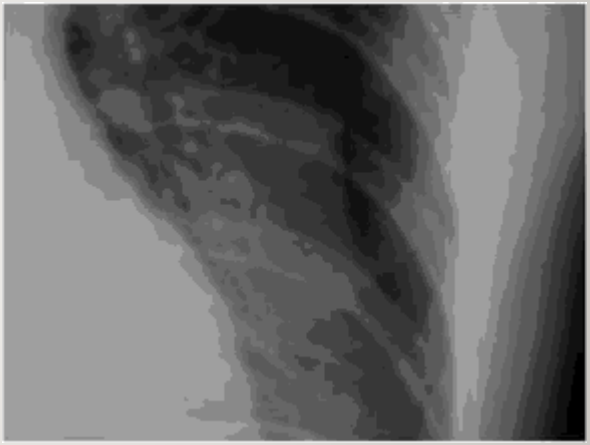
- Definition = Accumulation of air in the pleural space
- Pathophysiology
  - Traumatic pneumothorax is caused by fractured rib that is driven inward resulting in laceration of pleura
  - Also occurs without a fractures when impact is delivered at full inspiration with the glattis closed, leasing to tremendous increase in intra-alveolar pressure and subsequent rupture Df the alveoli
  - Penetrating trauma such as a gunshot wound or knife injury causing direct trauma to the pleura

PNEUMOTHORAX

- Types of Pneumothorax
  - — Simple Pneumothorax
    - No communication with the atmosphere or any shift of mediastinal structures or the hemi-diaphragm
    - Pneumothorax grading
      - — Small vs large
      - — Occult
  - — Communicating Pneumothorax (Open Pneumothorax)
    - ° Pneumothorax associated with loss of integrity of chest wall
    - "sucking chest wound"

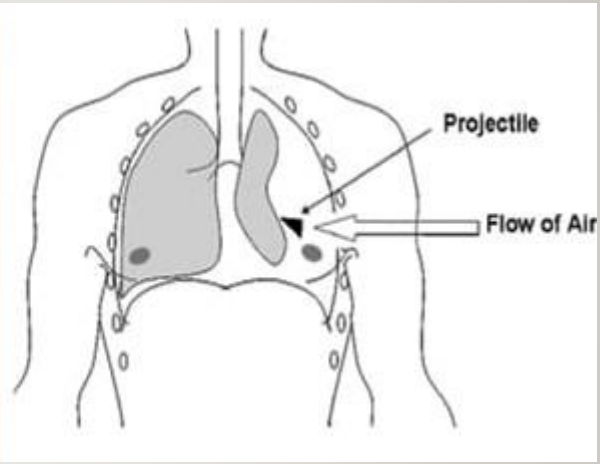
SIMPLE PNEUMOTHORAX





Chest X-Ray in inspirium

OPEN PNEUMOTHORAX



TENSION PNEUMOTHORAX

- Tension Pneumothorax

  Progressive accumulation of air under pressure within the chest cavity with shift of mediastinal structures to opposite hemithorax

  — Results in compression of contralateral lung and great vessel venous return

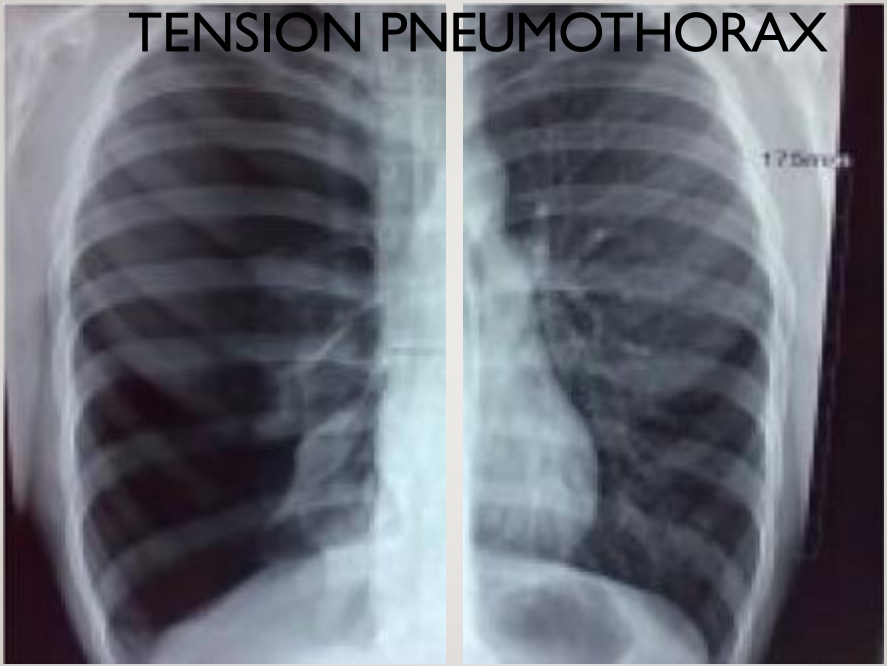
  — Results in decreased diastolic filling of the heart and subsequent decreased cardiac output

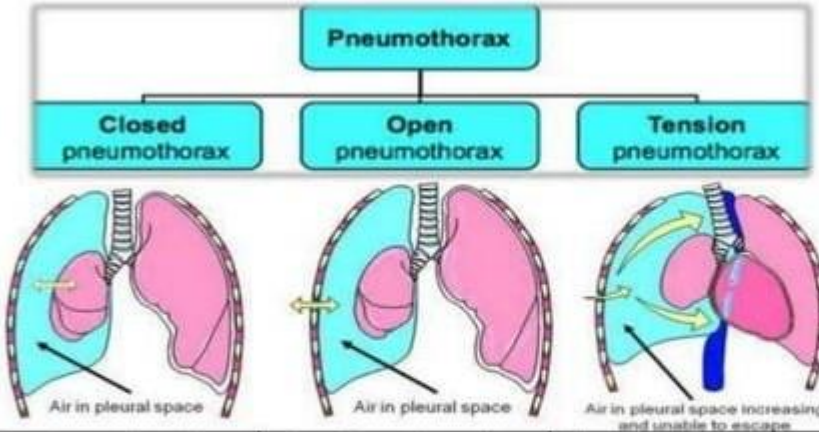
  — Leads to rapid onset of hypoxia, acidosis and shock

  — Cardinal Physical Exam Findings

    - Tachycardia, Jugular Venous Dissension, Tachypnea
    - AbSent Breath sounds on ipsilateral s‹de
    - Hypoxia and Hypotension, followed by cardiac drrest

TENSION PNEUMOTHORAX





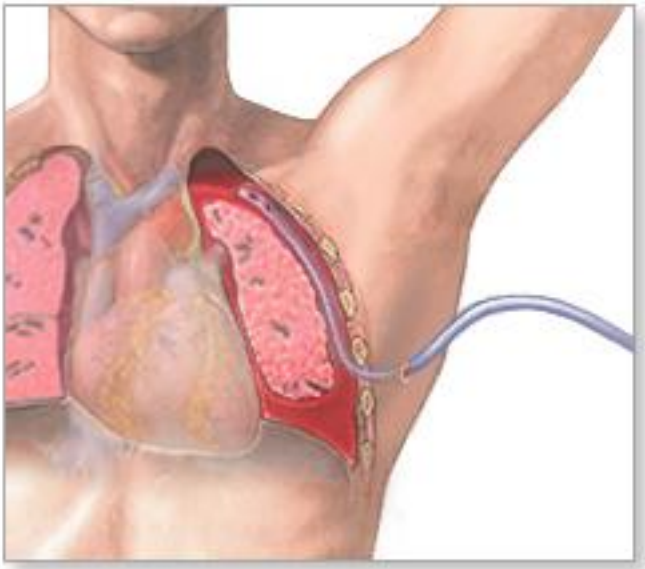
The pleural cavity pressure is < the atmospheric pressure	The pleural cavity pressure is = the atmospheric pressure	The pleural cavity pressure is > the atmospheric pressure

PNEUMOTHORAX

Management

- Penetrating Trauma/No Pneumothorax
  - If CXR is negative, Observation x 3 hrs, Repeat CXR prior to D/c
- Simple Pneumothorax
  - Some authors advocate chest tube for all traumatic pneumothoracies
  - Small Pneumothorax
    - Some people advocate careful observation if patient is symptoms free and does not need anesthesia or positive pressure ventilation
    - Small apical pneumothorax « 25% may also be observed closely
    - Occult CT diagnosed PTX is also suggested to be amenable to conservative treatment
    - If patient is to receive positive pressure ventilation or has evidence of multi-system trauma, chest tube should be placed
  - Moderate/Large Pneumothorax = Chest tube

Chest tube drains blood from the lungs



PNEUMOTHORAX

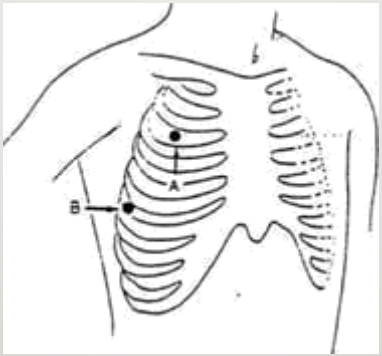
- Tension Pneumothorax

  Needle Thoracostomy(immediate)

  - 5” Intercostal Space —Anterior Axi1Iary Line

  Tube Thoracostomy

  ° 5” Intercostal Space —Anterior Axi1Iary Line



HEMOTHORAX

- Definition = accumulation of blood in the pleural space after blunt or penetrating traumatic injury
- Pathophysiology
  - Hemorrhage from injured lung parenchyma is most common cause but is usually self-limiting
  - Other vessels may be site of injury including intercostal and internal mammary arteries
  - Less commonly, major vessels or hilar vessels are site of bleeding
- Clinical Features
  - Depending on rate and quantity of hemorrhage, varying levels of hemorrhagic shock are encountered
  - Diminished or absent breath sounds on affected side

HEMOTHORAX

- Blood accumulation in plural cavity.
- Minor/ major-massive (up to 3 liter!!!)

- X-ray show >200ml fluid

- Tx- Chest tube
- lindications for thoracotomy-

1- blood 1500cc > initial

2- >150-200 cc blood/h for the next 2-3 hours

3- Persistent blood transfusion

Hemothorax

TRACHEOBRONCHIAL INJURY

- Epidemiology
  - Occur with either blunt of penetrating trauma to the chest or neck
  - More than half are result of MVC
  - Rare entity - occurring in < 3% of patients with significant chest trauma
  - Mortality = 10%

    - 80% of these injuries occur within 2 cm of the carina

TRACHEOBRONCHIAL INJURY

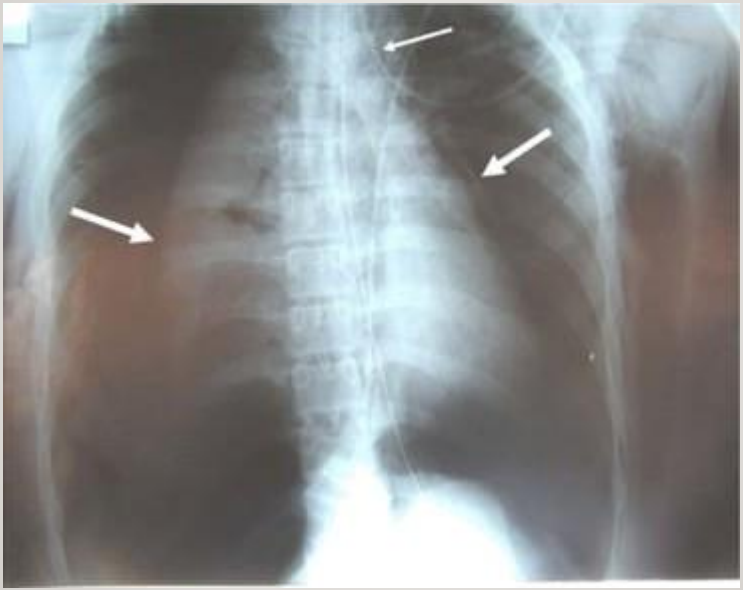
- Clinical Features
  - Symptoms
    - Massive Air Leak, Hemoptysis and Subcutaneous Emphysema
  - Two clinical Presentations
    - Wound opens into pleural space —Large PTX
      - Chest tube fails to evacuate the space and re-expand the lung characterized by bronChopleural fistula or persistent air leak
    - Complete transection of the tracheobronchial tree but little communication with the pleural space
      - Present with unexplained atelectasis or pneumonia days to weeks after injury

TRACHEOBRONCHIAL INJURY

- Diagnosis
  - — CXR may demonstrate secondary findings
    - i.e. Pneumothorax, Pneumomediastinum, etc
  - Definitive diagnosis is made with bronchoscopy
- Management
  - — Endotracheal Intubation
    - Preferable if done with bronchoscope to allow visualization of tube passing beyond site of injury
    - Blind intubation risks placing endotracheal tube into transected airway, false passage or convert partial tear into full tear
  - — Surgical Repair (Thoracotomy)

TRACHEOBRONCHIAL INJURY

- Tracheobronchial injury resulting in bilateral pneumothorax, pneumomediastinum and subcutaneous air



EMERGENCY DEPARTMENT THORACOTOMY

- Drastic potentially life-saving procedure
- Indications

1. Cardiac arrest in penetrating injury
2. Massive hemotfiorax (>1500cc, 300cc/h for 2-4h)
3. Penetrating injury to anterior chest with cardiac tamponade
4. Large open wound of chest wall
5. Major vascular injcry in hemodynamic instability
6. Major tracheobronchial injury
7. Esophagial perforation

Pulseless patient suffer from BLUNT trauma is contraindication!!!!

- Goal = Determine if a life-threatening fixable lesion is present

EMERGENCY DEPARTMENT THORACOTOMY