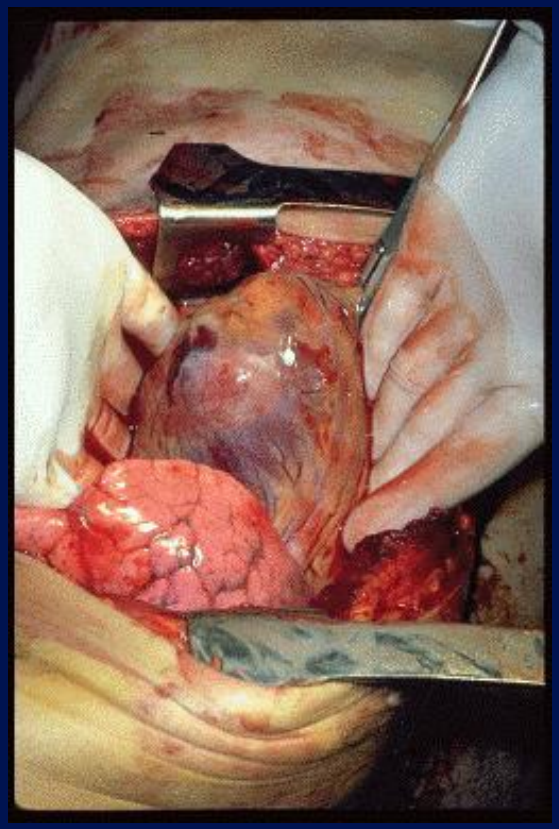
Thoracic Trauma



Catedra de Chirurgie nr.1 „Nicolae Anestiadi”

Thoracic Trauma

- Second leading cause of trauma deaths after head injury
- Cause of about 10-20% of all trauma deaths
- Many deaths due to thoracic trauma are preventable

Thoracic Trauma

- Prevention Strategies
  - Gun Safety Education
  - Sports Training & Protective Equipment
  - Seat Belt & Air Bag Use
  - Others?

Thoracic Trauma

- **Mechanisms of Injury**
  - **Blunt Injury**
    - Deceleration
    - Compression
  - **Penetrating Injury**
  - **Both**

Thoracic Trauma

- **Anatomical Injuries**
  - **Thoracic Cage (Skeletal)**
  - **Cardiovascular**
  - **Pleural and Pulmonary**
  - **Mediastinal**
  - **Diaphragmatic**
  - **Esophageal**
  - **Penetrating Cardiac**

What structures may be involved with each injury?

Classification according to clinical evolution, prognosis and grade of treatment emergency:

[J.Holliman, 2010]

Rapid lethal TT (6 types)

- airway obstruction
- tension pneumothorax
- open pneumothorax
- massive hemothorax
- flail chest
- cardiac tamponade

Classification according to clinical evolution, prognosis and grade of treatment emergency:
[J.Holliman, 2010]

Potential lethal TT (6 types)

- aortic rupture (dissection)
- miocardial contusion
- tracheobronchic rupture
- esophageal rupture
- pulmonary contusion
- diaphragmatic rupture (posttraumatic hernia)

Classification according to clinical evolution, prognosis and grade of treatment emergency:

[J.Holliman, 2010]

TT without lethal potential (8 types)

- simple pneumothorax or small hemothorax
- sternoclavicular luxation
- sternal fracture
- clavicle fracture
- scapular fracture
- traumatic asfixia
- simple rib fractures
- thoracic wall contusion

Thoracic Trauma

- **Often result in:**
  - **Hypoxia**
    - hypovolemia
    - pulmonary V/P mismatch
    - Δ in intrathoracic pressure relationships
  - **Hypercarbia**
    - Δ in intrathoracic pressure relationships
    - ↓ level of consciousness
  - **Acidosis**
    - hypoperfusion of tissues (metabolic)

Thoracic Trauma

- **Ventilation & Respiration Review**
  - **How & Why does ventilation (inspiration & expiration) occur?**
    - What actually happens in ventilation?
    - What stimulates its occurrence?
    - What stimulates its cessation?
  - **What happens in respiration?**
    - How does it affect acid-base balance?
    - What factors inhibit effective respiration?

Thoracic Trauma

- **General Pathophysiology**
  - **Impairments to cardiac output**
    - blood loss
    - increased intrapleural pressures
    - blood in pericardial sac
    - myocardial valve damage
    - vascular disruption

Thoracic Trauma

- **General Pathophysiology**
  - **Impairments in ventilatory efficiency**
    - chest excursion compromise
      - pain
      - air in pleural space
      - asymmetrical movement
    - bleeding in pleural space
    - ineffective diaphragm contraction

Thoracic Trauma

- **General Pathophysiology**
  - **Impairments in gas exchange**
    - atelectasis
    - pulmonary contusion
    - respiratory tract disruption

Thoracic Trauma

- **Initial exam directed toward life threatening:**
  - **Injuries**
    - Open pneumothorax
    - Flail chest
    - Tension pneumothorax
    - Massive hemothorax
    - Cardiac tamponade
  - **Conditions**
    - Apnea
    - Respiratory Distress

Thoracic Trauma

- **Assessment Findings**
  - **Mental Status (decreased)**
  - **Pulse (absent, tachy or brady)**
  - **BP (narrow PP, hyper- or hypotension, pulsus paradoxus)**
  - **Ventilatory rate & effort (tachy- or bradypnea, labored, retractions)**
  - **Skin (diaphoresis, pallor, cyanosis, open injury, ecchymosis)**

Thoracic Trauma

- Assessment Findings
  - Neck (tracheal position, SQ emphysema, JVD, open injury)
  - Chest (contusions, tenderness, asymmetry, absent or decreased lung sounds, bowel sounds, abnormal percussion, open injury, impaled object, crepitus, hemoptysis)
  - Heart Sounds (muffled, distant, regurgitant murmur)
  - Upper abdomen (contusion, open injury)

Thoracic Trauma

- Assessment Findings
  - ECG (ST segment abnormalities, dysrhythmias)
- History
  - Dyspnea
  - Pain
  - Past hx of cardiorespiratory disease
  - Restraint devices used
  - Item/Weapon involved in injury

Thoracic Trauma

SPECIFIC INJURIES

Rib Fracture

- Most common chest wall injury from direct trauma
- More common in adults than children
- Especially common in elderly
- Ribs form rings
  - Possibility of break in two places
- Most commonly 5th - 9th ribs
  - Poor protection

Rib Fracture

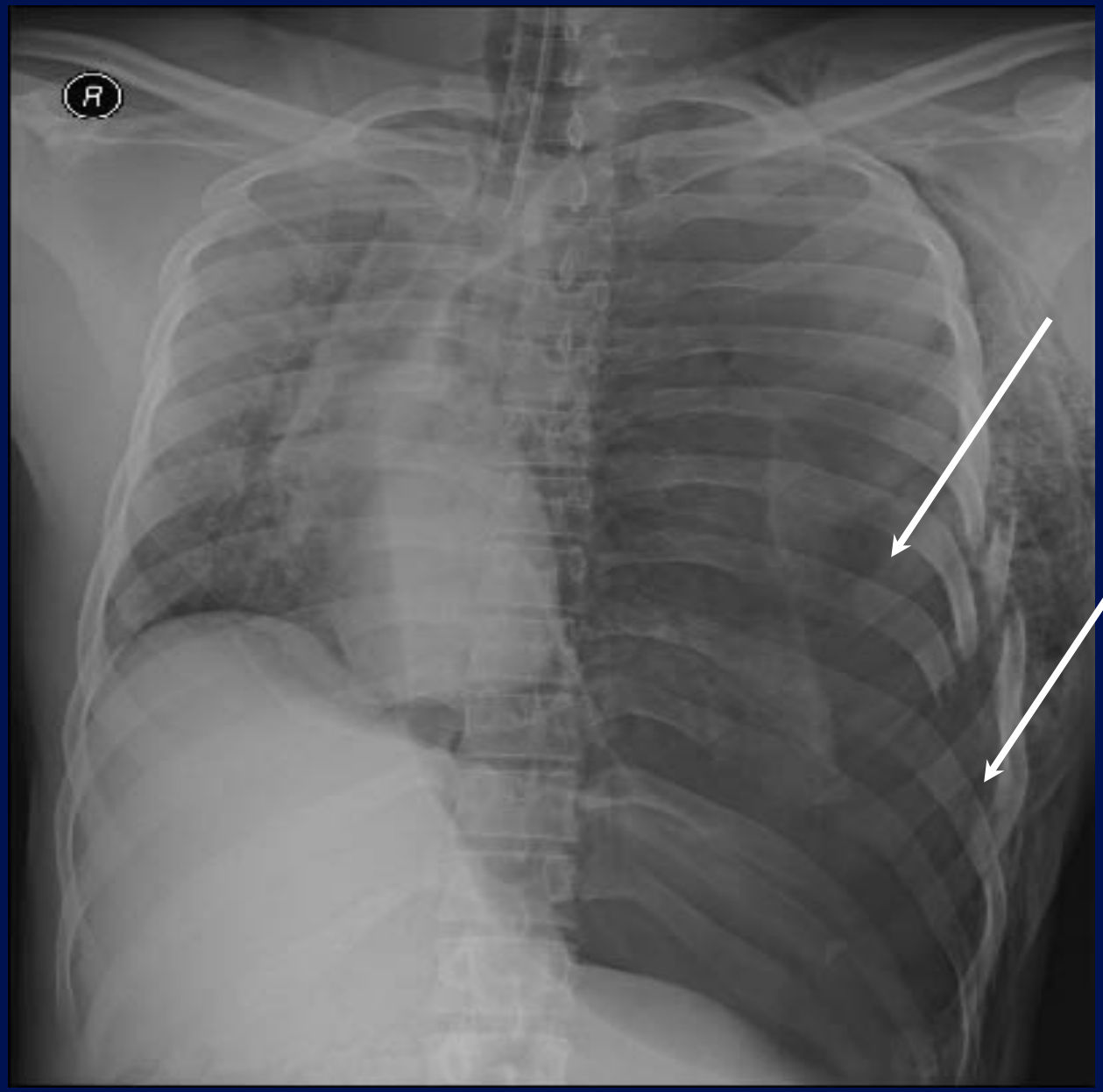
- Fractures of 1st and 2nd second require high force
  - Frequently have injury to aorta or bronchi
  - Occur in 90% of patients with tracheo-bronchial rupture
  - May injure subclavian artery/vein
  - May result in pneumothorax
- 30% will die

Rib Fracture

- Fractures of 10 to 12th ribs can cause damage to underlying abdominal solid organs:
  - Liver
  - Spleen
  - Kidneys

Rib Fracture

- Assessment Findings
  - Localized pain, tenderness
  - Increases on palpation or when patient:
    - Coughs
    - Moves
    - Breathes deeply
  - “Splinted” Respirations
  - Instability in chest wall, Crepitus
  - Deformity and discoloration
  - Associated pneumo or hemothorax


R

Rib Fracture

- **Management**
  - **High concentration O_2**
  - **Positive pressure ventilation as needed**
  - **Encourage pt to breath deeply**
    - **Helps prevent atelectasis**
  - **Analgesics for isolated trauma**

Rib Fracture

- Management
  - Monitor elderly and COPD patients closely
    - Broken ribs can cause decompensation
    - Patients will fail to breathe deeply and cough, resulting in poor clearance of secretions
  - Usually Non-Emergent Transport

Sternal Fracture

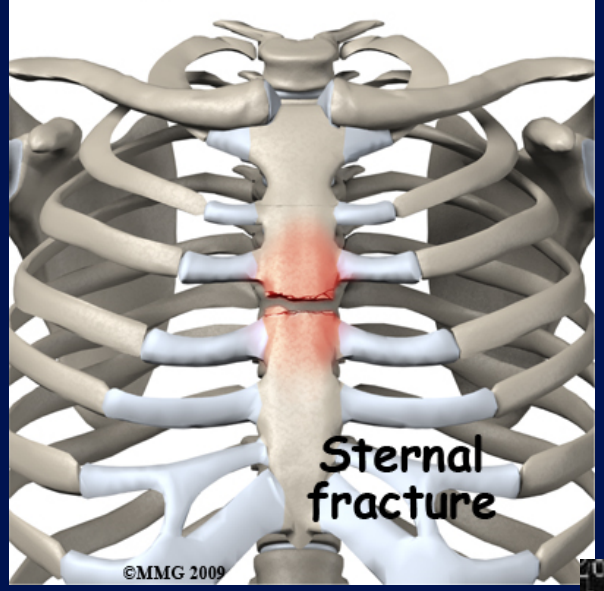
- Uncommon, 5-8% in blunt chest trauma
- Large traumatic force
- Direct blow to front of chest by
  - Deceleration
    - steering wheel
    - dashboard
  - Other object

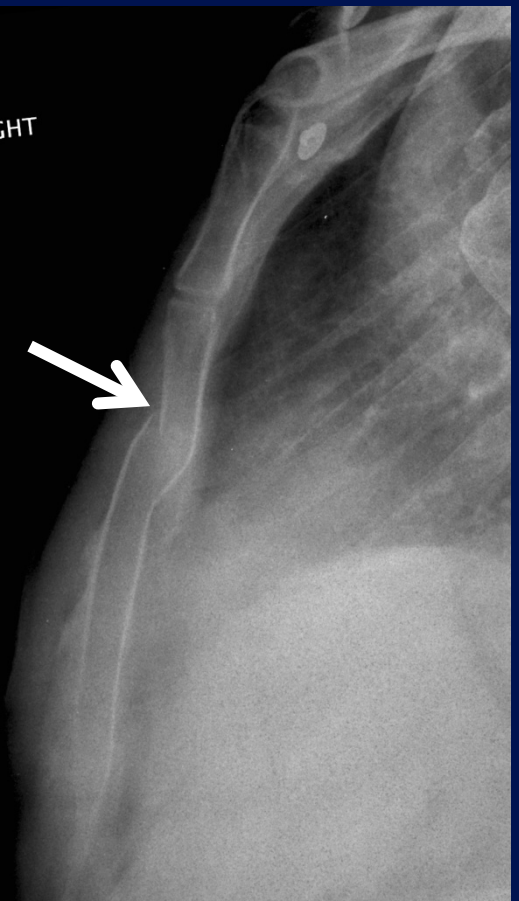
Sternal Fracture

- 25 - 45% mortality due to associated trauma:
  - Disruption of thoracic aorta
  - Tracheal or bronchial tear
  - Diaphragm rupture
  - Flail chest
  - Myocardial trauma
- High incidence of myocardial contusion, cardiac tamponade or pulmonary contusion

Sternal Fracture

- Assessment Findings
  - Localized pain
  - Tenderness over sternum
  - Crepitus
  - Tachypnea, Dyspnea
  - ECG changes with associated myocardial contusion
  - Hx/Mechanism of blunt chest trauma


Sternal
fracture
©MMG 2009



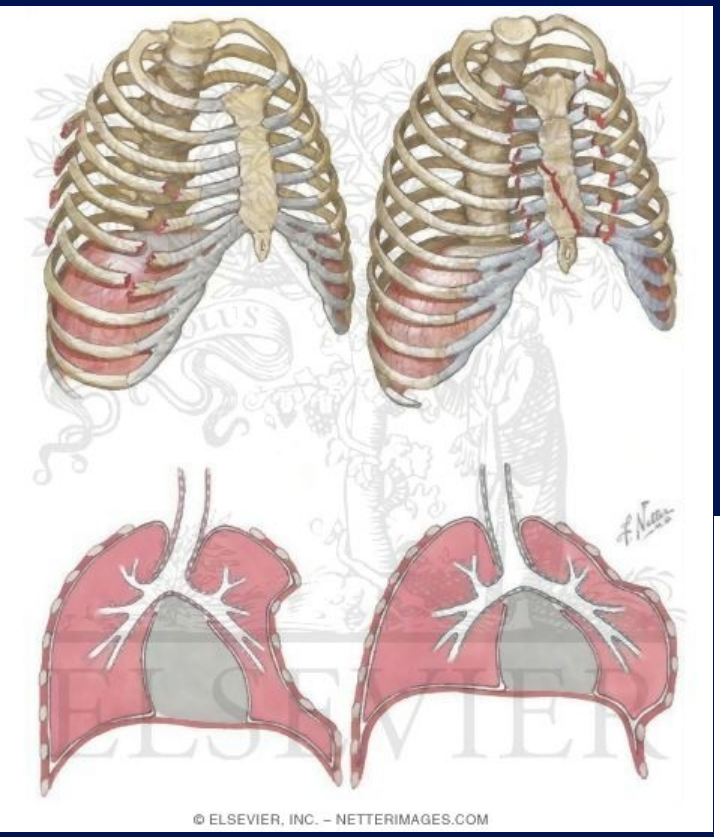
Sternal Fracture

- **Management**
  - **Establish airway**
  - **High concentration oxygen**
  - **Assist ventilations with BVM as needed**
  - **IV NS/LR**
    - Restrict fluids
  - **Emergent Transport**
    - Trauma center

Flail Chest

Two or more adjacent ribs fractured in two or more places producing a free floating segment of the chest wall

Flail Chest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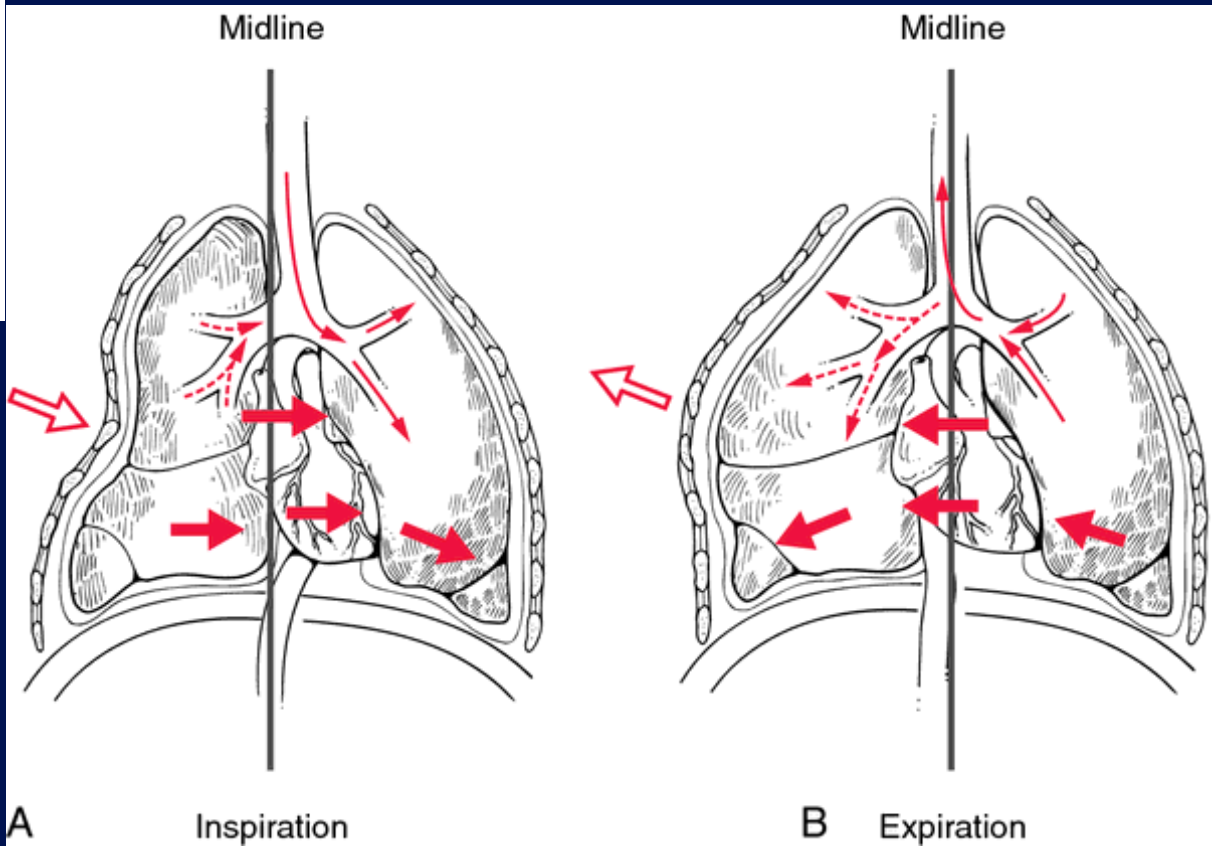

Midline
Midline
A
Inspiration
B
Expiration

Flail Chest

- **Usually secondary to blunt trauma**
  - **Most commonly in MVC**
  - **Also results from**
    - falls from heights
    - industrial accidents
    - assault
    - birth trauma
- **More common in older patients**

Flail Chest

- Mortality rates 20-40% due to associated injuries
- Mortality increased with
  - advanced age
  - seven or more rib fractures
  - three or more associated injuries
  - shock
  - head injuries

Flail Chest

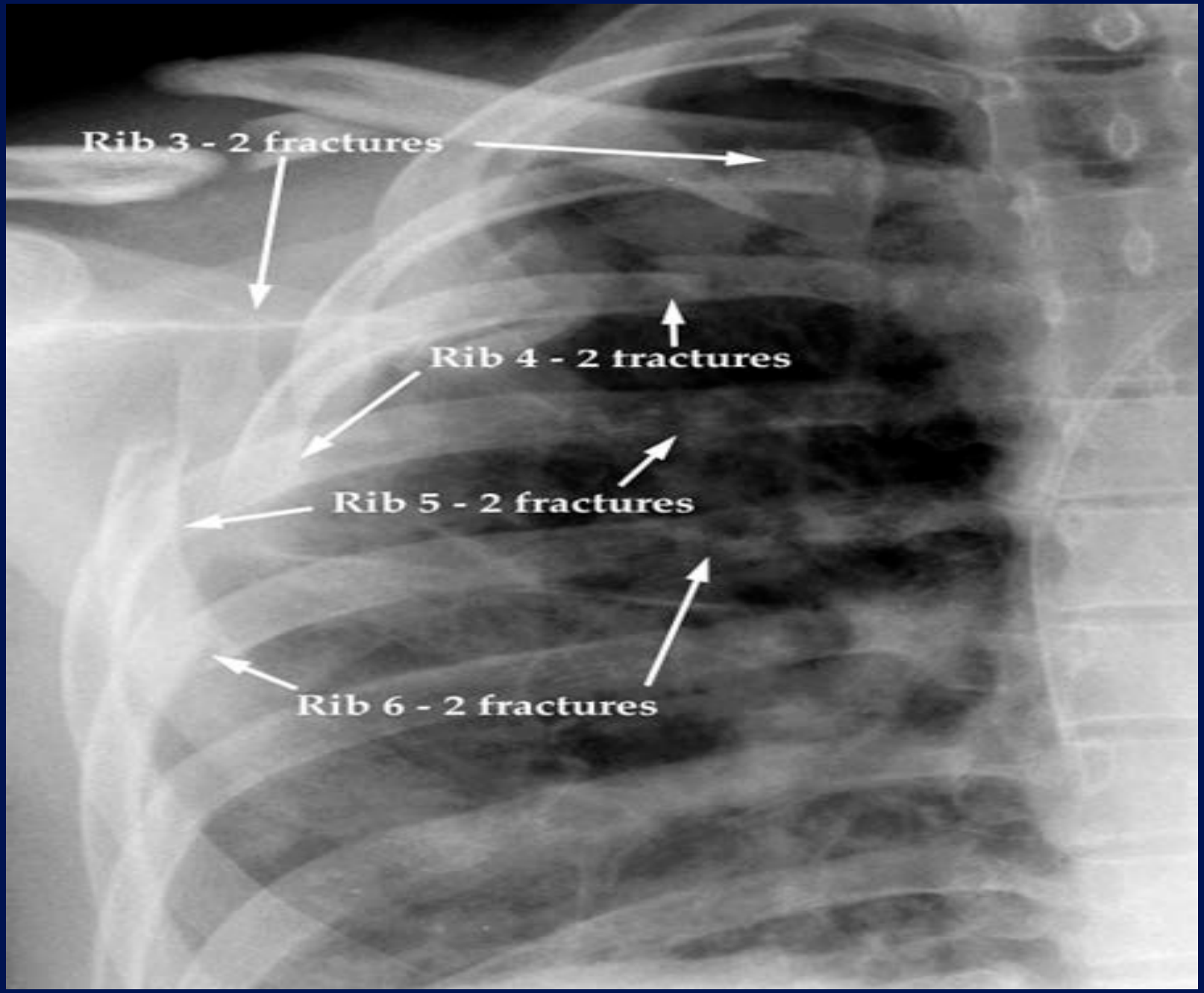
- **Consequences of flail chest**
  - **Respiratory failure due to**
    - pulmonary contusion
    - intrathoracic injury
    - inadequate diaphragm movement
  - **Paradoxical movement of the chest**
    - must be large to compromise ventilation
    - Increased work of breathing
  - **Pain, decreased chest expansion**
    - leading decreased ventilation

Flail Chest

- **Consequences of flail chest**
  - **Contusion of lung**
    - decreased lung compliance
    - intra alveolar-capillary hemorrhage
  - **Decreased ventilation**
    - Hypercapnea
    - Hypoxia

Flail Chest

- Assessment Findings
  - Chest wall contusion
  - Respiratory distress
  - Pleuritic chest pain
  - Splinting of affected side
  - Crepitus
  - Tachypnea, Tachycardia
  - Paradoxical movement (possible)


Rib 3 - 2 fractures
Rib 4 - 2 fractures
Rib 5 - 2 fractures
Rib 6 - 2 fractures

Flail Chest

- **Management**
  - **Suspect spinal injuries**
  - **Establish airway**
  - **High concentration oxygen**
  - **Assist ventilation with BVM**
    - **Treat hypoxia from underlying contusion**
    - **Promote full lung expansion**
  - **Consider need for intubation and PEEP**
  - **Mechanically stabilize chest wall**
    - questionable value

Flail Chest

- **Management**
  - **IV of LR/NS**
    - **Avoid rapid replacement in hemodynamically stable patient**
    - **Contused lung cannot handle fluid load**
  - **Monitor EKG**
    - **Chest trauma can cause dysrhythmias**
  - **Emergent Transport**
    - Trauma center

Simple Pneumothorax

- **Incidence**
  - **10-30% in blunt chest trauma**
  - **almost 100% with penetrating chest trauma**
  - **Morbidity & Mortality dependent on**
    - extent of atelectasis
    - associated injuries

Simple Pneumothorax

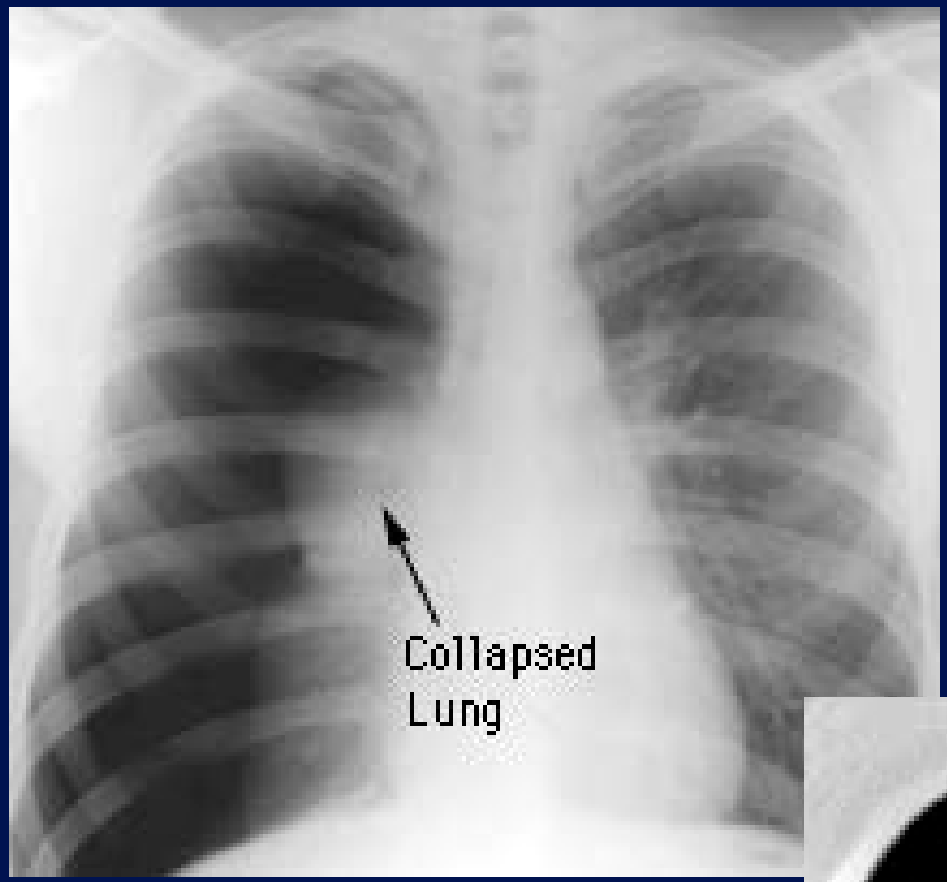
- **Causes**
  - **Commonly a fx rib lacerates lung**
  - **Paper bag effect**
  - **May occur spontaneously in tall, thin young males following:**
    - Exertion
    - Coughing
    - Air Travel
  - **Spontaneous may occur w/ Marfan's syndrome**

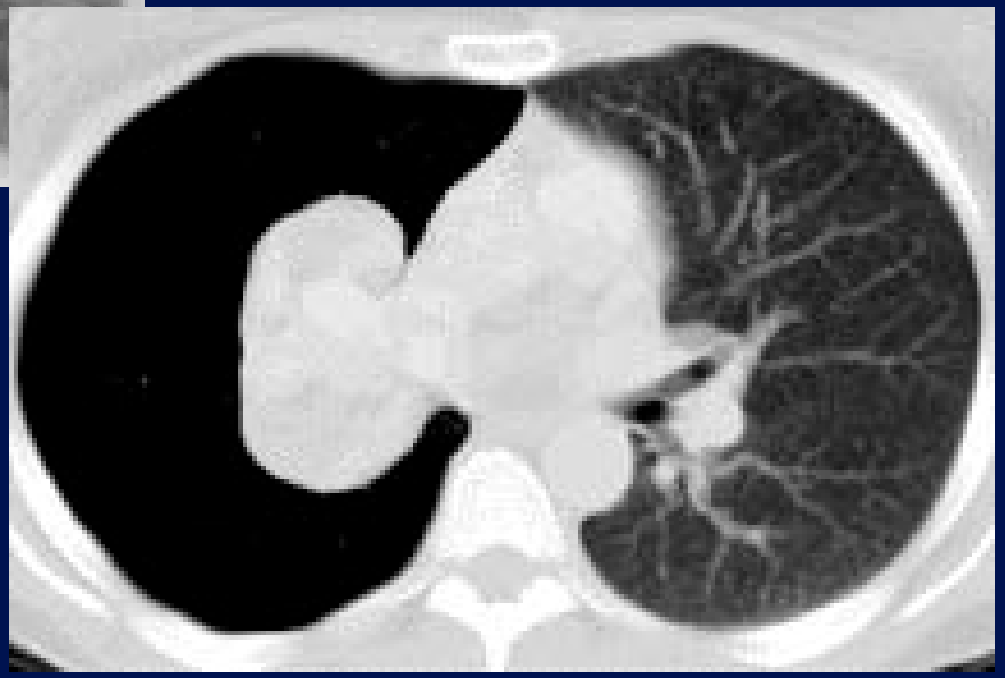
Simple Pneumothorax

- **Pathophysiology**
  - **Air enters pleural space causing partial lung collapse**
    - small tears self-seal
    - larger tears may progress
  - **Usually well-tolerated in the young & healthy**
  - **Severe compromise can occur in the elderly or patients with pulmonary disease**
  - **Degree of distress depends on amount and speed of collapse**

Simple Pneumothorax

- **Assessment Findings**
  - **Tachypnea, Tachycardia**
  - **Difficulty breathing or respiratory distress**
  - **Pleuritic pain**
    - may be referred to shoulder or arm on affected side
  - **Decreased or absent breath sounds**
    - **not always reliable**
      - **if patient standing, assess apices first**
      - **if supine, assess anteriorly**
    - **patients with multiple ribs fractures may splint injured side by not breathing deeply**


Collapsed
Lung



Simple Pneumothorax

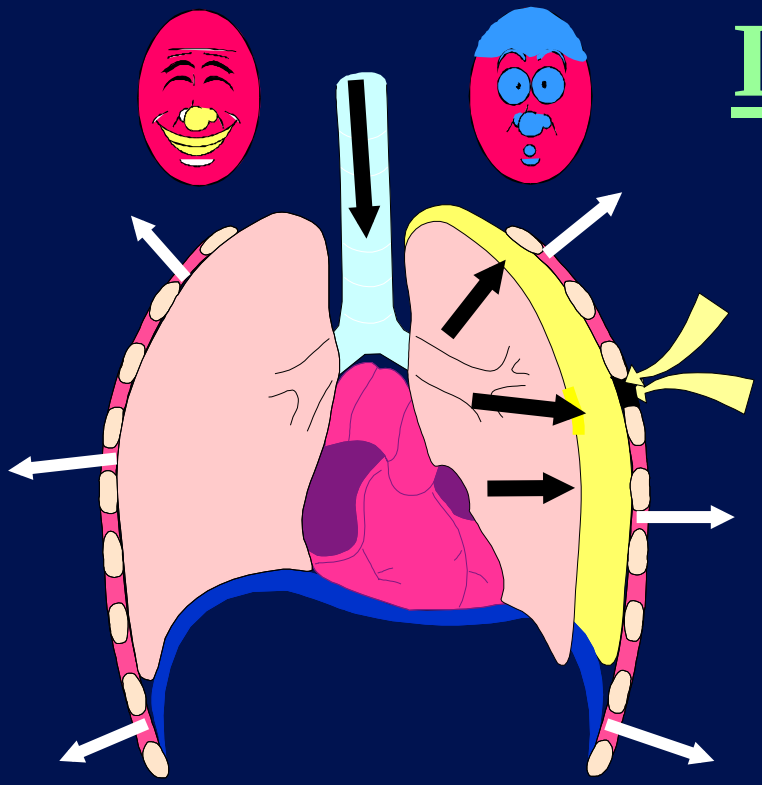
- **Management**
  - **Establish airway**
  - **High concentration O_2 with NRB**
  - **Assist with BVM**
    - decreased or rapid respirations
    - inadequate TV
  - **IV of LR/NS**
  - **Monitor for progression**
  - **Monitor ECG**
  - **Usually Non-emergent transport**

Open Pneumothorax

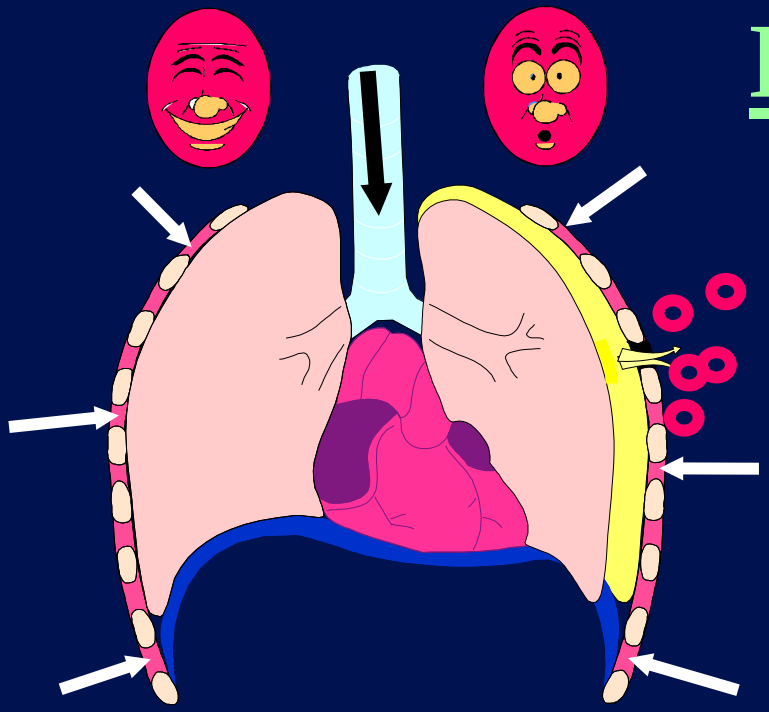
Hole in chest wall that allows air to enter pleural space.

Larger the hole the more likely air will enter there than through the trachea.

Inhale



Exhale



Open Pneumothorax

- If the trauma patient does not ventilate well with an open airway, look for a hole
  - May be subtle
  - Abrasion with deep punctures

Open Pneumothorax

- **Pathophysiology**
  - **Result of penetrating trauma**
  - **Profound hypoventilation may occur**
  - **Allows communication between pleural space and atmosphere**
  - **Prevents development of negative intrapleural pressure**
  - **Results in ipsilateral lung collapse**
    - inability to ventilate affected lung

Open Pneumothorax

- **Pathophysiology**
  - **V/Q Mismatch**
    - shunting
    - hypoventilation
    - hypoxia
    - large functional dead space
  - **Pressure may build within pleural space**
  - **Return from Vena cava may be impaired**

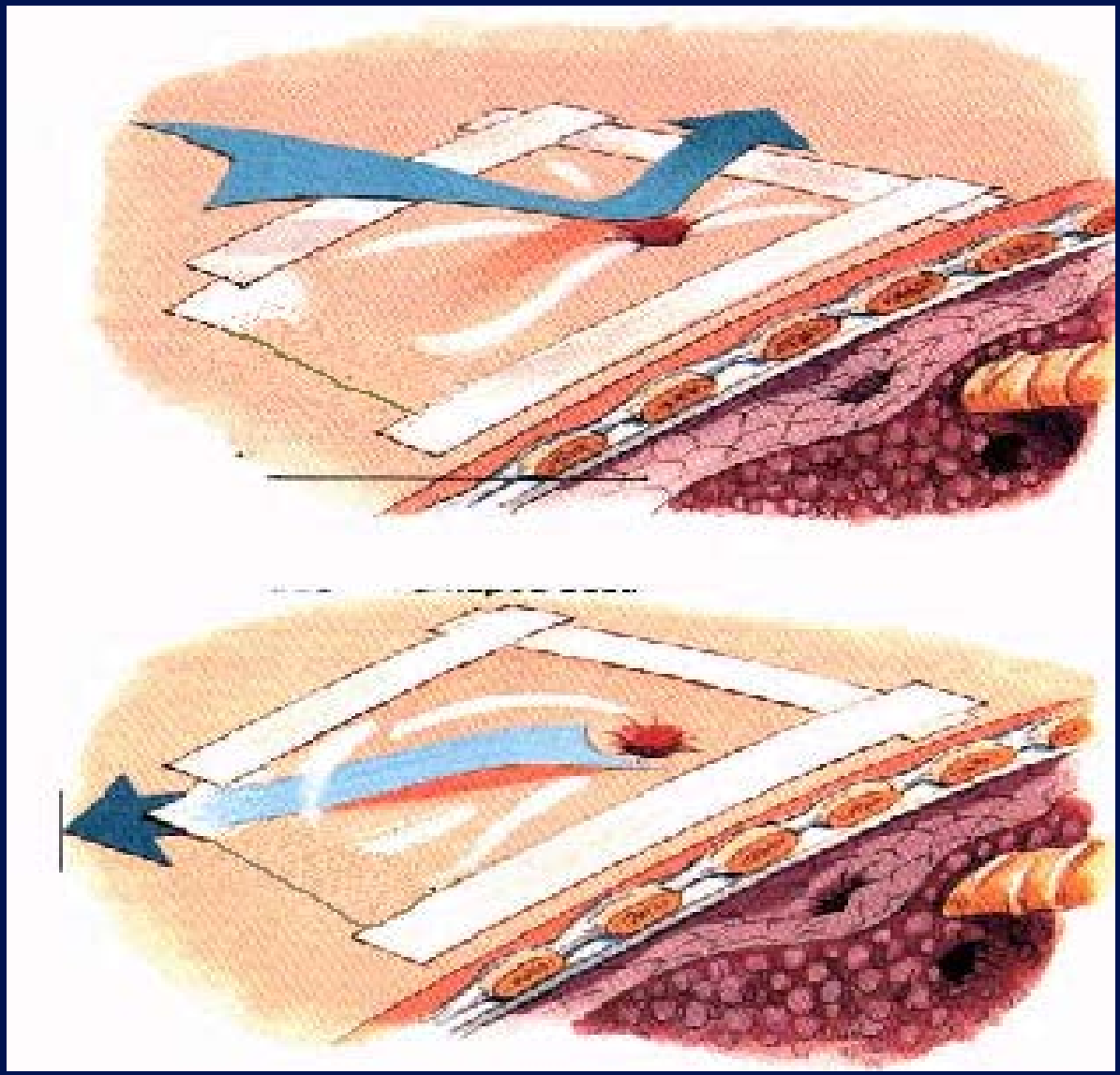
Open Pneumothorax

- Assessment Findings
  - Opening in the chest wall
  - Sucking sound on inhalation
  - Tachycardia
  - Tachypnea
  - Respiratory distress
  - SQ Emphysema
  - Decreased lung sounds on affected side

Open Pneumothorax

- **Management**
  - **Cover chest opening with occlusive dressing**
  - **High concentration O_2**
  - **Assist with positive pressure ventilations prn**
  - **Monitor for progression to tension pneumothorax**
  - **IV with LR/NS**
  - **Monitor ECG**
  - **Emergent Transport**
    - Trauma Center

Occlusive Dressing



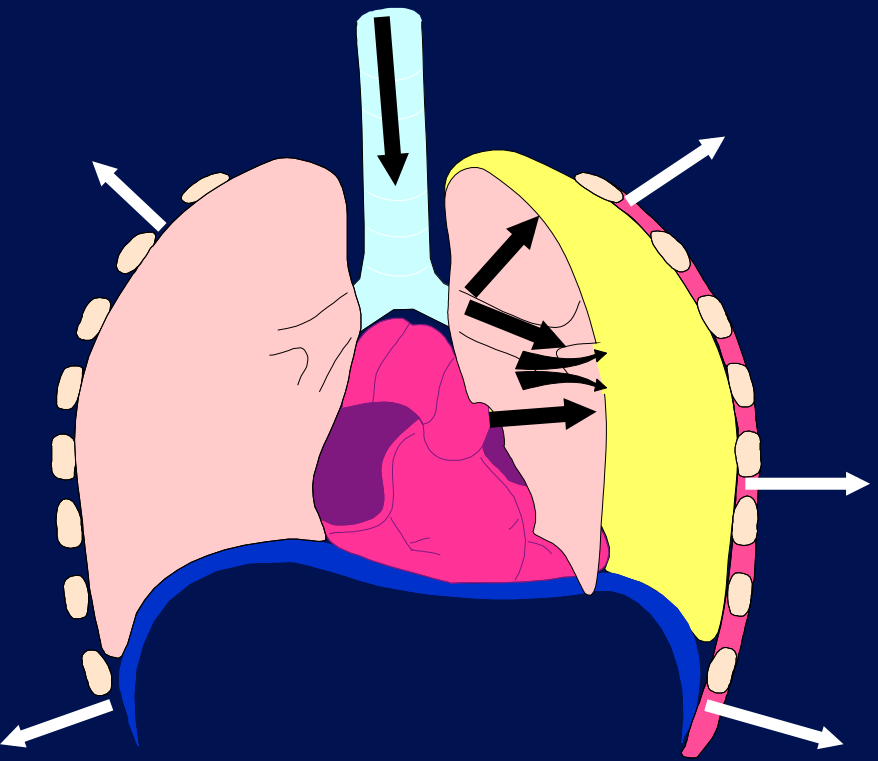
Tension Pneumothorax

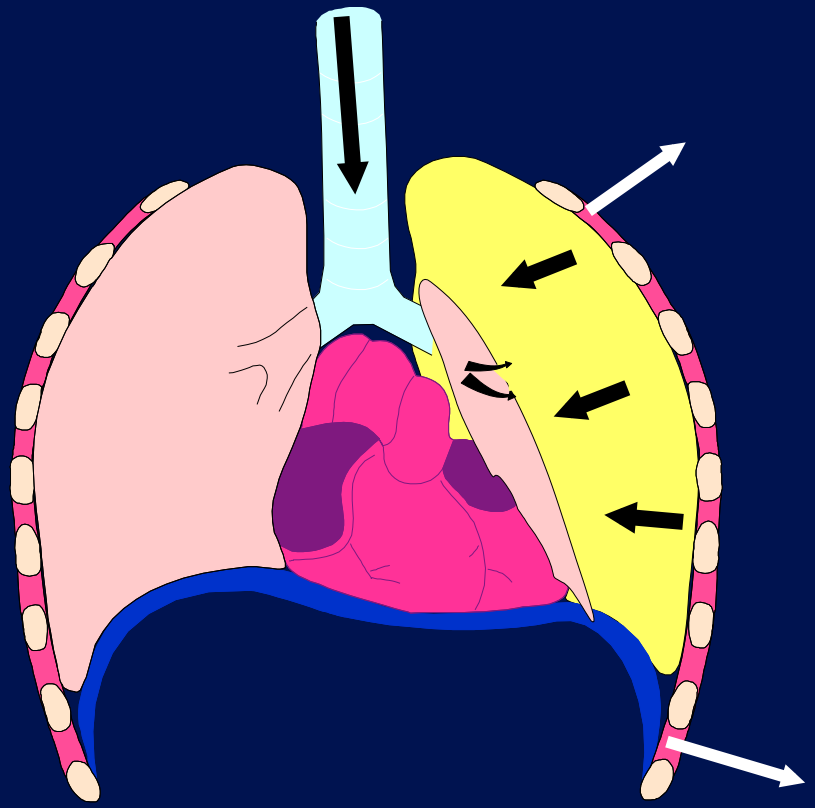
- Incidence
  - Penetrating Trauma
  - Blunt Trauma
- Morbidity/Mortality
  - Severe hypoventilation
  - Immediate life-threat if not managed early

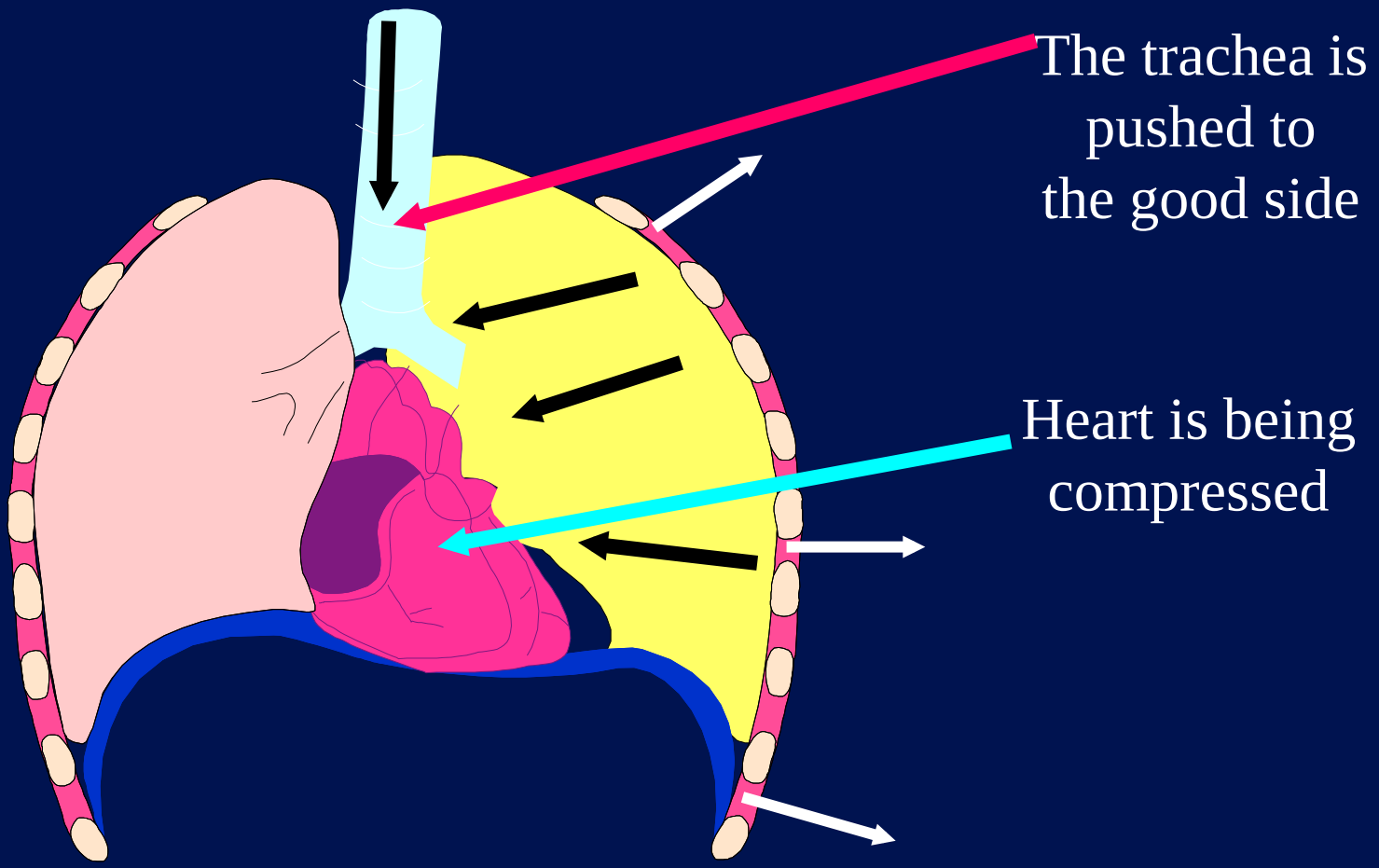
Tension Pneumothorax

- **Pathophysiology**
  - **One-way valve forms in lung or chest wall**
  - **Air enters pleural space, but cannot leave**
    - Air is trapped in pleural space
  - **Pressure collapses lung on affected side**
  - **Mediastinal shift to contralateral side**
    - Reduction in cardiac output
      - Increased intrathoracic pressure
      - deformed vena cava reducing preload

Each time we inhale, the lung collapses further. There is no place for the air to escape..



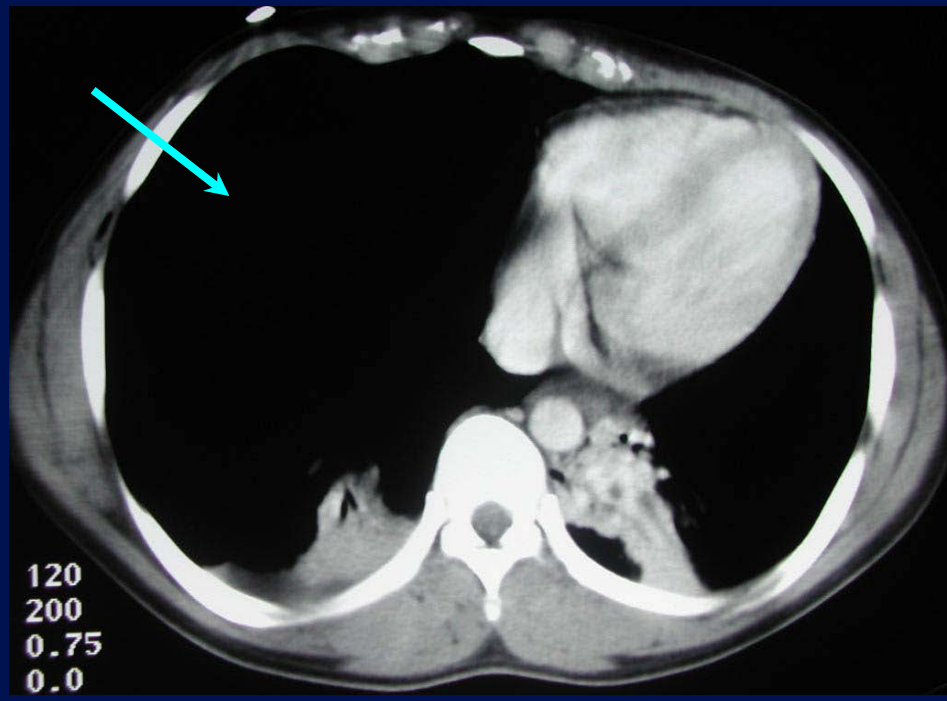



The trachea is
pushed to
the good side
Heart is being
compressed

Tension Pneumothorax

- **Assessment Findings - Most Likely**
  - **Severe dyspnea ⇒ extreme resp distress**
  - **Restlessness, anxiety, agitation**
  - **Decreased/absent breath sounds**
  - **Worsening or Severe Shock / Cardiovascular collapse**
    - Tachycardia
    - Weak pulse
    - Hypotension
    - Narrow pulse pressure


IMAGE 66
SPI 35
TP -512.5
SL10.0/15.0
TI 0.75
kV 120
mA 240
GI 0.0


120
200
0.75
0.0

Tension Pneumothorax

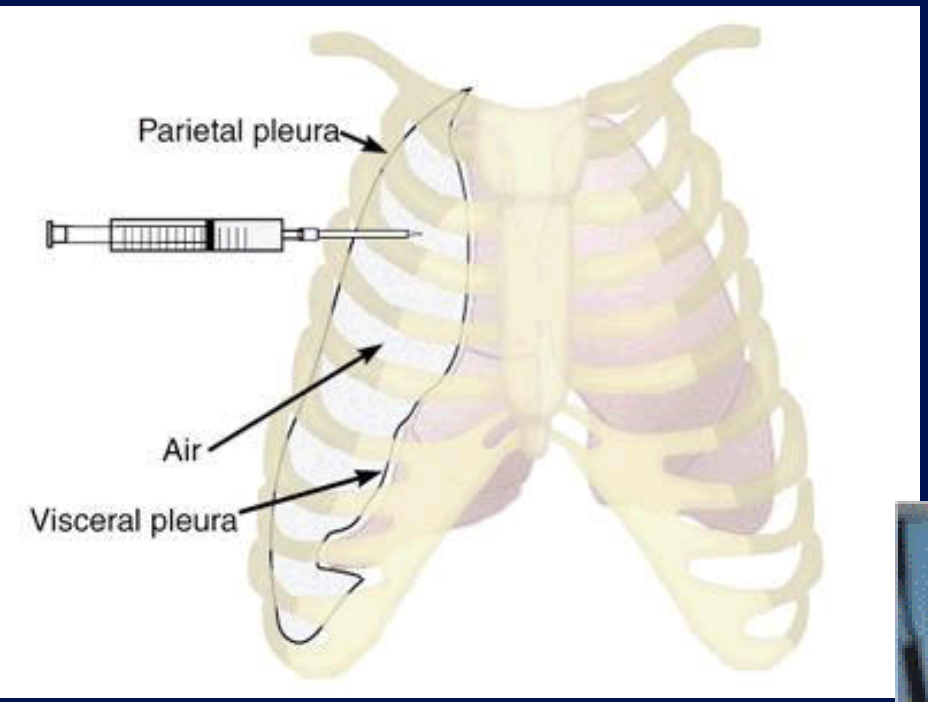
- **Assessment Findings - Less Likely**
  - **Jugular Vein Distension**
    - absent if also hypovolemic
  - **Hyperresonance to percussion**
  - **Subcutaneous emphysema**
  - **Tracheal shift away from injured side (late)**
  - **Cyanosis (late)**

Tension Pneumothorax

- **Management**
  - **Recognize & Manage early**
  - **Establish airway**
  - **High concentration O_2**
  - **Positive pressure ventilations w/BVM prn**
  - **Needle thoracostomy**
  - **IV of LR/NS**
  - **Monitor ECG**
  - **Emergent Transport**
    - Consider need to intubate
    - Trauma Center preferred

Tension Pneumothorax

- Management
  - Needle Thoracostomy Review
    - Decompress with 14g (lg bore), 2-inch needle
    - Midclavicular line: 2nd intercostal space
    - Midaxillary line: 4-5th intercostal space
    - Go over superior margin of rib to avoid blood vessels
    - Be careful not to kink or bend needle or catheter
    - If available, attach a one-way valve


Parietal pleura
Air
Visceral pleura


Needle thoracocentesis
Emergency decompression of
clinical tension pneumothorax

Hemothorax

- **Pathophysiology**
  - **Blood in the pleural space**
  - **Most common result of major trauma to the chest wall**
  - **Present in 70 - 80% of penetrating and major non-penetrating trauma cases**
  - **Associated with pneumothorax**
  - **Rib fractures are frequent cause**

Hemothorax

- **Pathophysiology**
  - **Each can hold up to 3000 cc of blood**
  - **Life-threatening often requiring chest tube and/or surgery**
  - **If assoc. with great vessel or cardiac injury**
    - 50% die immediately
    - 25% live five to ten minutes
    - 25% may live 30 minutes or longer
  - **Blood loss results in**
    - **Hypovolemia**
    - **Decreased ventilation of affected lung**

Hemothorax

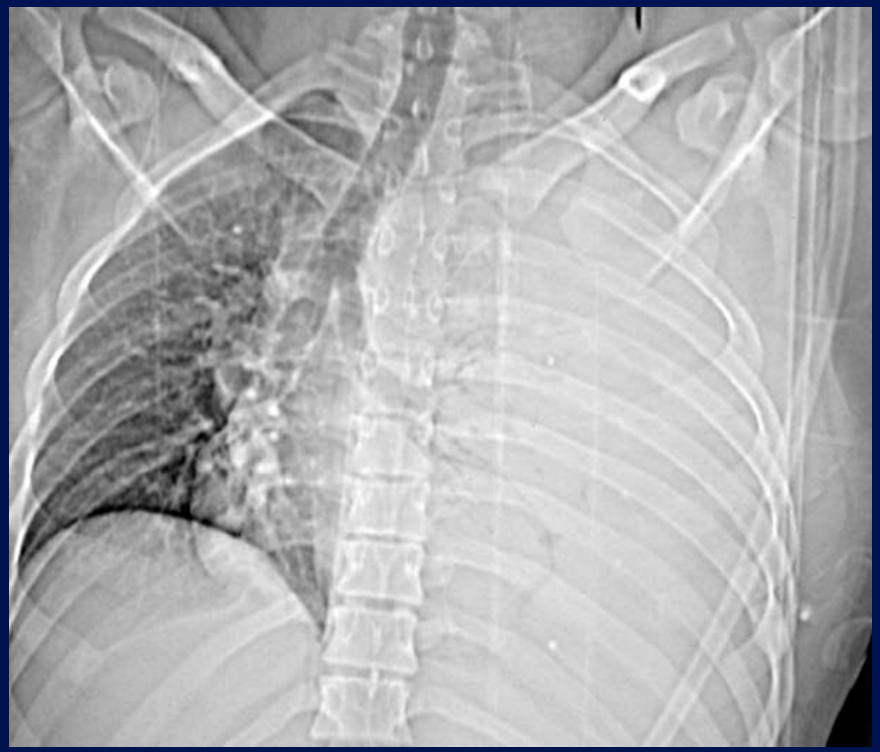
- **Pathophysiology**
  - **Accumulation of blood in pleural space**
    - penetrating or blunt lung injury
    - chest wall vessels
    - intercostal vessels
    - myocardium
  - **Massive hemothorax indicates great vessel or cardiac injury**
  - **Intercostal artery can bleed 50 cc/min**
  - **Results in collapse of lung**

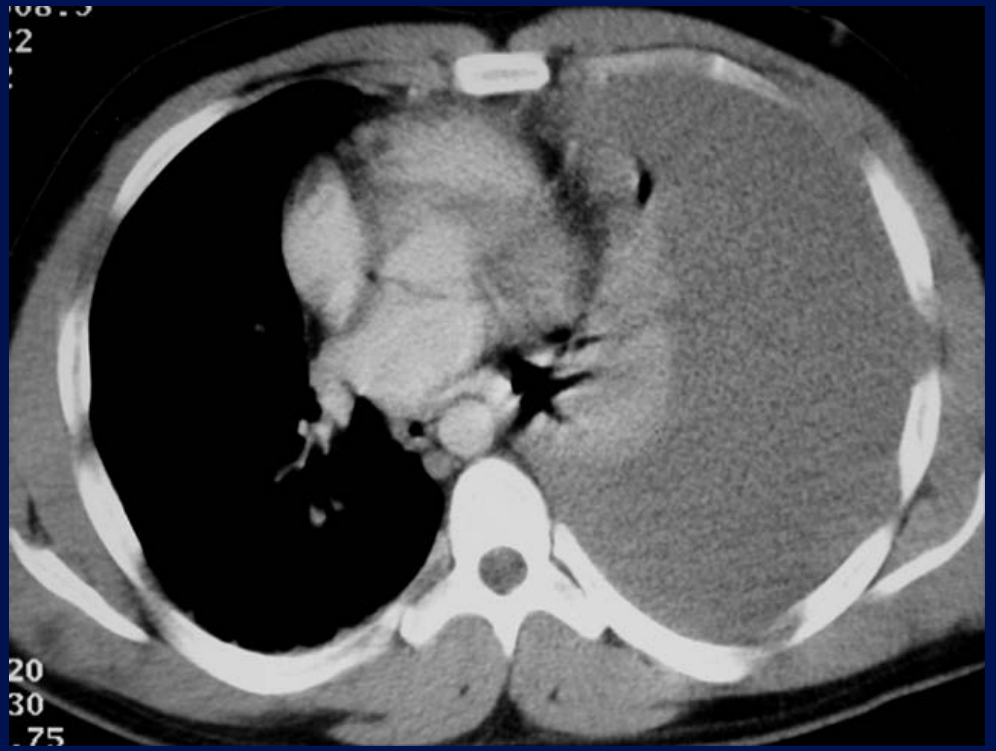
Hemothorax

- **Pathophysiology**
  - **Accumulated blood can eventually produce a tension hemothorax**
    - **Shifting the mediastinum producing**
      - **ventilatory impairment**
      - **cardiovascular collapse**

Hemothorax

- **Assessment Findings**
  - **Tachypnea or respiratory distress**
  - **Shock**
    - Rapid, weak pulse
    - Hypotension, narrow pulse pressure
    - Restlessness, anxiety
    - Cool, pale, clammy skin
    - Thirst
  - **Pleuritic chest pain**
  - **Decreased lung sounds**
  - **Collapsed neck veins**
  - **Dullness on percussion**





Hemothorax

- **Management**
  - **Establish airway**
  - **High concentration O_2**
  - **Assist Ventilations w/BVM prn**
  - **± MAST in profound hypotension**
  - **Needle thoracostomy if tension & unable to differentiate from Tension Pneumothorax**
  - **IVs x 2 with LR/NS**
  - **Monitor ECG**
  - **Emergent transport to Trauma Center**

Pulmonary Contusion

- **Pathophysiology**
  - **Blunt trauma to the chest**
    - Rapid deceleration forces cause lung to strike chest wall
    - high energy shock wave from explosion
    - high velocity missile wound
    - low velocity as with ice pick
  - **Most common injury from blunt thoracic trauma**
    - 30-75% of blunt trauma
    - mortality 14-20%

Pulmonary Contusion

- **Pathophysiology**
  - **Rib Fx in many but not all cases**
  - **Alveolar rupture with hemorrhage and edema**
    - increased capillary membrane permeability
    - Large vascular shunts develop
      - Gas exchange disturbances
      - Hypoxemia
      - Hypercarbia

Pulmonary Contusion

- Assessment Findings
  - Tachypnea or respiratory distress
  - Tachycardia
  - Evidence of blunt chest trauma
  - Cough and/or Hemoptysis
  - Apprehension
  - Cyanosis

Pulmonary Contusion

- **Management**
  - **Supportive therapy**
  - **Early use of positive pressure ventilation reduces ventilator therapy duration**
  - **Avoid aggressive crystalloid infusion**
  - **Severe cases may require ventilator therapy**
  - **Emergent Transport**
    - Trauma Center

Cardiovascular Trauma

Any patient with significant blunt or penetrating trauma to chest has heart/great vessel injury until proven otherwise

Myocardial Contusion

- Most common blunt injury to heart
- Usually due to steering wheel
- Significant cause of morbidity and mortality in the blunt trauma patient

Myocardial Contusion

- **Pathophysiology**
  - **Behaves like acute MI**
  - **Hemorrhage with edema**
    - Cellular injury
    - vascular damage may occur
  - **Hemopericardium may occur from lacerated epicardium or endocardium**
  - **May produce arrhythmias**
  - **May cause hypotension unresponsive to fluid or drug therapy**

Myocardial Contusion

- **Assessment Findings**
  - **Cardiac arrhythmias following blunt chest trauma**
  - **Angina-like pain unresponsive to nitroglycerin**
  - **Precordial discomfort independent of respiratory movement**
  - **Pericardial friction rub (late)**

Myocardial Contusion

- **Assessment Findings**
  - **ECG Changes**
    - Persistent tachycardia
    - ST elevation, T wave inversion
    - RBBB
    - Atrial flutter, Atrial fibrillation
    - PVCs
    - PACs

Myocardial Contusion

- **Management**
  - **Establish airway**
  - **High concentration O_2**
  - **IV LR/NS**
    - Cautious fluid administration due to injured myocardium
  - **ECG**
    - Standard drug therapy for arrhythmias
    - 12 Lead ECG if time permits
  - **Consider vasopressors for hypotension**
  - **Emergent Transport**
    - Trauma Center

Pericardial Tamponade

- Incidence
  - Usually associated with penetrating trauma
  - Rare in blunt trauma
  - Occurs in < 2% of chest trauma
  - GSW wounds have higher mortality than stab wounds
  - Lower mortality rate if isolated tamponade

Pericardial Tamponade

- **Pathophysiology**
  - **Space normally filled with 30-50 ml of straw-colored fluid**
    - lubrication
    - lymphatic discharge
    - immunologic protection for the heart
  - **Rapid accumulation of blood in the inelastic pericardium**

Pericardial Tamponade

- **Pathophysiology**
  - **Heart is compressed decreasing blood entering heart**
    - Decreased diastolic expansion and filling
    - Hindered venous return (preload)
  - **Myocardial perfusion decreased due to**
    - pressure effects on walls of heart
    - decreased diastolic pressures
  - **Ischemic dysfunction may result in injury**
  - **Removal of as little as 20 ml of blood may drastically improve cardiac output**

Pericardial Tamponade

- Signs and Symptoms
  - Beck's Triad
    - Resistant hypotension
    - Increased central venous pressure (distended neck/arm veins in presence of decreased arterial BP)
    - Small quiet heart (decreased heart sounds)

Pericardial Tamponade

- Signs and Symptoms
  - Narrowing pulse pressure
  - Pulsus paradoxicus
    - Radial pulse becomes weak or disappears when patient inhales
    - Increased intrathoracic pressure on inhalation causes blood to be trapped in lungs temporarily

Pericardial Tamponade

- **Management**
  - **Secure airway**
  - **High concentration O_2**
  - **Pericardiocentesis**
    - Out of hospital, primarily reserved for cardiac arrest
  - **Rapid transport**
    - Trauma Center
  - **IVs of LR/NS**

Pericardial Tamponade

- **Management**
  - **Definite treatment is pericardiocentesis followed by surgery**
    - Pericardial Window
- **Tamponade is hard to diagnosis**
  - **Hypotension is common in chest trauma**
  - **Heart sounds are difficult to hear**
  - **Bulging neck veins may be absent if hypovolemia is present**
  - **High index of suspicion is required**

Traumatic Aortic Dissection/Rupture

- **Caused By:**
  - **Motor Vehicle Collisions**
  - **Falls from heights**
  - **Crushing chest trauma**
  - **Animal Kicks**
  - **Blunt chest trauma**
    - 15% of all blunt trauma deaths

Traumatic Aortic Dissection/Rupture

- **1 of 6 persons dying in MVC's has aortic rupture**
  - **85% die instantaneously**
  - **10-15% survive to hospital**
    - 1/3 die within six hours
    - 1/3 die within 24 hours
    - 1/3 survive 3 days or longer
- **Must have high index of suspicion**

Traumatic Aortic Dissection/Rupture

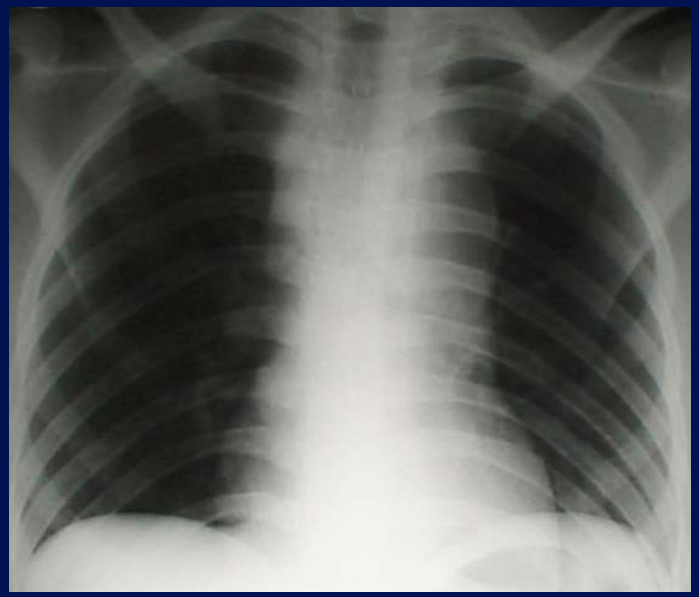
- Separation of the aortic intima and media
  - Tear 2° high speed deceleration at points of relative fixation
- Blood enters media through a small intima tear
  - Thinned layer may rupture
- Descending aorta at the isthmus distal to left subclavian artery most common site of rupture
  - ligamentum arteriosom

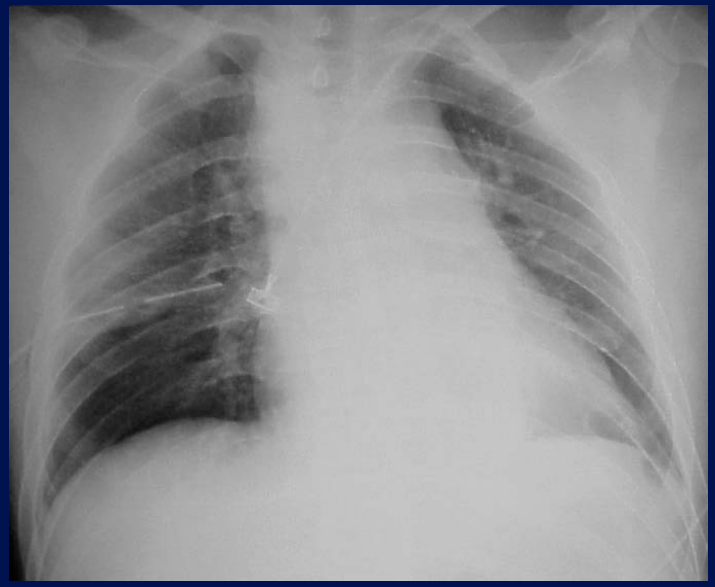
Traumatic Aortic Dissection/Rupture

- **Assessment Findings**
  - **Retrosternal or interscapular pain**
  - **Pain in lower back or one leg**
  - **Respiratory distress**
  - **Asymmetrical arm BPs**
  - **Upper extremity hypertension with**
    - Decreased femoral pulses, OR
    - Absent femoral pulses
  - **Dysphagia**

Traumatic Aortic Dissection/Rupture

- **Management**
  - **Establish airway**
  - **High concentration oxygen**
  - **Maintain minimal BP in dissection**
    - IV LR/NS TKO
      - minimize fluid administration
    - Avoid PASG
  - **Emergent Transport**
    - Trauma Center
    - Vascular Surgery capability



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Traumatic Asphyxia

Name given to these patients because they looked like they had been strangled or hanged

Traumatic Asphyxia

- **Pathophysiology**
  - **Blunt force to chest causes**
    - **Increased intrathoracic pressure**
    - **Backward flow of blood out of right heart into vessels of upper chest and neck**
      - **Jugular veins engorge**
      - **Capillaries rupture**

Traumatic Asphyxia

- Assessment Findings
  - Purplish-red discoloration of:
    - Head and Face
    - Neck
    - Shoulders
  - Blood shot, protruding eyes
  - JVD
  - ? Sternal fracture or central flail
  - Shock when pressure released

Traumatic Asphyxia

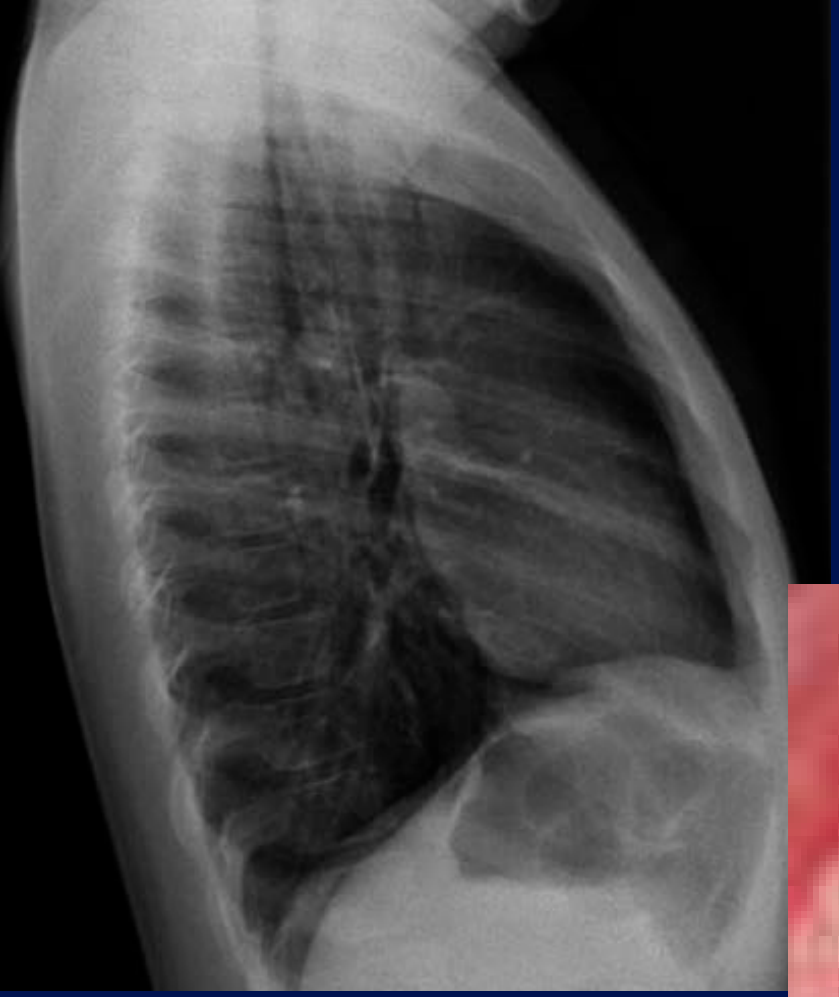
- **Management**
  - **Airway with C-spine control**
  - **Assist ventilations with high concentration O_2**
  - **Spinal stabilization**
  - **IV of LR**
  - **Monitor EKG**
  - **± MAST in severely hypotensive patients**
  - **Rapid transport**
    - Trauma Center
    - Consider early sodium bicarbonate in arrest

Esophageal Injury

- **Penetrating Injury most frequent cause**
  - **Rare in blunt trauma**
  - **Can perforate spontaneously**
    - violent emesis
    - carcinoma

Esophageal Injury

- **Assessment Findings**
  - **Pain, local tenderness**
  - **Hoarseness, Dysphagia**
  - **Respiratory distress**
  - **Resistance of neck on passive motion**
  - **Mediastinal esophageal perforation**
    - mediastinal emphysema / mediastinal crunch
    - mediastinitis
    - SQ Emphysema
    - splinting of chest wall
  - **Shock**



Esophageal Injury

- **Management**
  - **Establish Airway**
  - **Consider early intubation if possible**
  - **IV LR/NS titrated to BP 90-100 mm Hg**
  - **Emergent Transport**
    - Trauma Center
    - Surgical capability

Tracheobronchial Rupture

- Uncommon injury
  - less than 3% of chest trauma
- Occurs with penetrating or blunt chest trauma
- High mortality rate (>30%)
- May involve fracture of upper 3 ribs

Tracheobronchial Rupture

- **Pathophysiology**
  - **Majority (80%) occur at or near carina**
  - **rapid movement of air into pleural space**
  - **Tension pneumothorax refractory to needle decompression**
  - **continuous flow of air from needle of decompressed chest**

Tracheobronchial Rupture

- Assessment Findings
  - Respiratory Distress
    - Dyspnea
    - Tachypnea
  - Obvious SQ emphysema
  - Hemoptysis
    - Especially of bright red blood
  - Signs of tension pneumothorax unresponsive to needle decompression

Tracheobronchial Rupture

- **Management**
  - **Establish airway and ventilations**
  - **Consider early intubation**
    - intubating right or left mainstem may be life saving
  - **Emergent Transport**
    - Trauma Center

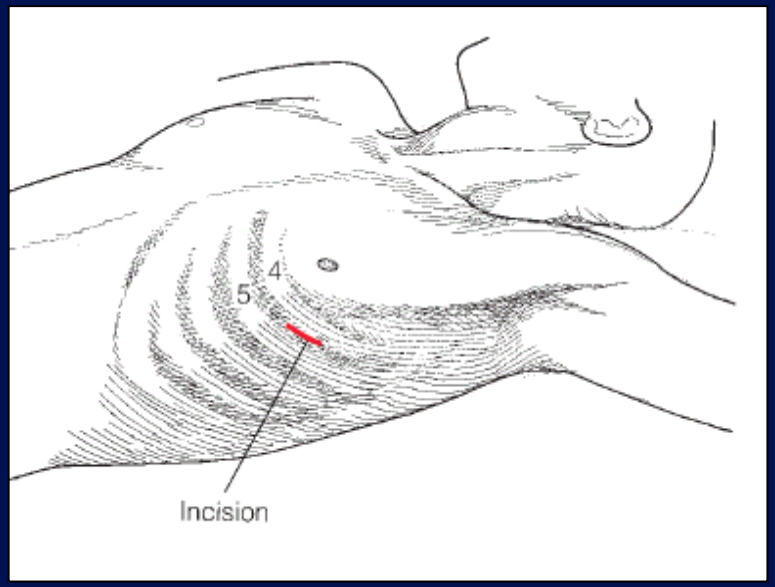
INDICATIONS FOR EMERGENCY TORACOTOMY IN TRAUMA

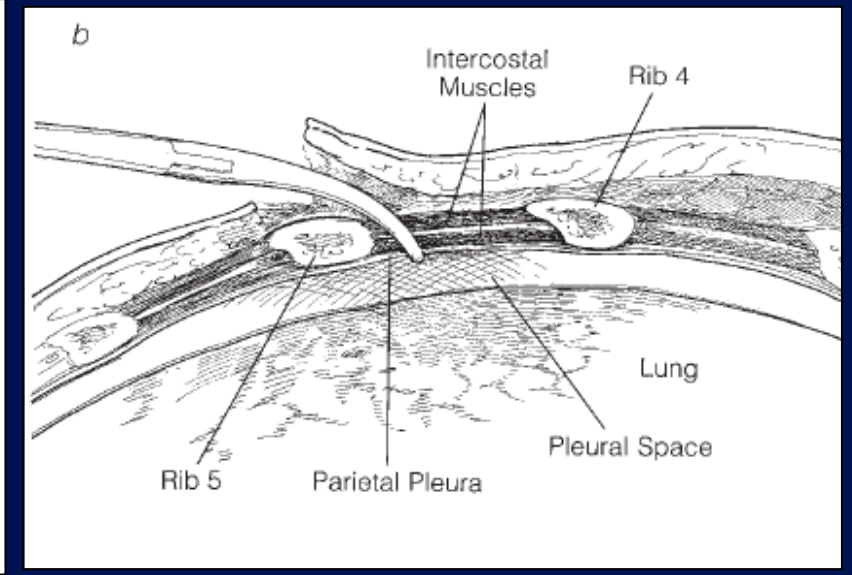
- Early chest tube bleeding > 500 ml/hour
- Continuous chest tube bleeding > 200ml/hour for 1-2 hours
- Persistent pneumothorax despite thoracic drainage (even double)
- Suspicion for cardiac tamponade
- Suspicion for lung hilum vessels' injury
- Persistent hypotension (not caused by neurogenic shock) despite treatment

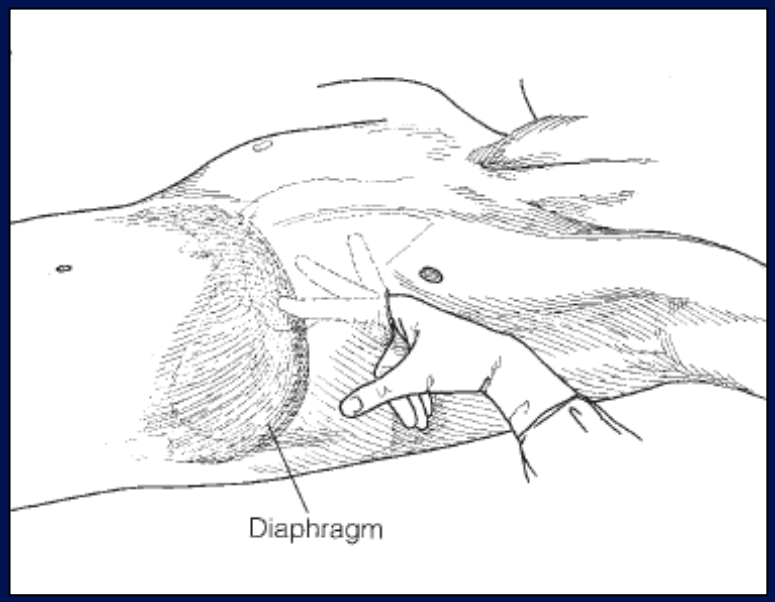
THORACOSTOMY IN TRAUMA

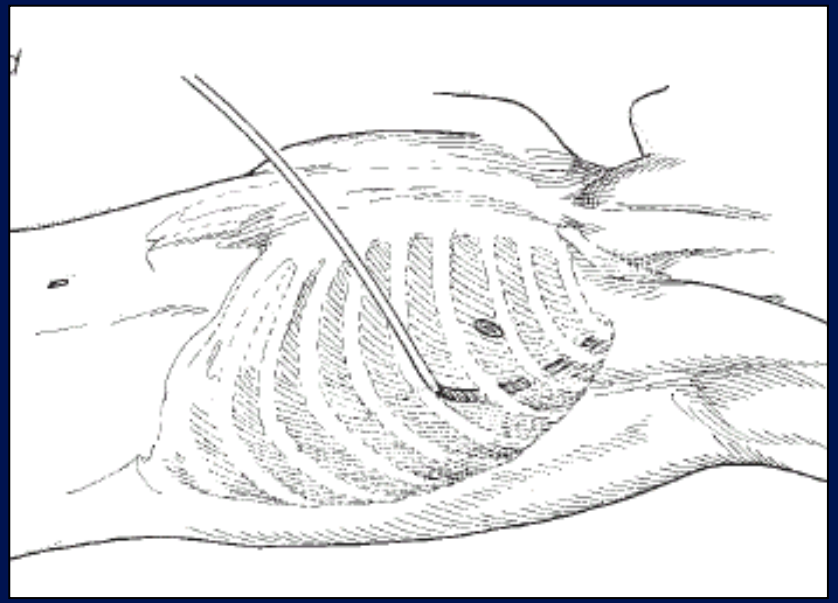
- **Always indicated for:**
  - **Tension pneumothorax**
  - **Massive hemothorax**
  - **Suspicion for tracheobronchial injury**
  - **Suspicion for esophagean injury**
  - **Small pneumothorax when intubation and mechanical ventilation needed**
- **Not always indicated for :**
  - **Simple pneumothorax < 5-10%**
  - **Small hemothorax caused by rib fractures**
  - **Flail chest**

THORACOSTOMY

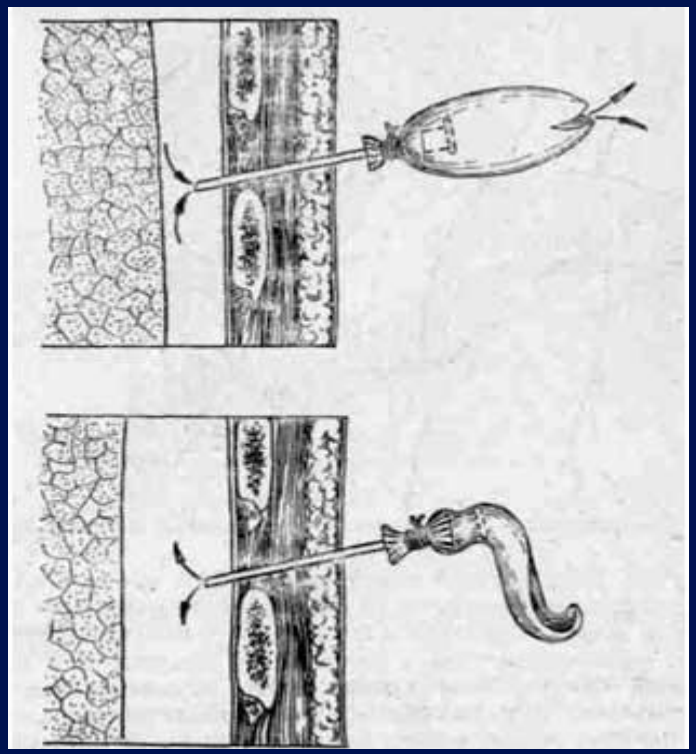








THORACOSTOMY



THORACOSTOMY

Unidirectional Heimlich valve

PERFORMING MEDICAL PROCEDURES

Chest-Tube Insertion

Shelly P. Dev, M.D.
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Pitfalls to Avoid

- Elderly do not tolerate relatively minor chest injuries
  - Anticipate progression to acute respiratory insufficiency
- Children may sustain significant intrathoracic injury w/o evidence of thoracic skeletal trauma
  - Maintain a high index of suspicion

Pitfalls to Avoid

- Don’t overlook the Obvious!
- Be suspicious of the non-obvious!

Diaphragmatic Rupture

- Usually due to blunt trauma but may occur with penetrating trauma
- Usually life-threatening
- Likely to be associated with other severe injuries

Diaphragmatic Rupture

- **Pathophysiology**
  - **Compression to abdomen resulting in increased intra-abdominal pressure**
    - abdominal contents rupture through diaphragm into chest
    - bowel obstruction and strangulation
    - restriction of lung expansion
    - mediastinal shift
  - **90% occur on left side due to protection of right side by liver**

Diaphragmatic Rupture

- **Assessment Findings**
  - **Decreased breath sounds**
    - Usually unilateral
    - Dullness to percussion
  - **Dyspnea or Respiratory Distress**
  - **Scaphoid Abdomen (hollow appearance)**
  - **Usually impossible to hear bowel sounds**

Diaphragmatic Rupture

- **Management**
  - **Establish airway**
  - **Assist ventilations with high concentration O_2**
  - **IV of LR**
  - **Monitor EKG**
  - **NG tube if possible**
  - **Avoid**
    - MAST
    - Trendelenburg position

Diaphragmatic Penetration

- Suspect intra-abdominal trauma with any injury below 4th ICS
- Suspect intrathoracic trauma with any abdominal injury above umbilicus