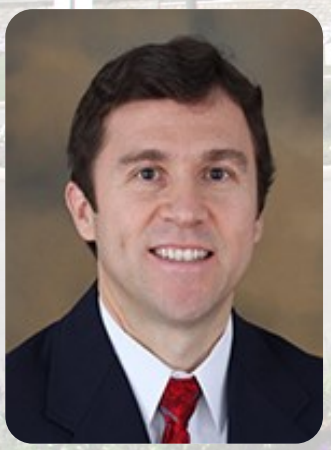
Chest Tube Workshop

10 Questions and a Demonstration



Presented By:
Joseph E. Fondriest, M.D.
Department of Radiology
Licking Memorial Health Systems

Objectives

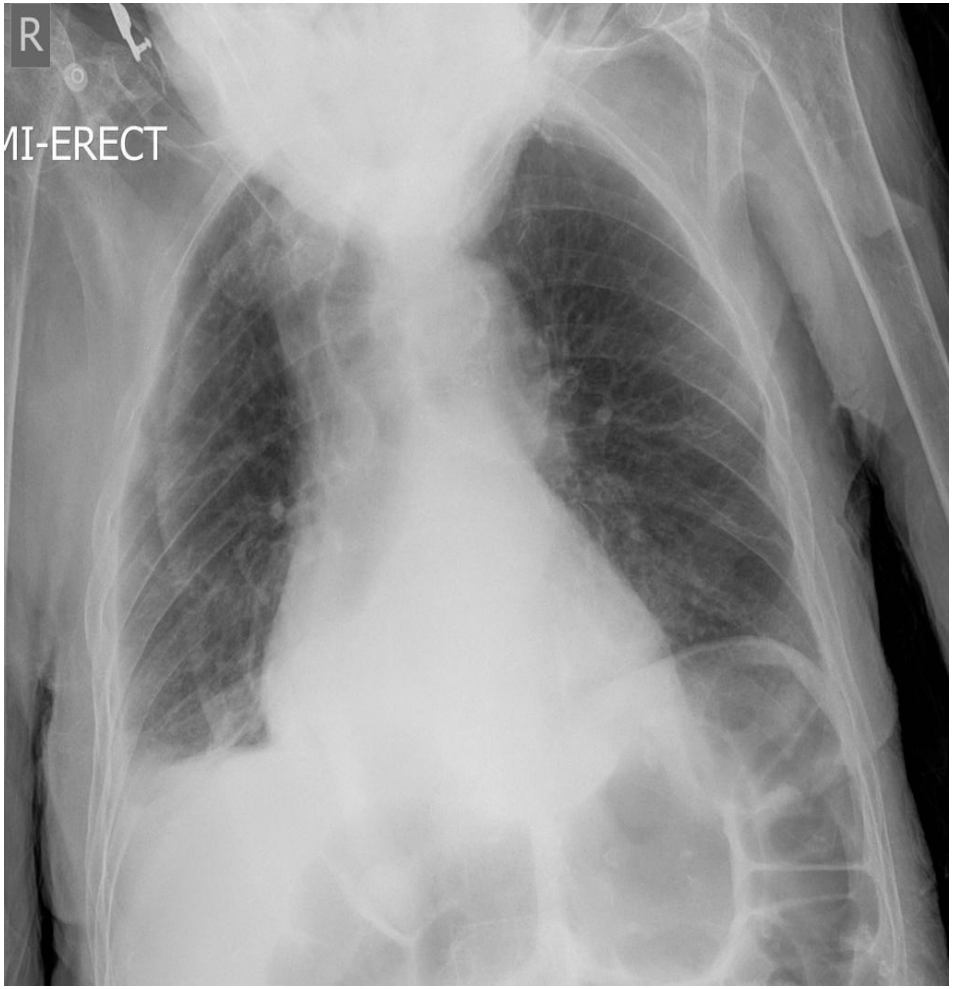
- Describe indications for chest tube placement
- Employ proper technique for chest tube placement
- Assess and troubleshoot ineffective chest tube function
- Examine chest tube removal and follow up.

What are some conditions that may require a chest tube?

What are some conditions that may require a chest tube?

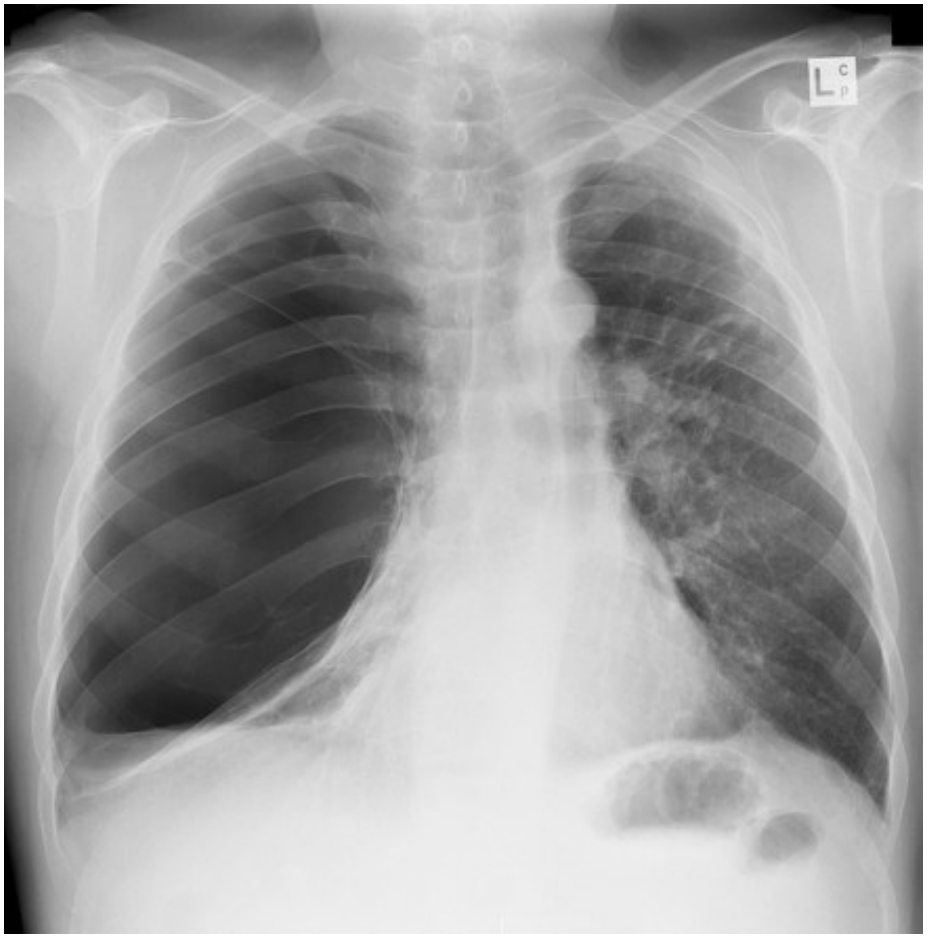
- Pneumothorax.
- Traumatic hemothorax.
- Symptomatic pleural effusion.
- Empyema.
- Not skin fold, artefact, bulla!
- When is doubt, CT imaging may be indicated.

Skin Fold



Case courtesy of Dr Andrew Dixon, Radiopaedia.org, rID: 52780

Right Sided Bulla



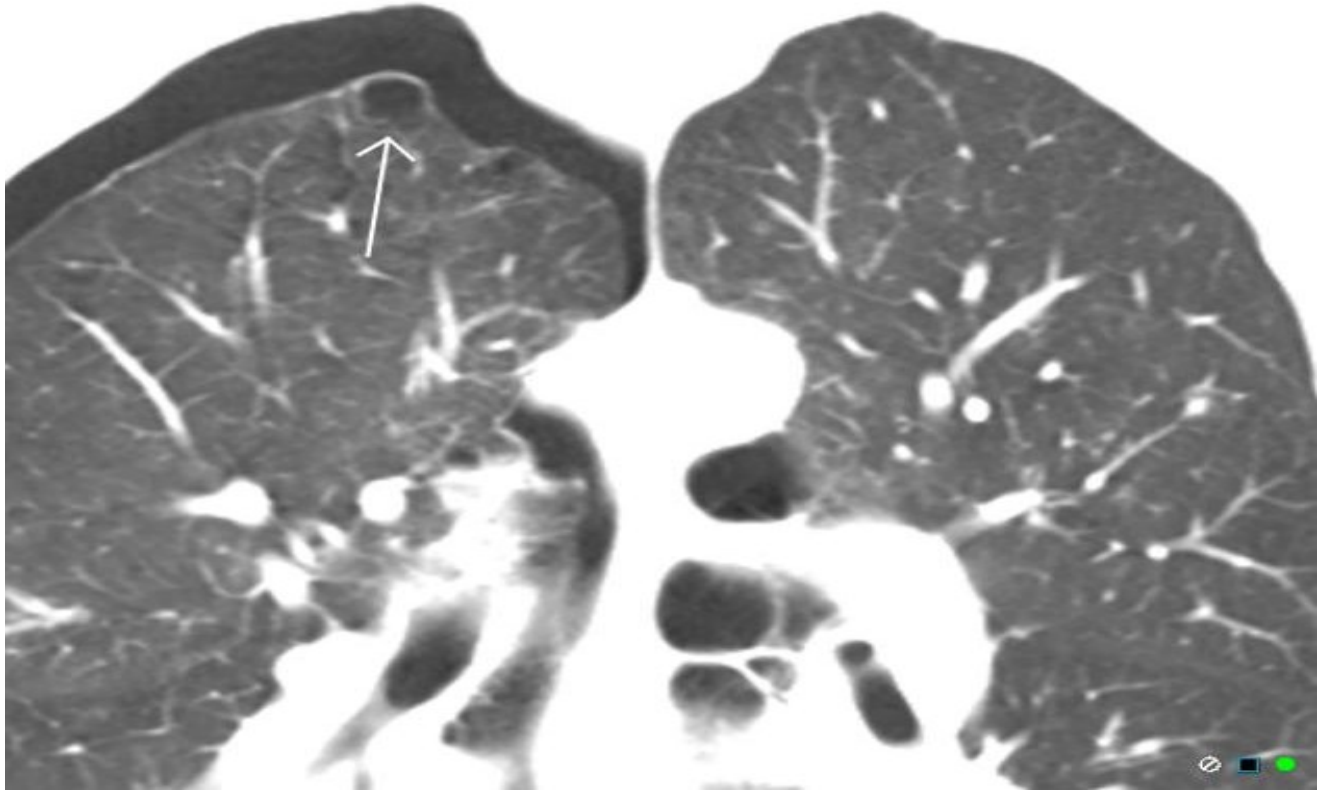
Case courtesy of Assoc Prof Craig Hacking, Radiopaedia.org, rID: 73253

Does the condition require a chest tube insertion?

Does the condition require a chest tube insertion?

- A pneumothorax that is greater than 2 – 3 cm from the lung apex.
- Moderate to large size symptomatic pleural effusions .
- Symptomatic or increasing pneumothorax typically require chest tube placement.
- Known injury to the lung.
- A tension pneumothorax should be urgently treated.

CT image of Small Right Pneumothorax and Apical BlebZ

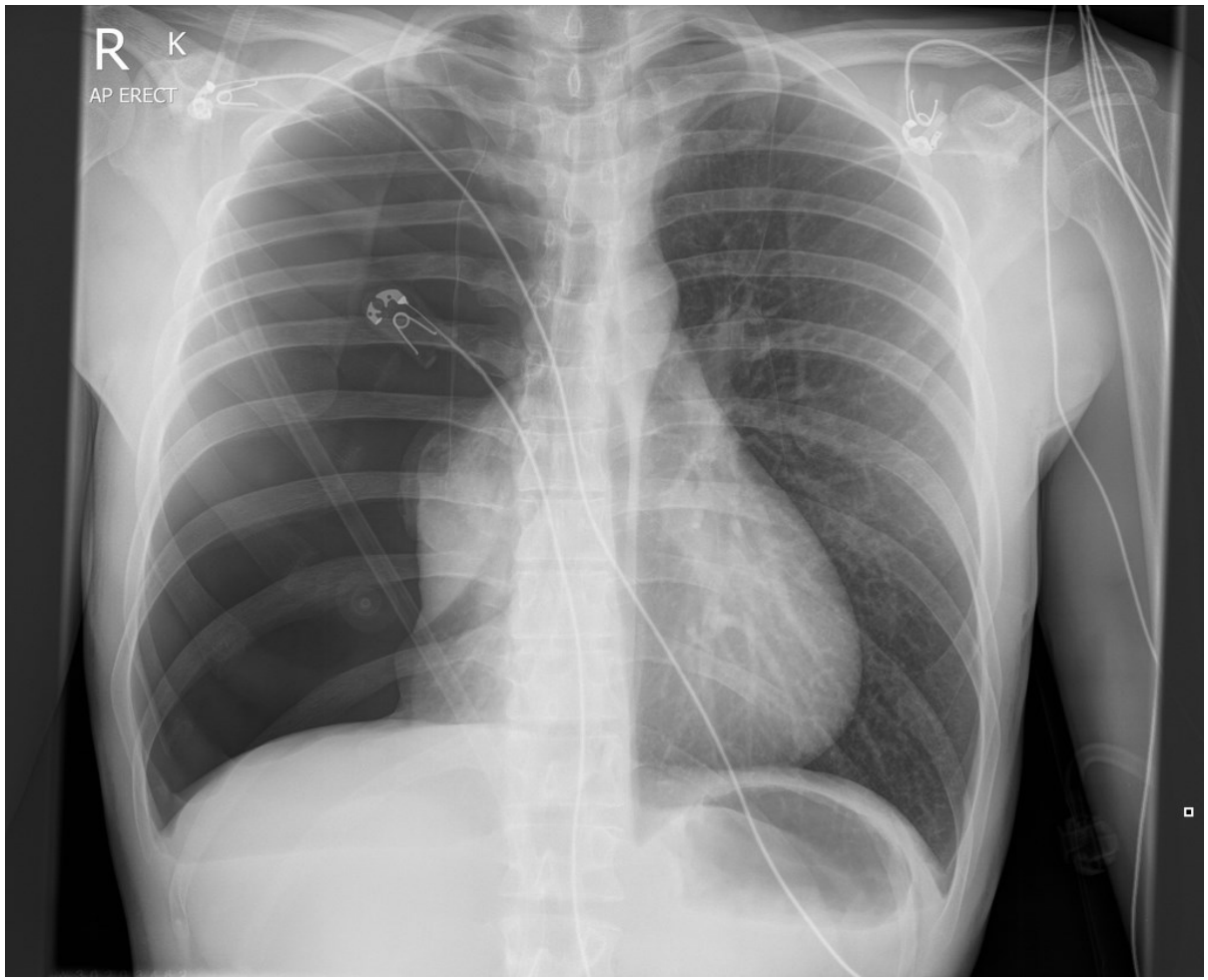


Case courtesy of Dr Chris O'Donnell, Radiopaedia.org, rID: 19792

Pneumothorax Categories

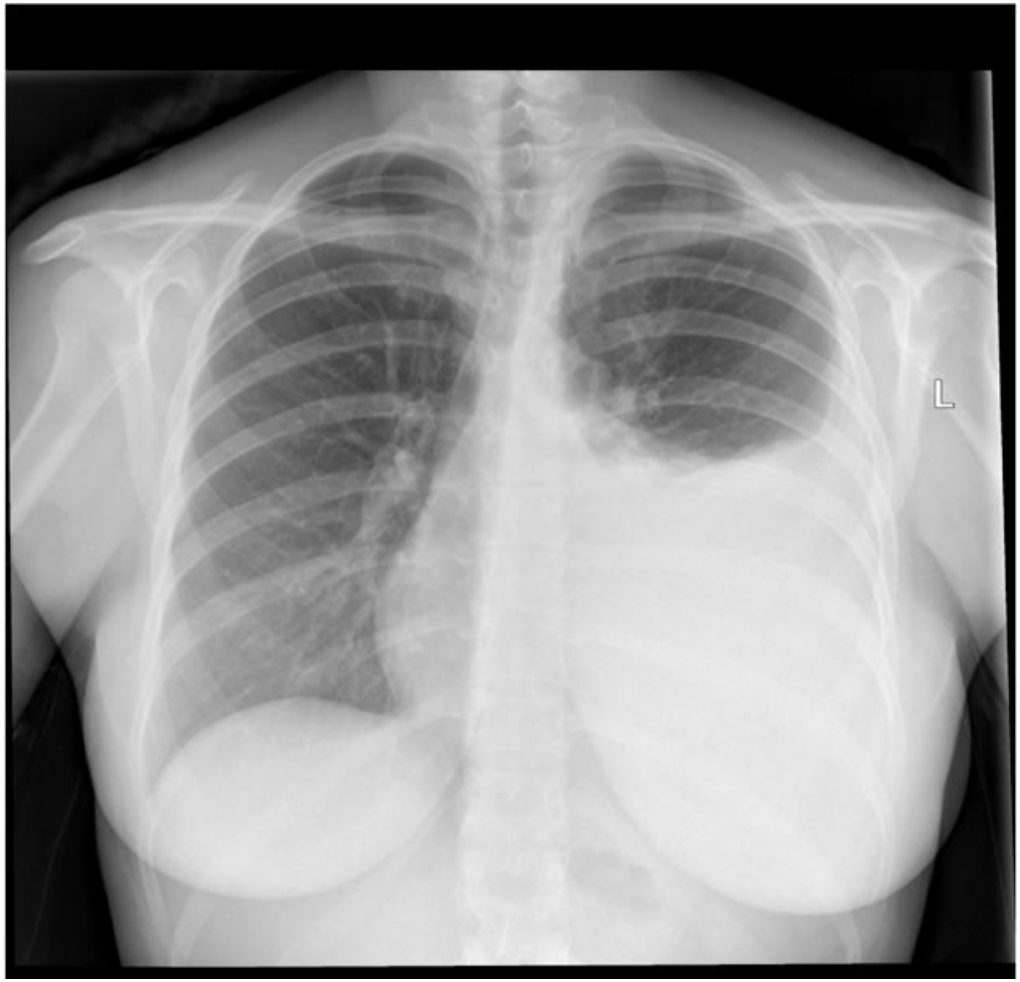
- Primary spontaneous pneumothorax occurs in patients with no known underlying lung disease, typically younger than 35 years of age. Often present with chest pain and mild/moderate dyspnea.
- Secondary spontaneous pneumothorax occurs in patients with underlying lung disease, typically over the age of 45. Often present with severe dyspnea with mild or no chest pain.
- Iatrogenic and traumatic pneumothorax.

Spontaneous Pneumothorax



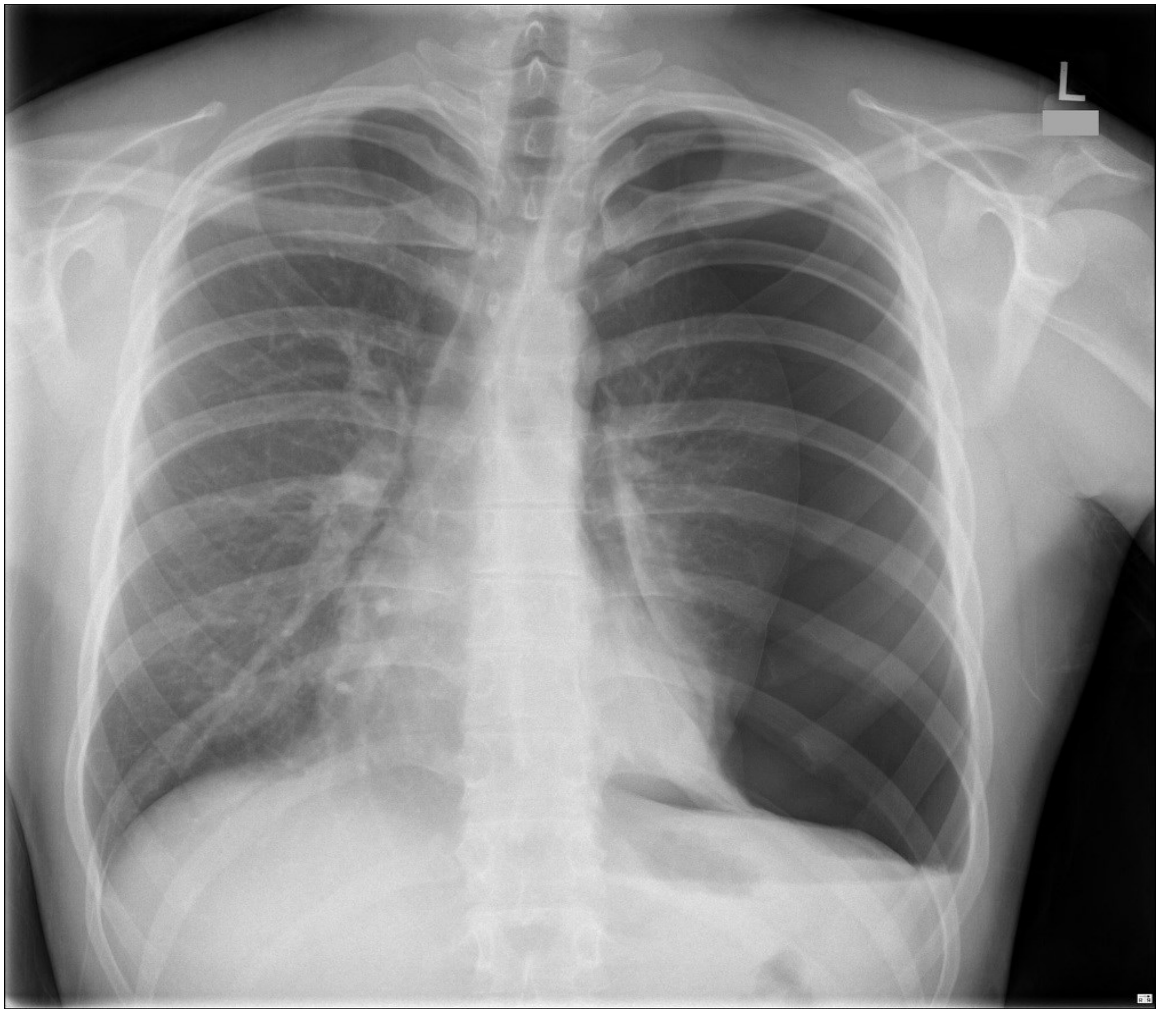
Case courtesy of Andrew Murphy, Radiopaedia.org, rID: 46492

Left Side Pleural Effusion



Case courtesy of Assoc Prof Frank Gaillard, Radiopaedia.org, rID: 21736

Tension Pneumothorax



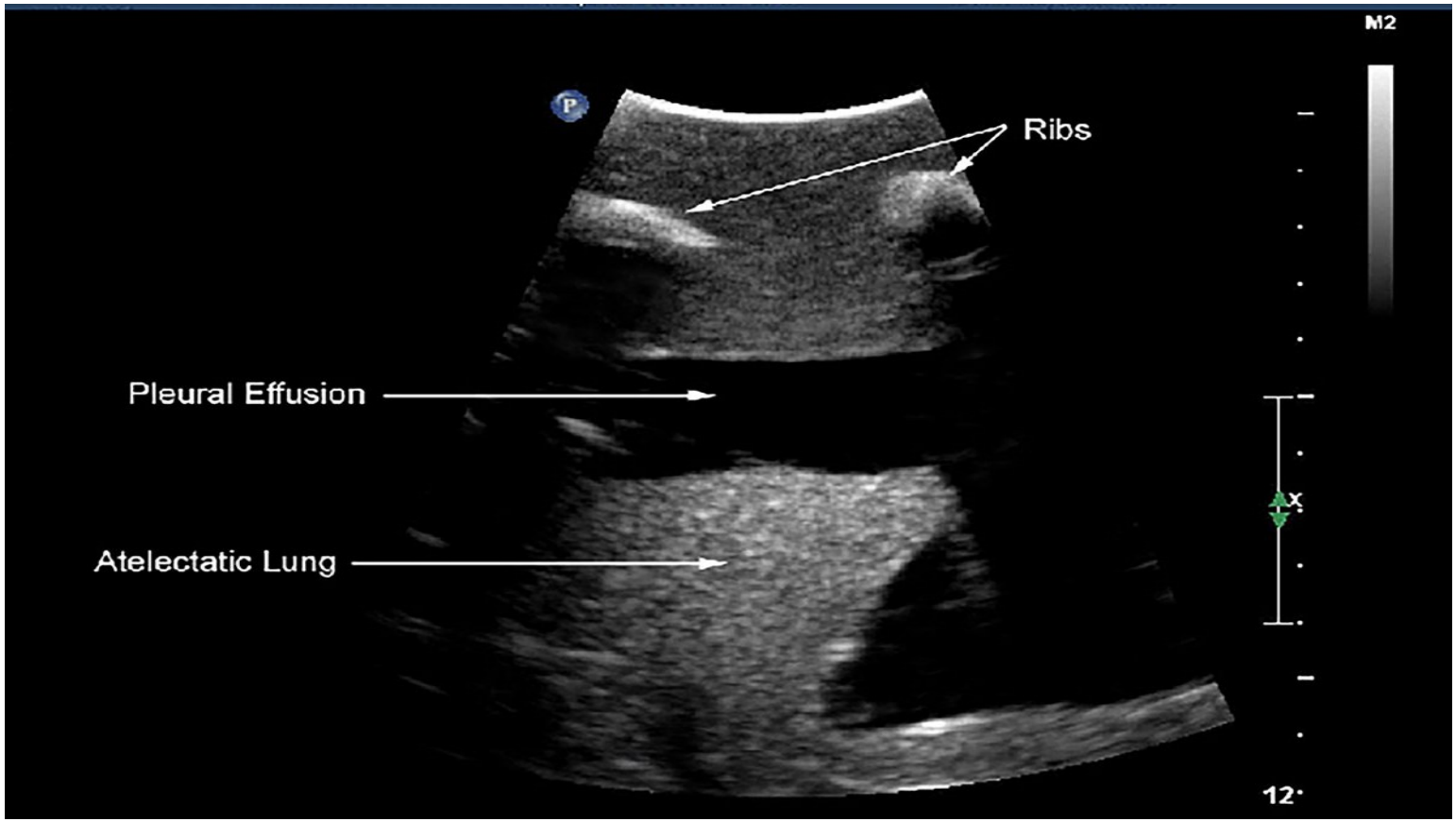
Case courtesy of Dr Tom Foster, Radiopaedia.org, rID: 73655

Which method is most appropriate for placing the chest tube?

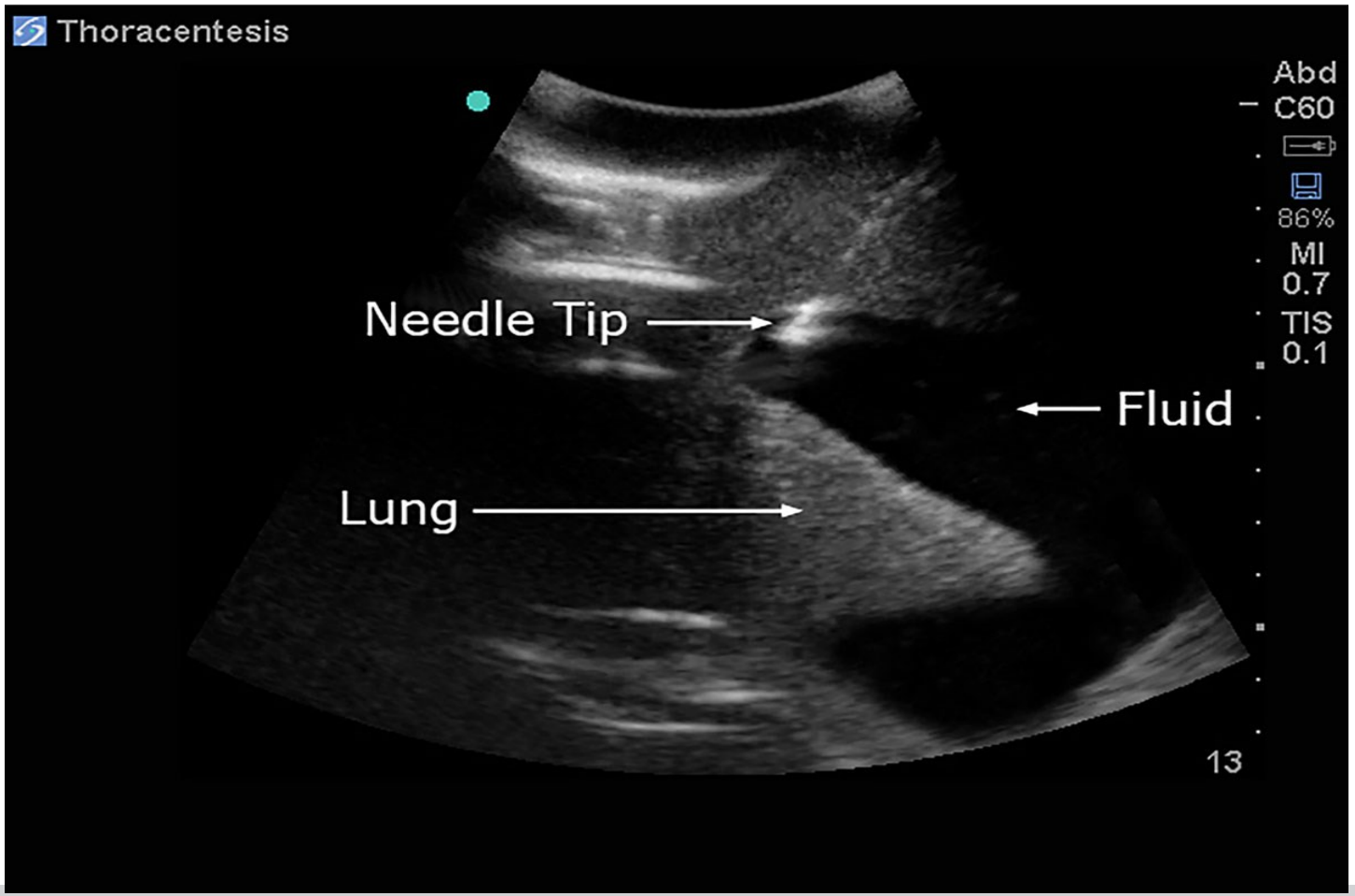
Which method is most appropriate for placing the chest tube?

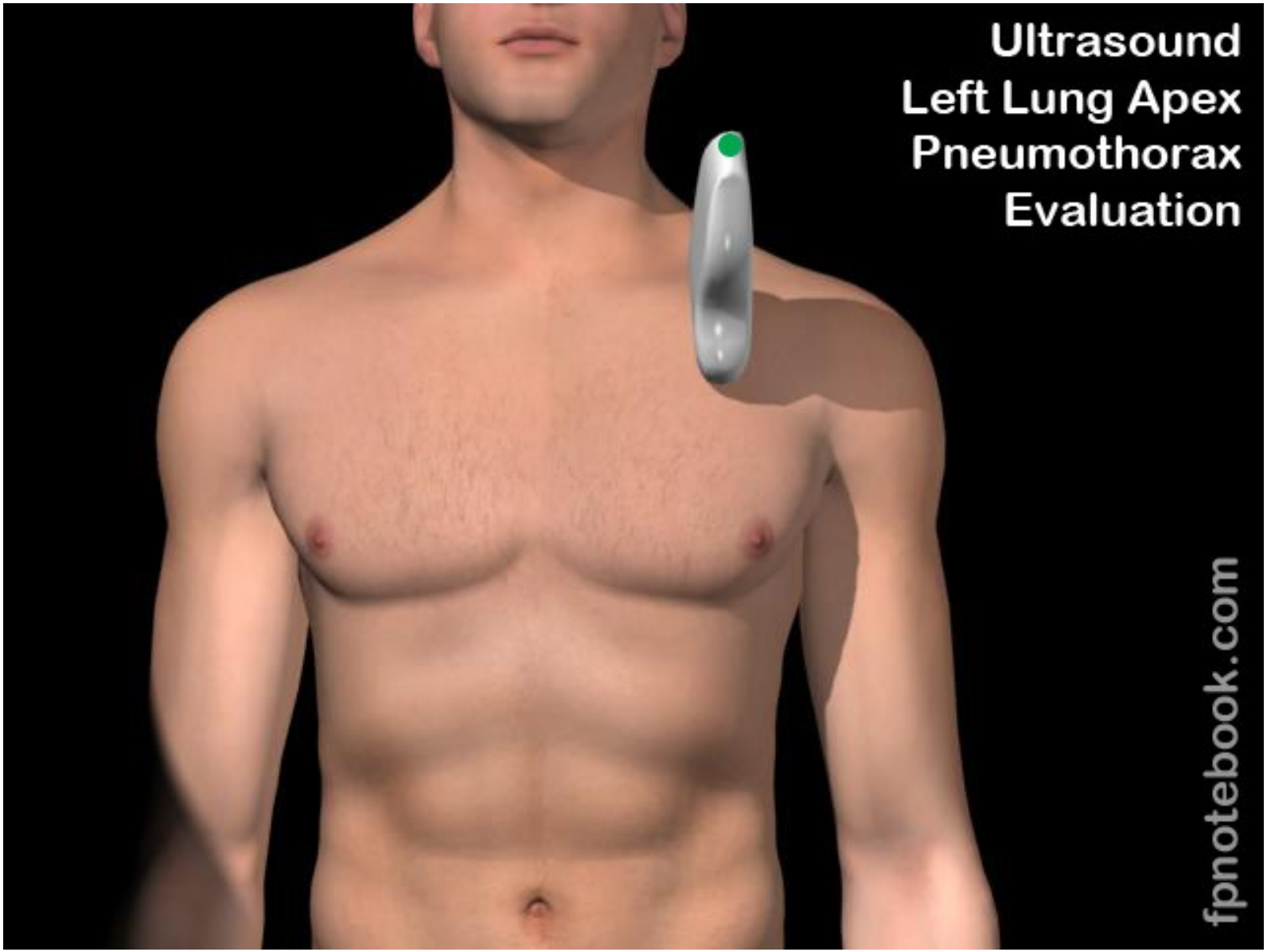
- Emergency: At the bedside, with or without imaging guidance.
- Small or complicate pneumothorax: CT guidance may be best if the patient is able to undergo CT imaging.
- Non mobile or non movable patient (i.e. ICU): At the bedside, with possible ultrasound or fluoroscopy guidance.

Ultrasound Exam of a Pleural Effusion.

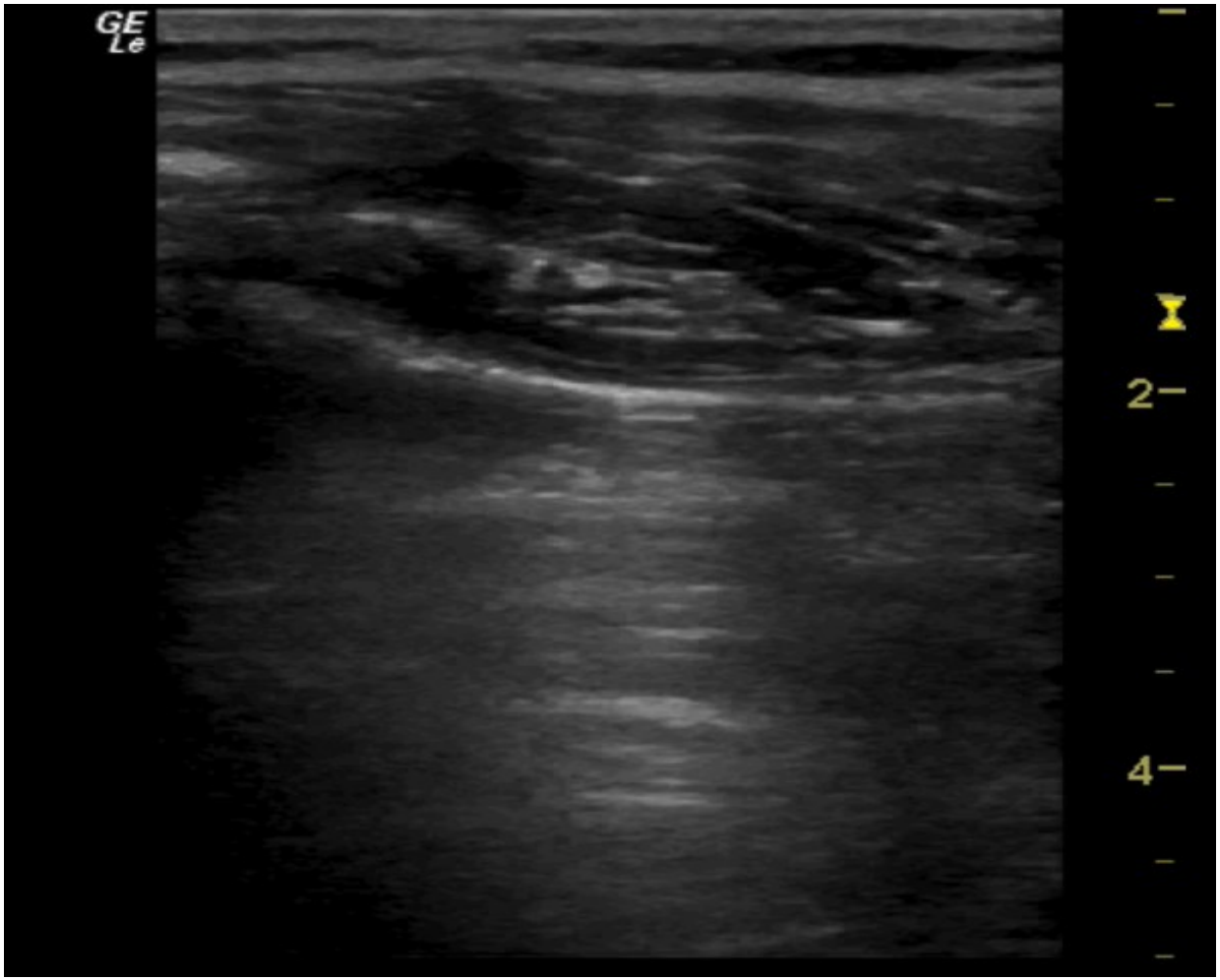


Ultrasound Exam of a Pleural Effusion.




Ultrasound
Left Lung Apex
Pneumothorax
Evaluation
fpnotebook.com

Ultrasound of a Pneumothorax



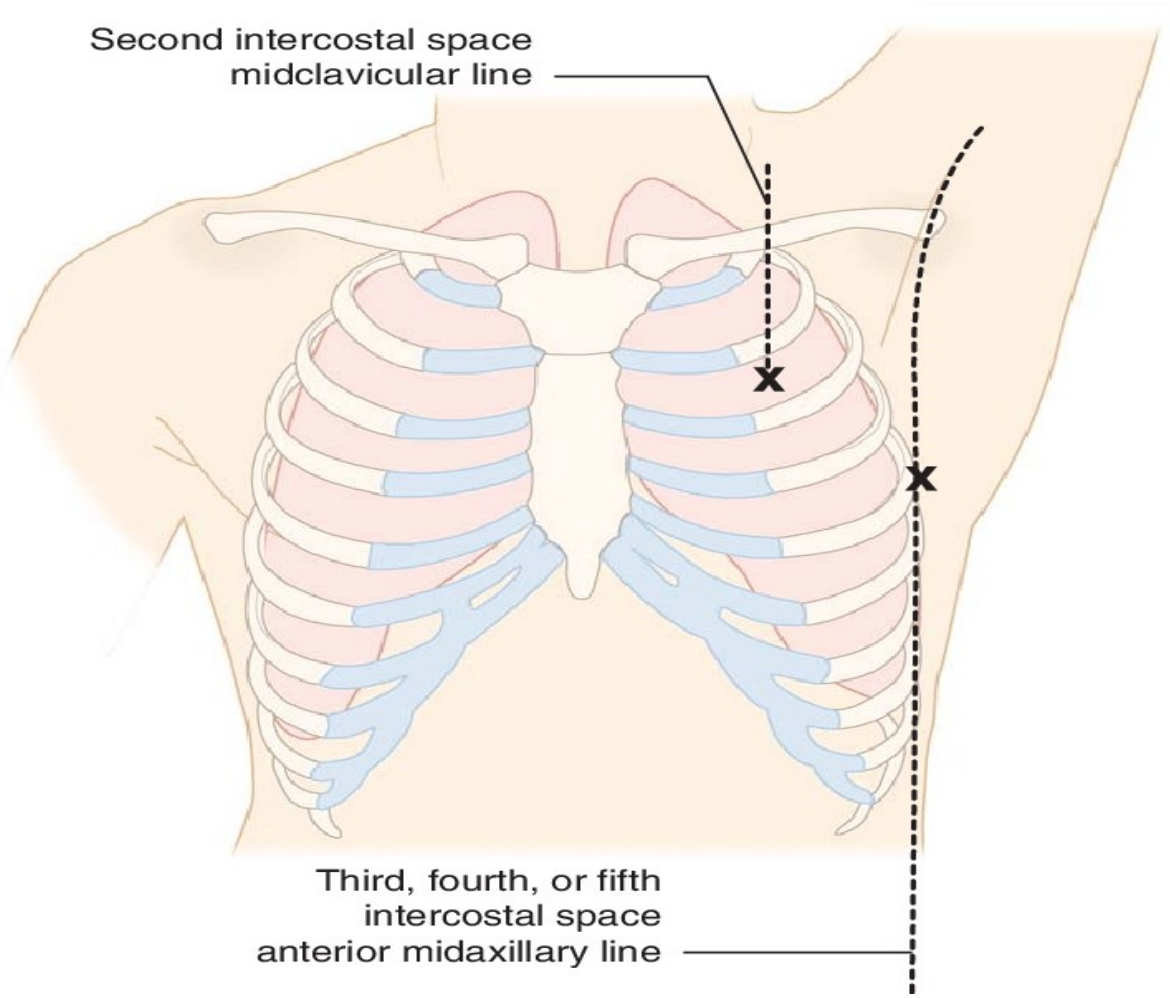
Case courtesy of Dr Andrew Dixon, Radiopaedia.org, rID: 45149

Anatomically, where should the chest tube be placed?

Anatomically, where should the chest tube be placed?

- Pneumothorax: Mid clavicular line or mid axillary line.
- Effusion: Mid axillary line or posterior.
- Complex pneumothorax or complex pleural effusion: As directed by CT guidance.

Chest Tube Placement Anatomy



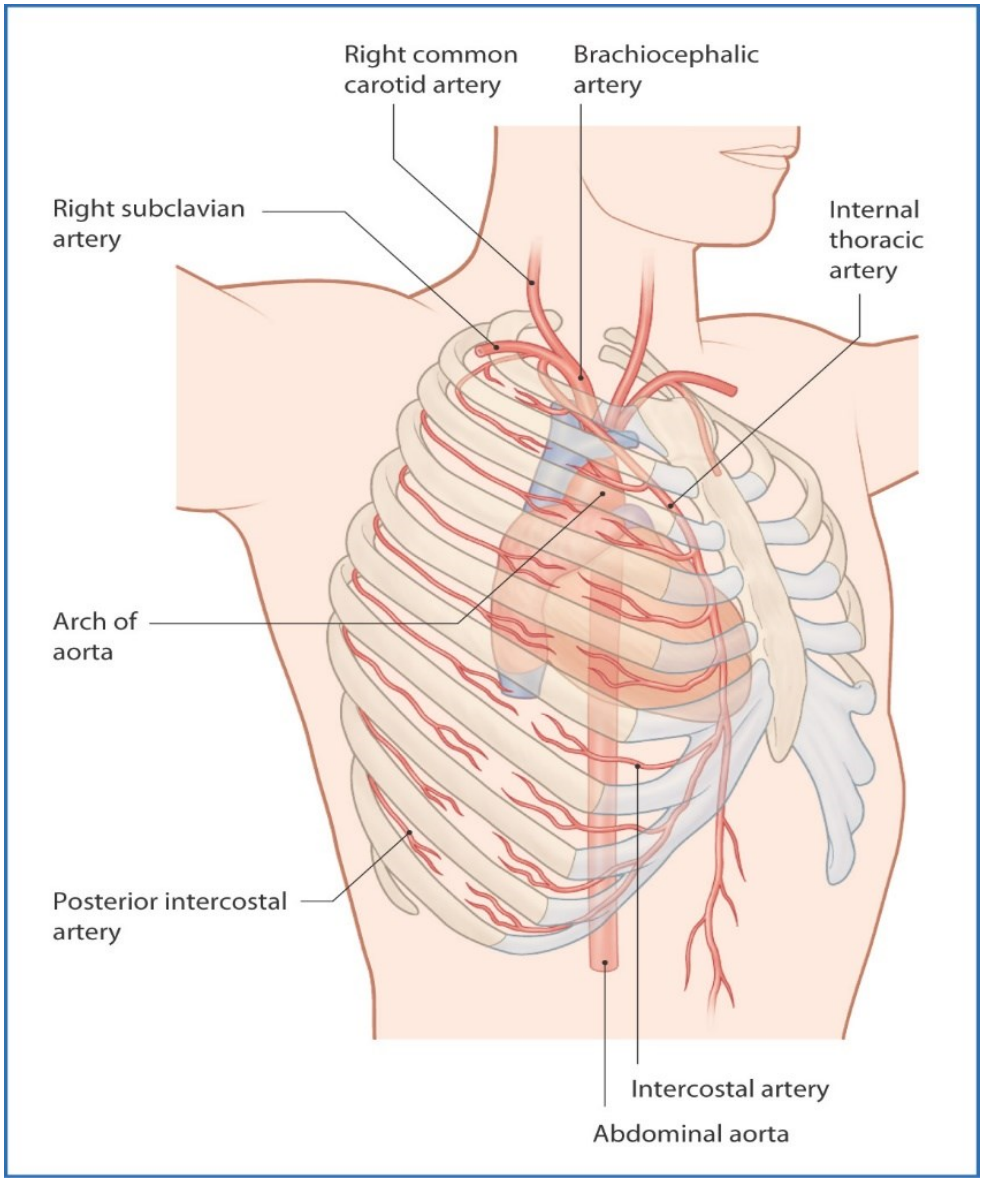
(From Connors KM, Terndrup TE: Tube thoracostomy and needle decompression of the chest. In Henretig FM, King C [eds]: Textbook of Pediatric Emergency Procedures. Baltimore: Williams & Wilkins, 1997, p 399.)

What is the chest wall anatomy?

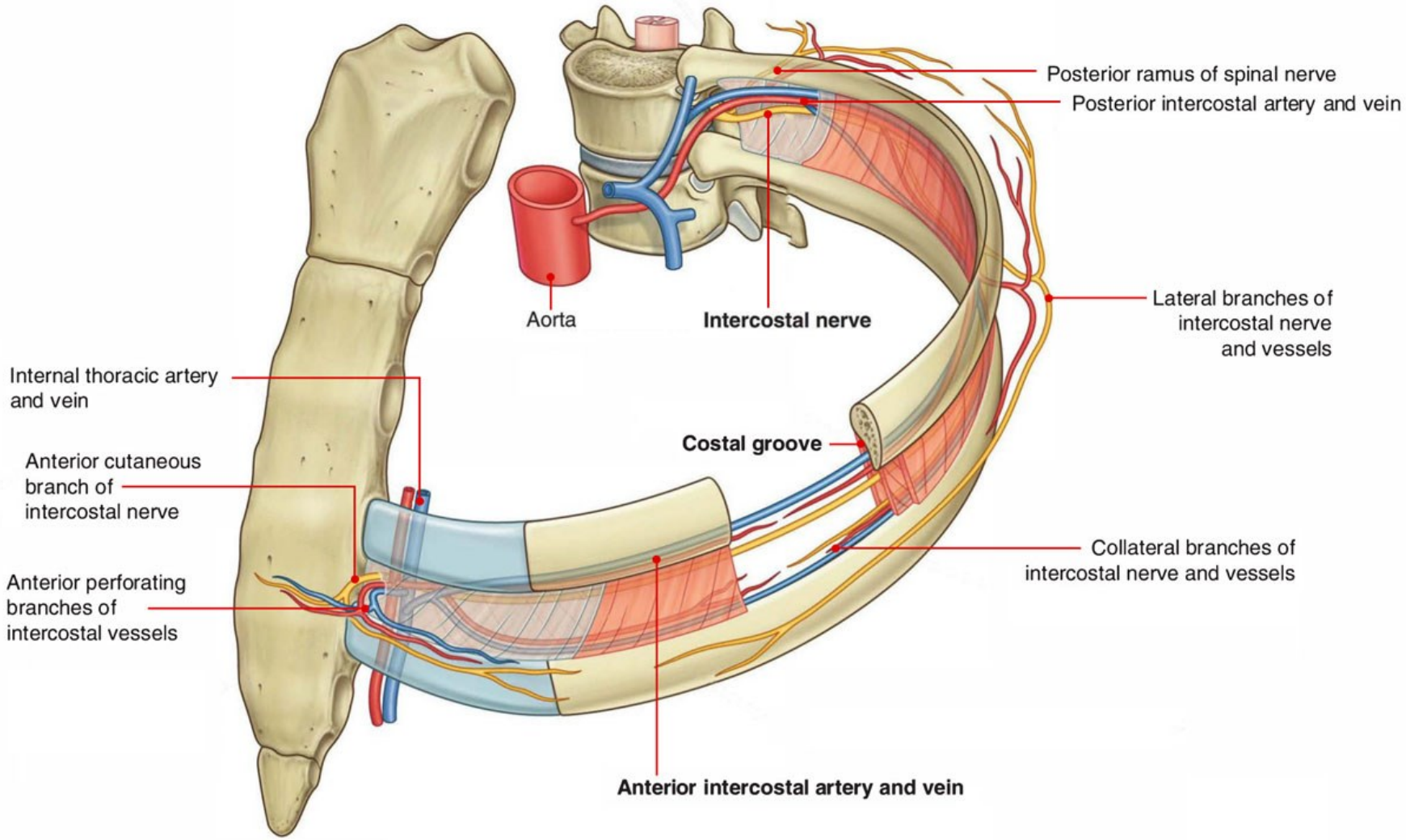
What is the chest wall anatomy?

- The main blood vessels are located medially in the anterior and posterior thorax. The arteries become smaller along the lateral aspect of the chest.
- The vein, artery and nerve are located under the inferior margin of the rib.

Chest Wall Anatomy



Basic Medical Key, Jun 11, 2016 | Posted by admin in ANATOMY

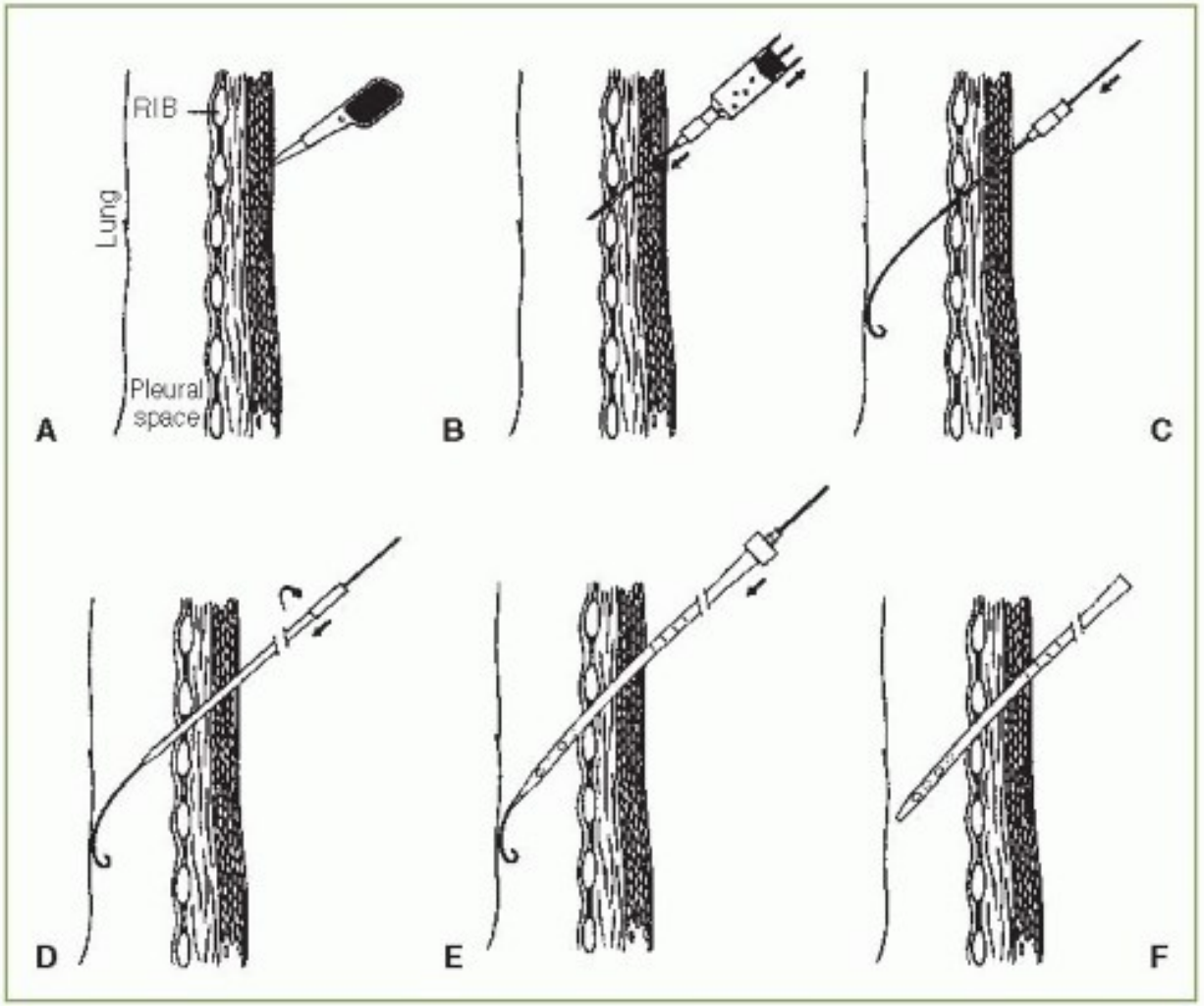

Posterior ramus of spinal nerve
Posterior intercostal artery and vein
Aorta
Intercostal nerve
Lateral branches of intercostal nerve and vessels
Internal thoracic artery and vein
Costal groove
Anterior cutaneous branch of intercostal nerve
Collateral branches of intercostal nerve and vessels
Anterior perforating branches of intercostal vessels
Anterior intercostal artery and vein

What are common techniques for placing the chest tube?

What are common techniques for placing the chest tube?

- The guidewire (Seldinger) technique, where one places a very small needle into the pneumothorax, followed by successive wire and dilator exchanges until the final chest tube is placed.
- A one step (trocar method) technique, where the chest tube is directly inserted into the chest, more commonly used in emergency situations. Higher risk of complications.

Guidewire Chest Tube Placement



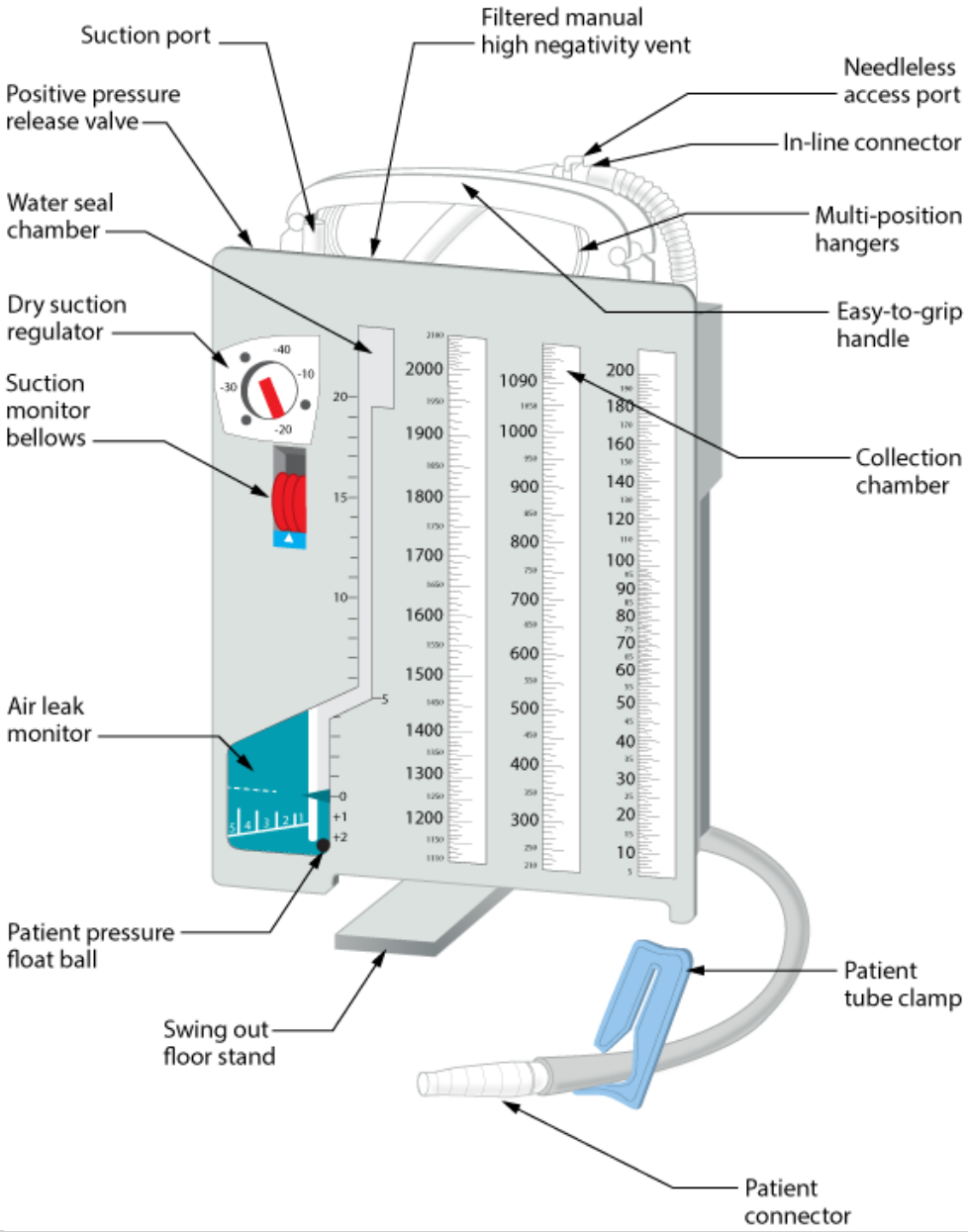
Jun 19, 2016 | Posted by drzezo in RESPIRATORY

One Step (Trocar) Method

Chest Tube Placement Demonstration

Typical Pleural Drainage System

Typical Pleural Drainage System

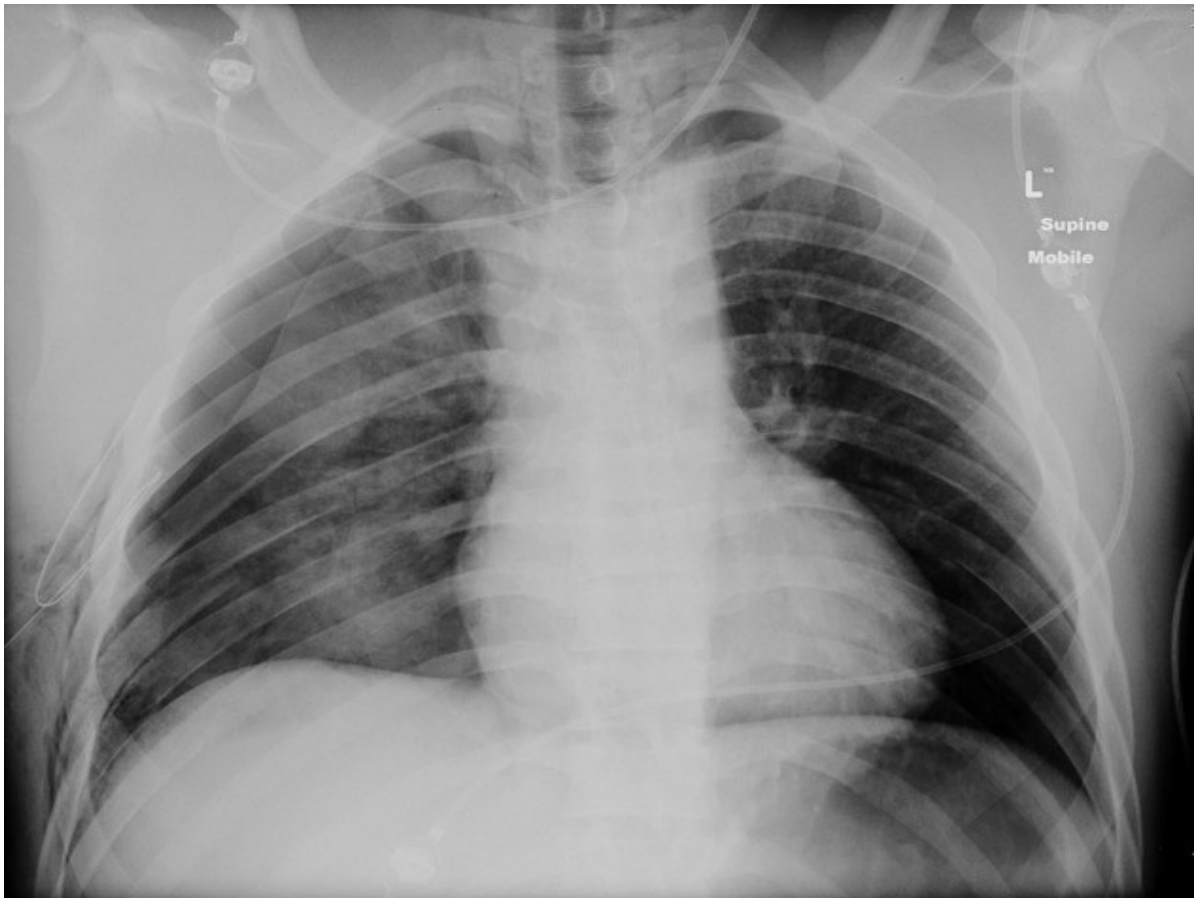

Suction port
Filtered manual high negativity vent
Needleless access port
Positive pressure release valve
In-line connector
Water seal chamber
Multi-position hangers
Dry suction regulator
Easy-to-grip handle
Suction monitor bellows
Collection chamber
Air leak monitor
Patient pressure float ball
Patient tube clamp
Swing out floor stand
Patient connector

How do I assess proper positioning of the chest tube immediately after placement?

How do I assess proper positioning of the chest tube immediately after placement?

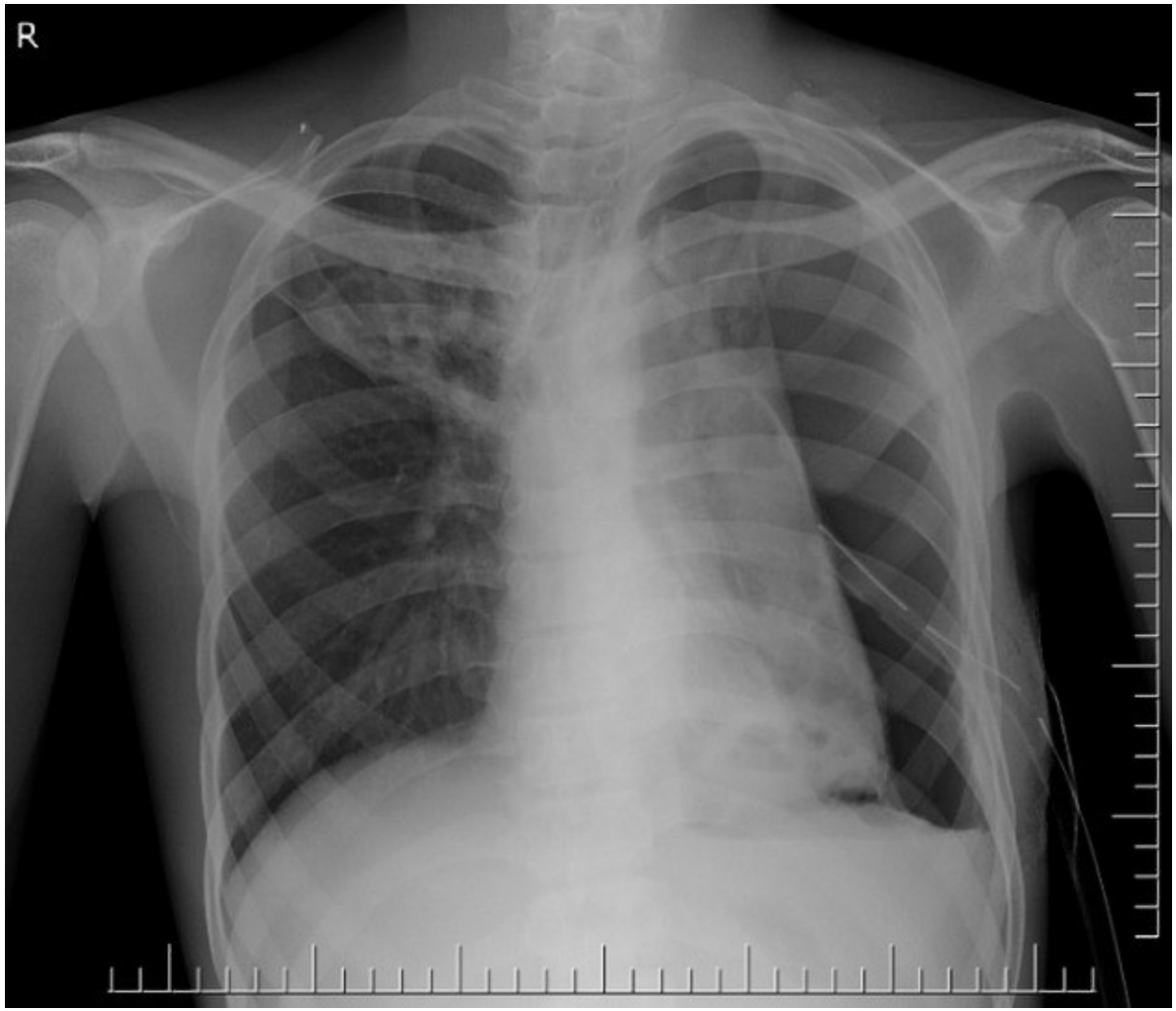
- Look for air return through the chest tube.
- Auscultate the lung for breath sounds.
- Evaluate the lung with portable CXR or bedside ultrasound.

Chest Tube Outside The Pleural Space



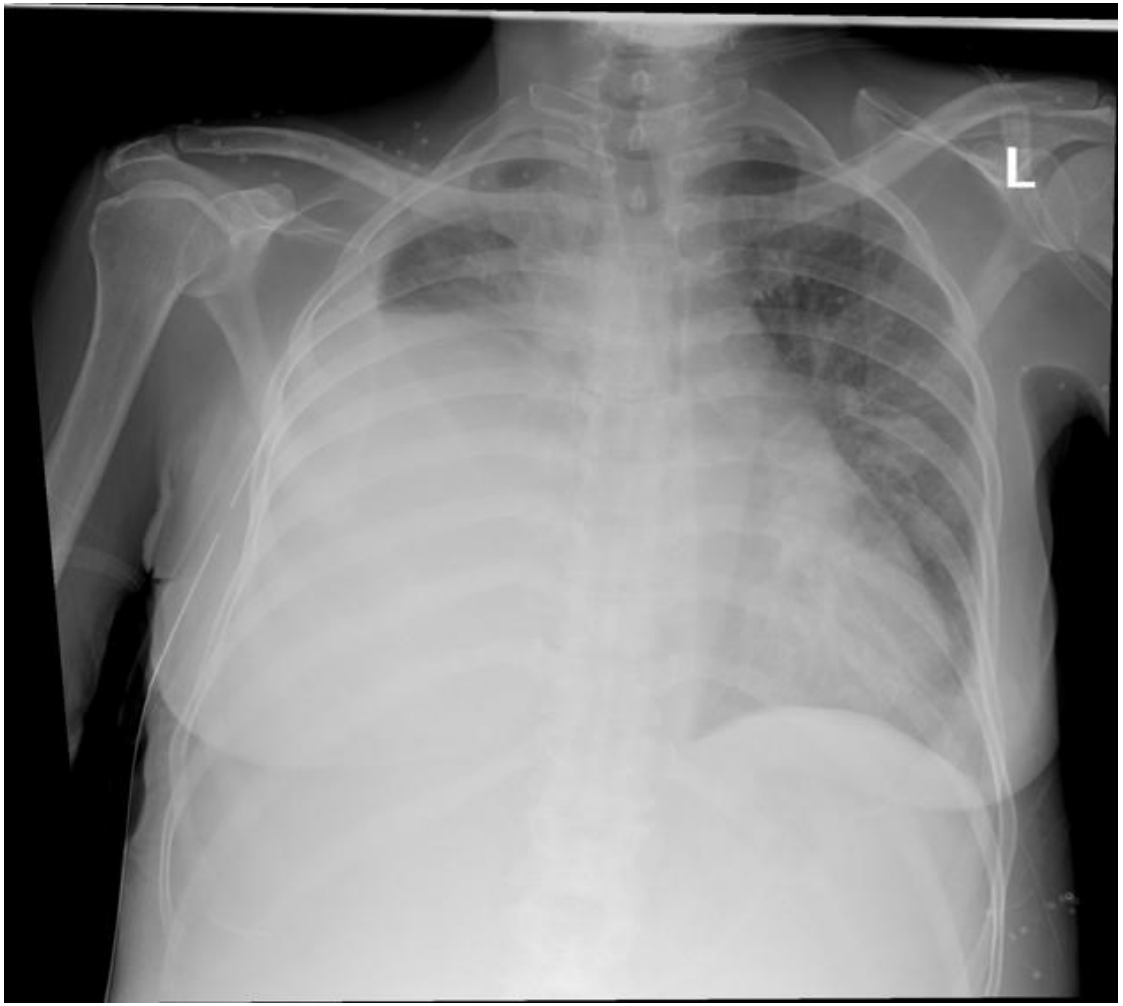
Case courtesy of Assoc Prof Craig Hacking, Radiopaedia .org, rID: 73308

Chest Tube Outside The Pleural Space



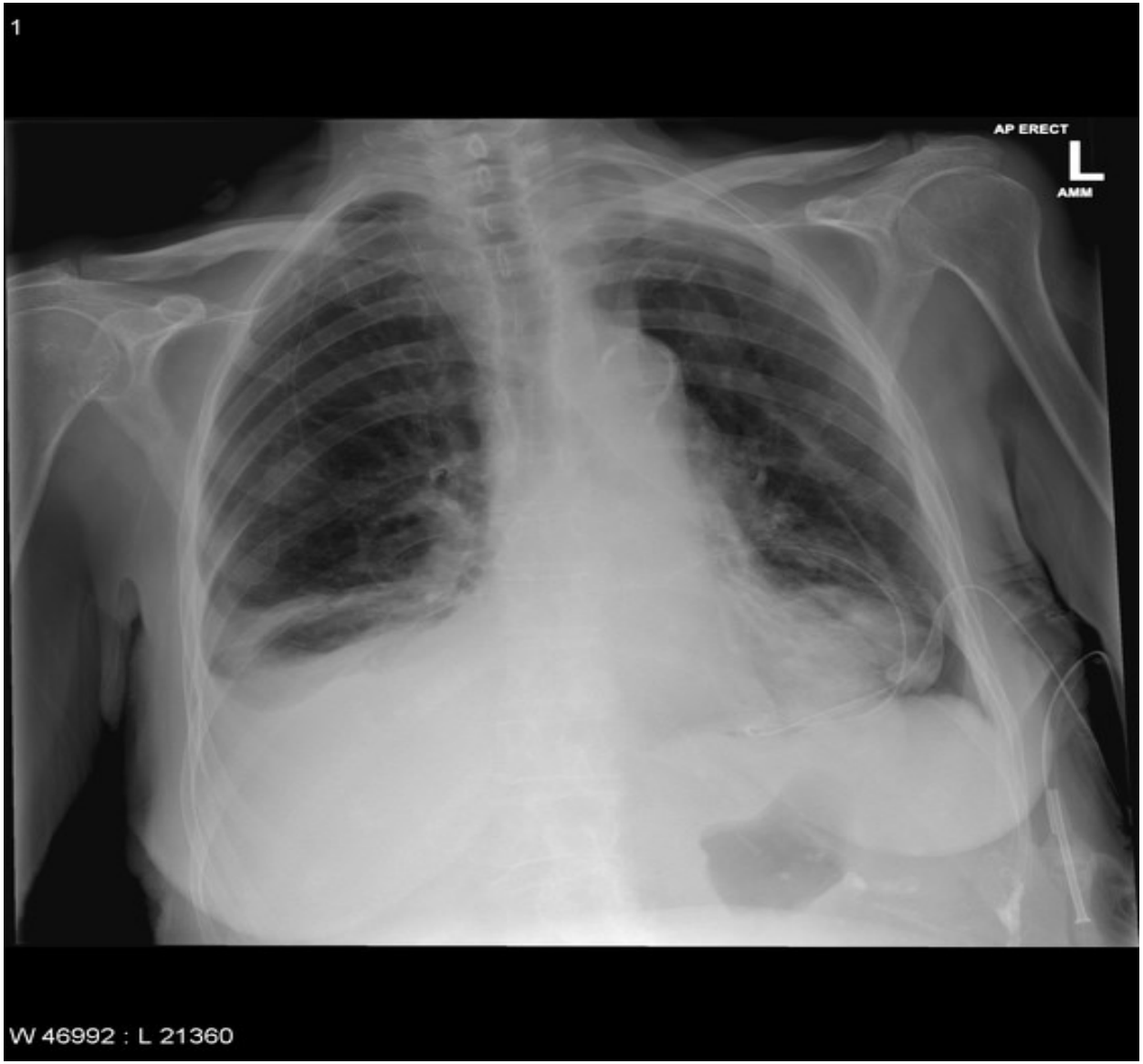
Case courtesy of Dr Aditya Shetty, Radiopaedia.org, rID: 27673

Chest Tube Outside The Pleural Space



Case courtesy of Assoc Prof Craig Hacking, Radiopaedia

Kinked Chest Tube

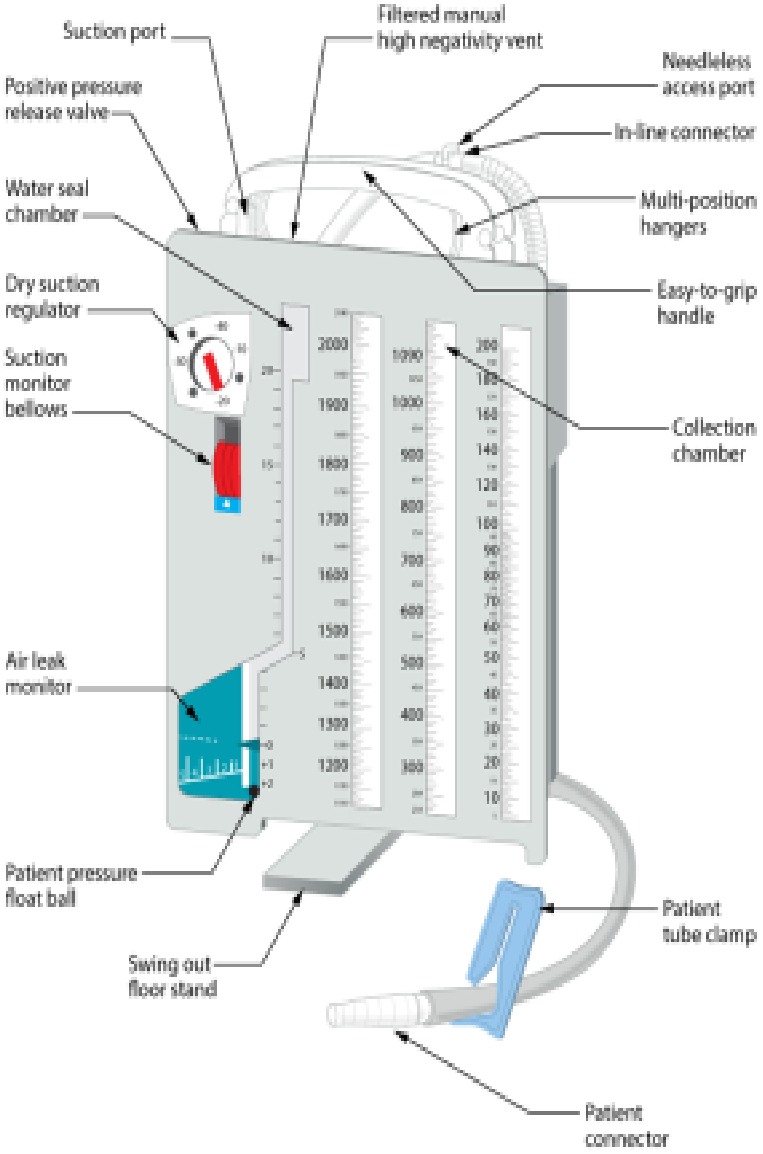


Case courtesy of Dr Sachintha Hapugoda, Radiopaedia.org, rID: 59664

What is an air leak?

What is an air leak?

- Some air is expected from the chest tube until the pneumothorax has resolved.
- If there is persistent air returning in the chest tube after stabilization of the pneumothorax, then an air leak is present.
- One can use the pleural drainage system to assess the characteristics of the air leak.


Suction port
Filtered manual high negativity vent
Needleless access port
Positive pressure release valve
In-line connector
Water seal chamber
Multi-position hangers
Dry suction regulator
Easy-to-grip handle
Suction monitor bellows
Collection chamber
Air leak monitor
Patient pressure float ball
Patient tube clamp
Swing out floor stand
Patient connector

Initial Evaluation of the Air Leak

- Make sure that all of the tubing is properly connected.
- Inspect the tube insertion site for possible external air leaking into the chest cavity along the chest tube.

Spontaneous Pneumothorax and Air Leak

- Approximately 95% of spontaneous pneumothoraces can be successfully treated with chest tube placement or needle decompression.
- In spontaneous pneumothorax patients who don't respond to chest tube placement, Video Assisted Thorascopic Surgery (VATS) is recommended to repair the alveolar pleural fistula (often a result of a bleb), and to treat with surgical pleurodesis as needed.
- VATS is also recommended for recurrent spontaneous pneumothorax.

Iatrogenic Pneumothorax and Air Leak

- Most air leaks will heal with conservative therapy in otherwise healthy lung.
- Some authors recommend lower pressure suction to allow the visceral pleura to adhere to the chest wall and promote healing . Most disagree with increasing suction as higher suction only increases the alveolar pleural fistula (except in patients with severe bullous emphysema).
- Air leaks lasting greater than 5 days are considered ("Persistent air leaks" or PAL)

Additional Treatment Options for Iatrogenic Air Leaks

- VATS
- Autologous blood patch: 100cc's of peripheral drawn blood from the patient is placed in the thorax to promote pleural healing, sealing and pleurodesis.
- Endobronchial valve placement
- Heimlich valve placement and outpatient follow up.

Heimlich Valve

How long does the chest tube remain in place?

How long does the chest tube remain in place?

- The chest tube should remain in the pleural cavity until the lung is fully expanded,
- There is no evidence of air leak,
- The patient is in satisfactory condition,
- There is minimal fluid drainage.

What is the method for removing the chest tube?

What is the method for removing the chest tube?

- Clamp the tube for 4-12 hours.
- Obtain a follow up chest radiograph to assess for possible air leak.
- If no leak, unsecure the chest tube and dressings from the chest wall.
- Have the patient exhale and promptly remove the chest tube.
- Immediately cover and seal the chest tube insertion site.
- Obtain a follow up chest radiograph at about 4 hours to assess for recurrent pneumothorax.

Thank you!

Chest tube placement demonstration to follow.

References

- Hacking, C., Weerakkody, Y. Intercostal catheter. Reference article, Radiopaedia.org. (accessed on 22 Nov 2021) https://doi.org/10.53347/rID-59341
- Connors KM, Terndrup TE: Tube thoracostomy and needle decompression of the chest. In Henretig FM, King C [eds]: Textbook of Pediatric Emergency Procedures. Baltimore: Williams & Wilkins, 1997
- Alveolopleural fistula and prolonged air leak in adults, Up to Date, Authors:Adnan Majid, MD, FCCPFayez Kheir, MD, MScSection Editor:Henri G Colt, MDDeputy Editor:Geraldine Finlay, MD. May 12, 2020.