高雄市立旗津醫院
(委託財團法人私立高雄醫學大學經營)

KAOHSIUNG
MUNICIPAL
CIJIN HOSPITAL

急重症胸部X光判讀

高雄醫學大學胸腔內科
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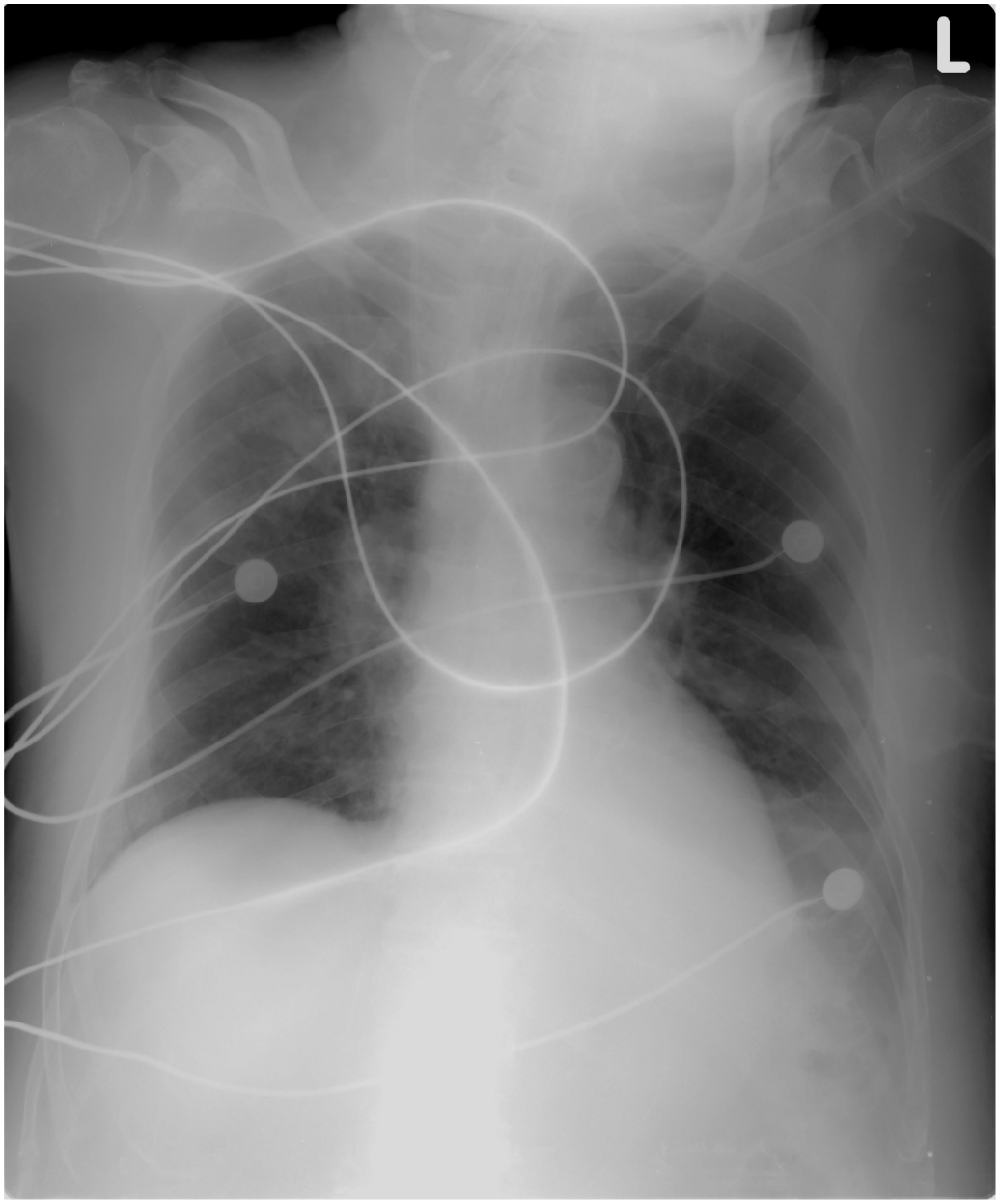
守護旗津世代健康
成為全人照護標竿社區醫院

Outlines

- 重症胸部影像之條件與先天限制
- 各種管路之影像學
  - Endotracheal tube
  - Tracheostomy tube
  - Central venous catheter
  - PA catheter
  - Pacemaker
  - NG tube
  - S-B tube
  - Chest tube
  - Barotrauma

Portal x-ray limitation

- 先天限制（PA: 72 inches. AP: 40 inches)
- 曝光不足及功率有限
- 呼吸動作之影響
  - 吸氣不足, 躺平姿勢之影響會有放大效果(15-20%)
- 體位不正 :每次照相之技術與X光機至病患距離之捏拿不能恆定
- 患者身上有許多貼片及治療器材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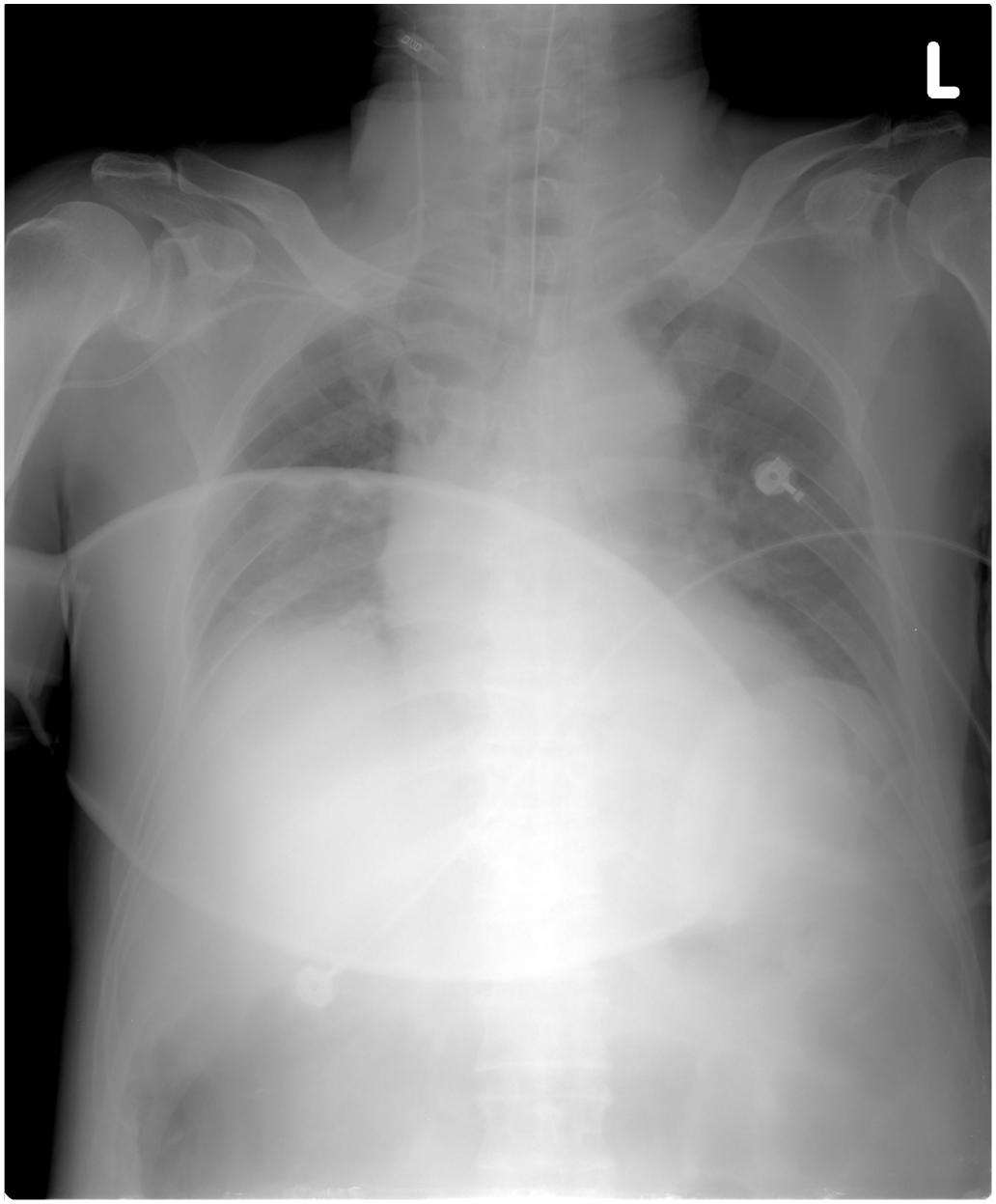
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AP view

1. From ant. to post.
2. Patient supine
3. In very sick patients, infants, unable to stand or sit.
4. Misdiagnosis:
    - pleural effusion
    - lung abscess
    - pneumothorax (deep sulcus sign)

AP view 與 PA view判讀之差異

1.透亮度(lucency)：

AP view 肺尖與肺底之透亮度較為接近

2.肺野(lung field)：

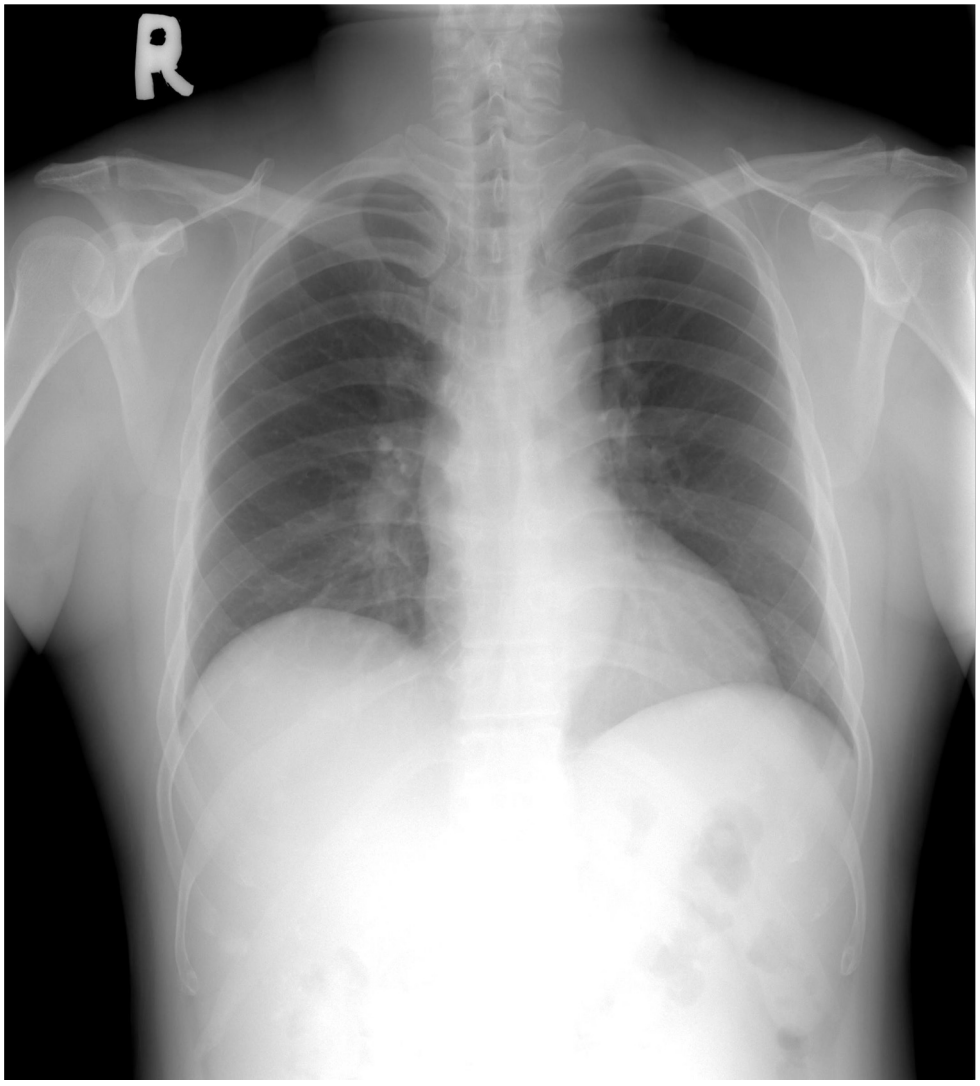
AP view 因平躺(supine)，因重力(gravity)的關係上肺野之肺血管紋(lung markings)較站立時明顯

3.肺容積(lung volume)：

a.肺容積減少　b.橫膈上升　c.肋間距縮短

4.心臟及橫膈的影像(shadows)：

a.心臟大小：較大　b.橫膈高低：不明顯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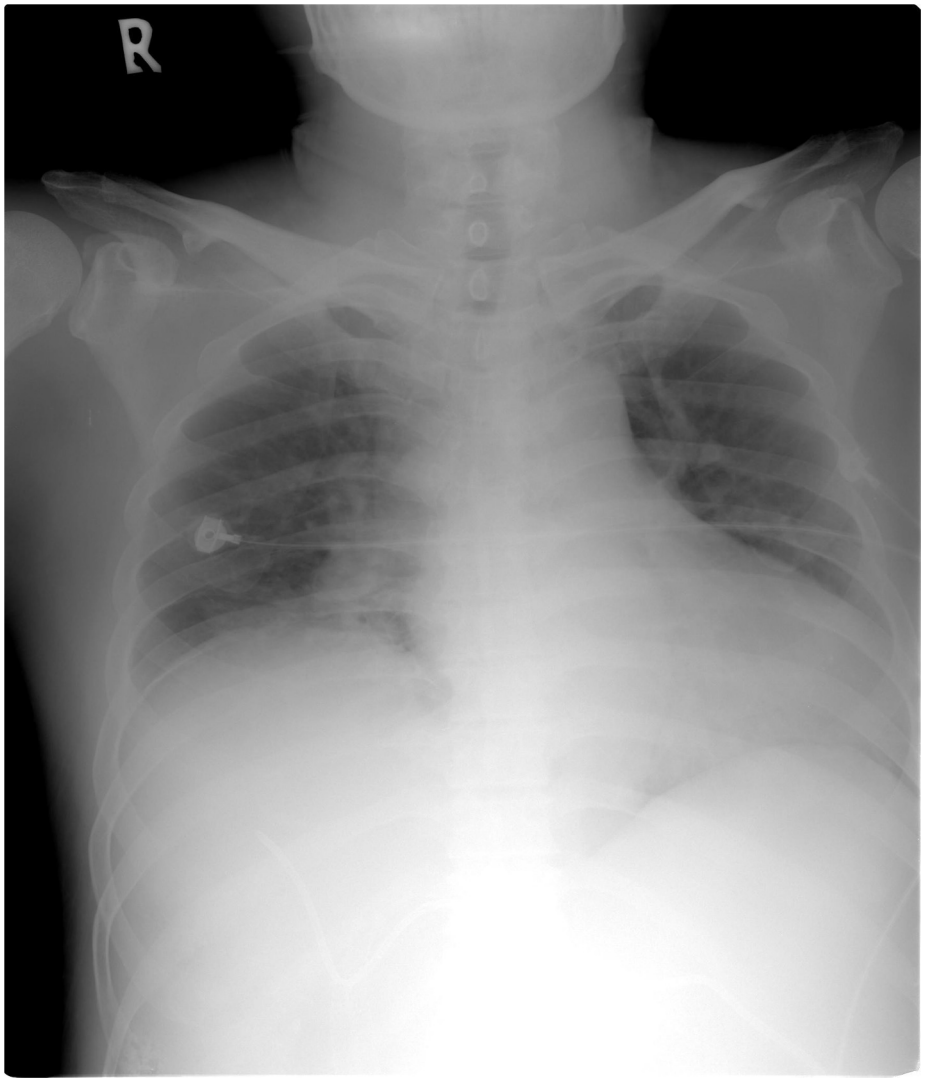
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Rules for better portal CXR films in ICU

- Consistent patients‘ position (supine)
- Focus-film distance: at least 40 inches, constant
- All external devices removed

Rule of chest X-ray in ICU

- The sensitivity and specificity of the ICU chest radiograph are low.

- 65% of ICU chest radiographs reveal a significant pathology that results in a change in patient management.

ACR Appropriateness Criteria 2015

- Routine daily chest radiographs are not indicated for patients admitted to the ICU.
- In stable patients admitted for cardiac monitoring, or in stable patients admitted for extrathoracic disease only, an initial ICU admission radiograph is recommended
- Follow-up radiographs should be obtained only for specific clinical indications including clinical worsening and tube or line insertion.
- Daily chest radiographs be obtained on patients with acute cardiopulmonary problems and those receiving mechanical ventilation.

Evaluate the Position of Tubes/Catheters

1.先評估導管及裝置位置是否正確，有無併發症。
2.再判讀有關心肺方面之疾病。

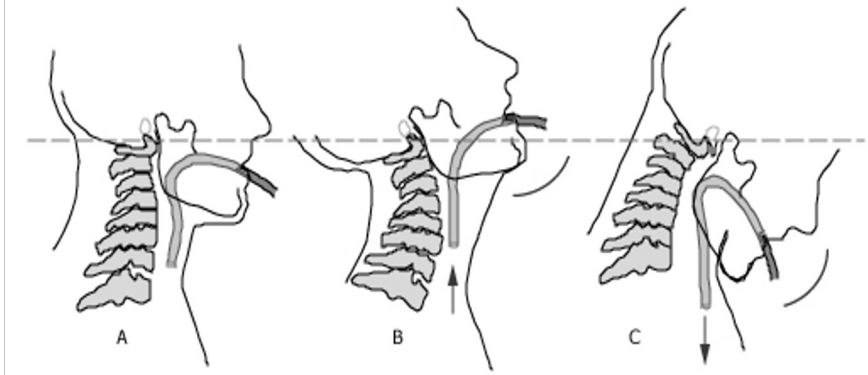
Endotracheal tube

- Endotracheal tube tip : Safe level 5 cm from carina (T4-T5 interspace), minimum distance 2 cm
- Misplaced ET may cause serious compromise of respiratory function
  - 10%

Complications:

tracheal stenosis, tracheal rupture, cord paralysis, cervical and mediastinal emphysema, hematoma and abscess formation.

Most tracheal ruptures are placed posteriorly.

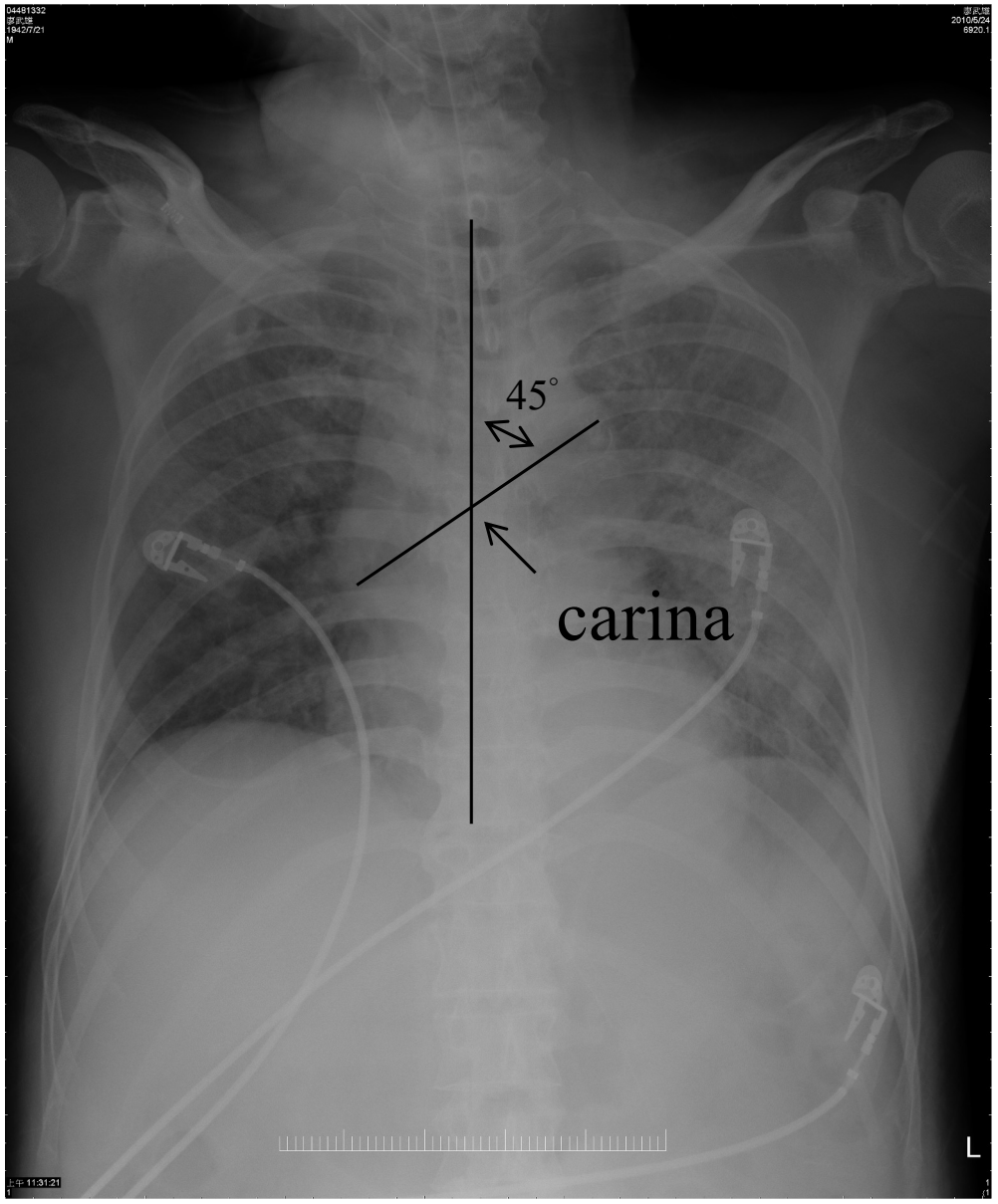


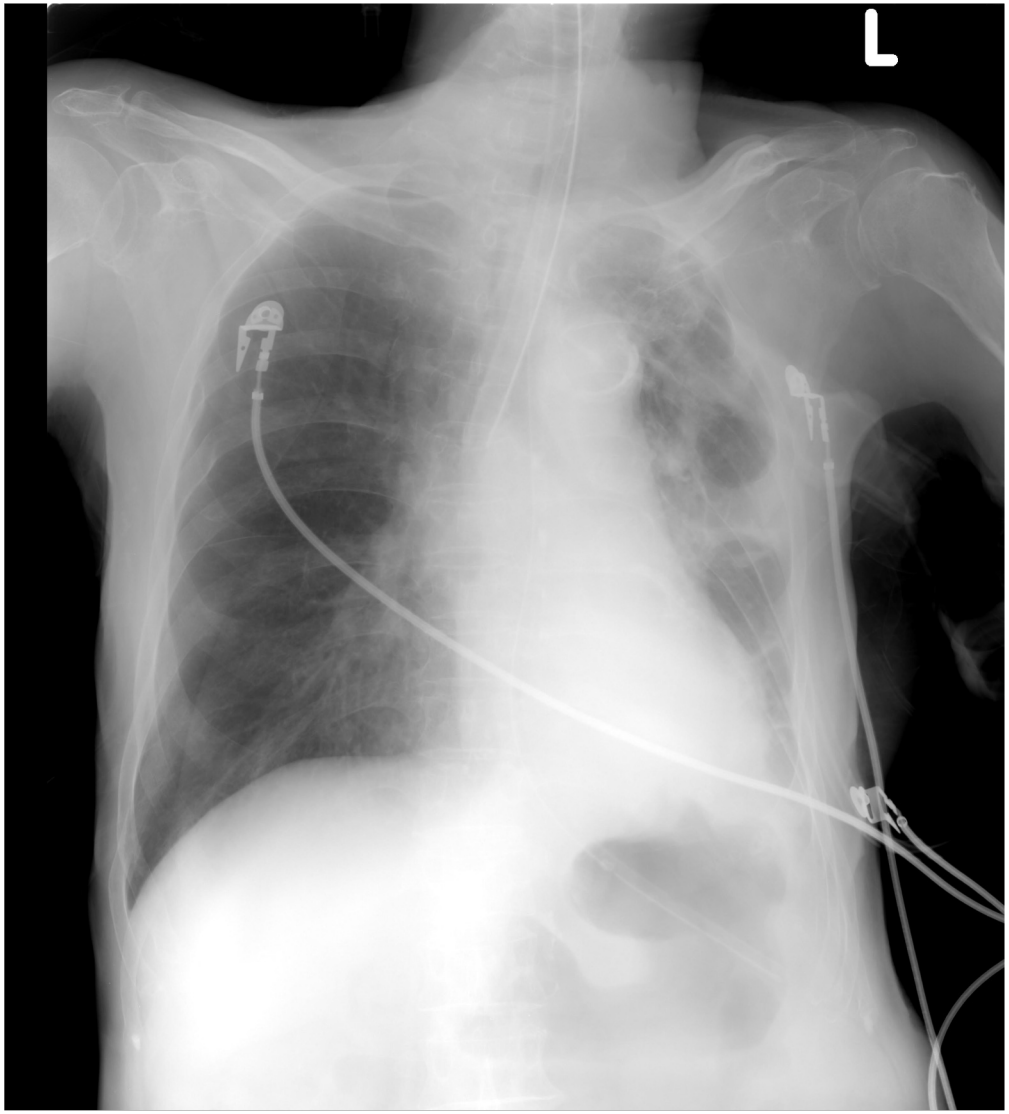
Uptodate

ACR Appropriateness Criteria 2015

- Very few mal-positioned tubes are detected by physical examination.
  - Symmetric breathing sound
  - Chest wall expansion
- Radiographs immediately post-intubation are indicated to ensure proper positioning.

Dee method

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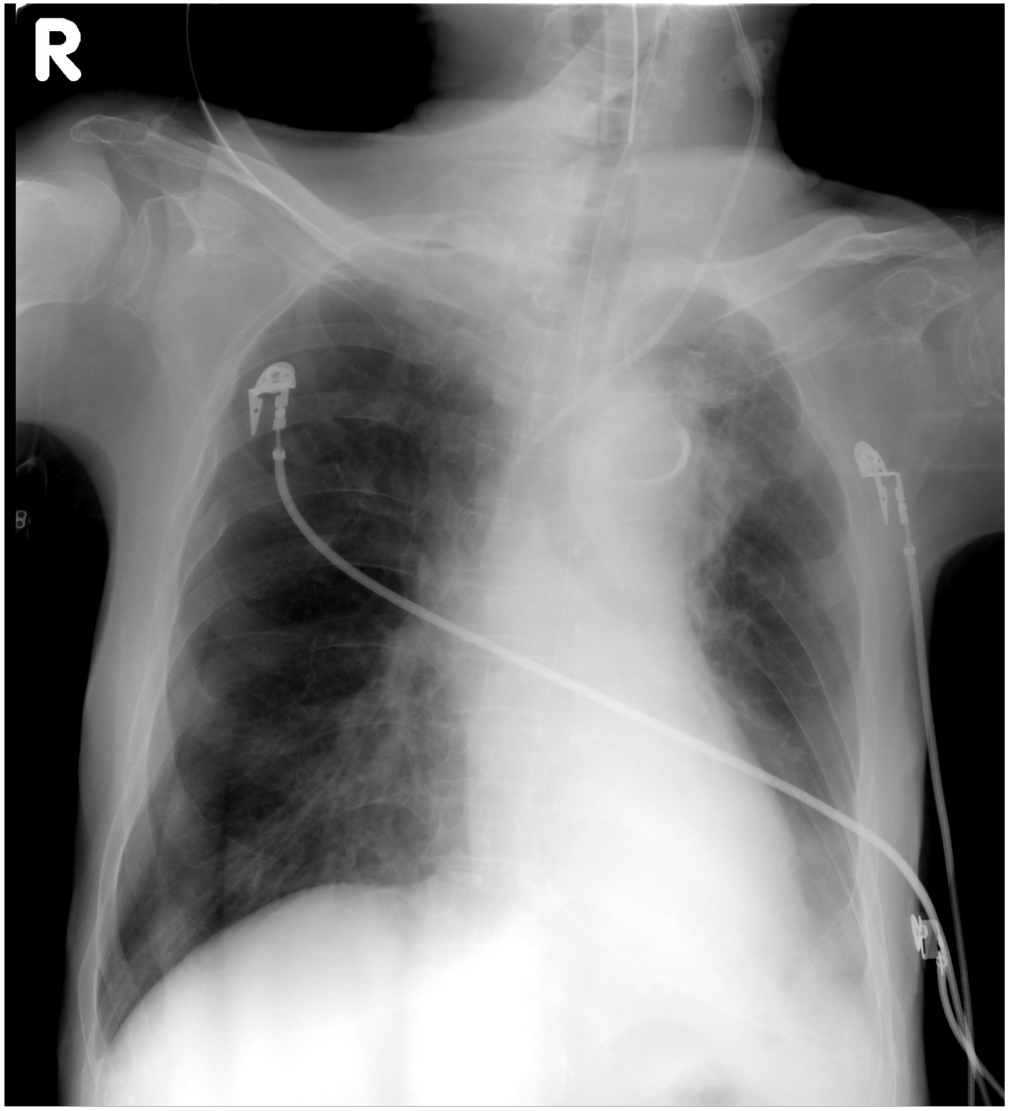
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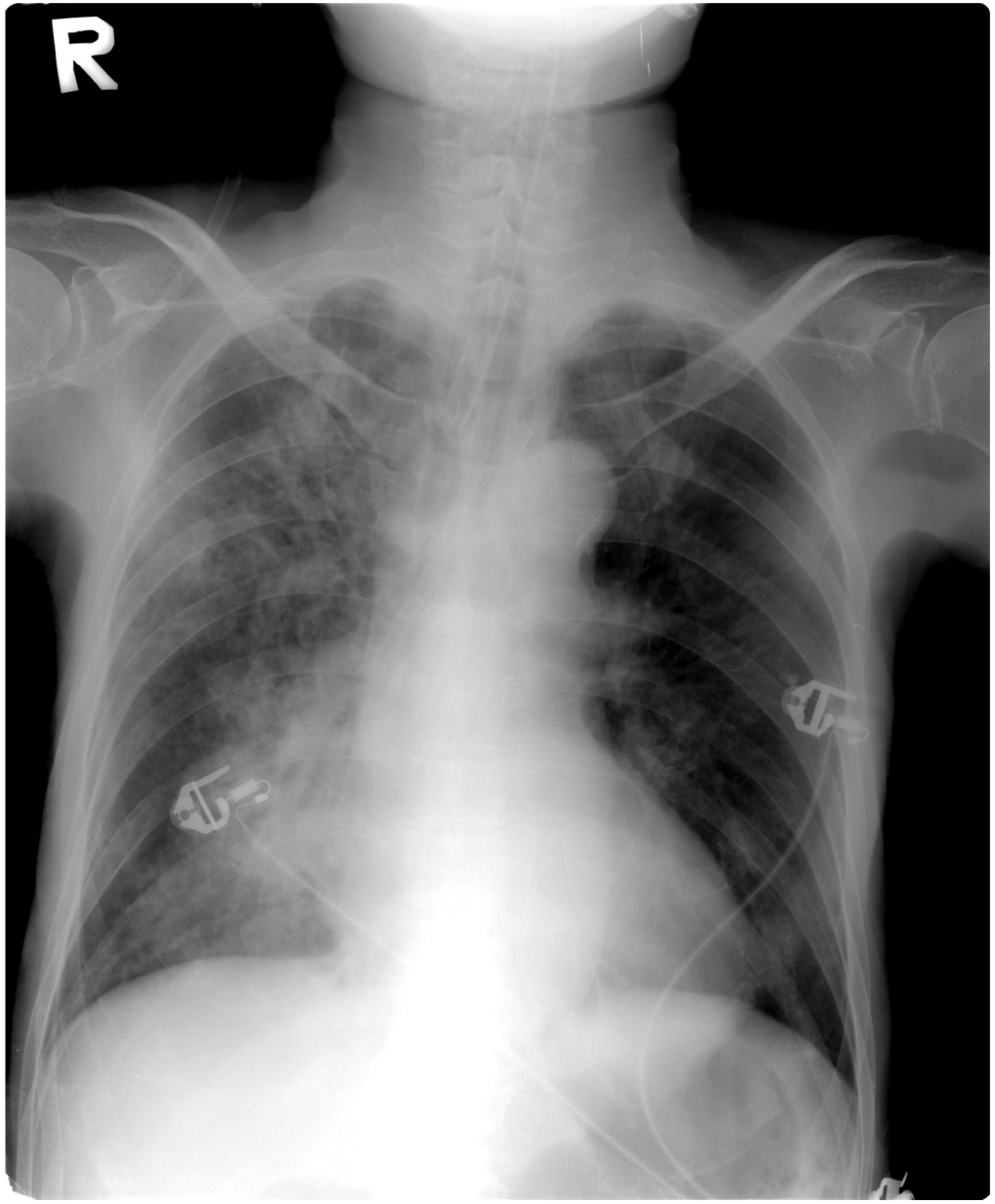
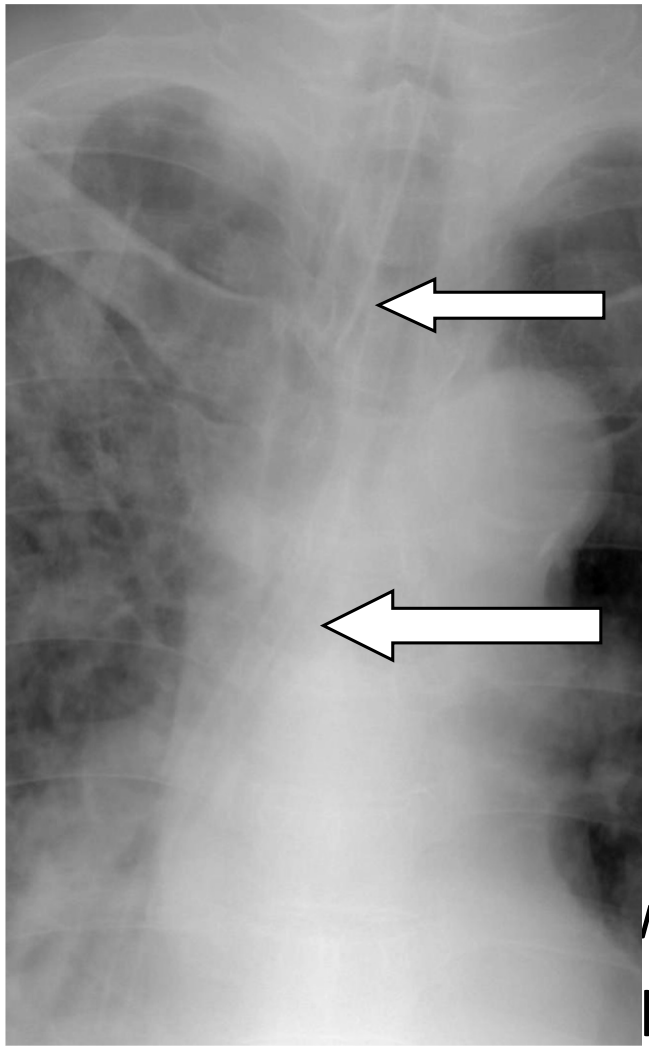
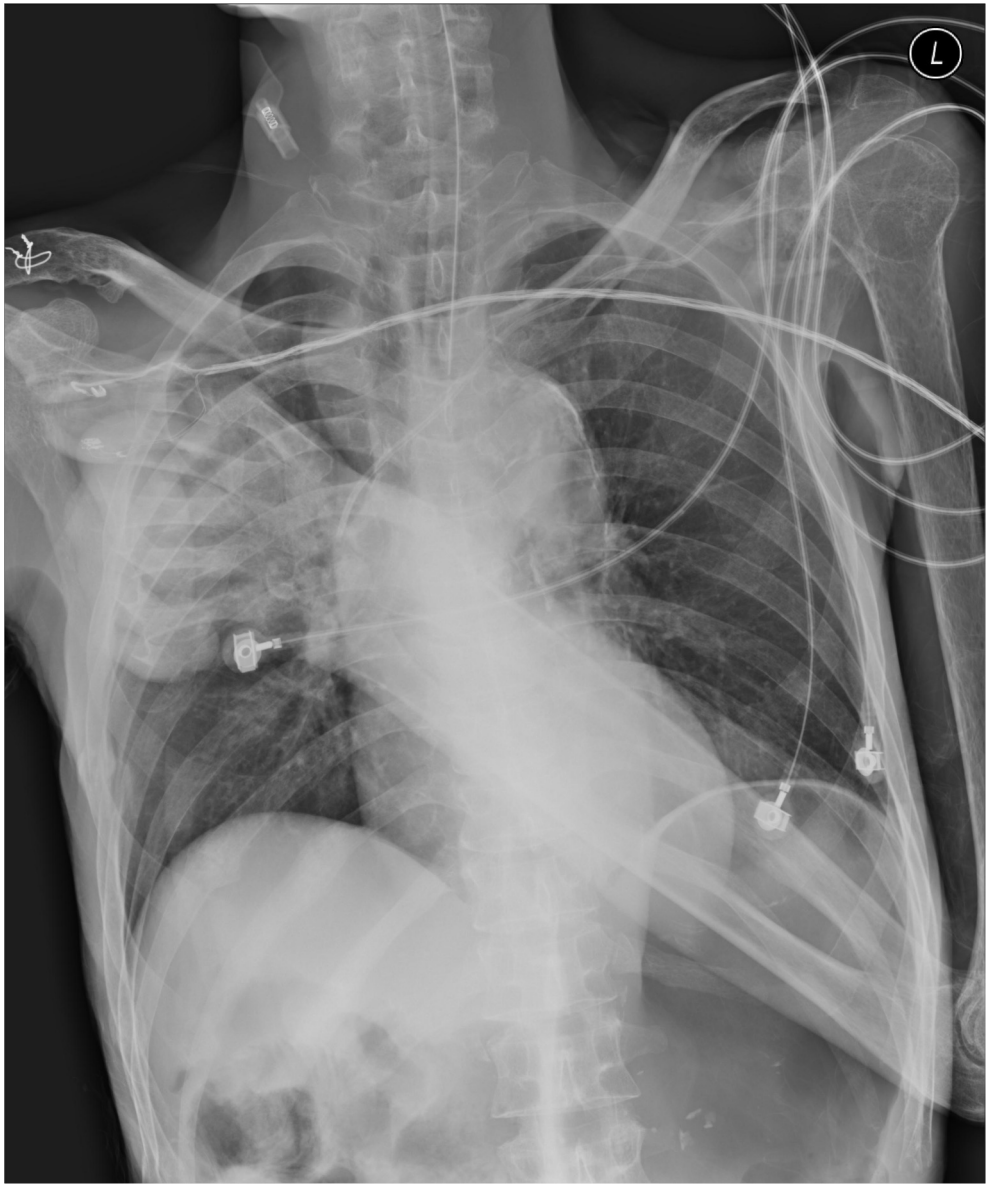


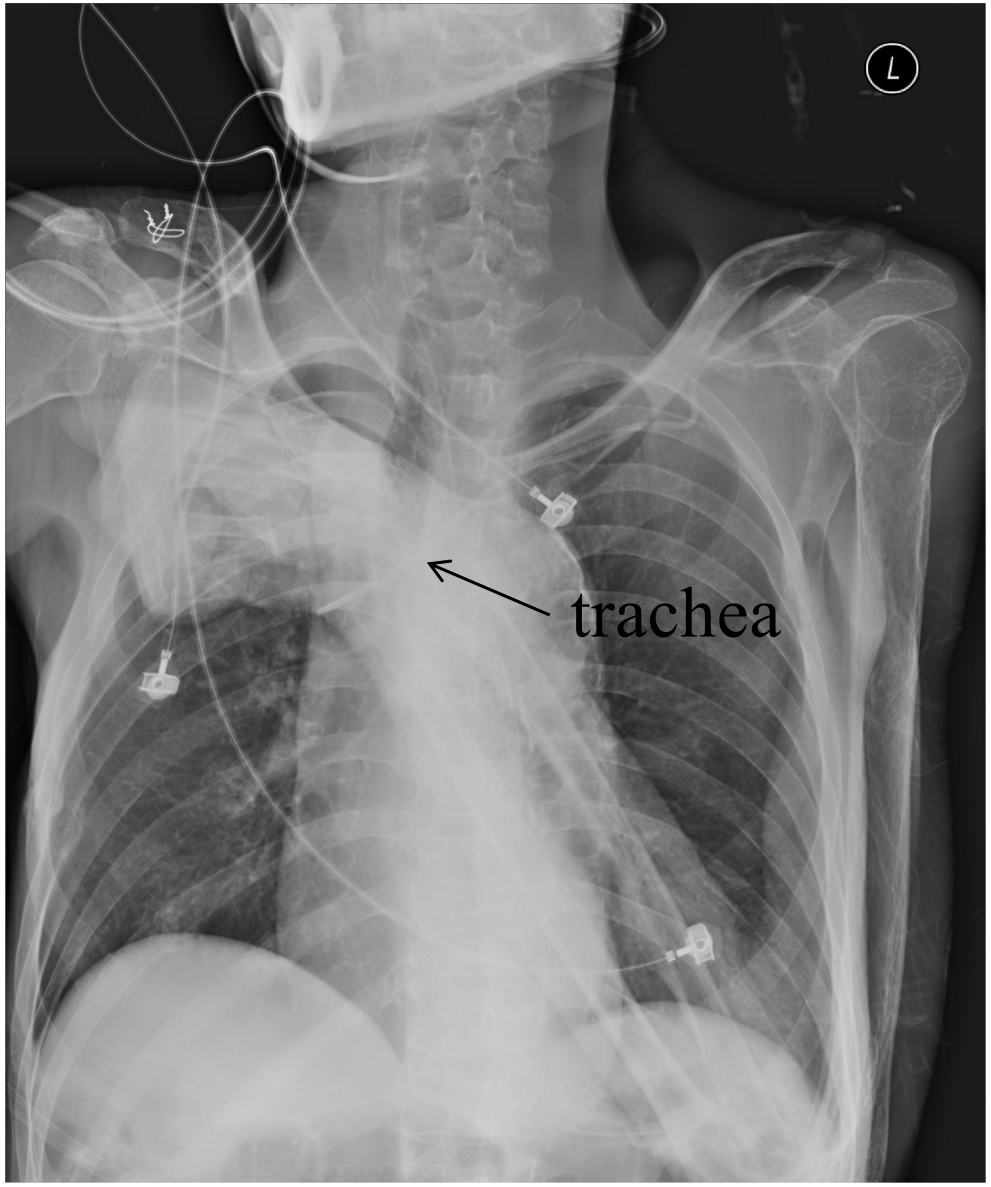


- with
  psis
- Air leakage was noted

74 years old male

- Old CVA
- Sudden respiratory failure with intubation
- NG can’t insert

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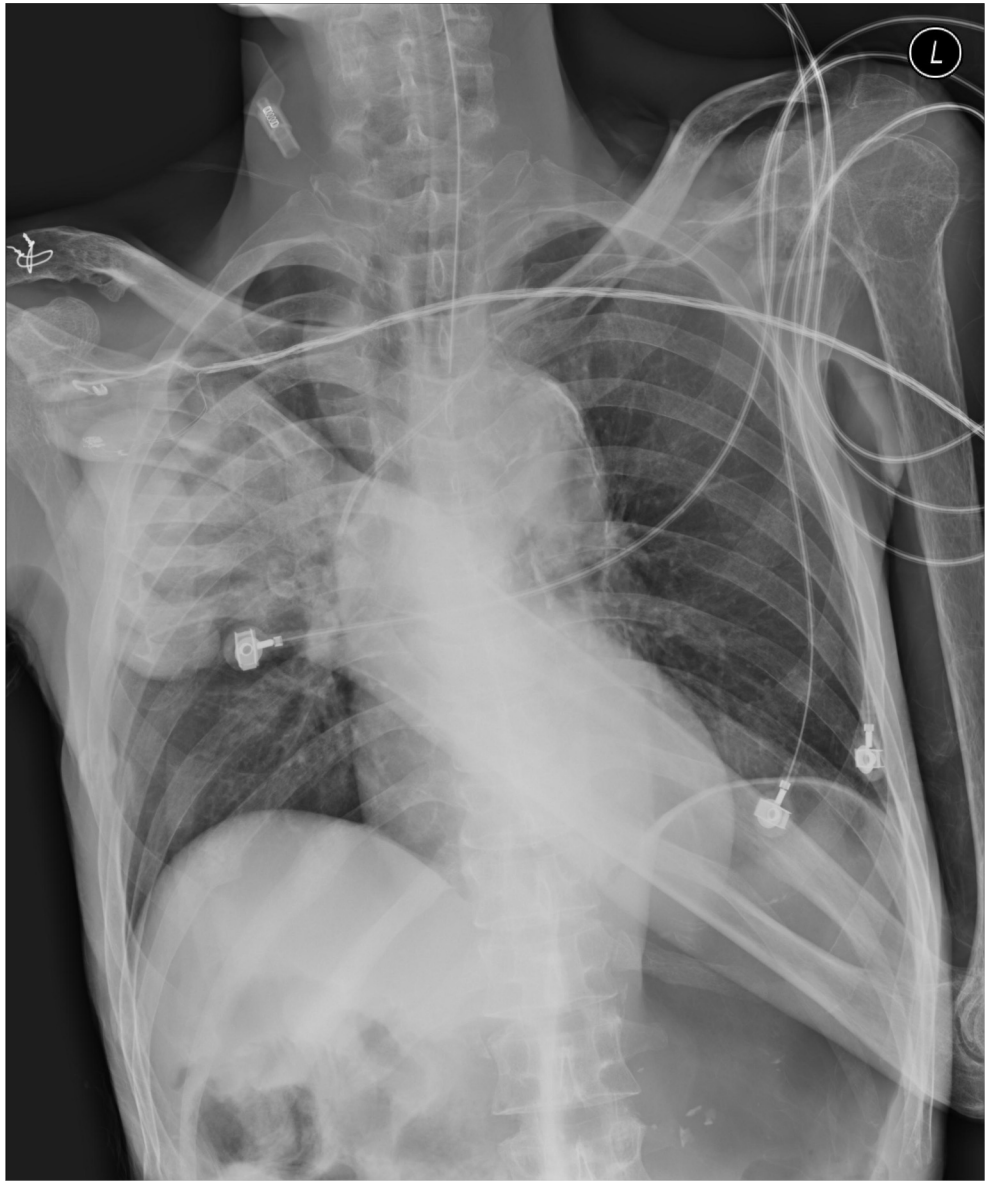
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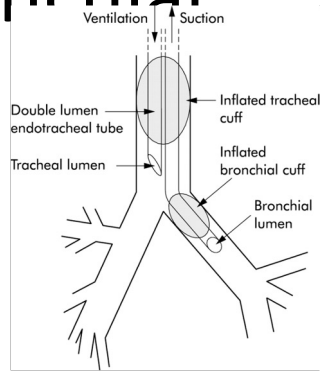
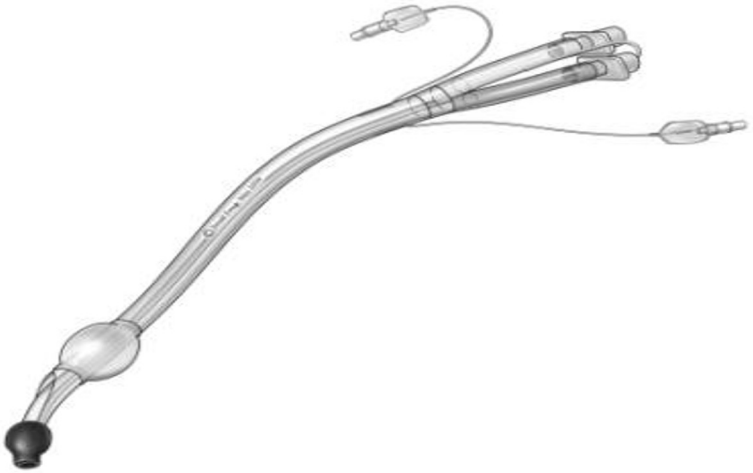
Double lumen endotracheal tube

- Isolation of each lung to prevent contamination of a healthy lung (eg, infection, massive hemorrhage)
- Control of distribution of ventilation to only one lung (eg, bronchopleural/bronchopleural cutaneous fistulas, unilateral cyst or bullae, major bronchial trauma/disruption)
- Unilateral lung lavage
- Video-assisted thoracoscopic surgery





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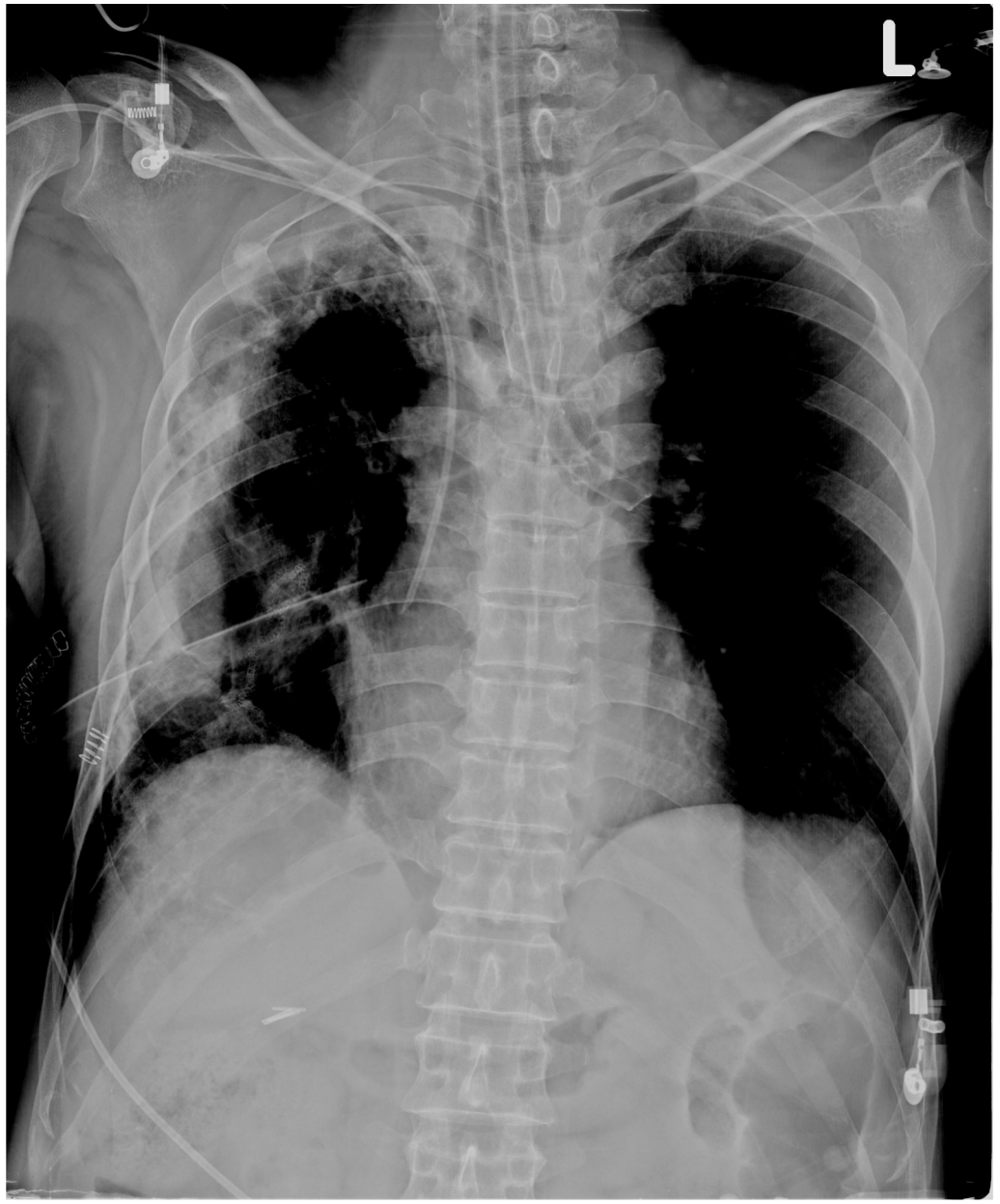


Tracheostomy Tube

1.Tip：1/2 – 2/3 between stoma & carina

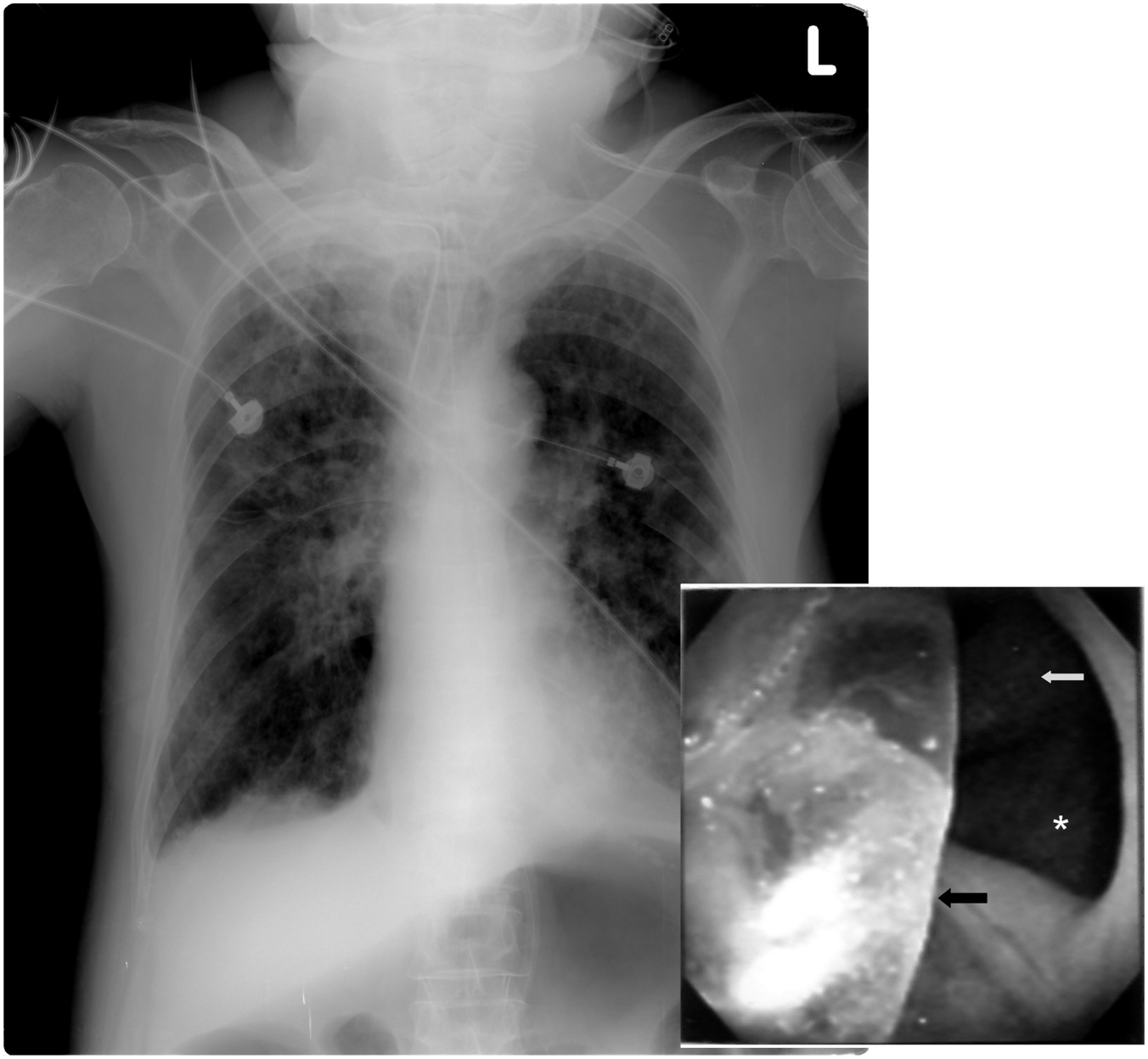
2.Inner diameter：

2/3 of tracheal lumen

3.Long axis：parallel to tracheal wall

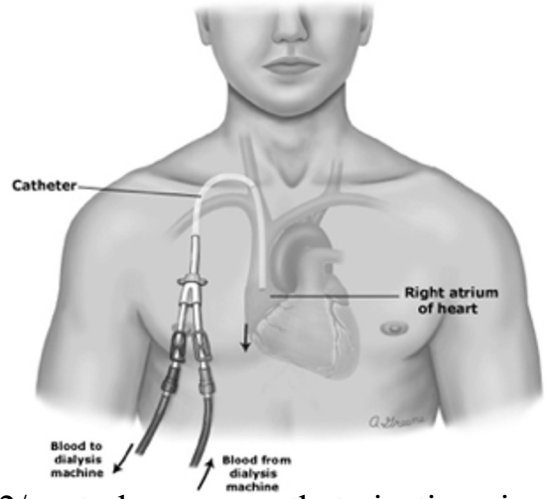
4.Distal end：Do Not abut tracheal wall

- Chronic respiratory failure with trachestomy tube
- Fever and purulent sputum

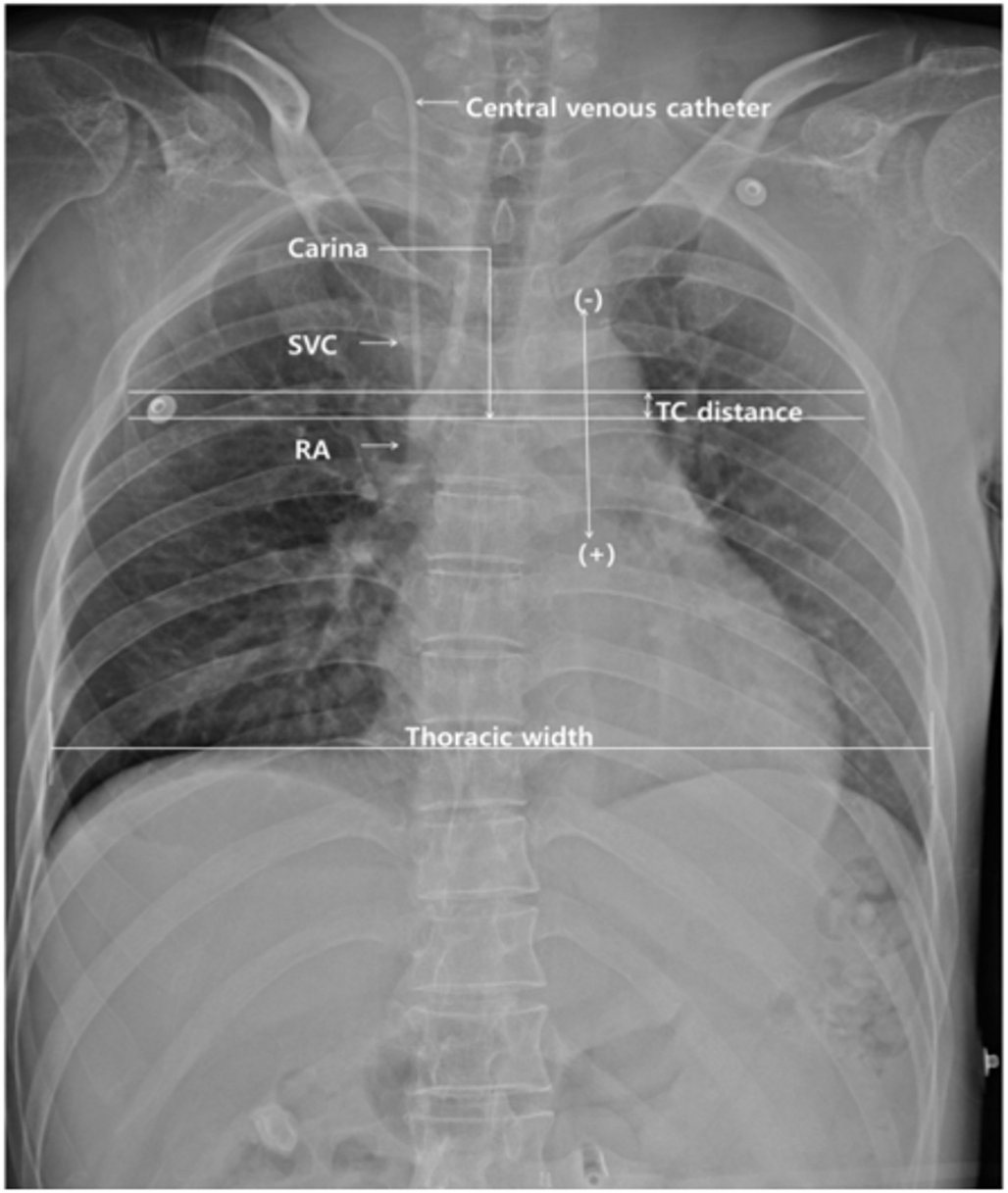


Central Venous Line

- Positioning the tip of a central venous catheter (CVC) within the superior vena cava (SVC) at or just above the level of the carina is generally considered acceptable for most short-term uses
- Complications:
  - Malposition
  - Arrhythmia, cardiac damage
  - Pneumothorax
  - Vessel perforation



http://medsim.eu/artykul/102/central-venous-catheterization-simulator-m93ub-/



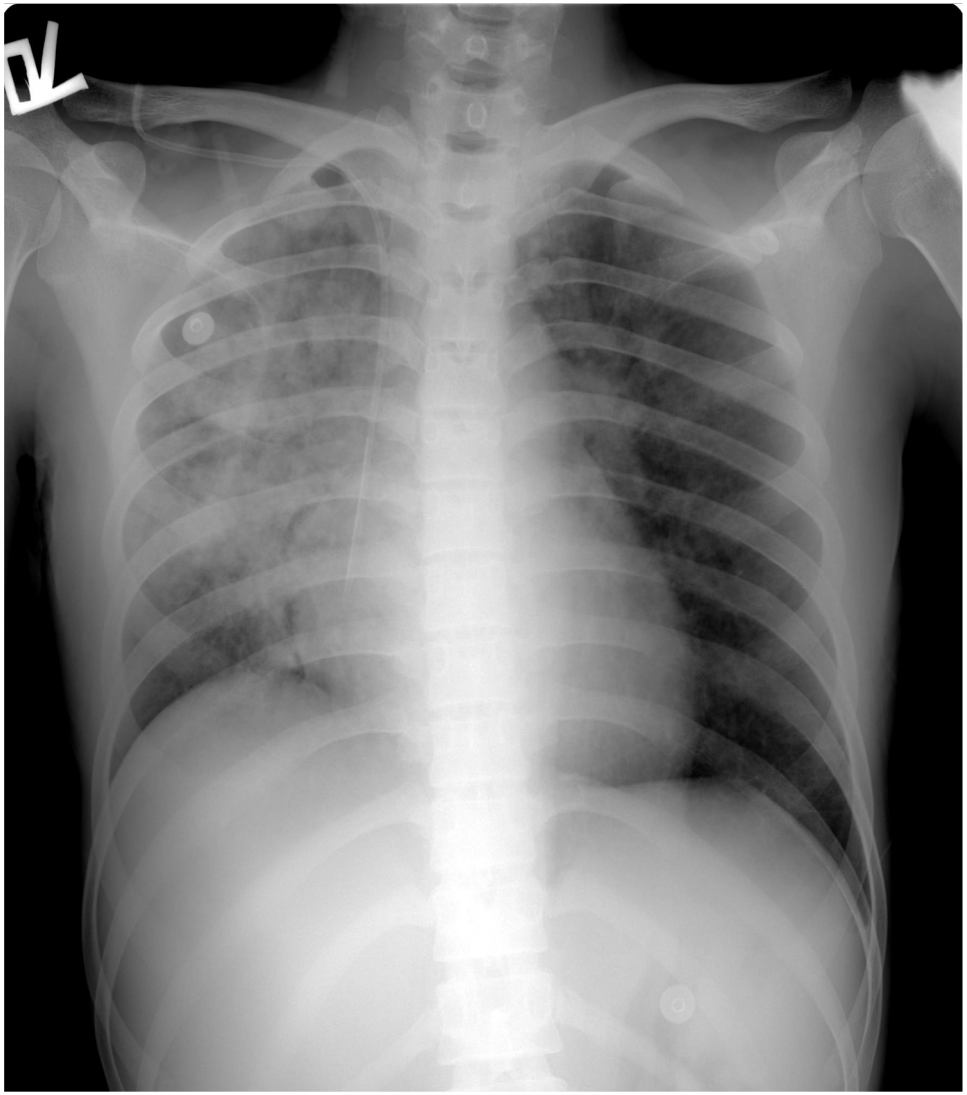
The TC(tip to carina) distances in the range of −6.69 mm to 15.61mm can be used as a reference range to define cutoffs for the optimal positioning of the CVC tip.

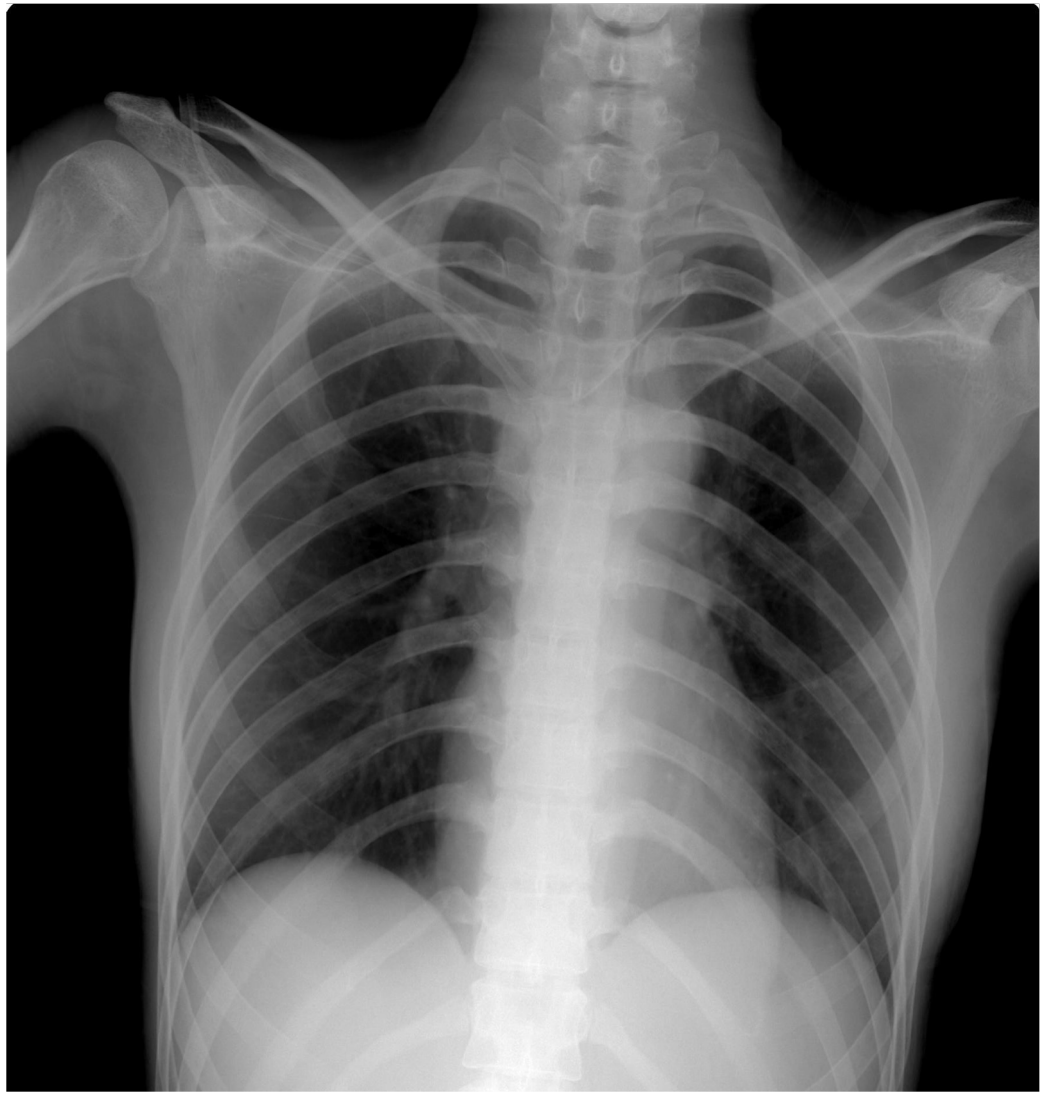
BMJ Open 2021 Jan 4;11(1):e041101.

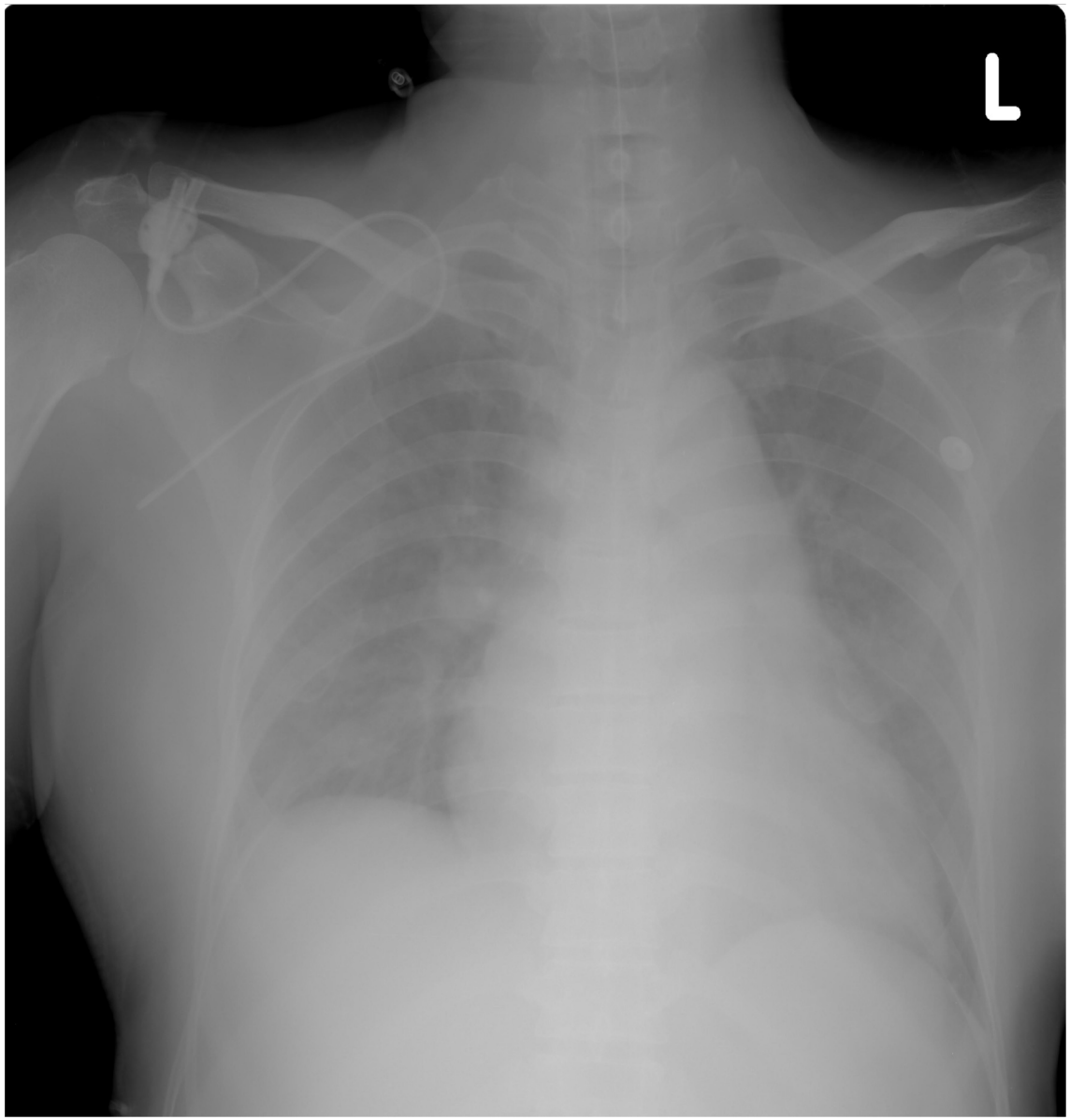
ACR Appropriateness Criteria 2015

- A chest radiograph after insertion of a CVC and/or Swan-Ganz catheter is recommended to demonstrate proper placement and to detect complications.

- Beyond initial insertion, follow-up chest radiographs have a low yield for revealing complications and are only suggested when complications are clinically suspected.



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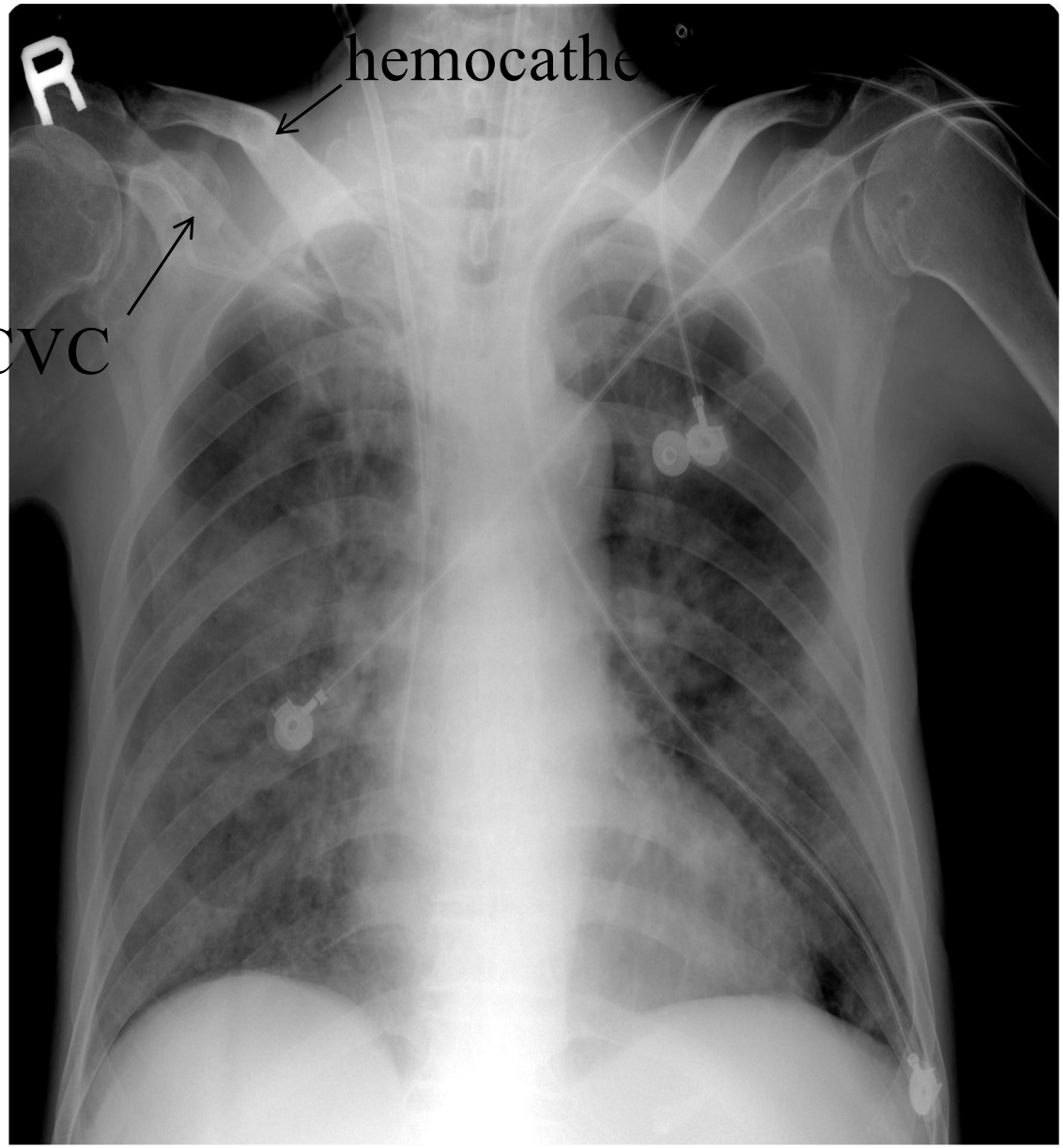
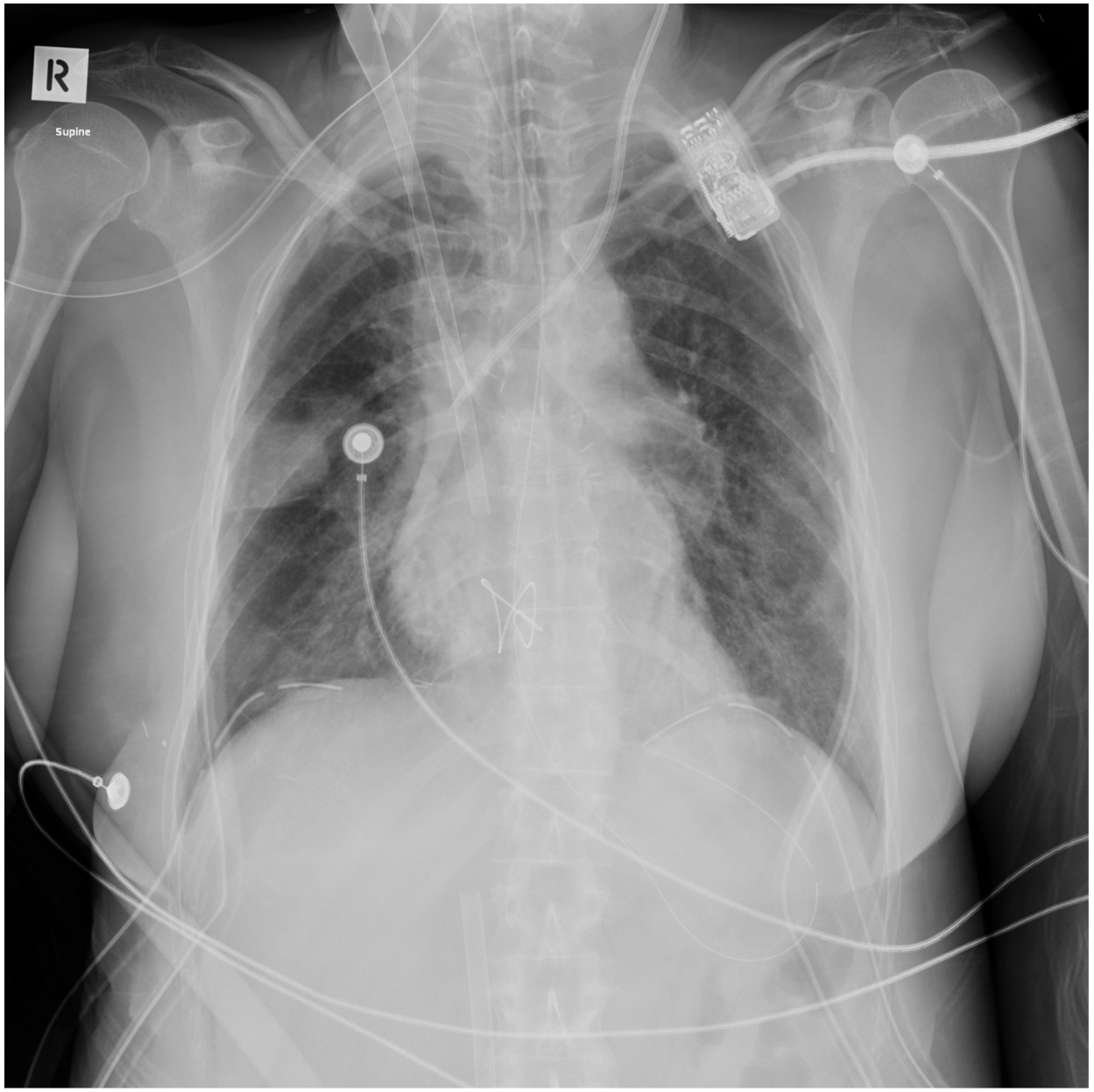
http://www.covidien.com/dialysiscatheter/pages.aspx?page=Products/AcuteHemodialysis/207613

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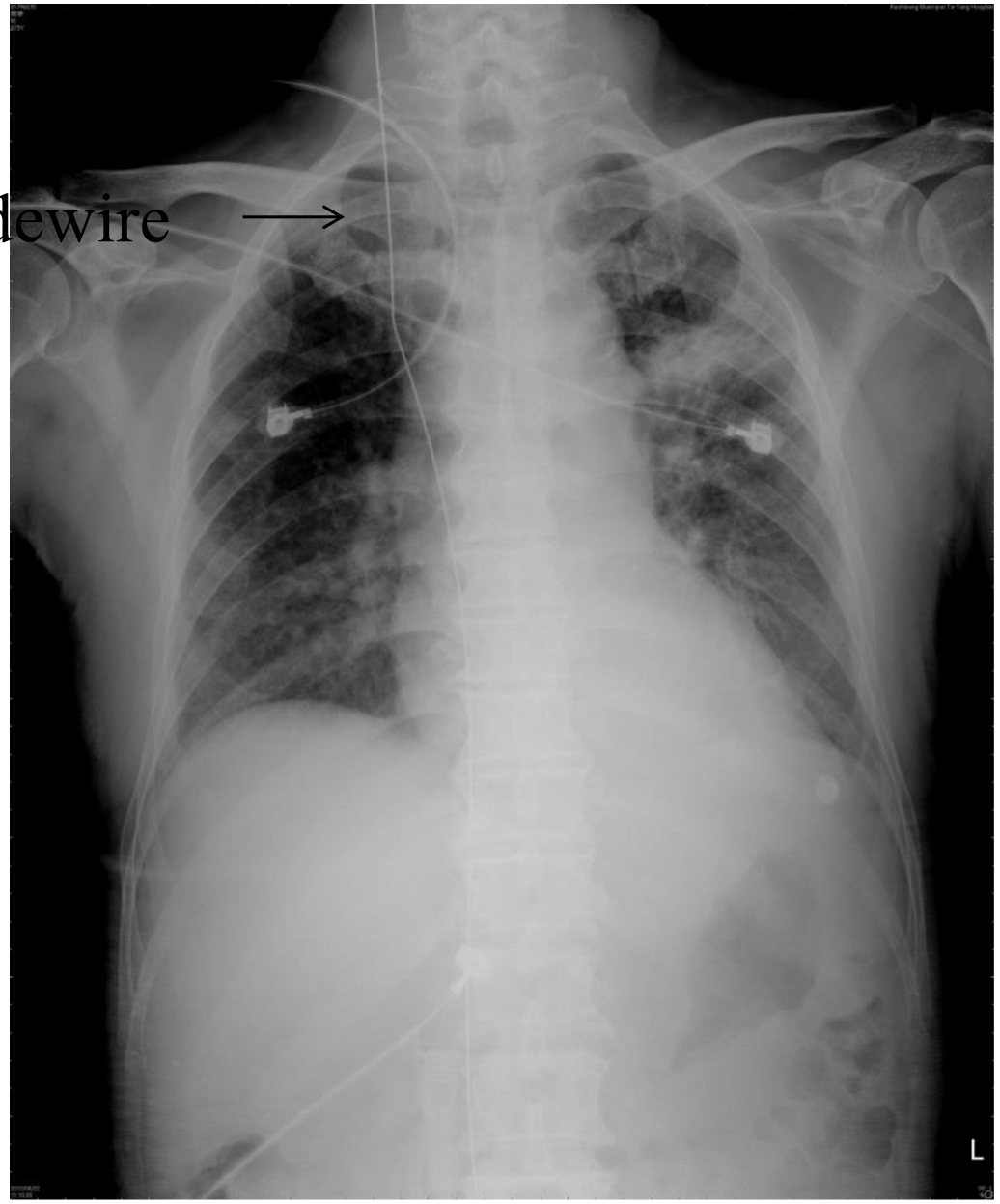
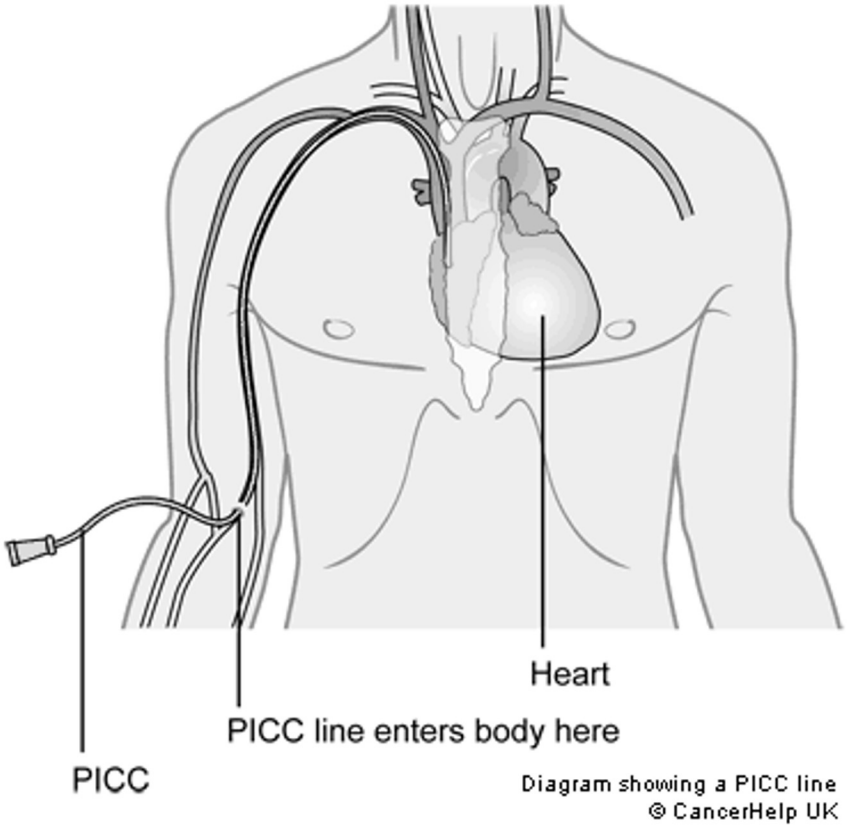
Supine

guidewire ⟶

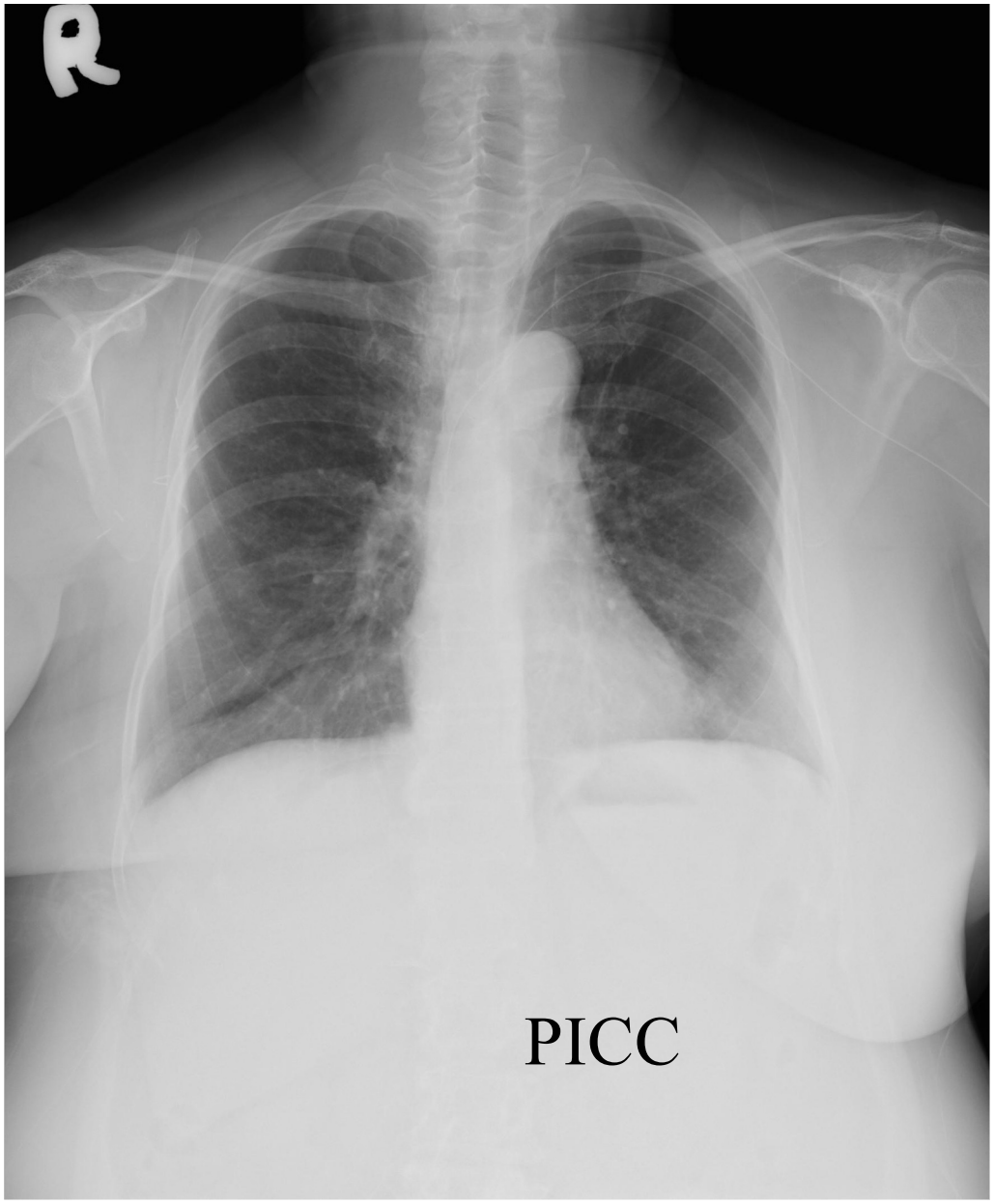


PICC

- Peripherally inserted central catheter (**PICC**) is correctly located with its tip at the level of the cavo-atrial junction - approximately the height of two vertebral bodies below the level of the carina

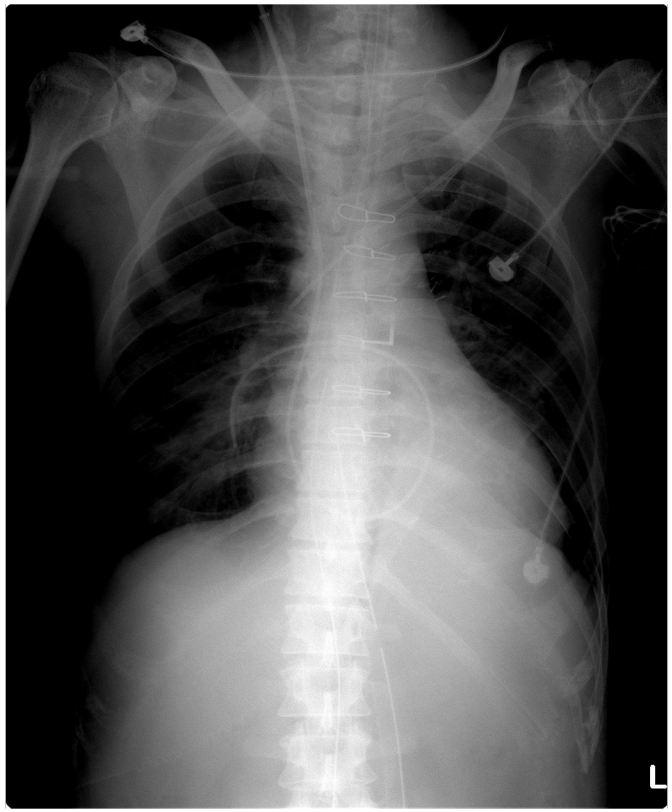


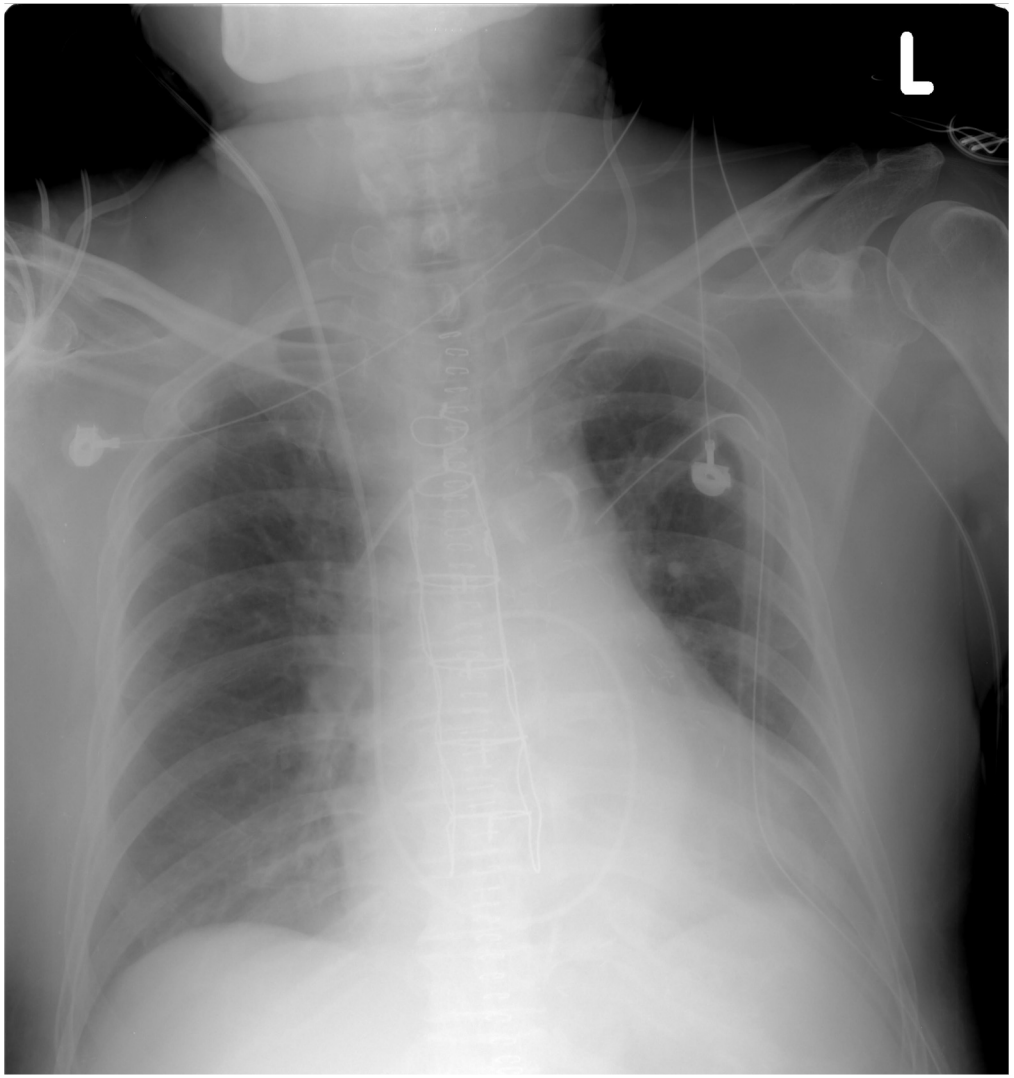
codybuker.com



Swan-Ganz Catheter

- **The tip is wedged into the distal pulmonary artery.**
- **The balloon is deflated once the pressure is taken, and the tip is pulled back to the main pulmonary artery.**
- **The tip of the catheter located within the mediastinal shadow indicates correct placement.**
  - in the right or left main pulmonary arteries, and the tip should not extend beyond the proximal interlobar pulmonary artery (within 2 cm of the hilum
- **Complication: arrhythmia, cardiac damage, pulmonary hemorrhage, infarction**

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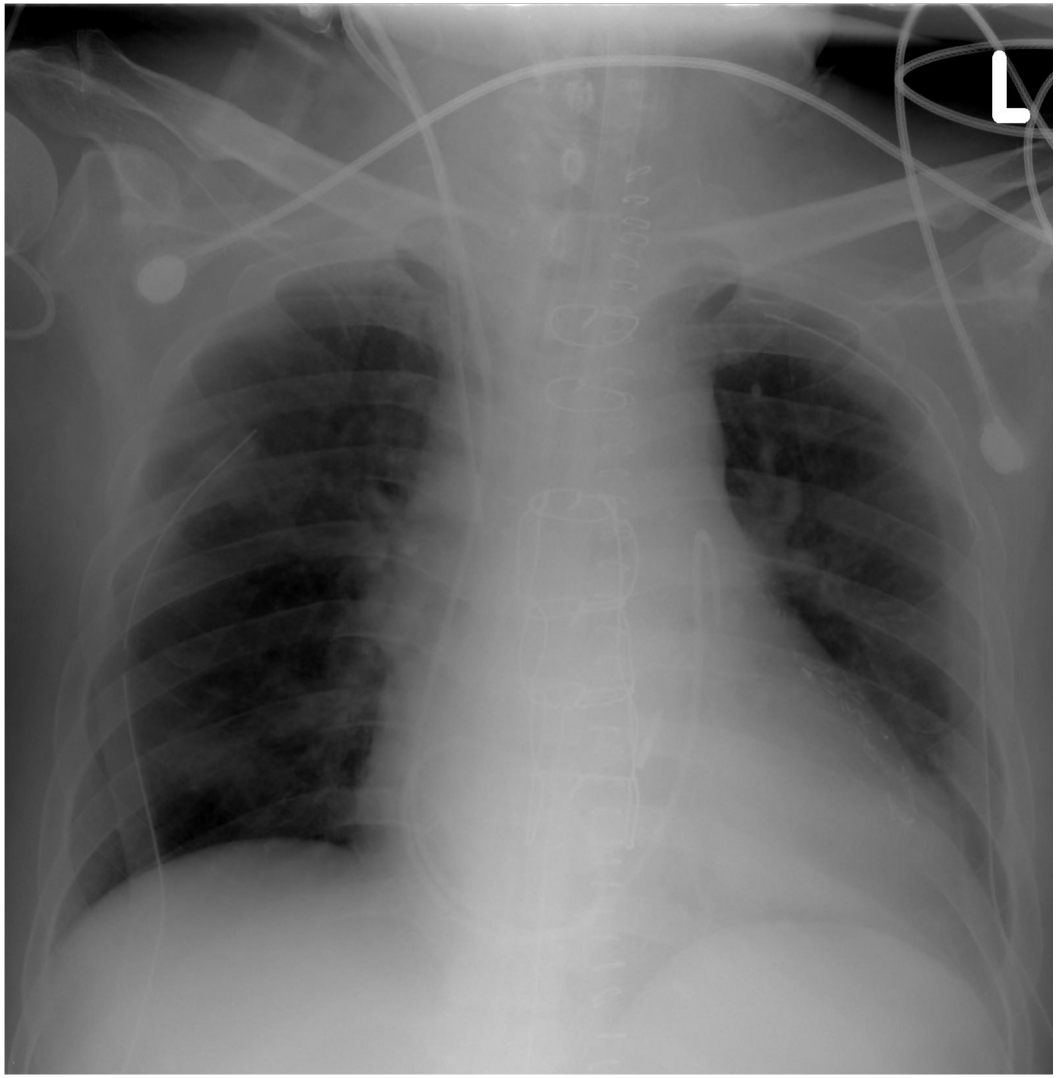
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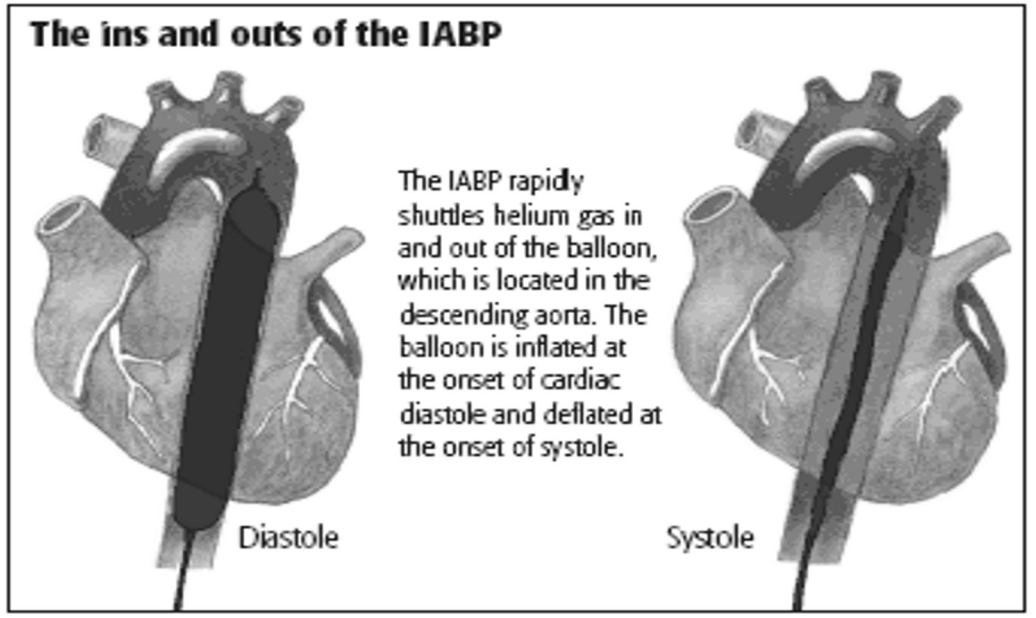
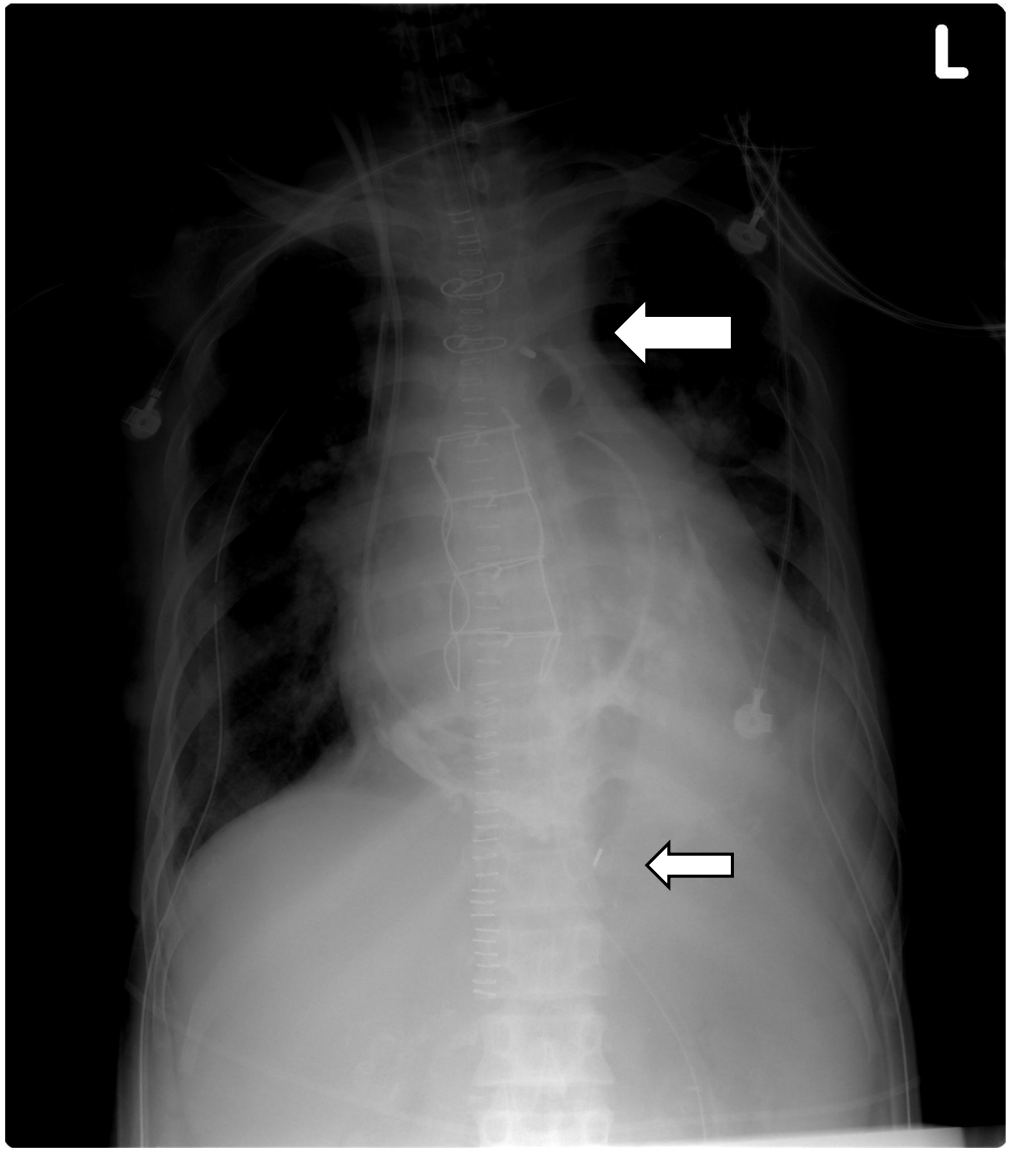
Intraaortic Balloon Pumping

- > 4cm below upper part of aortic knob
- Distal to the origin of left subclavian artery
- Inflated balloon above sup mesenteric and renal artery



http://www.fda.gov/MedicalDevices/Safety/AlertsandNotices/TipsandArticlesonDeviceSafety/ucm064547.htm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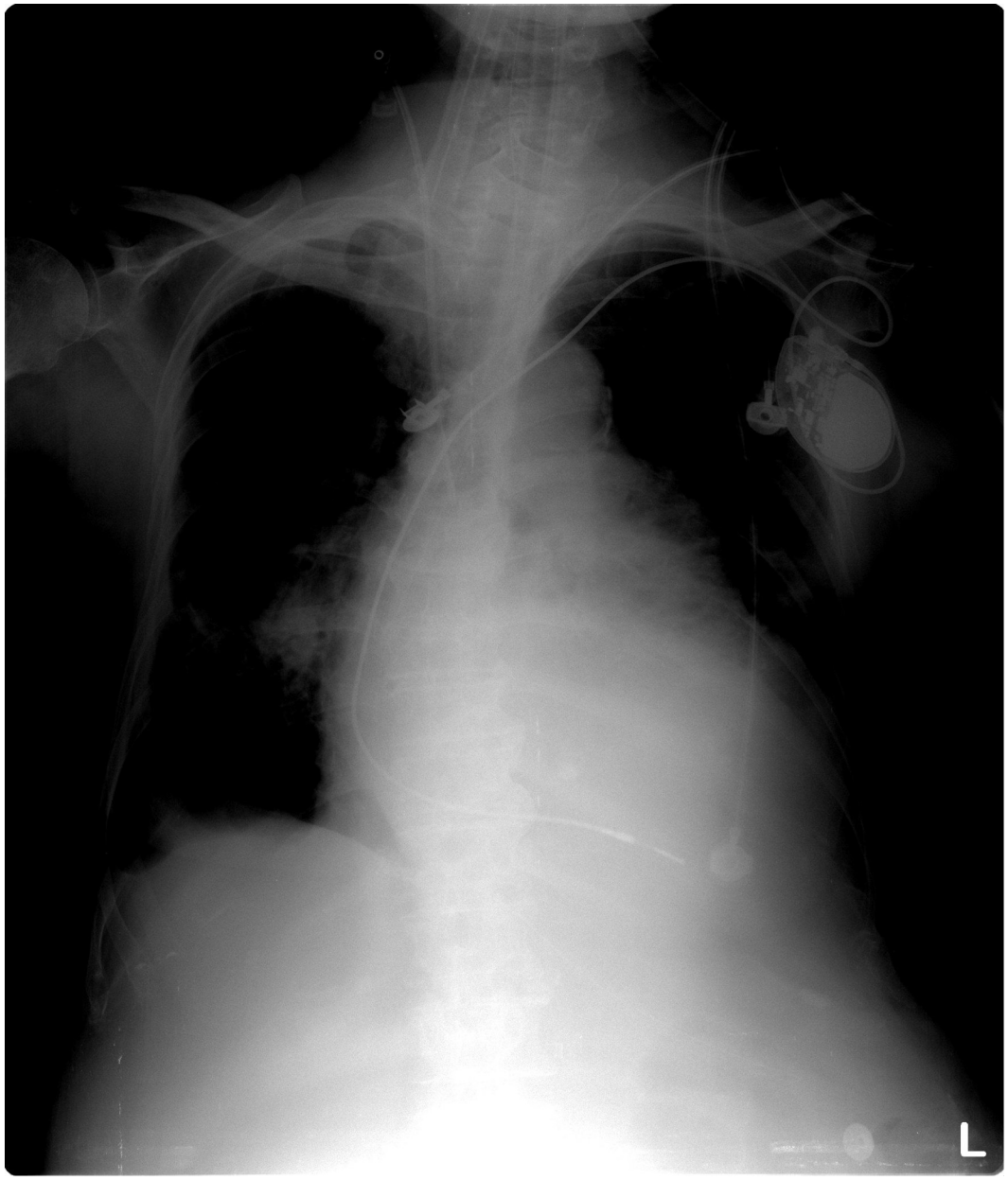
Cardiac Pacemaker

- Tip：apex of RV
- Bipolar： RA & RV
- Ventricular tip directed anteriorly , 3-4mm beneath epicardial fat
- Pulse generator： free of air
  - R/O subcutaneous emphysema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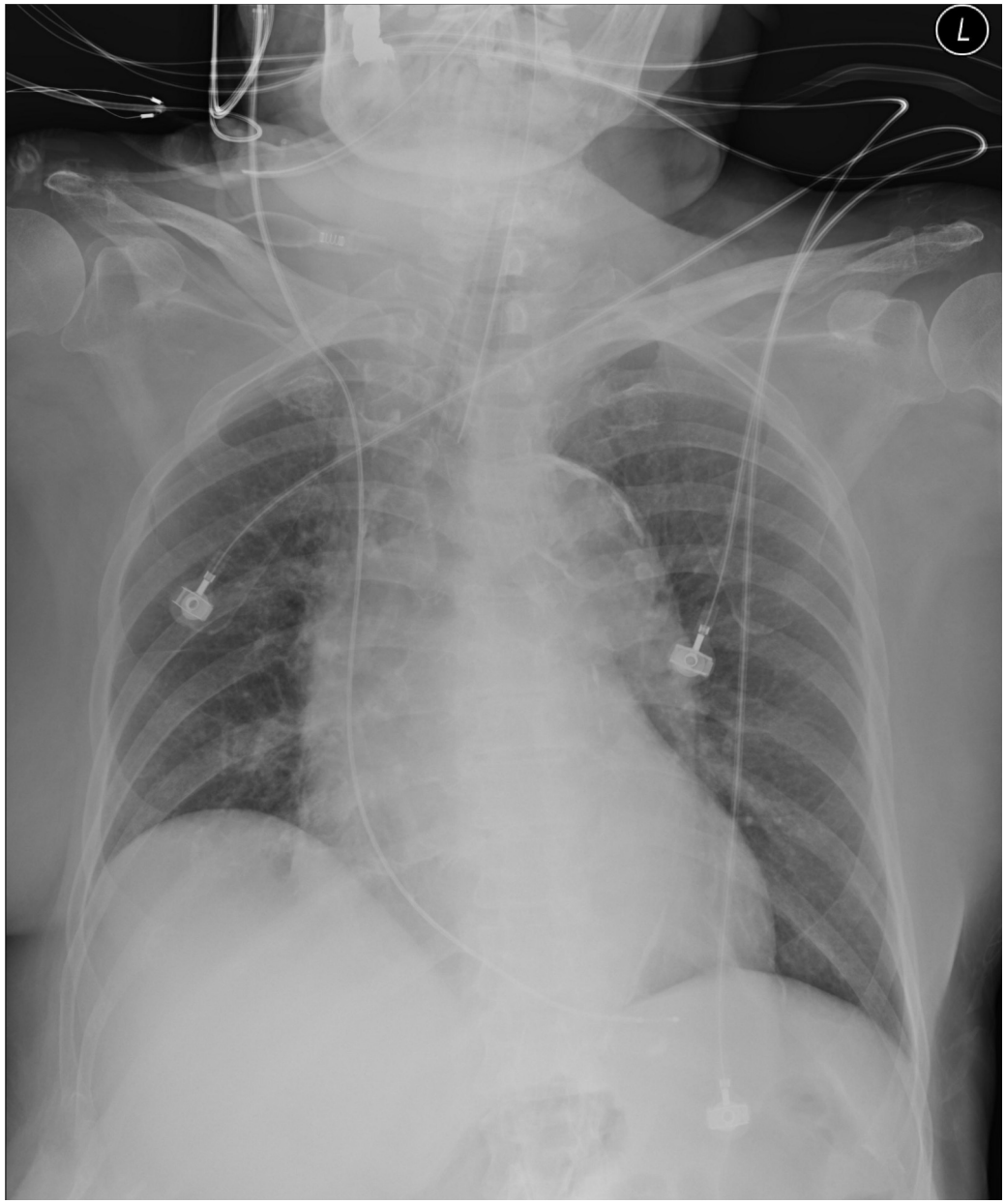
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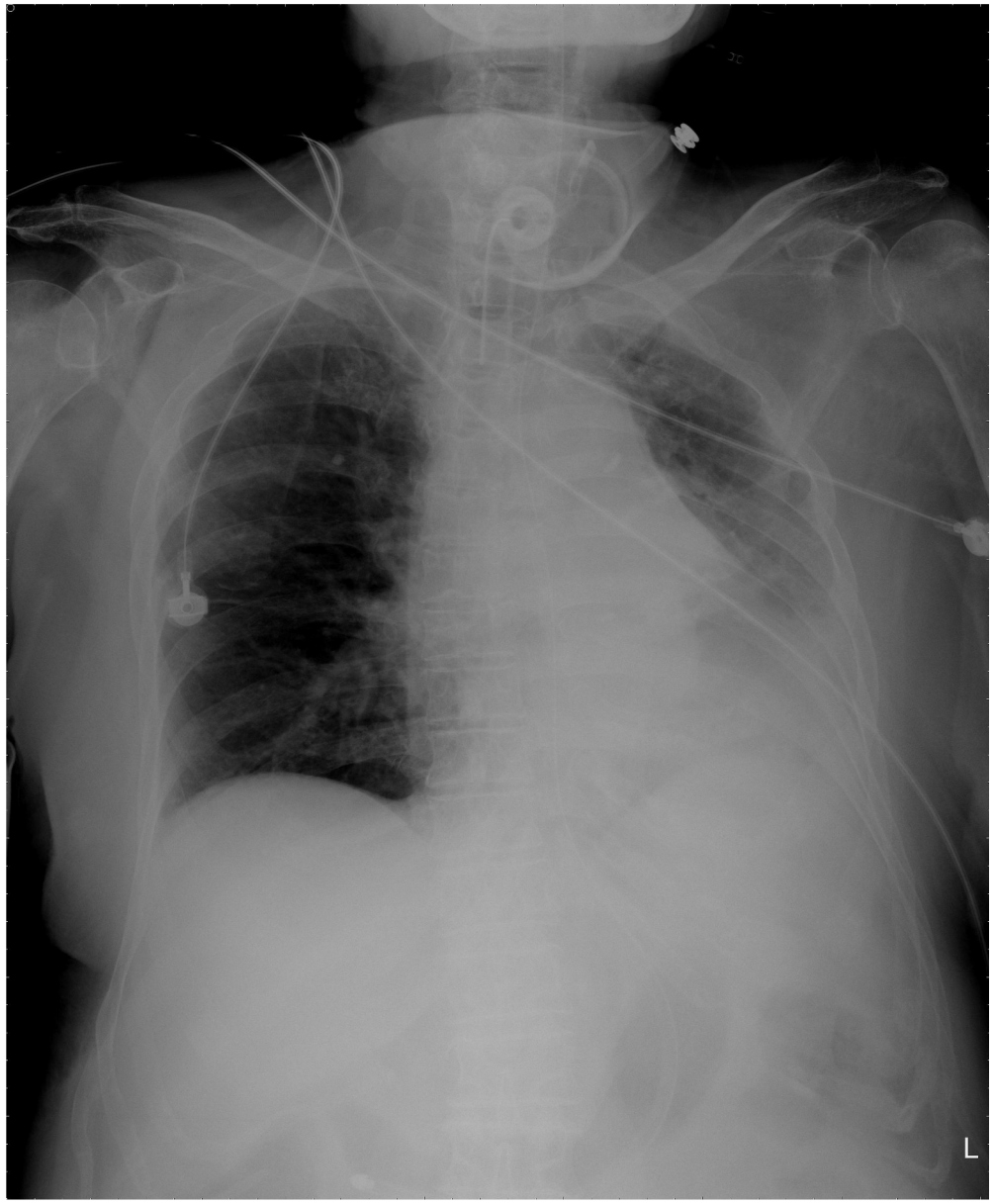
Nasogastric tube

- Patient discomfort is common.
  - Generous lubrication, the use of topical anesthetic, and a gentle technique
- Epistaxis
- Respiratory tree intubation
- Esophageal perforation.

http://www.novinholding.com/Products/PolyMed/All_Gastroenterology.html

ACR Appropriateness Criteria 2015

- A chest radiograph is warranted after initial nasogastric tube insertion and before the first feeding.
- Beyond the initial chest radiograph, follow-up chest radiographs are not required for managing stable tubes.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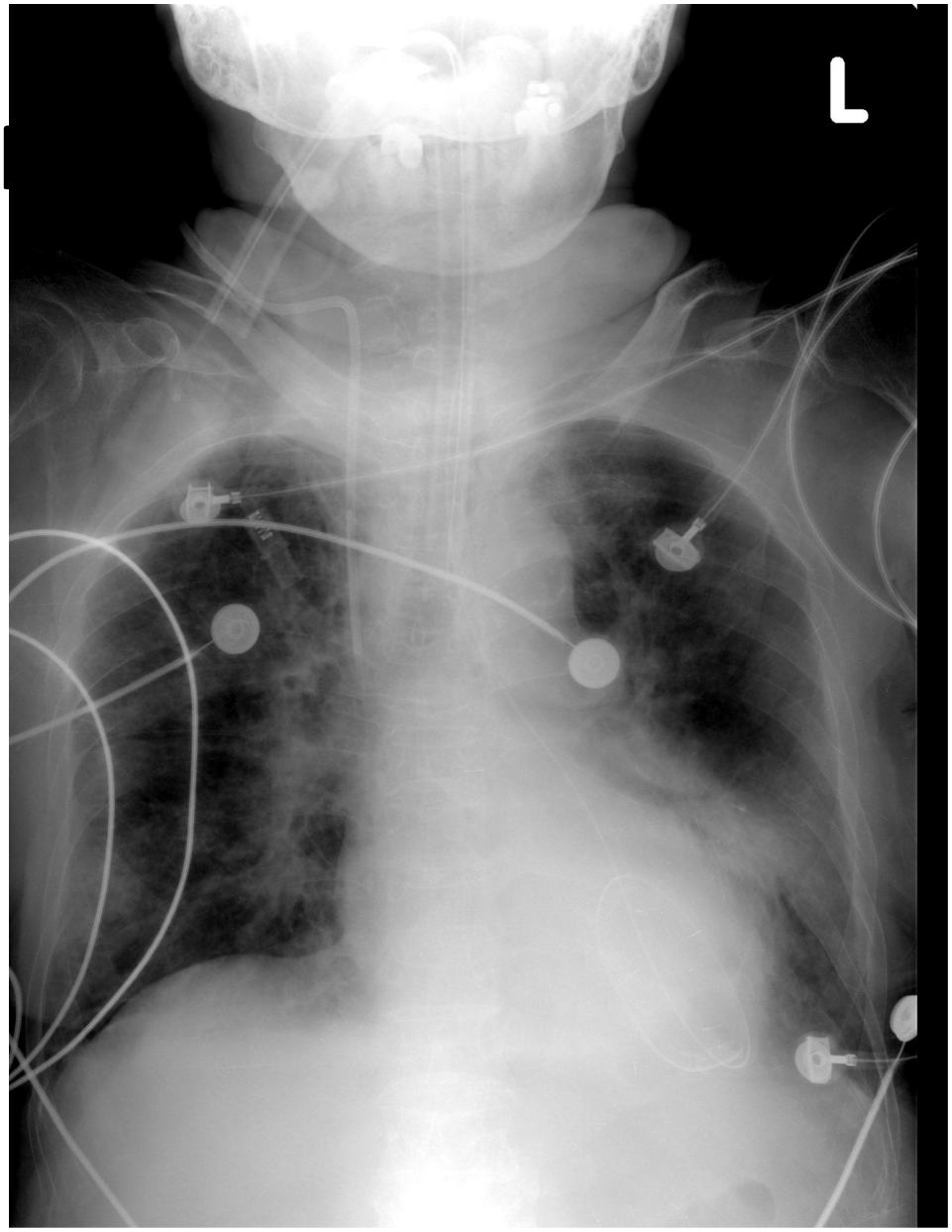
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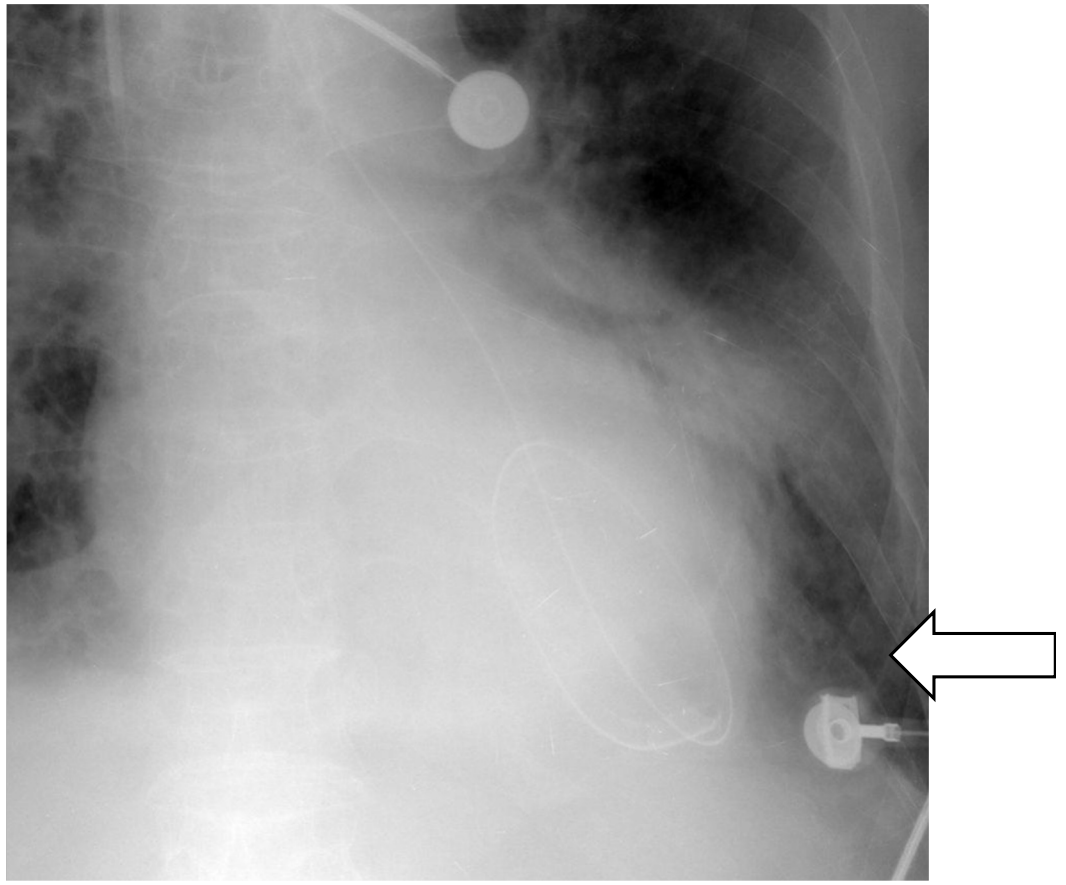

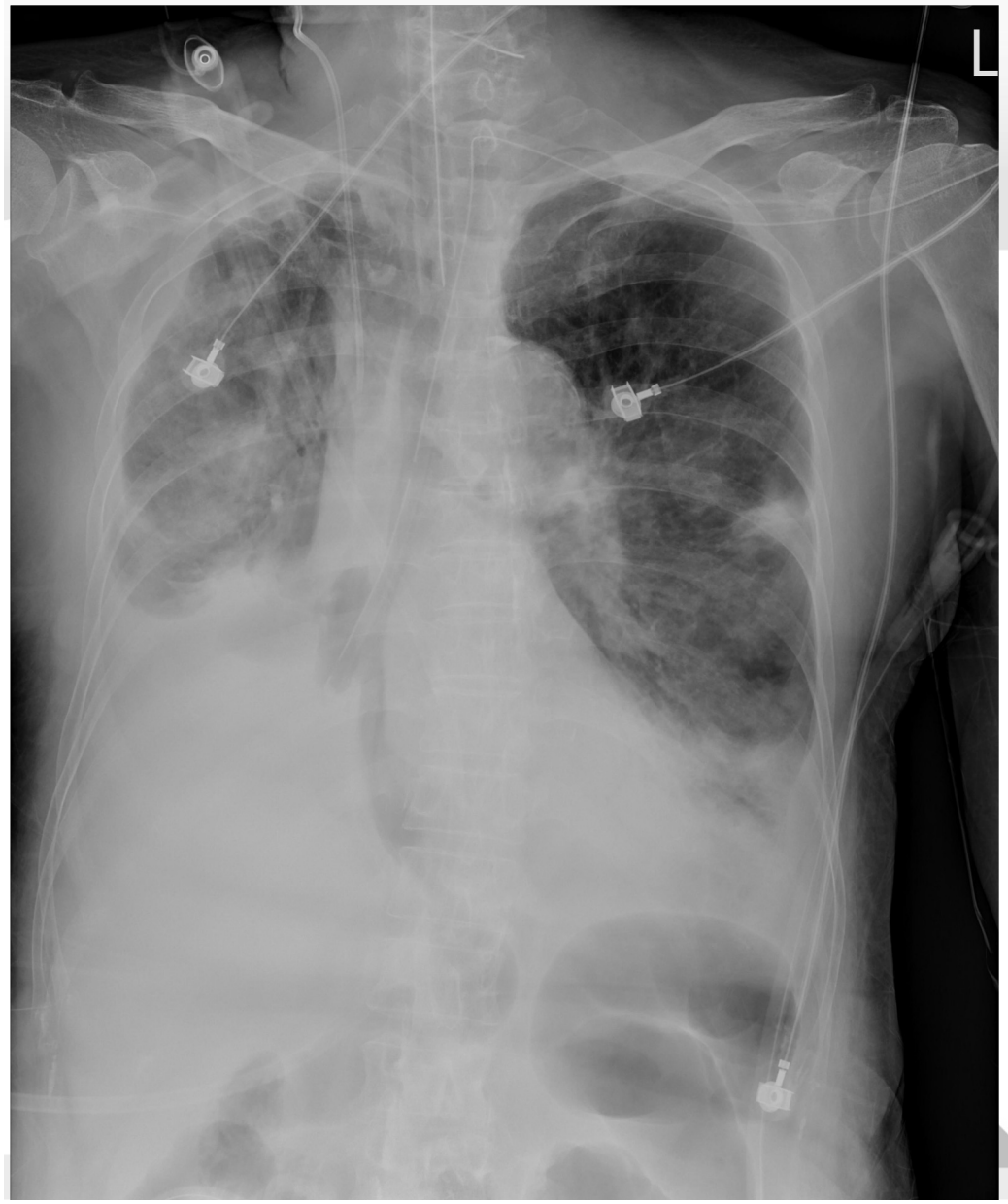
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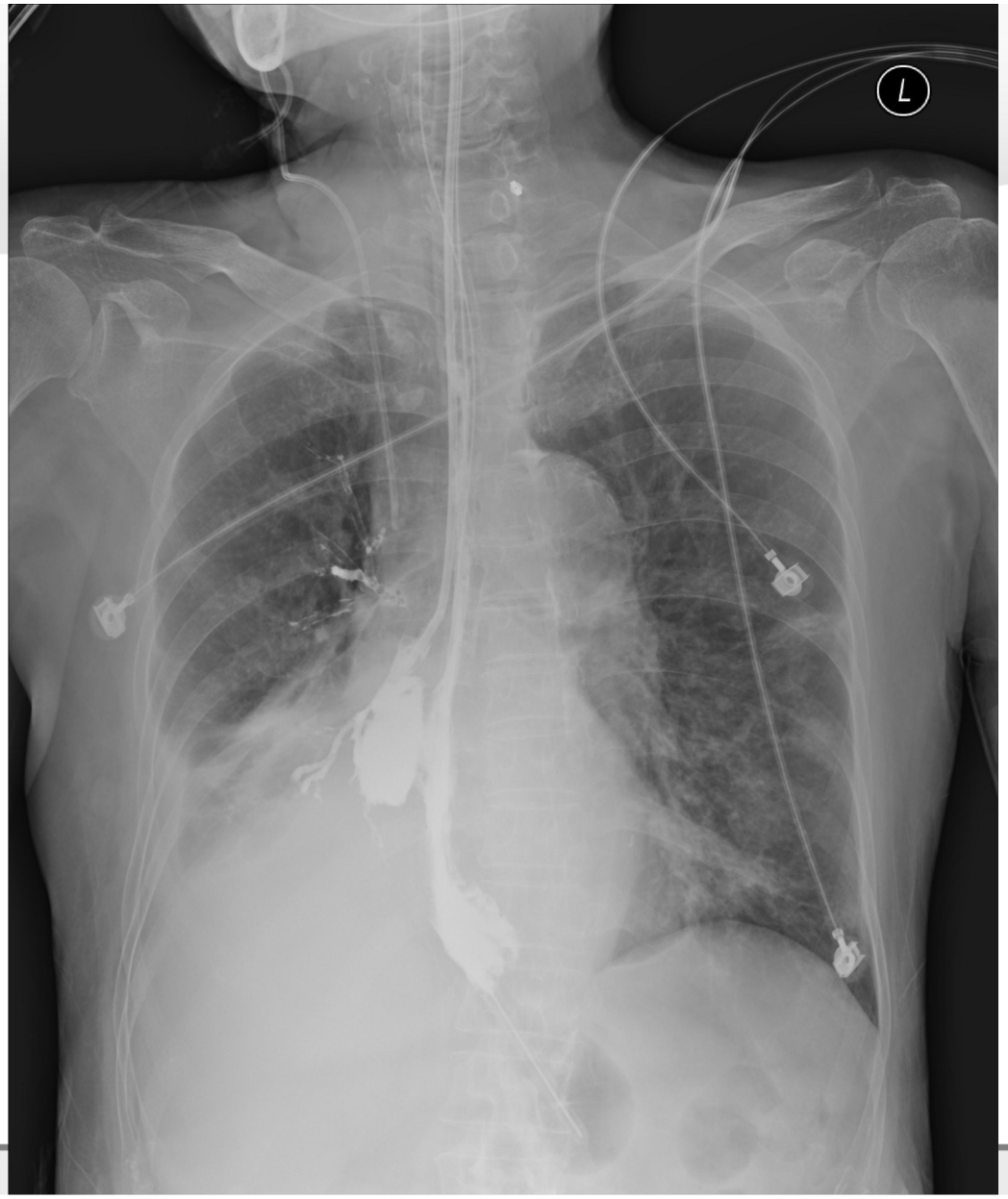
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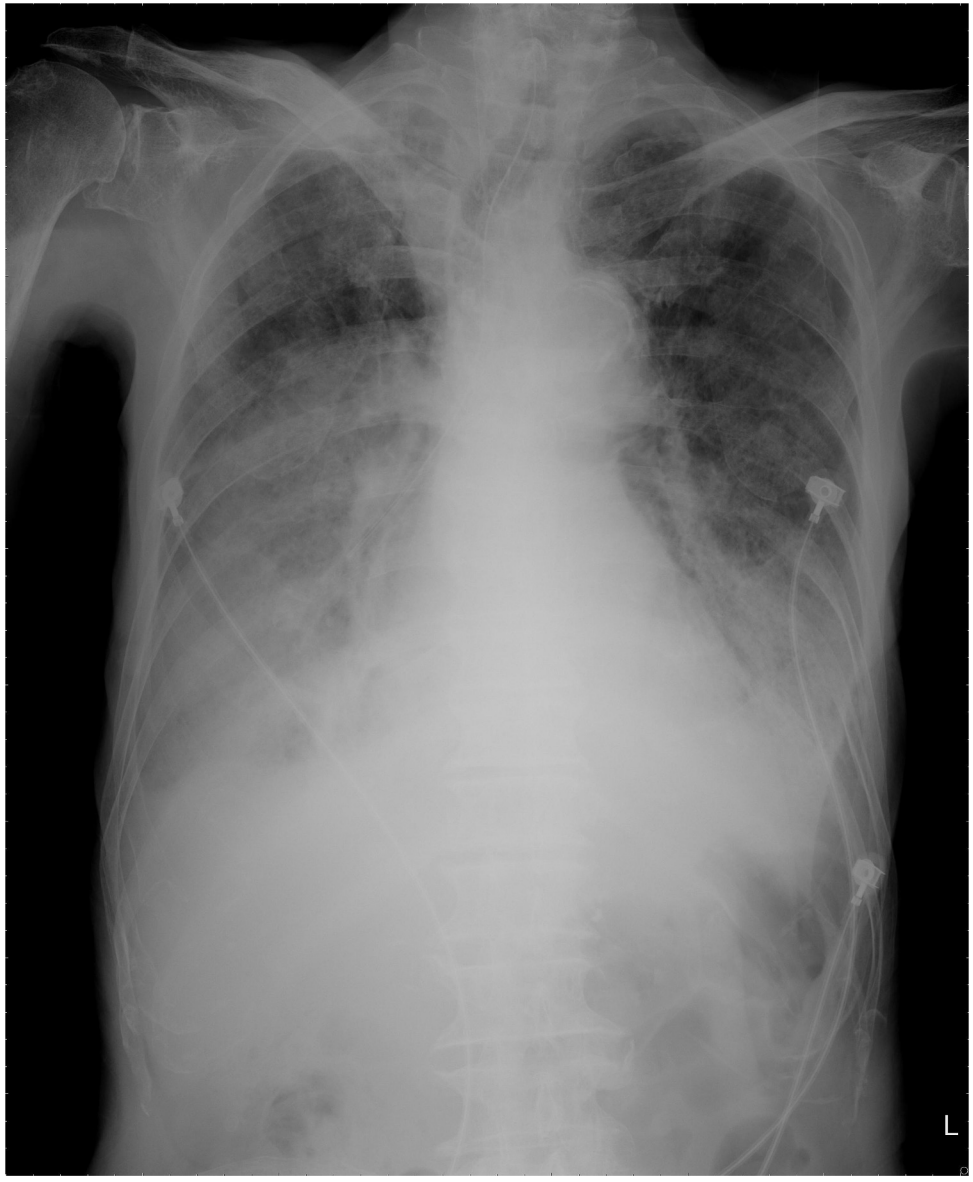
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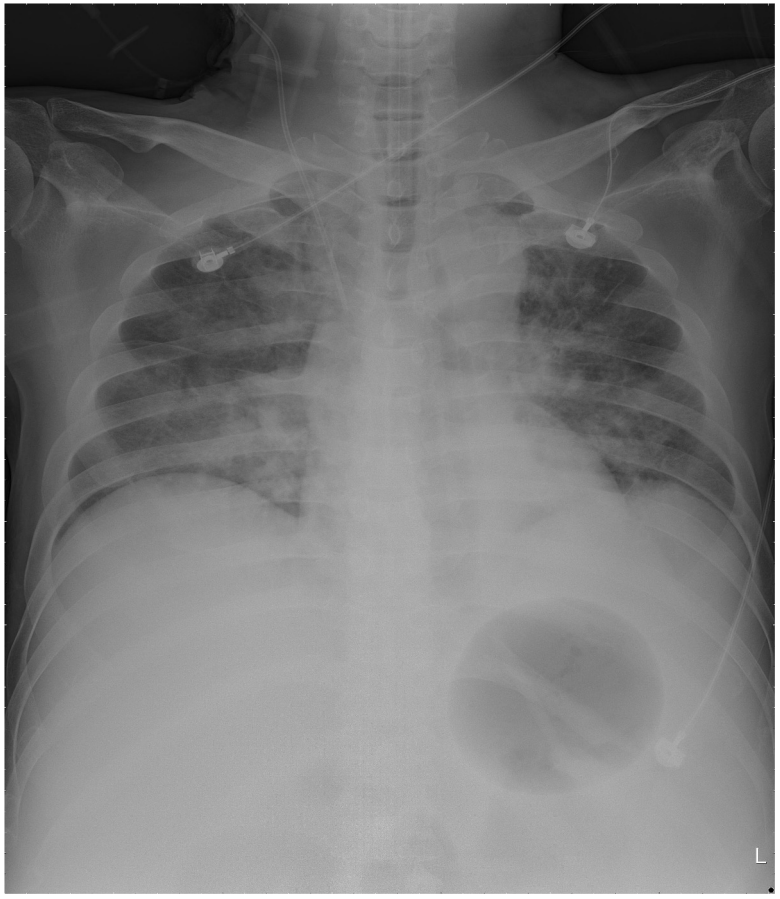
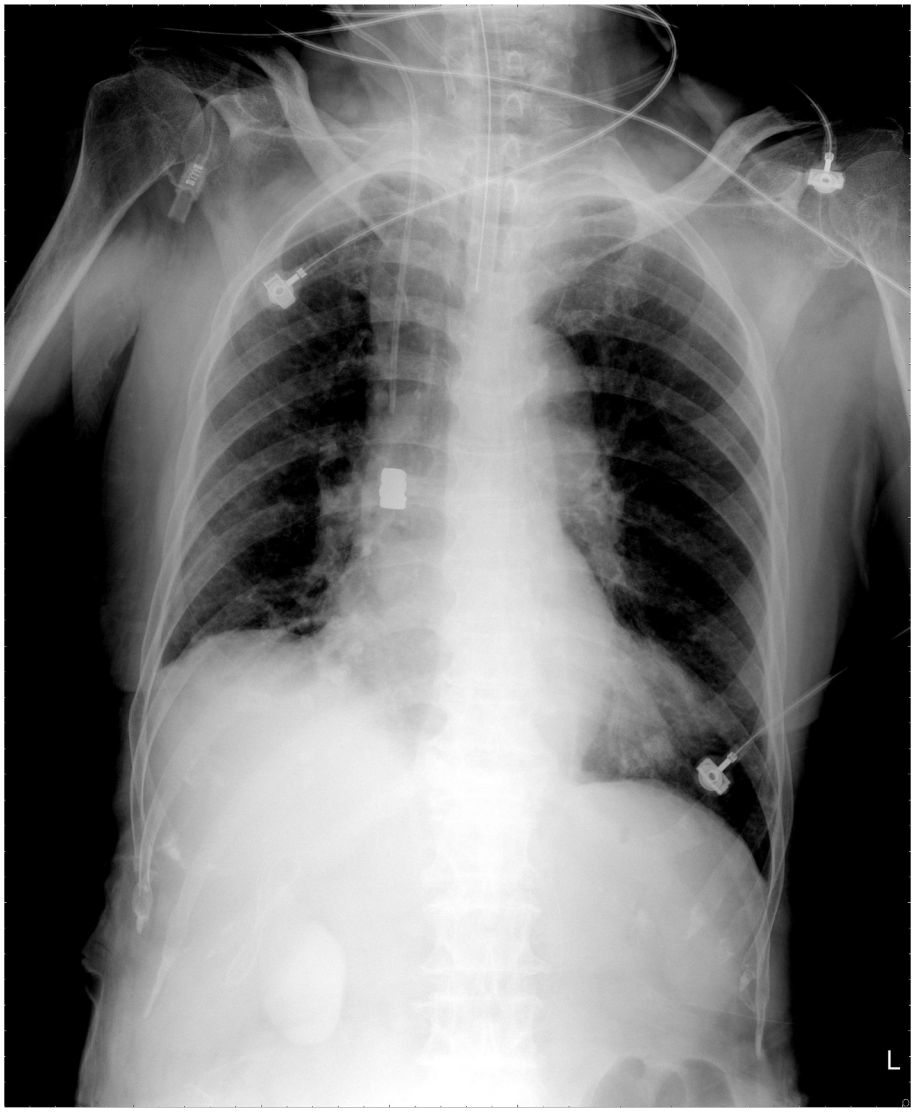
Sengstaken-Blakemore tube (SB tube)

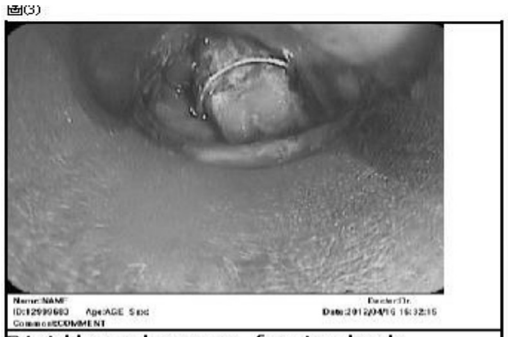


Gastric balloon: 250-300 cc

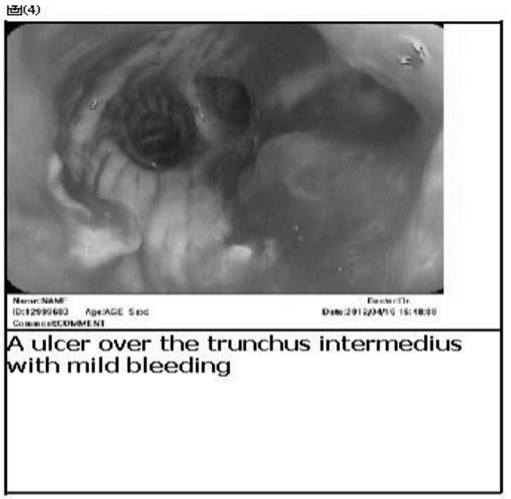
Esophageal balloon : 25-40 mmHg



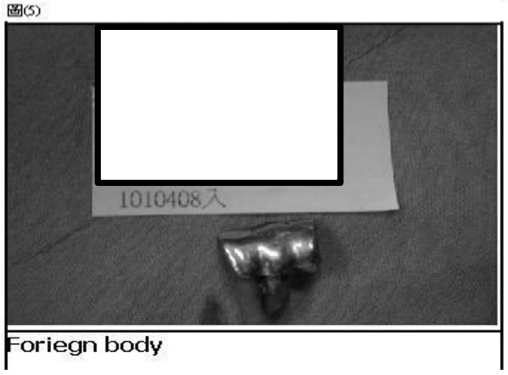
Foreign body



Rigid bronchoscopy, foreign body removal



A ulcer over the trunchus intermedius with mild bleeding



Foriegn body

Barotrauma

- Barotrauma is estimated to affect from 10-65% of all patients who require mechanical ventilation.
- High-risk patients are those who have acute respiratory distress syndrome (ARDS), as opposed to acute lung injury (ALI), preexisting chronic obstructive pulmonary disease (COPD), and direct traumatic injury.

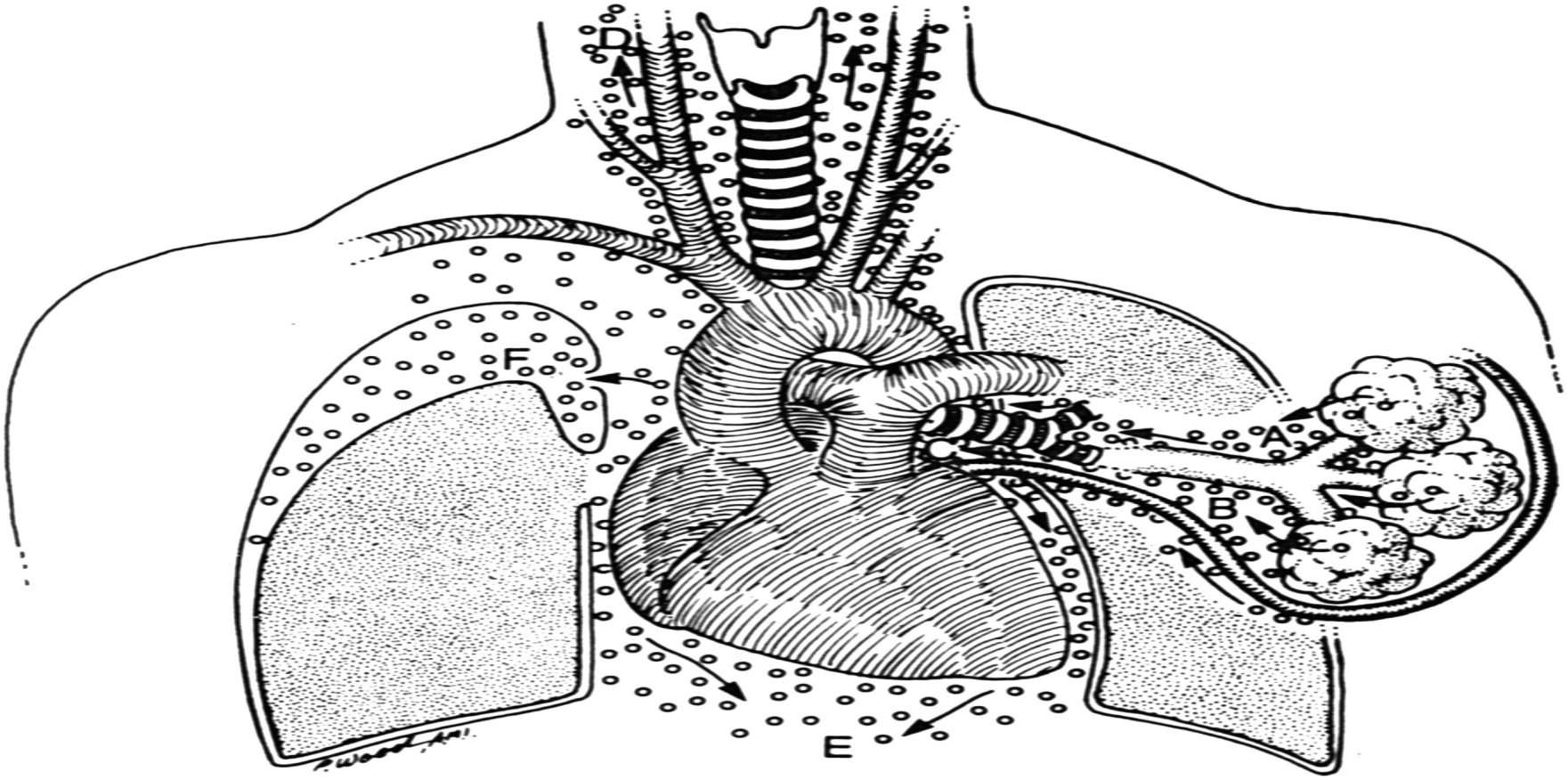


FIGURE 94-5 Possible routes of air following alveolar disruption. Air from the alveolus (*A*) enters perivascular interstitium (*B*), dissecting proximally within bronchovascular sheath toward mediastinum (*C*). As mediastinal pressure rises, decompression occurs in cervical (*D*), subcutaneous, and retroperitoneal (*E*) soft tissue spaces. A pneumothorax is possible if the pleura (*F*) is ruptured. *(From Maunder et al,[19] with permission.)*

Radiology of chest disease 1995

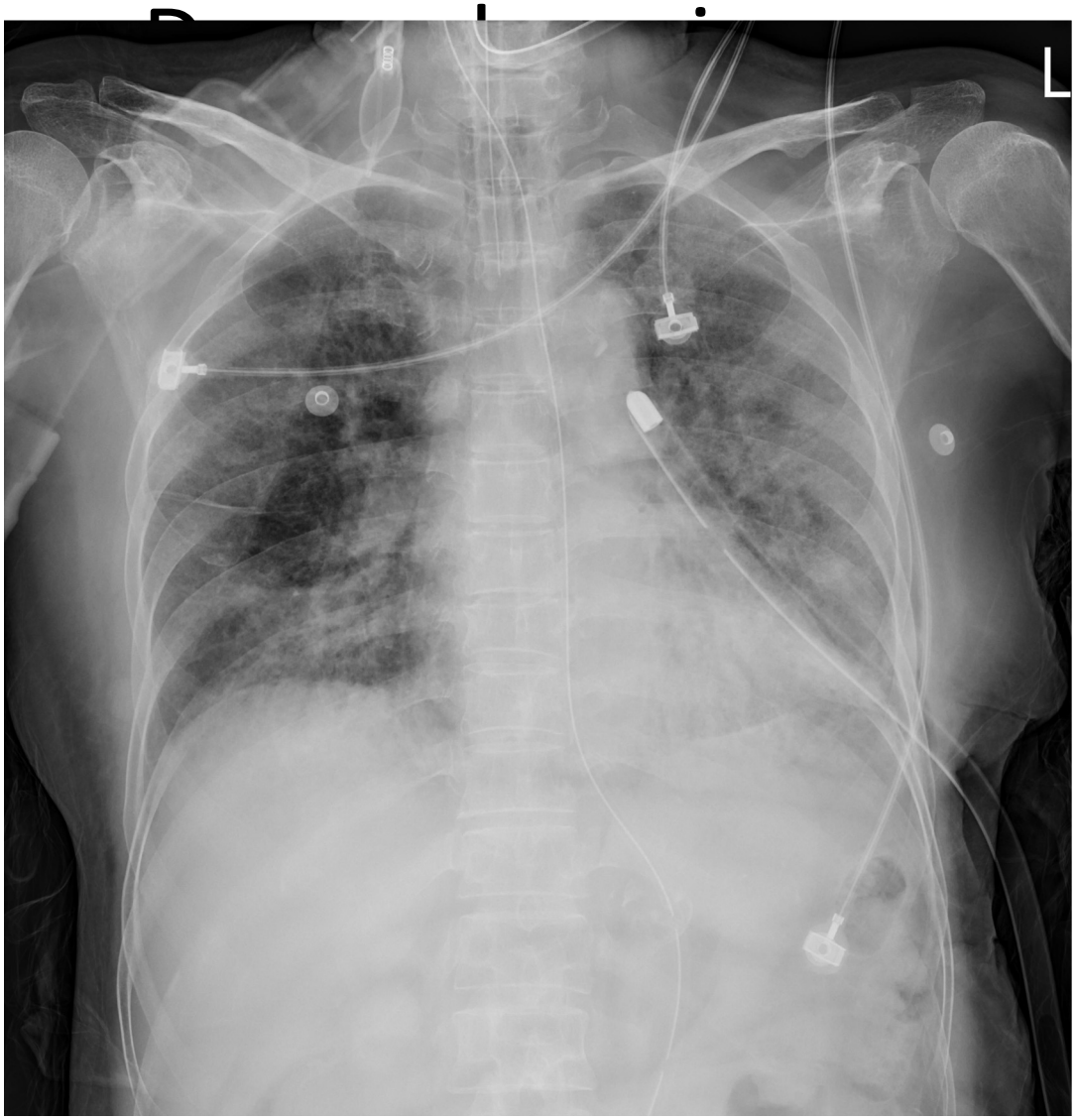
Barotrauma

- Pneumothoraces
- pulmonary interstitial emphysema
- Pneumatoceles
- Pneumomediastinum
- pneumoperitoneum

Deep sulcus sign

- Seen on a supine chest radiograph, it is a sign, and may be the only sign, of a pneumothorax
- In the supine position, air rises to the anterior and inferior portion of the thorax, first medially and then laterally
- The air may cause the costophrenic angle on the side of the pneumothorax to project more inferiorly than the costophrenic angle on the opposite side

- **pneumomediastinum**: 在心臟縱膈邊緣可見到radiolucent band, 有時可見到continuous diaphragm sign, 有時可見到皮下氣腫
- **Pneumopericardium:** 較少因氣壓傷害造成,大多出現於手術後外傷,其特徵為心臟側面及橫膈面出現一radiolucent band,有時會類似continuous diaphragm sign, 和縱膈氣腫不同的是:心包膜氣腫的radiolucent band不會延伸超過主動脈和肺動脈根部
- **pneumoperitonium:** 非常重要,須緊急處理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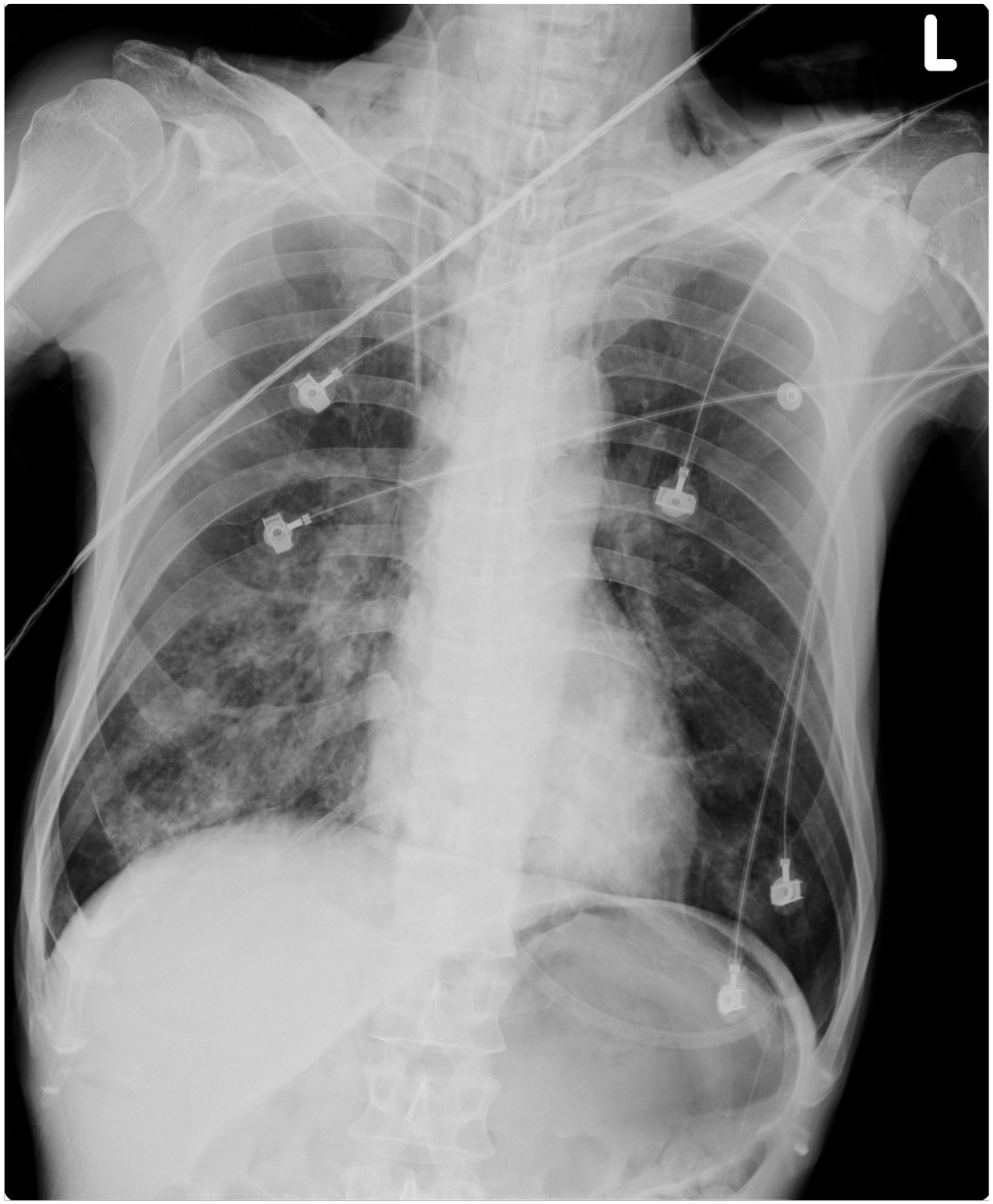
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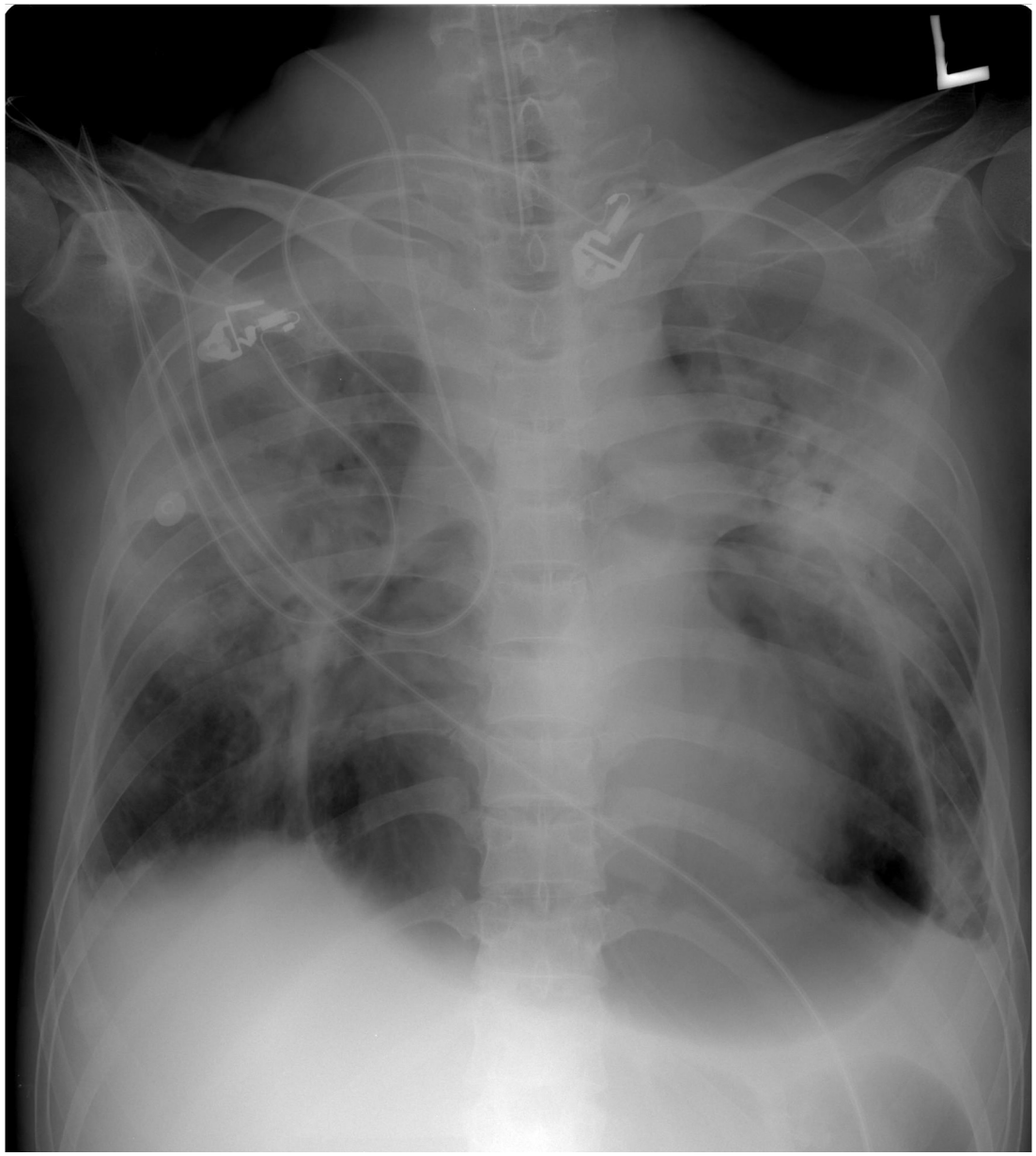
AML (M3) post c/t

pneumopericardia



Chest Tube

1. End & side holes ：

   intrapleurally

2. Pneumo thorax ：

   ant.-sup. , 3rd i.c.s. , axillary line

3. Hydro- or hemothorax ：

   post.-inf. , 8th i.c.s. , post. axillary line

- The last side-hole in a thoracostomy tube can be identified by an interruption in the radiopaque line.
- This interruption in the radiopaque line should lie within the thoracic cavity, if not and or with evidence of subcutaneous air, a misplaced tube is suspected.
- Incorrectly placed tubes for empyemas may delay drainage and result in loculation of the purulent fluid.
- Thoracostomy tubes placed within pleural fissures often cease to drain when the lung surfaces become apposed.

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ACR Appropriateness Criteria 2015

- After insertion of a chest tube, a chest radiograph is recommended to show the position of the tube, any success in drainage, and possible complications from insertion.
- Beyond this point, evaluation of tube position and function is warranted based on management of the pleural space and clinical indications.


L

Pleural effusion

- Most dependent part of pleural cavity on supine: apex and post basilar space
- Features
  - Absence of air-bronchogram
  - Loss of hemidiaphragm silhouette
  - Apical cap
  - Bronchovascular markings not lost

Summary

- The radiography of critical ill is limited
- There are several pitfalls in interpretation chest x-ray of critical ill patients.