



Thoracic Trauma

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Thoracic Trauma

- **Thoracic trauma** (or **Chest trauma**) is an Injury of the Chest
- Most of the patients belong the age group of 20 -50 years
- Thoracic trauma is a common cause of significant disability and mortality
- Blunt thoracic injuries are the leading cause of death from Physical Trauma after head and spinal cord injury
- The Mortality rates is about 10%

Thoracic Trauma

- It is estimated that 25% of all blunt trauma deaths are due to thoracic trauma
- Early recognition and treatment of thoracic trauma is crucial in decreasing potentially preventable mortality
- Isolated chest trauma is uncommon (16%); 84% of these patients will have additional injuries
- Basic interventions such as prompt resuscitation, pleural decompression, chest tube insertion, etc. account for the majority of initial life-saving interventions

Thoracic Trauma

2 main types - Blunt & Penetrating

Blunt chest trauma

- Occurs in both rural and urban settings
- Motor vehicle crashes are responsible for 70-80% of blunt thoracic trauma
- Less than 10% of blunt thoracic trauma necessitates surgical intervention

Thoracic Trauma

Penetrating chest trauma

- Usually associated with an urban setting
- Commonly due to gun shot wounds and knife wounds
- Increased incidence of wounds due to semi-automatic guns
- 15-30% mandate an open thoracotomy
- 75% require only tube thoracostomy

Thoracic Trauma

Penetrating chest trauma - Mechanisms

Low Energy

Arrows, knives, handguns

Injury caused by direct contact and mild cavitation

High Energy

Military, hunting rifles & high powered hand guns

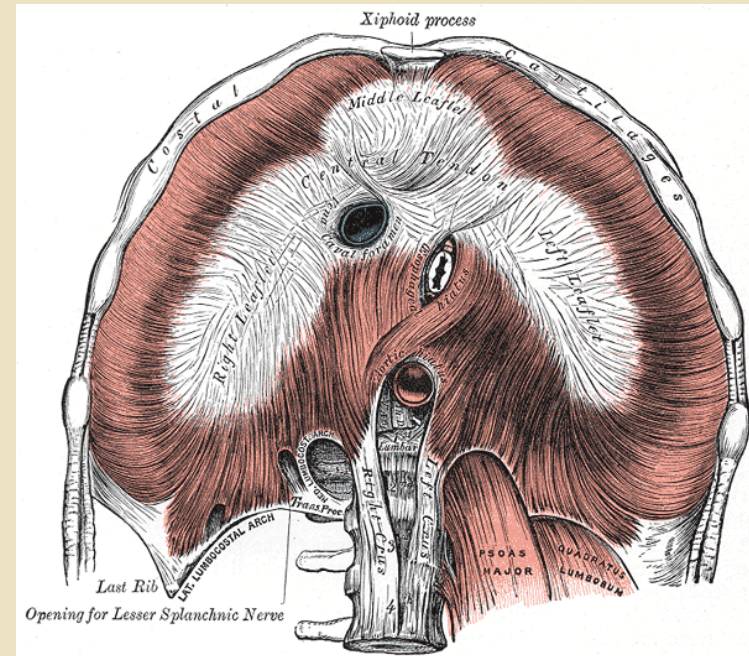
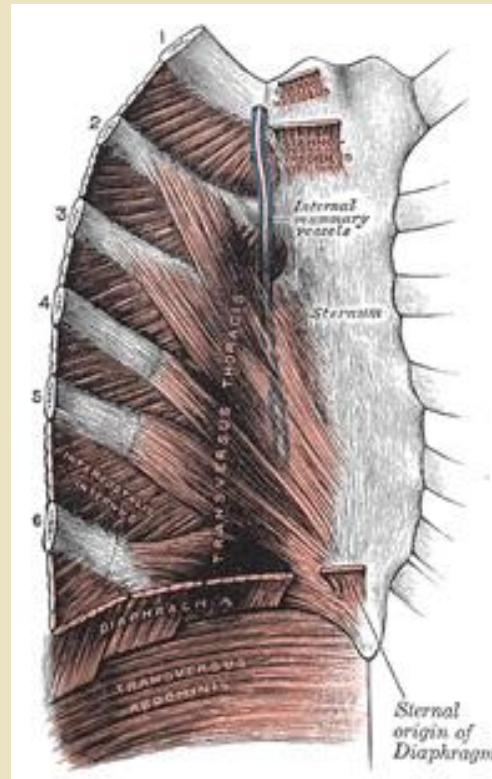
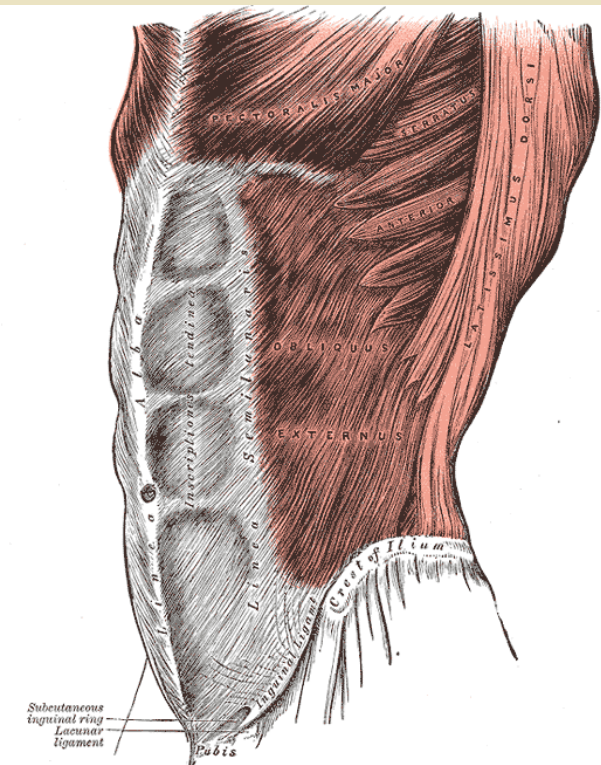
Extensive injury due to high pressure cavitation

- If the energy is great enough, the tissue may heat enough to produce steam
- This steam may expand explosively, causing a cavity in the tissue
- This process occurs along the bullet tract, temporarily creating an expanding cone-shaped cavity
- Once the heat is dissipated, the cavity collapses, contributing to shock waves within the tissue . This phenomenon is known as a cavitation injury
- This cavitation injury can disrupt tissue several centimeters away from the path of the projectile

Thoracic Trauma

Anatomy

Muscles of the Thorax



Thoracic Trauma

Thoracic Skeleton - Anatomy

12 Pair of C-shaped ribs

Ribs 1-7: Join at sternum with cartilage end-points

Ribs 8-10: Join sternum with combined cartilage at 7th rib

Ribs 11-12: No anterior attachment

Sternum

Manubrium

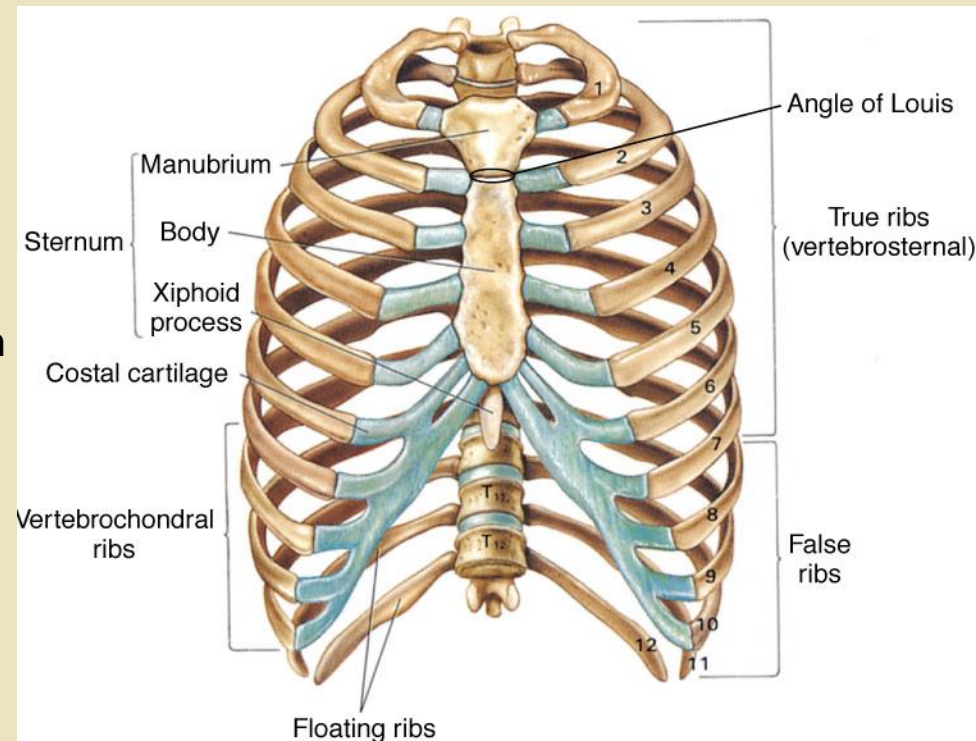
Joins to clavicle and 1st rib
Jugular Notch

Body

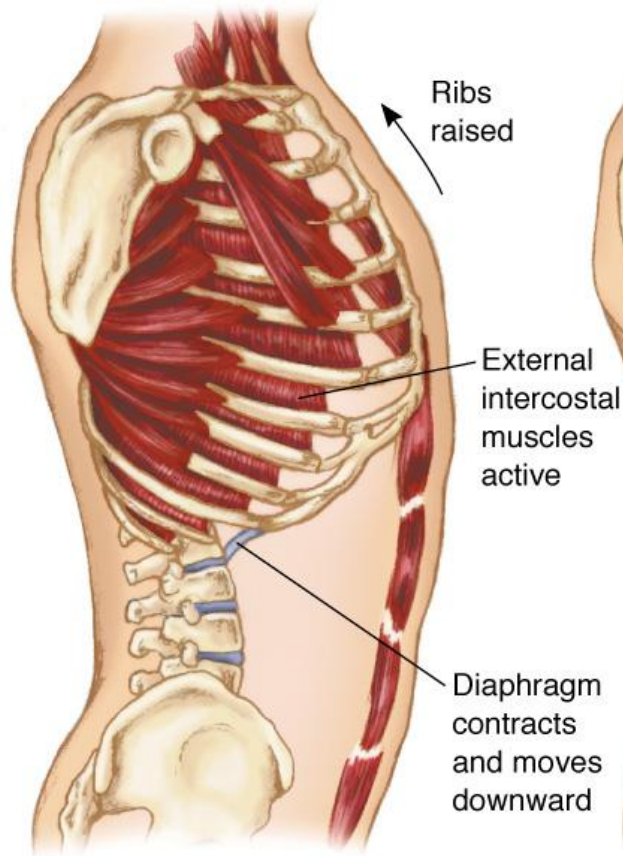
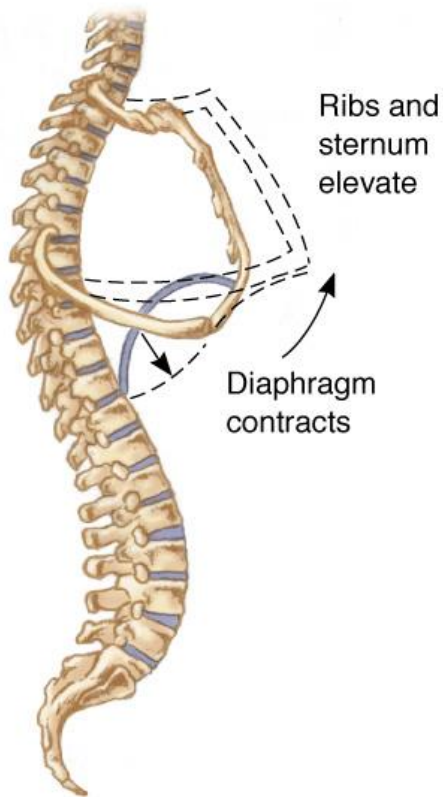
Sternal angle (Angle of Louis)
Junction of the manubrium with
the sternal body Attachment
of 2nd rib

Xiphoid process

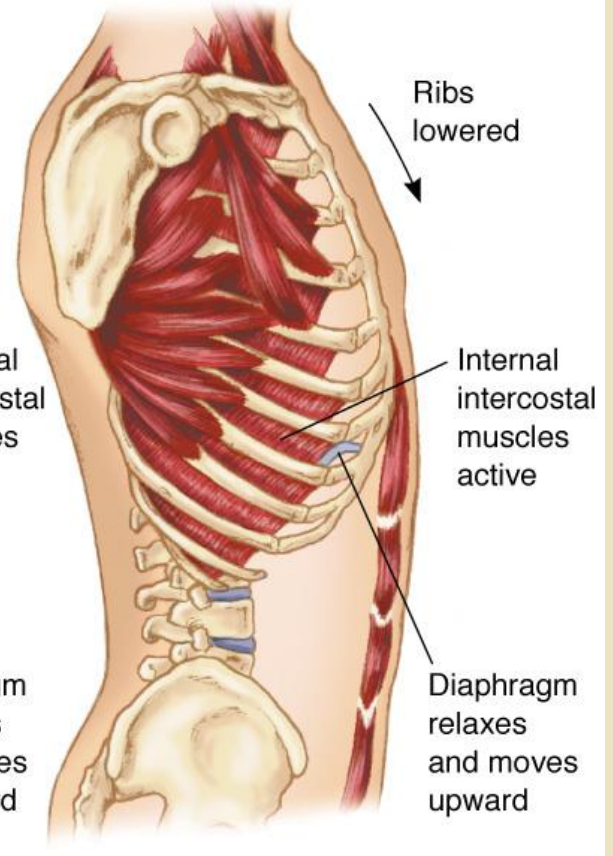
Distal portion of sternum



Thoracic Trauma



Inspiration



Expiration

Thoracic Trauma

Chest wall Injuries

- Contusion/ Haemetoma
- Muscle tears
- Rib fractures/ Flail Chest
- Sternal Fractures
- Fractures of the Clavicle and Shoulder Girdle

Thoracic Trauma

Rib Fractures - one of the Commonest Injuries

- A **rib fracture** is a breaking one or more of the bones
- Fractures usually occur from direct blows or from indirect crushing injuries making up the rib cage
- The *weakest part of a rib is just anterior to its angle*, but a fracture can occur anywhere
- A lower rib fracture has the complication of potentially injuring the diaphragm
- Rib fractures are usually quite painful because the ribs have to move to allow for breathing and is involved even in simple movements -

Physical Signs? - Pain, Tenderness, Difficulty in breathing
A/P compression - Pain laterally

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Rib Fractures

- The **first rib is rarely fractured** because of its protected position behind the clavicle and is short & stout.
- If it is broken serious damage may occur to the of Brachial plexus and the Subclavian vessels or Aorta
- aortography is indicated if the patient also has brachial plexus deficit, absent radial pulse, pulsating supraclavicular mass, or widened mediastinum
- The **middle ribs are the ones most commonly fractured**
- Single Rib fracture - Blood loss = 100 ml
- **Significant intrathoracic injury may be present without rib fracture in children due to rib cage elasticity**

Thoracic Trauma

Rib Fractures

- Management is Analgesia , Rest and gentle movements
(Usually 4-6 weeks to heal)

What not to do:

- Do not confuse simple rib fractures with massive blunt trauma to the chest
- Do not tape ribs or use continuous strapping. This will lead to an atelectatic lung prone to pneumonia.
- Do not assume there is no fracture just because the x rays are negative
- Rib fractures are often not apparent on x ray, especially when they occur in the cartilagenous portion of the rib

Thoracic Trauma

Flail Chest

It usually occurs in the setting of a high-speed motor vehicle crash

- It occurs when at least **two ribs** are broken in **at least two places**
- Part of the chest wall becomes detached from the rest of the chest wall moves independently from the rest
- The flail segment moves in the opposite direction as the rest of the chest wall: because of the higher ambient pressure in comparison to the pressure inside the lungs, it goes in while the rest of the chest is moving out, and vice versa
- This so-called "**paradoxical motion**" can increase the work and pain involved in breathing.

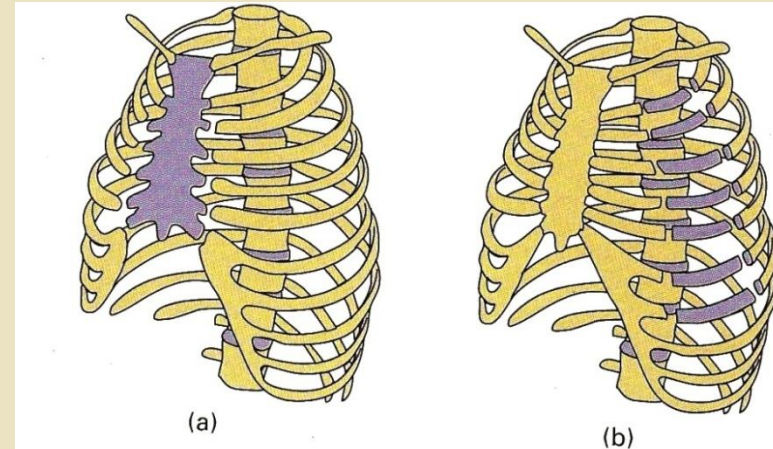
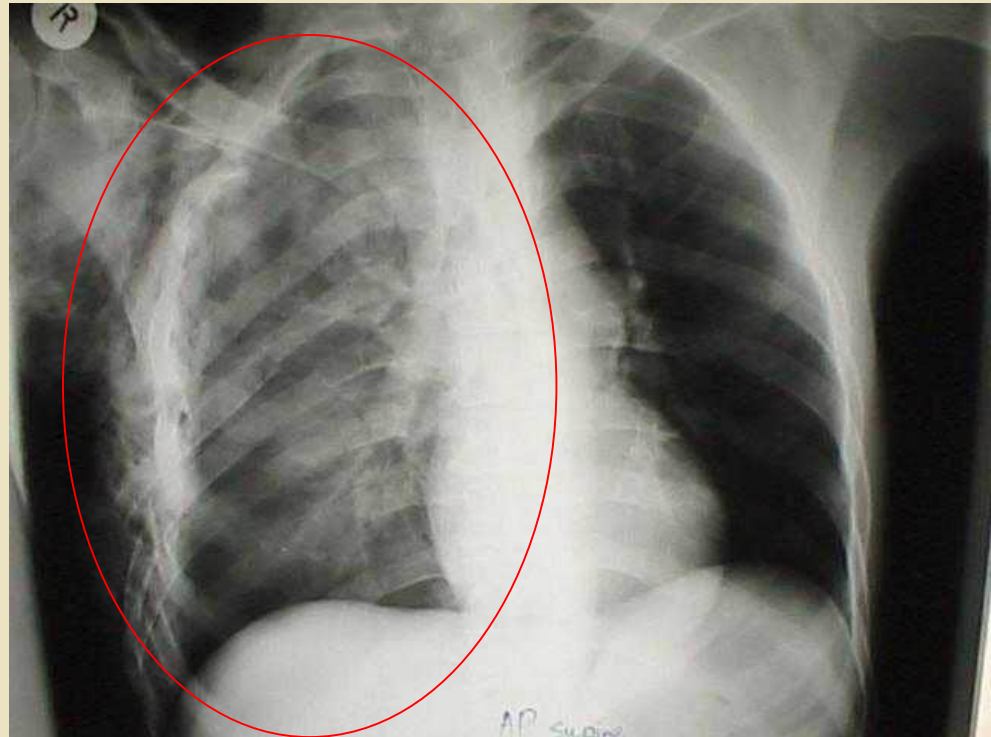


Fig. 10 Flail segments due to multiple unilateral or bilateral rib fractures.

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Flail chest is usually evident if there is :

- Fracture of 4 or more ribs anteriorly and posteriorly
- Bilateral anterior rib fractures
- Sternal and rib fractures
- Costochondral fracture of 4-5 ribs



Thoracic Trauma

Management

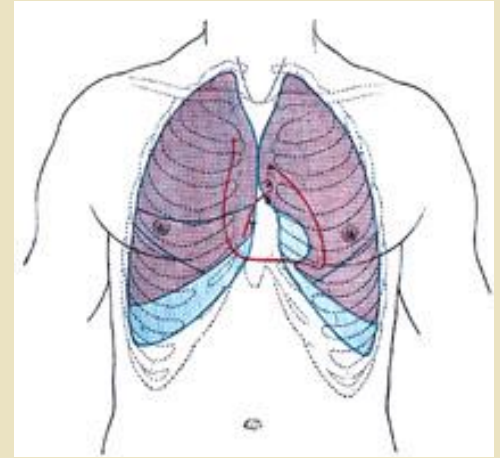
Flail chest may be successfully managed

- With facemask oxygen, CPAP, and chest physiotherapy
- Adequate analgesia is of paramount importance in patient recovery and may contribute to the return of normal respiratory mechanics
- Others will require Intubation/Tracheostomy and mechanical ventilation
- Frequent flexible bronchoscopy should be considered to provide effective pulmonary toilet
- Surgical Stabilization may be required in some

Thoracic Trauma

Lungs and Pleural Space

- Pneumothorax
- Tension Pneumothorax
- Haemothorax
- Haemopneumothorax



Physical Signs?

Classic signs of Pneumothorax

Trachea



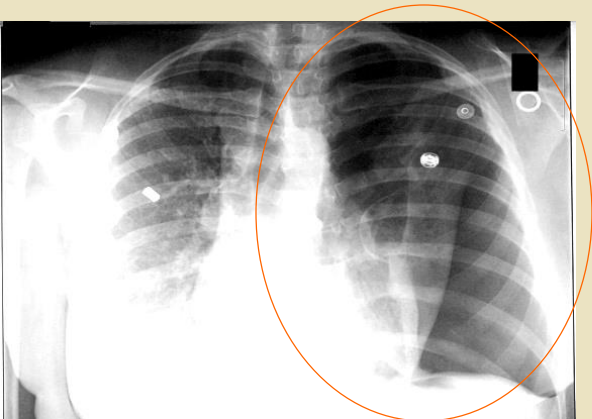
Expansion



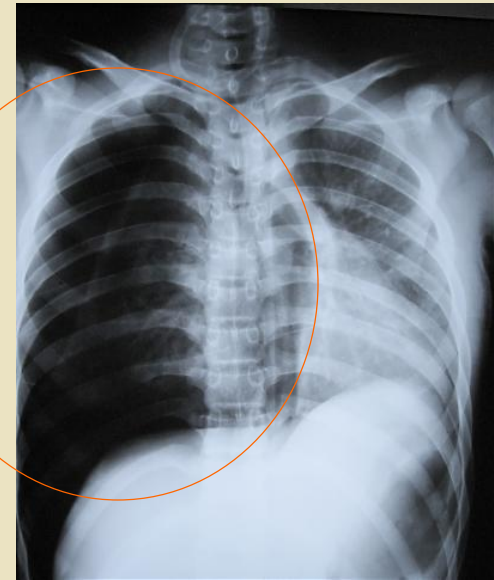
Percussion Note



Breath sounds



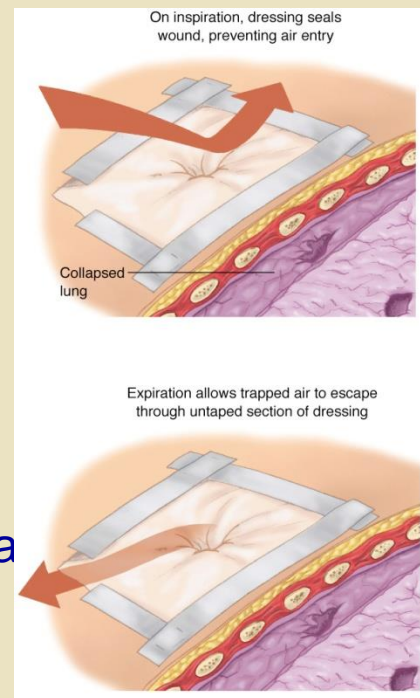
Management - IC tube



Thoracic Trauma

Open Pneumothorax

- High flow O₂
- Cover site with sterile occlusive dressing
- taped on three sides



Haemothorax - Shock ,Dyspnoea, Tachycardia, Tachypnoea
Diaphoresis , Hypotension, Dull to percussion over injured side

- Should be managed with early chest tube drainage to prevent clot formation and incomplete evacuation
- Surgical exploration is recommended if initial output is more than 1500 ml or chest tube drainage is more than 200 ml/hr for 4 hours
- A clotted Haemothorax should be evacuated early by thoracotomy to improve pulmonary function and prevent late fibrothorax

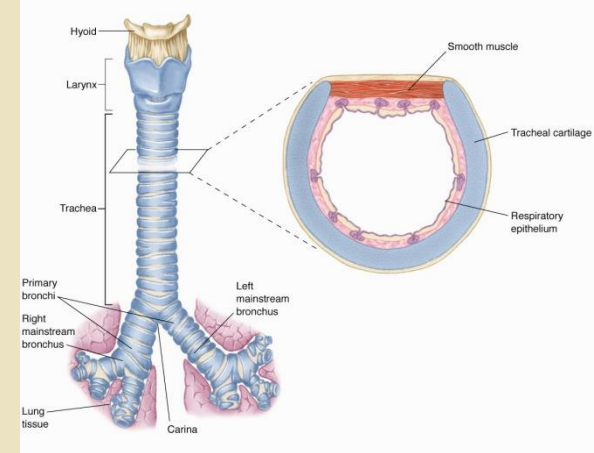


Thoracic Trauma

Injury to the airways

Tracheal/Bronchial Injuries

- Most tracheal injuries are cervical and range from crush injuries to complete tracheal separation
- If endotracheal intubation is not possible, a surgical airway should be obtained
- Only 50% of patients will have a pneumothorax with this injury, and Haemothorax is uncommon
- Only 1/3 of patients are diagnosed in the first 24 hours, and only 1/2 within the first month
- Blunt trauma typically causes a circumferential laceration of either main bronchus with complete separation
- Early repair is the preferred treatment if the diagnosis is made, and requires thoracotomy with intubation of the uninjured bronchus



Thoracic Trauma

Cardiac injury

- Cardiac Tamponade

Emergency



Beck's triad

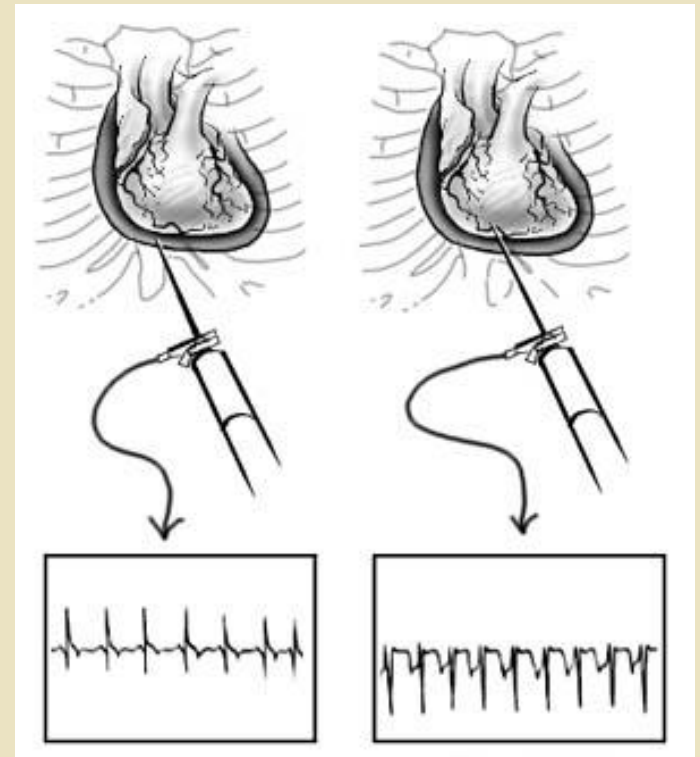
- low BP,
- Increasing JVP
- Muffled heart sound

is noticed in <30% of cases

Two-dimensional echocardiographic-guided Pericardiocentesis

If all fail Thoracotomy

Subxiphoid Pericardiocentesis



Left xipho-costal junction

Thoracic Trauma

Myocardial Contusion

- Occurs in 75% of patients with severe blunt chest trauma
- Right Atrium and Ventricle is commonly injured
- Injury may reduce strength of cardiac contractions
- Reduced cardiac output
- Cause electrical disturbances due to irritability of damaged myocardial cells

Progressive Problems

Haematoma

Myocardial necrosis

Dysrhythmias

CHF & or Cardiogenic shock

Thoracic Trauma

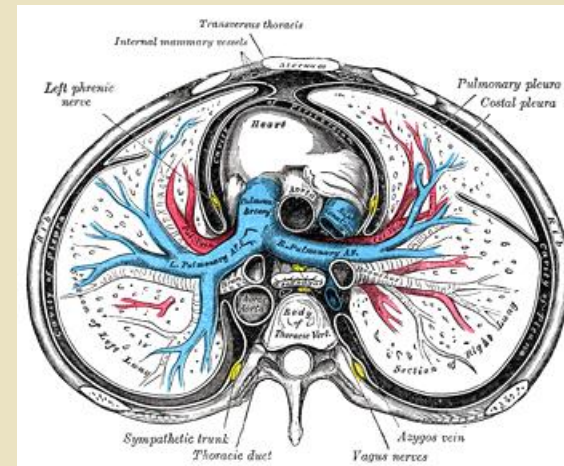
Blood vessel injuries

Traumatic Rupture of Aorta

- Usually caused by high speed impacts
- The condition is frequently fatal due to the profuse Bleeding that results from the rupture . 80–85% of patients die before arriving at a hospital
- Most patients have no symptoms
- However, a minority of patients may be hoarse, or have shortness of breath, or have chest or upper Back Pain
- **Emergency surgery is the only option - Complications high (Paraplegia)**

Injury to Pulmonary Vessels

- Difficult to treat
- Early recognition
- Surgery
- Out come -poor



Thoracic Trauma

Injuries to other structures within the torso

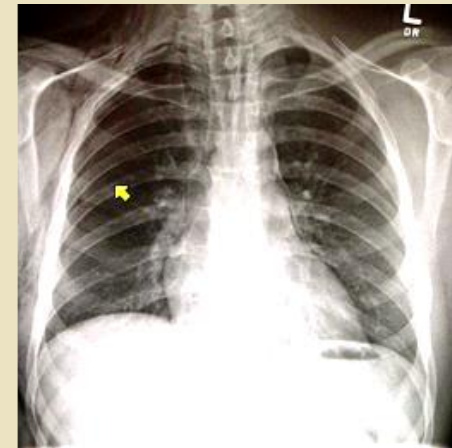
Oesophageal Injury

- The rupture occurs due to raised intraluminal pressure from abdominal compression in the presence of a closed glottis
- It may be due to compression of the oesophagus between the sternum and the vertebrae. Rib fractures are unusual

Classical features

- (1) Retrosternal pain
- (2) Tachypnoea
- (3) Surgical emphysema in the absence of fracture ribs

X-ray of the chest showed pneumomediastinum



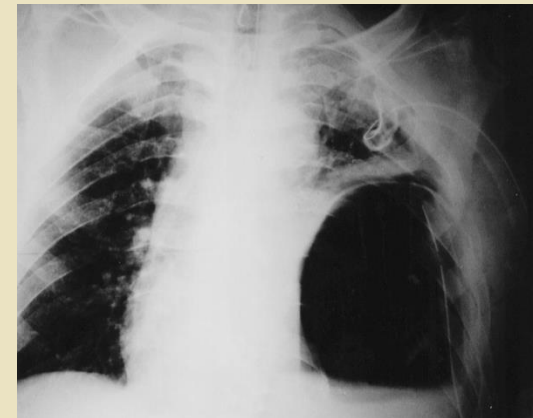
- Drainage of the appropriate cavity with near total exclusion of the thoracic oesophagus by cervical oesophagostomy and gastrostomy
- The cervical oesophagostomy prevents further mediastinal contamination by saliva which is the main source of organisms causing mediastinitis
- Primary suturing of the oesophageal tear is not advocated as there is marked contusion of the oesophagus around the tear

Thoracic Trauma



Diaphragmatic Injury

- Most lacerations occur on the left hemidiaphragm and result from automobile accidents
- Usually, the stomach herniates and undergoes volvulus, massively dilates, and causes left lung collapse and mediastinal shift to the right
- Gastric distension can also result in perforation and should be prevented by NG tube placement
- Splenic and liver injury is also common in this setting
- The diaphragm can be repaired either through the chest or abdomen, and all tears should be closed in double-layer fashion



Thoracic Trauma

Summary

Immediate deaths are usually due to

- Major disruption of the heart
- Injury great vessels (Aorta/ Pulmonary vessels)

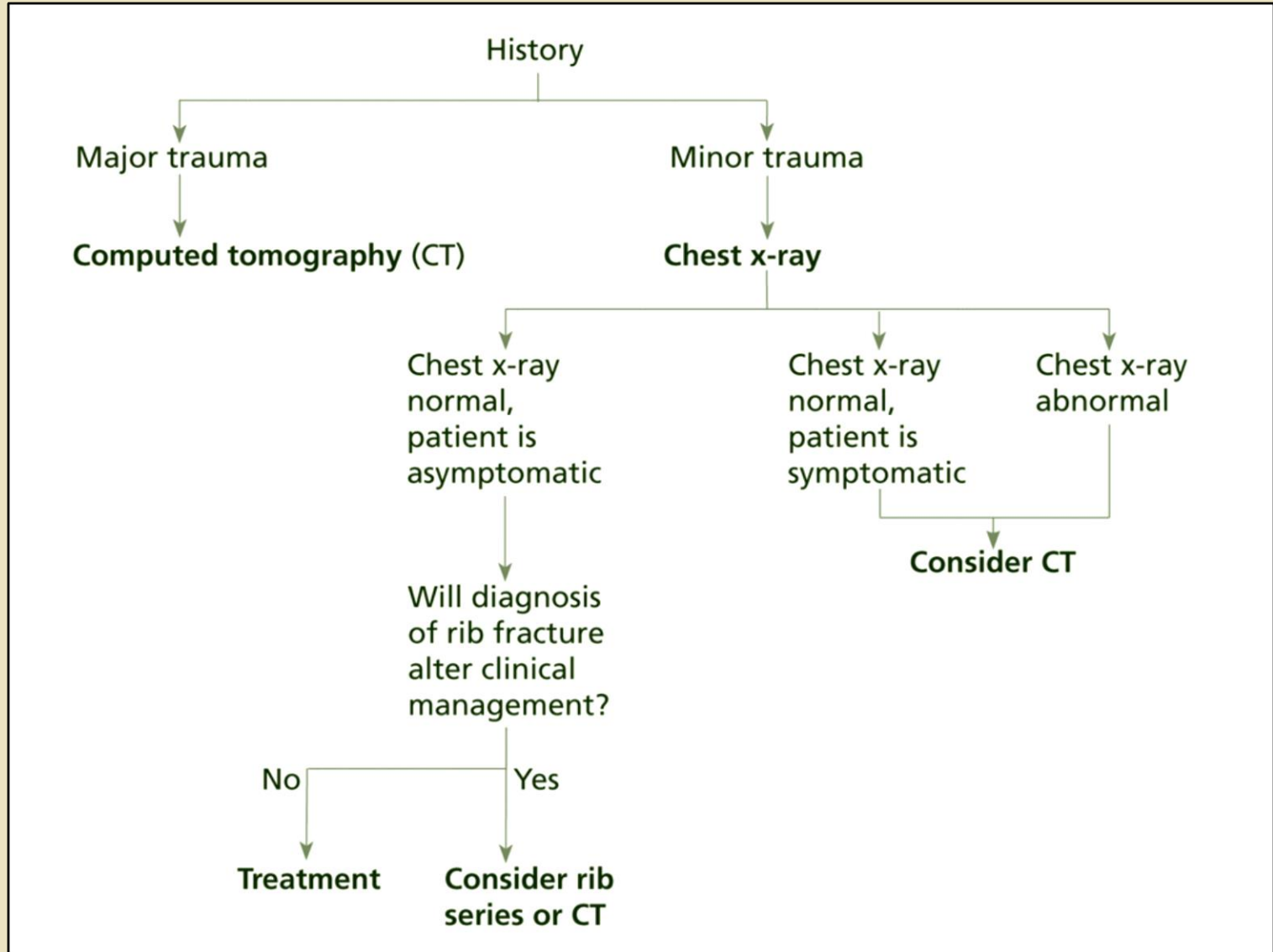
Early deaths due to thoracic trauma (within 30 minutes to 3 hours after the injury)

- Cardiac Tamponade
- Tension pneumothorax
- Airway obstruction
- Aspiration

Prevent , Detect, Prompt treatment

Thoracic Trauma

Summary - When to order CT (Protocols)



Thoracic Trauma

Summary

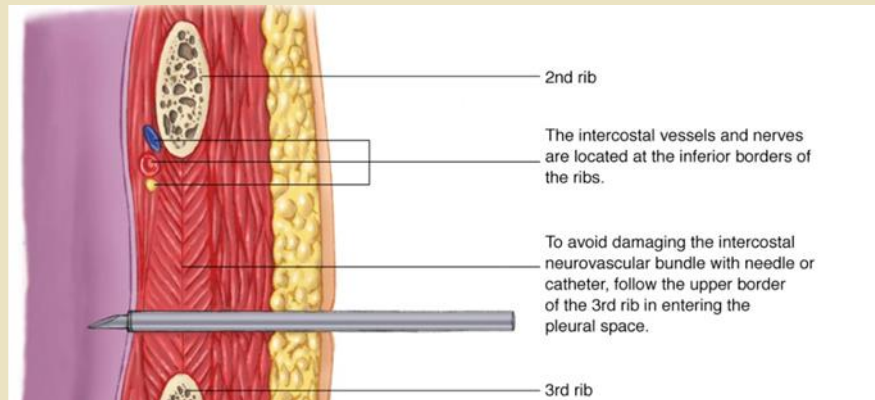
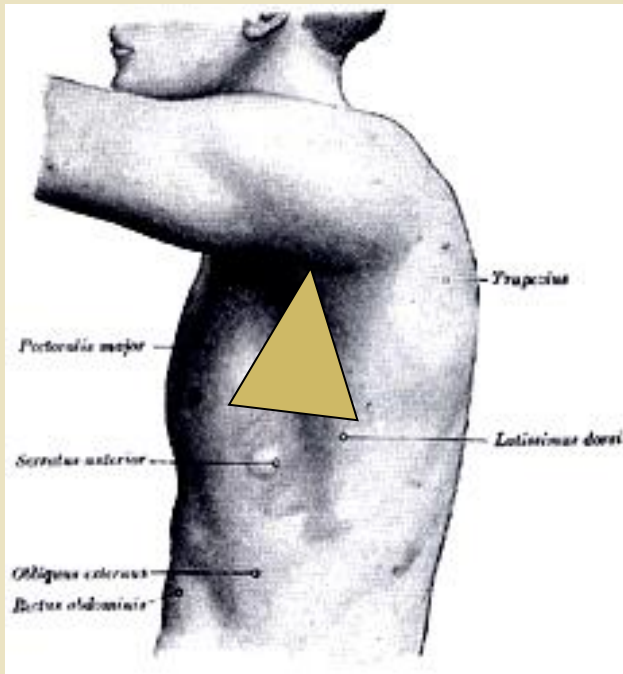
General measures in all forms of chest injuries include:

- Analgesics and antibiotics
 - Oxygen by mask; if patient is hypoxic, consider manual ventilation
 - Appropriate intercostal drainage tubes
 - Arterial blood gas measurements
 - Intercostal block/ epidural block
 - Chest physiotherapy
 - Repeated bronchoscopic suction
- Indications for ventilatory support are**
- Tachypnoea
 - Shock
 - Cyanosis
 - $PAO_2 < 60\text{mm Hg}$
 - $PCO_2 > 50\text{mm Hg}$

Thoracic Trauma

- Tube thoracostomy (Chest Drain /IC tube)

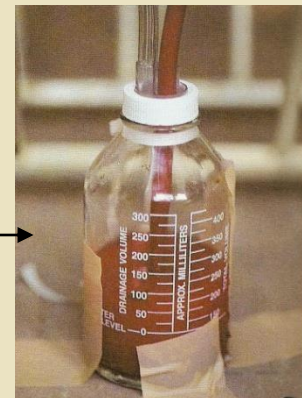
Insert in the Triangle of safety



TOP OF RIB

Connect to underwater seal →

2nd intercostal space Mid clavicular line - May be dangerous



Thoracic Trauma

Summary

- Only 10-15% of blunt trauma require thoracic surgery
- 15-30% of the penetrating chest trauma require open thoracotomy
- 85% of patients with thoracic trauma, can be managed by basic interventions such as prompt resuscitation, pleural decompression, chest tube insertion

Indications for Urgent Surgical intervention

- Haemodynamically unstable patient
- 1500 ml on insertion or chest tube drainage is more than 200 ml/hr for 4 hours
- Suspected abdominal injuries/ Other injuries/ Multiple Injuries
- Rare injuries - Aortic injury

2 Incisions – Left Thoracotomy/ Median Sternotomy -Depends on injury

Thoracic Trauma

Acute respiratory distress syndrome (ARDS)

- Is a serious reaction to various forms of injuries to the Lung

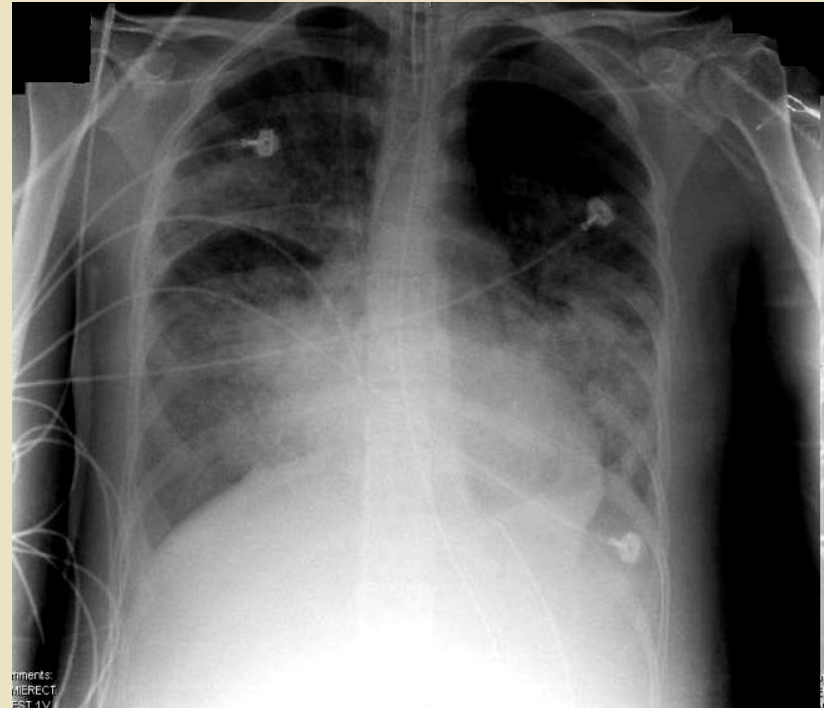
It is characterized by inflammation of the lung parenchyma impaired gas exchange concomitant systemic release of inflammatory mediators causing

- Inflammation
- Hypoxia
- Multi organ Failure

ARDS can occur within 24 to 48 hours of an injury or attack of acute illness

Dyspnoea, Tachypnoea

Treated with Mechanical Ventilation



Thoracic Trauma

Prevention Strategies

- Seat belts and Air bags
- Sports safety equipment
- Gun control laws
- Others