急重症與心血管影像判讀

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PA vs AP

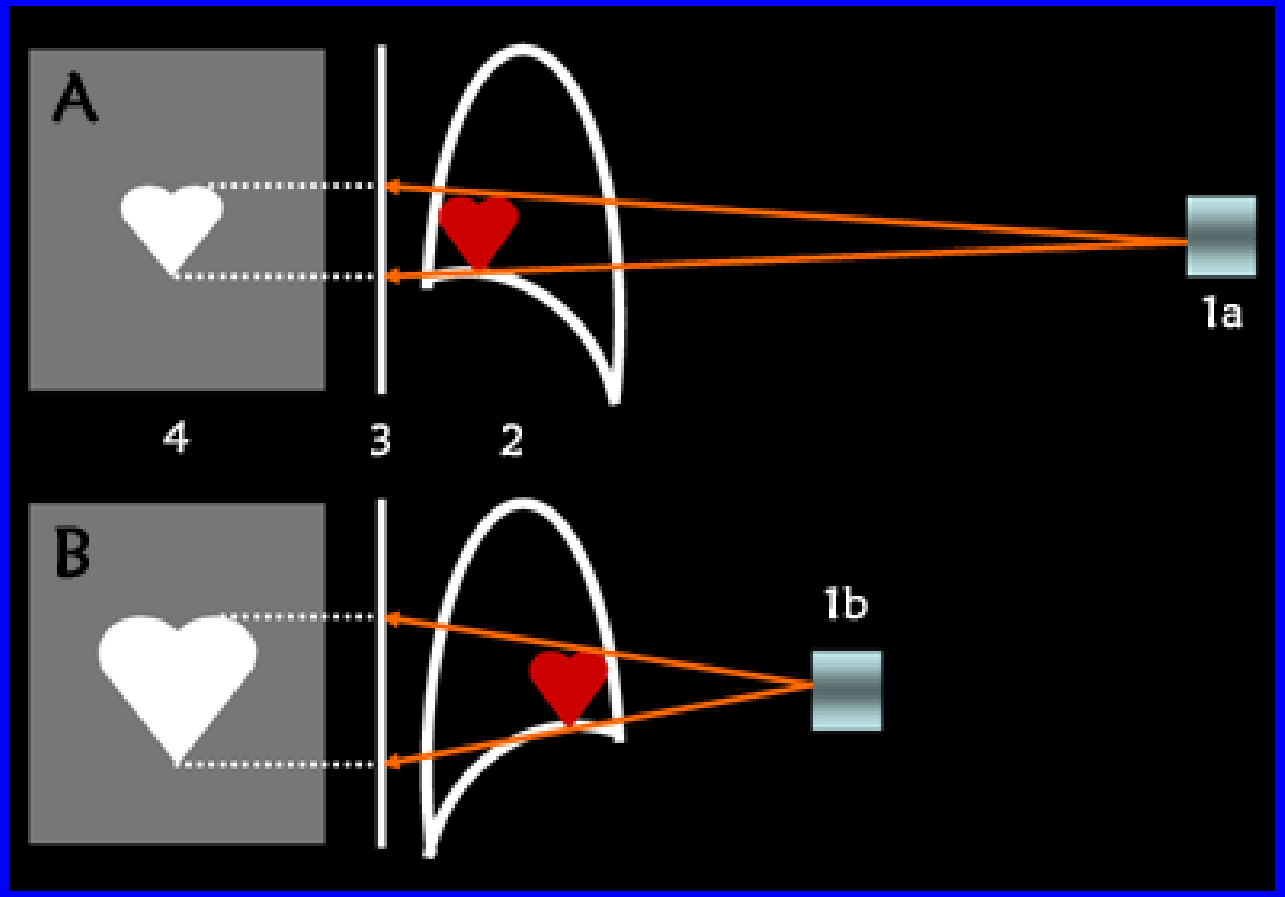
(posterioranterior) position.
Note that the x-ray tube is 72 inches away.

the supine AP (anteriorposterior) position
the x-ray tube is 40 inches from the patient.

Magnification of the heart with AP portable x-ray

PA in Radiology

AP as a portable

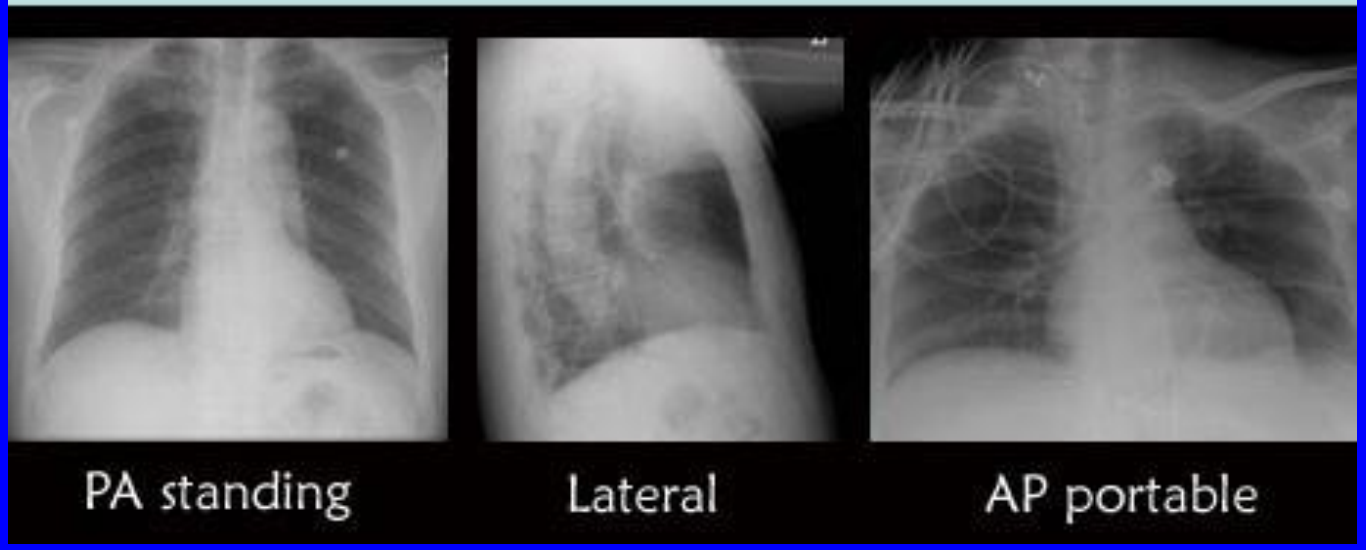


SUMMARY POINTS

PA in department:
- Minimal magnification of all structures
- Standard reproducible upright position

Lateral:
- More sensitive for pleural fluid
- Helps localize abnormalities
- Can show significant abnormalities not seen on the PA

AP portable:
- Magnification of all structures with particular magnification of anterior structures: heart and mediastinum
- Position, rotation, and technique are difficult to reproduce
- Position varies from supine to various degrees of uprightness
- Longer exposure times result in increased motion artifact

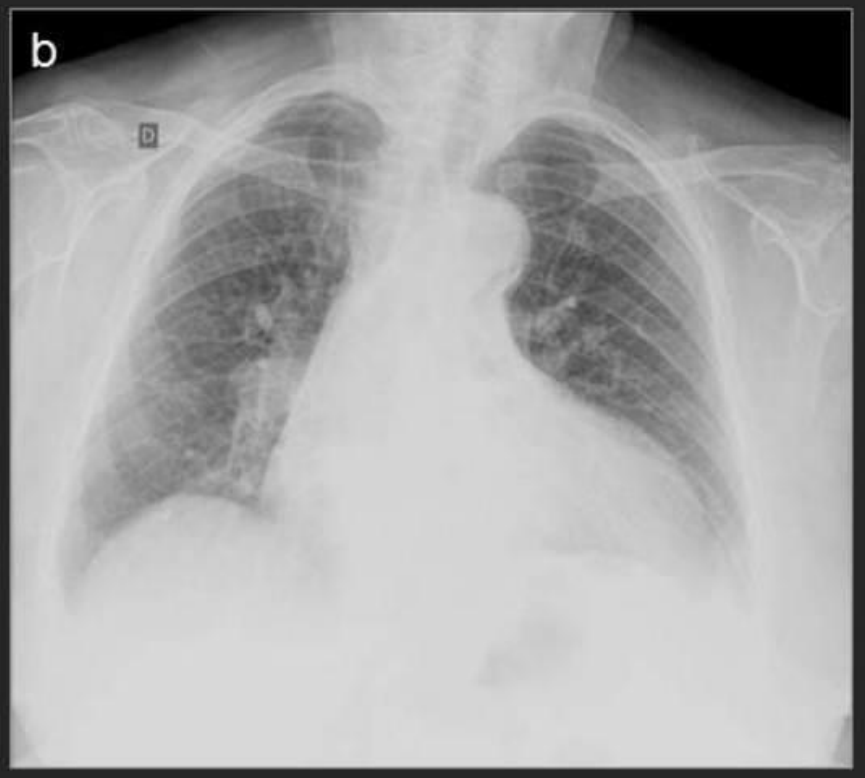


AP projection CXR

- Mediastinum and heart magnified due to gravitational and geometrical effects.
- Alteration of the physiology of the pulmonary vasculature due to supine position,diverting the blood to lung apices.
- Problems of supine radiographs in differentiating pleural effusions from air space shadowing, in detecting pneumothorax.
- Incomplete inspiration produces artifacts making the diagnosis of basilar atelectasis and pulmonary edema difficult

AnteroPosterior chest radiograph

PosteroAnterior chest radiograph



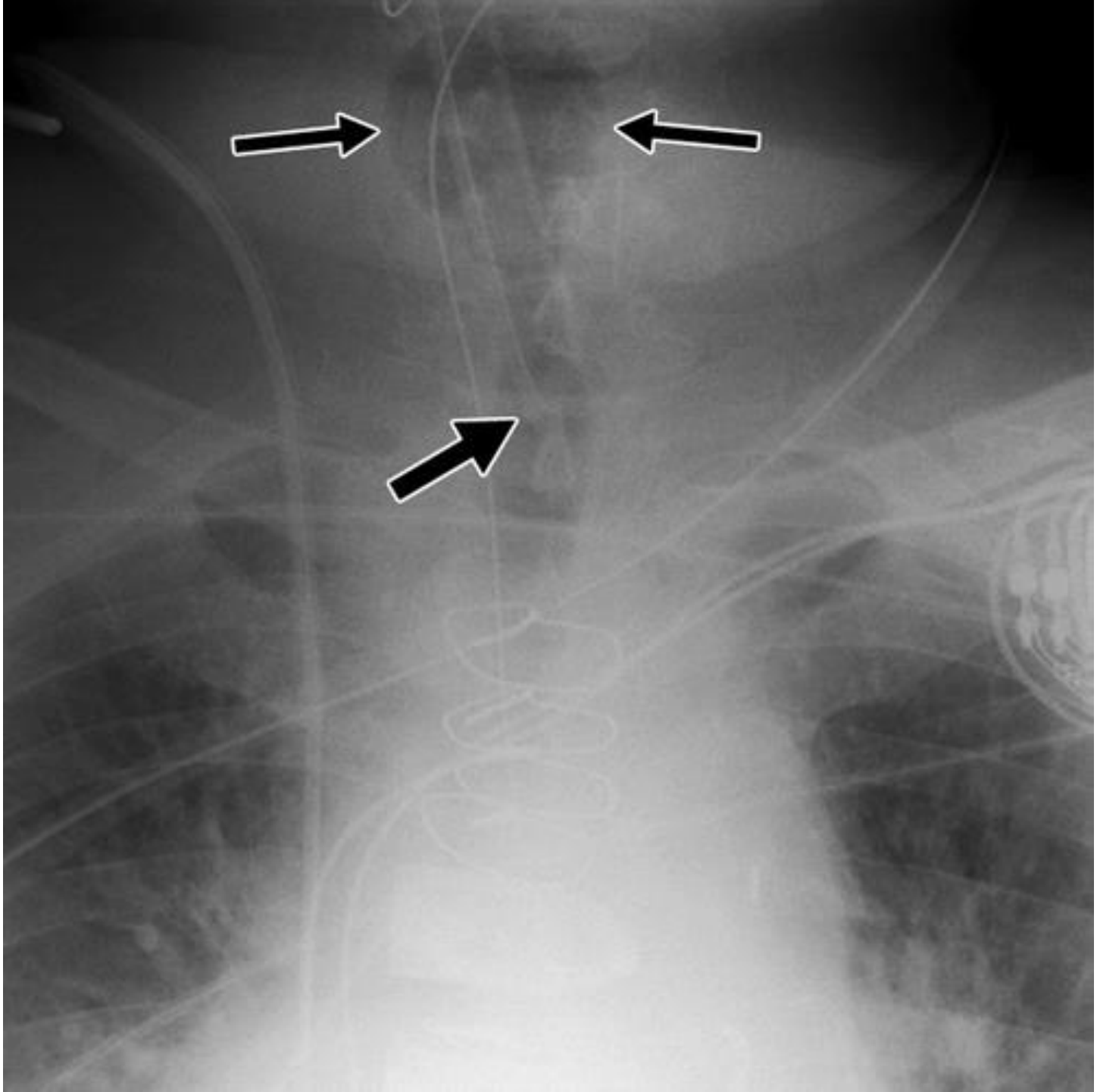
Chest radiographs on the same patient a few minutes apart showing the effect of technique, In (a) image shows mediastinal widening and left basal clouding due to poor inspiratory effort. In (b) image has been taken in good inspiration; cardiomegaly, middle lobe atelctasis are persistent, but basal clouding disapears.

ideal location of the tip of the ETT

- 5 cm above the carina if the patients head is in the neutral position
- the inferior border of the mandible is projecting over the lower cervical spine
- Flexion of the head and neck causes a 2-cm descent of the tip of the tube,
- extension of the head and neck causes a 2-cm ascent of the tip

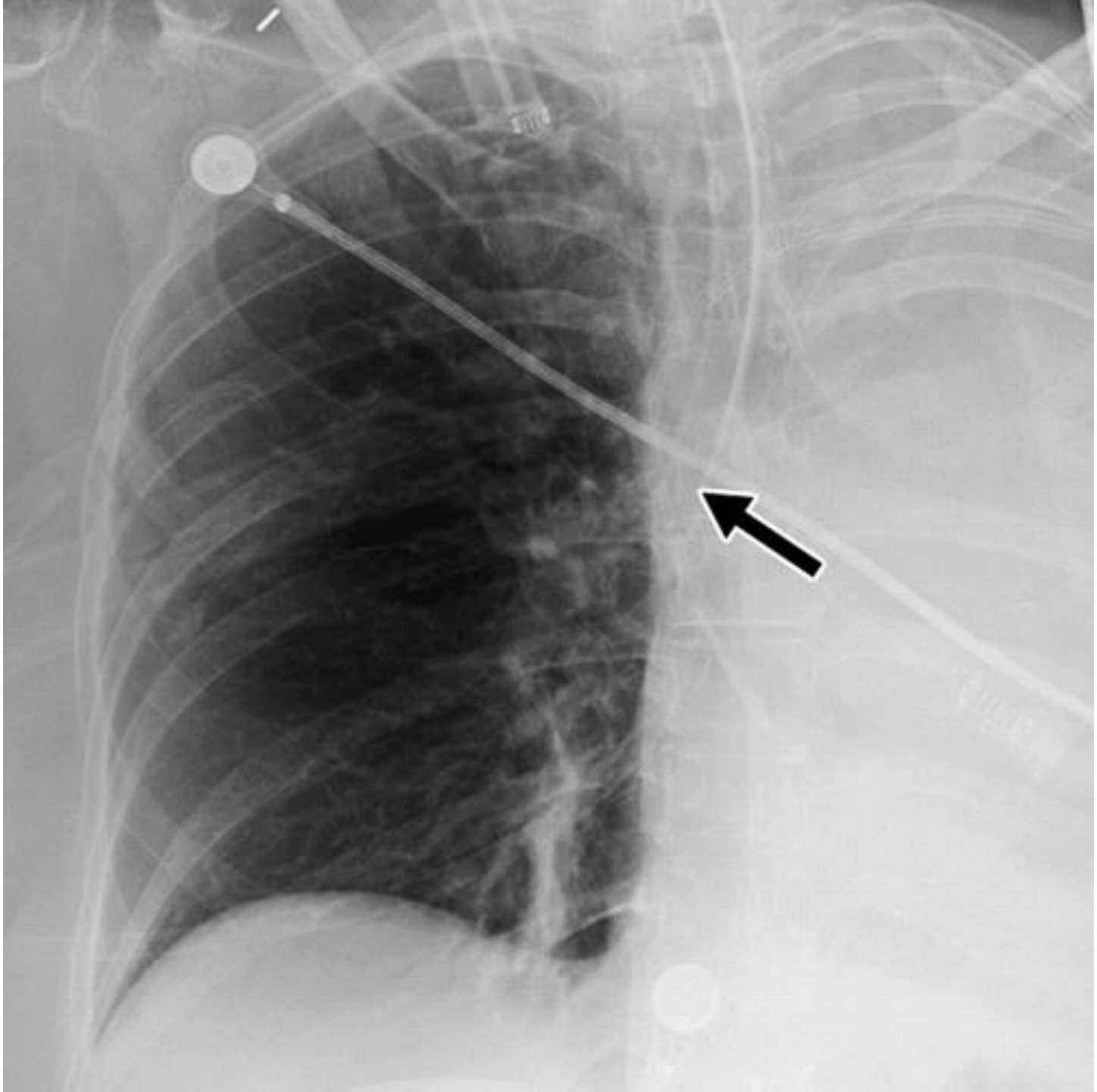
ETT is too high

- inadvertent extubation or hypopharyngeal intubation
- cause ineffective ventilation and gastric distention.
- ETT’s occluding cuff may cause vocal cord injury.
- tip of the ETT should be at least 3 cm distal to the vocal cords



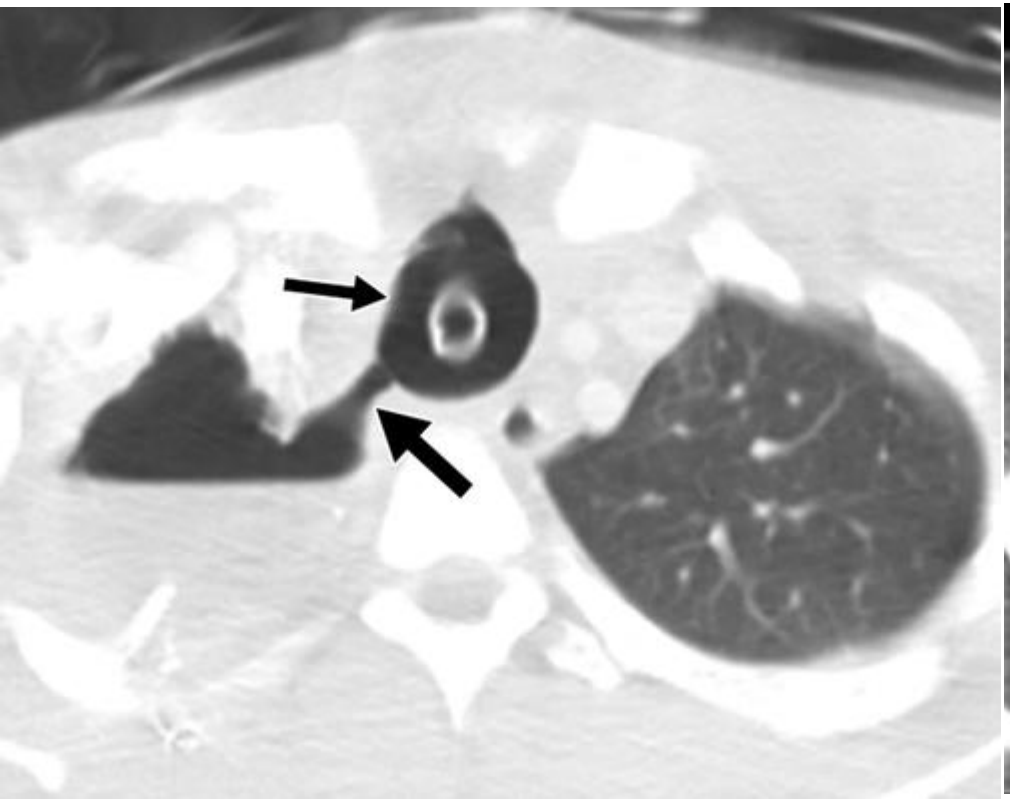
ETT is too low

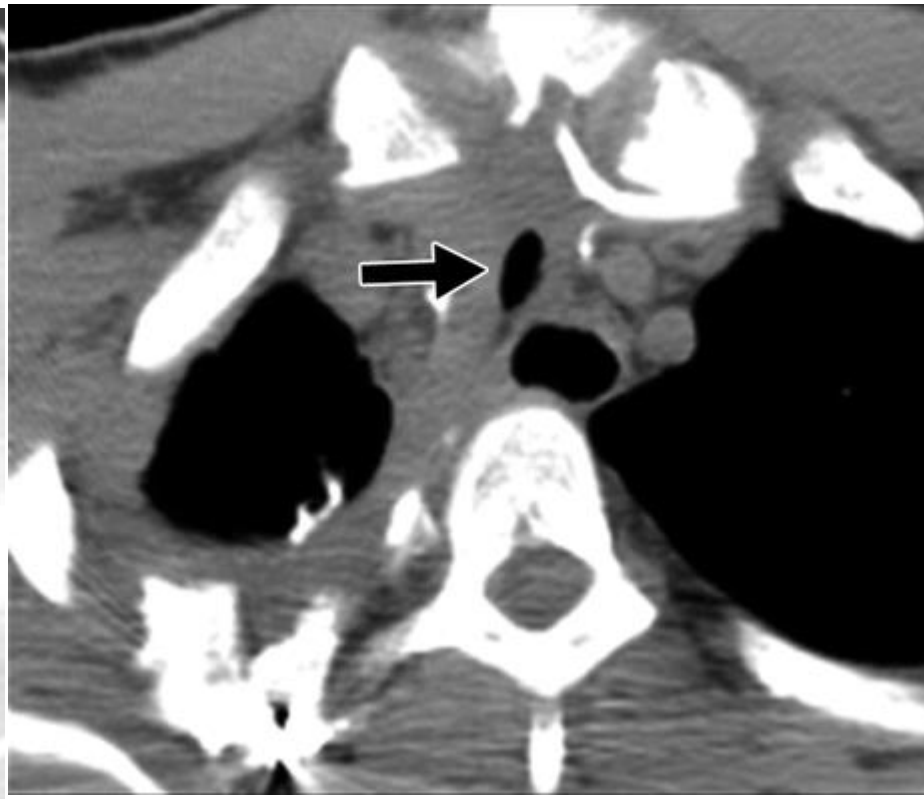
- selective bronchial intubation in the right main bronchus
- Consequently, segmental or complete collapse of the contralateral lung
- overinflation of the ipsilateral lung with increased risk of pneumothorax



Overinflation of the balloon

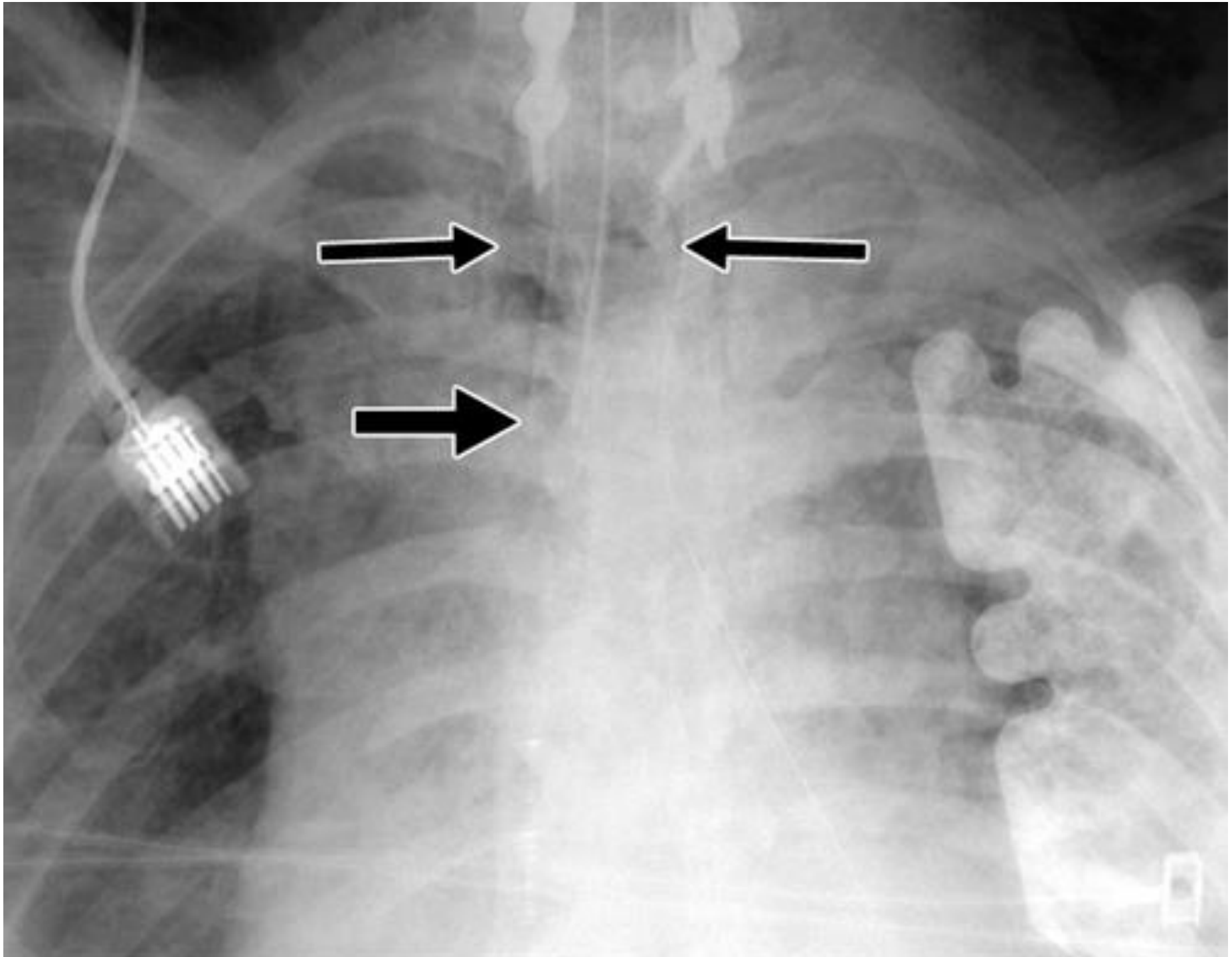
- 1.5 times the diameter of the normal trachea has been shown to cause tracheal injury
- acute tracheal rupture
- chronic damage, such as tracheomalacia or tracheal stenosis

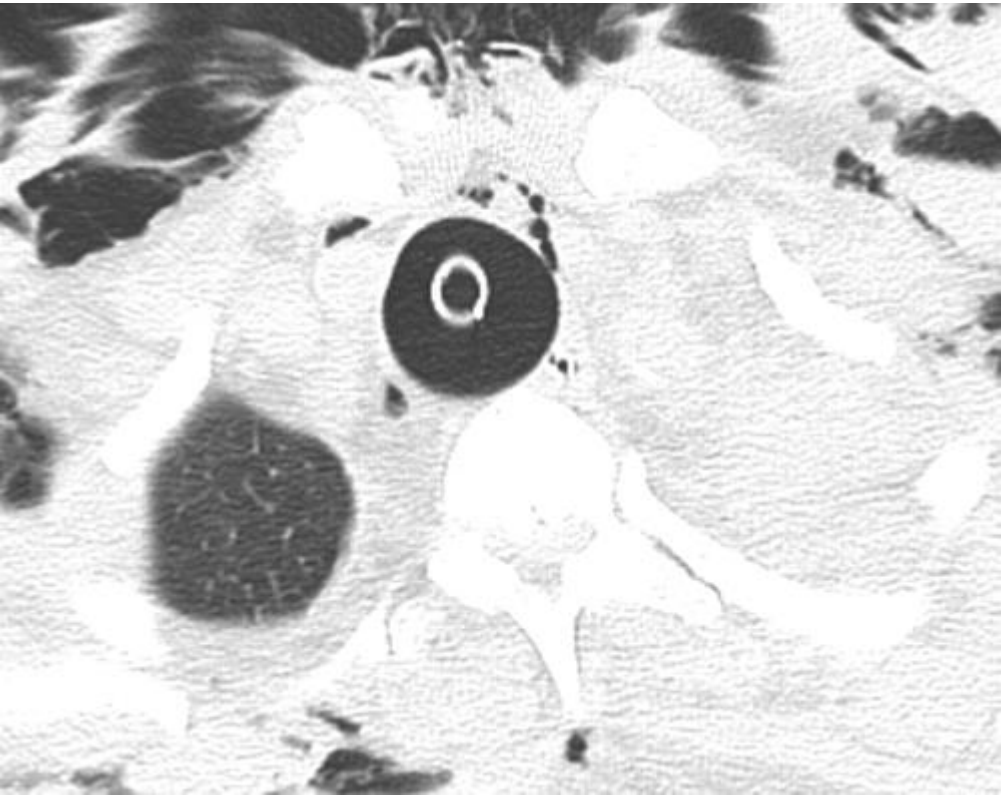




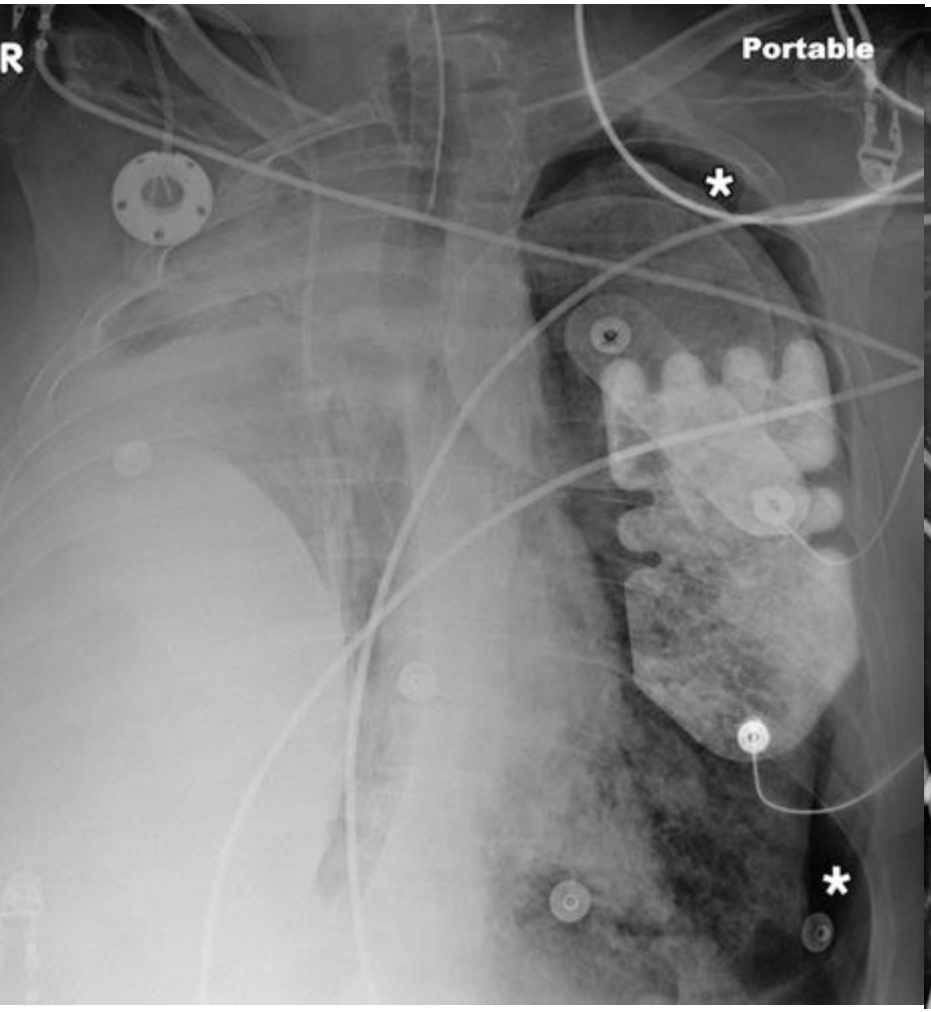
ETT-related tracheal rupture

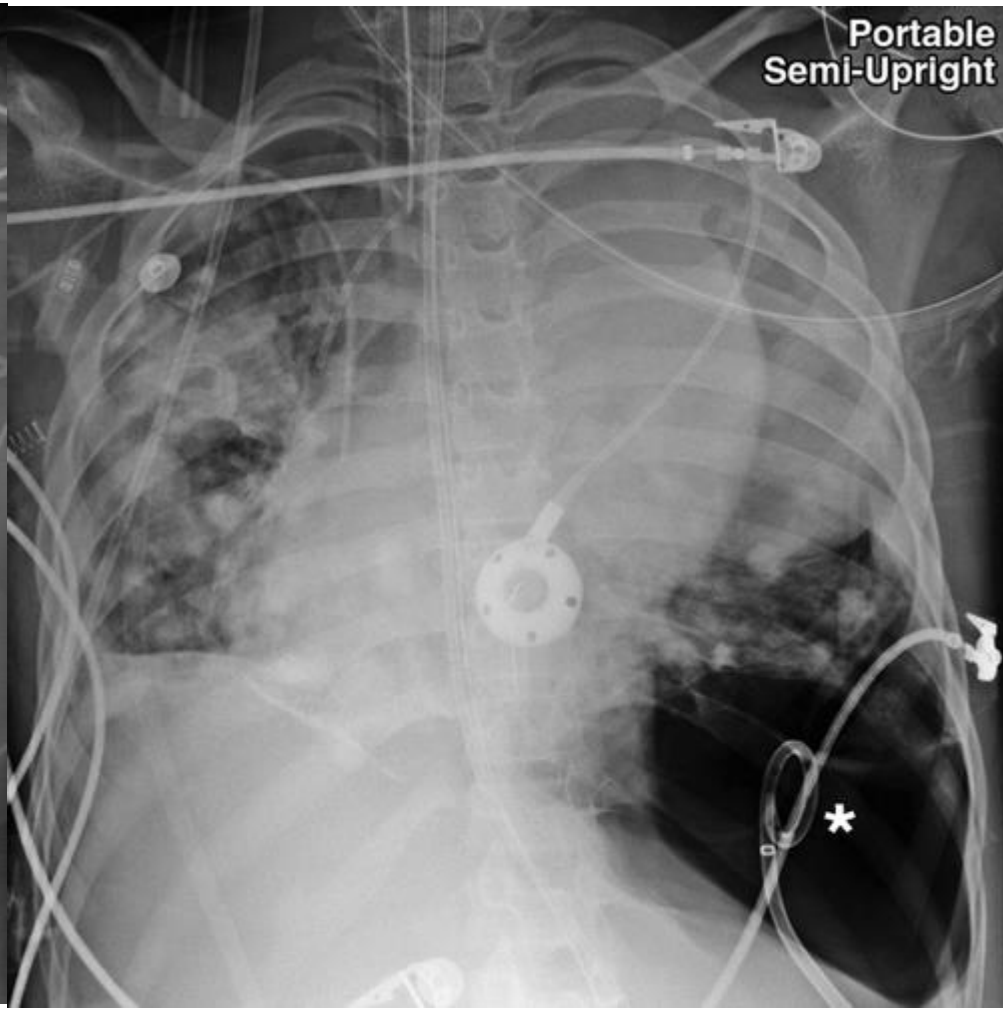
- usually involves the membranous posterior wall of the trachea within 7 cm of the carina
- Radiographic indications of tracheal rupture include subcutaneous emphysema, pneumomediastinum, pneumothorax,
- overdistension of the ETT balloon (> 2.8 cm)
- reduced balloon-to-tip distance (i.e., distance < 1.3 cm; the normal balloon-to-tip distance is 2.5 cm)

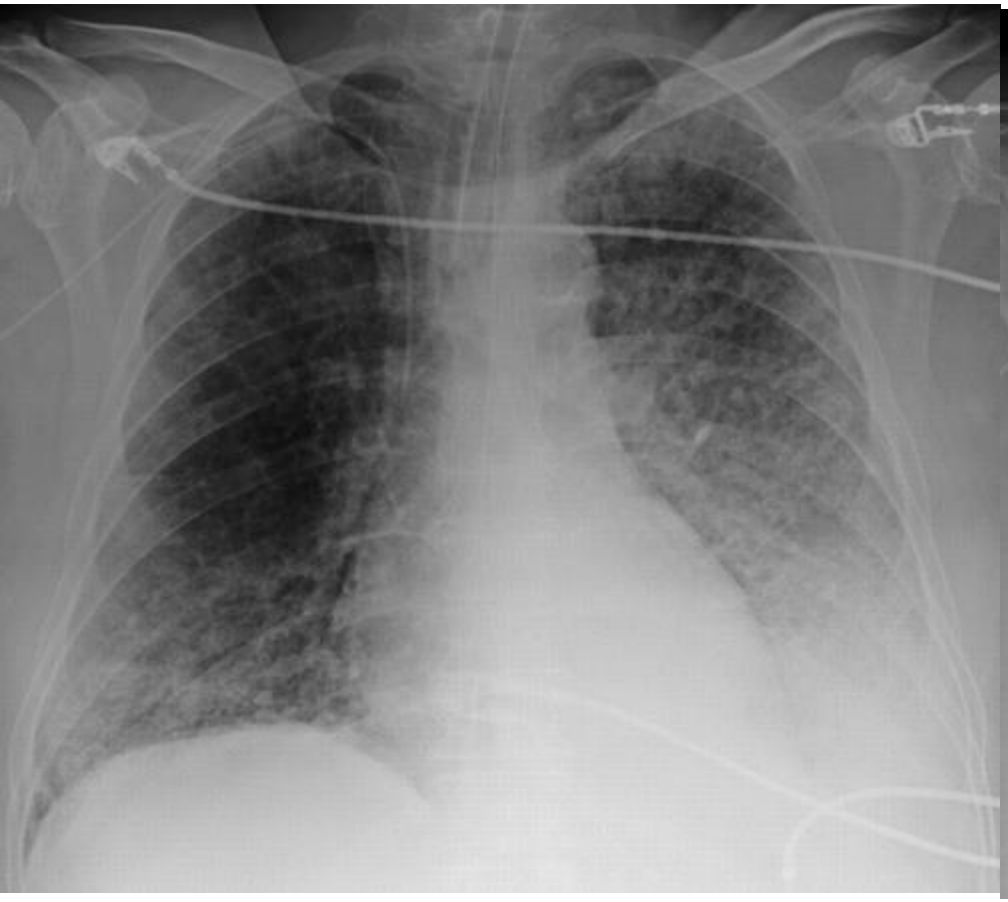


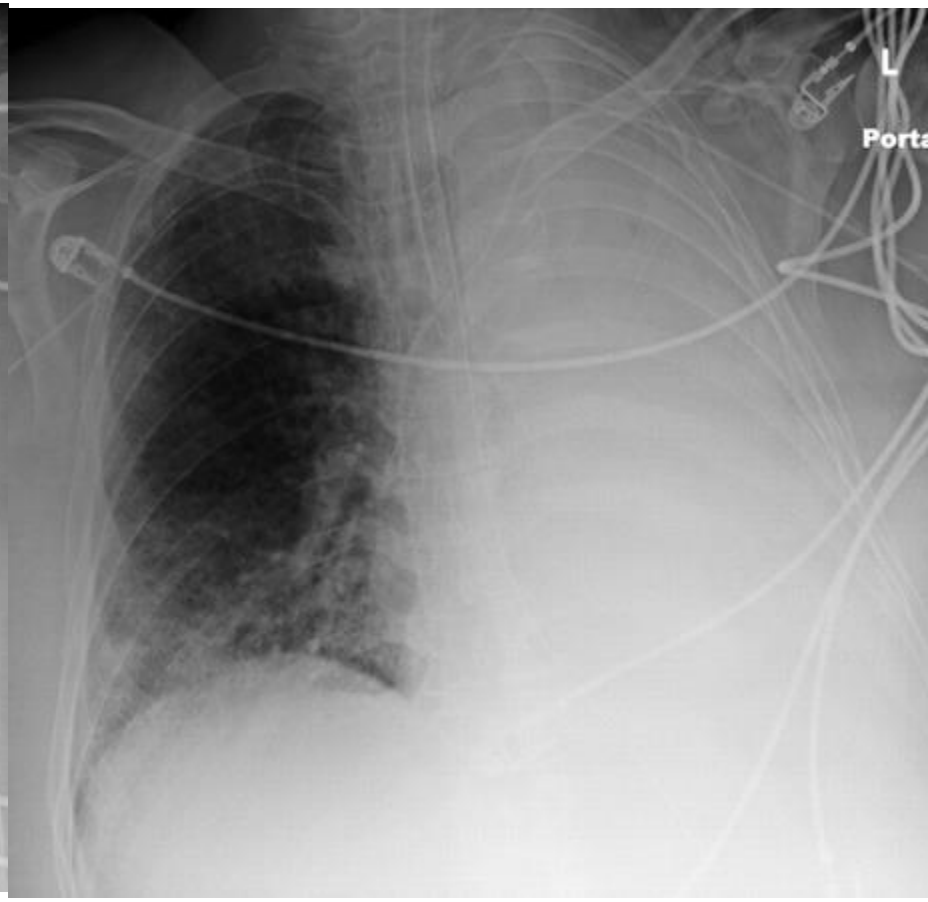


Positive pressure ventilation cause barotrauma





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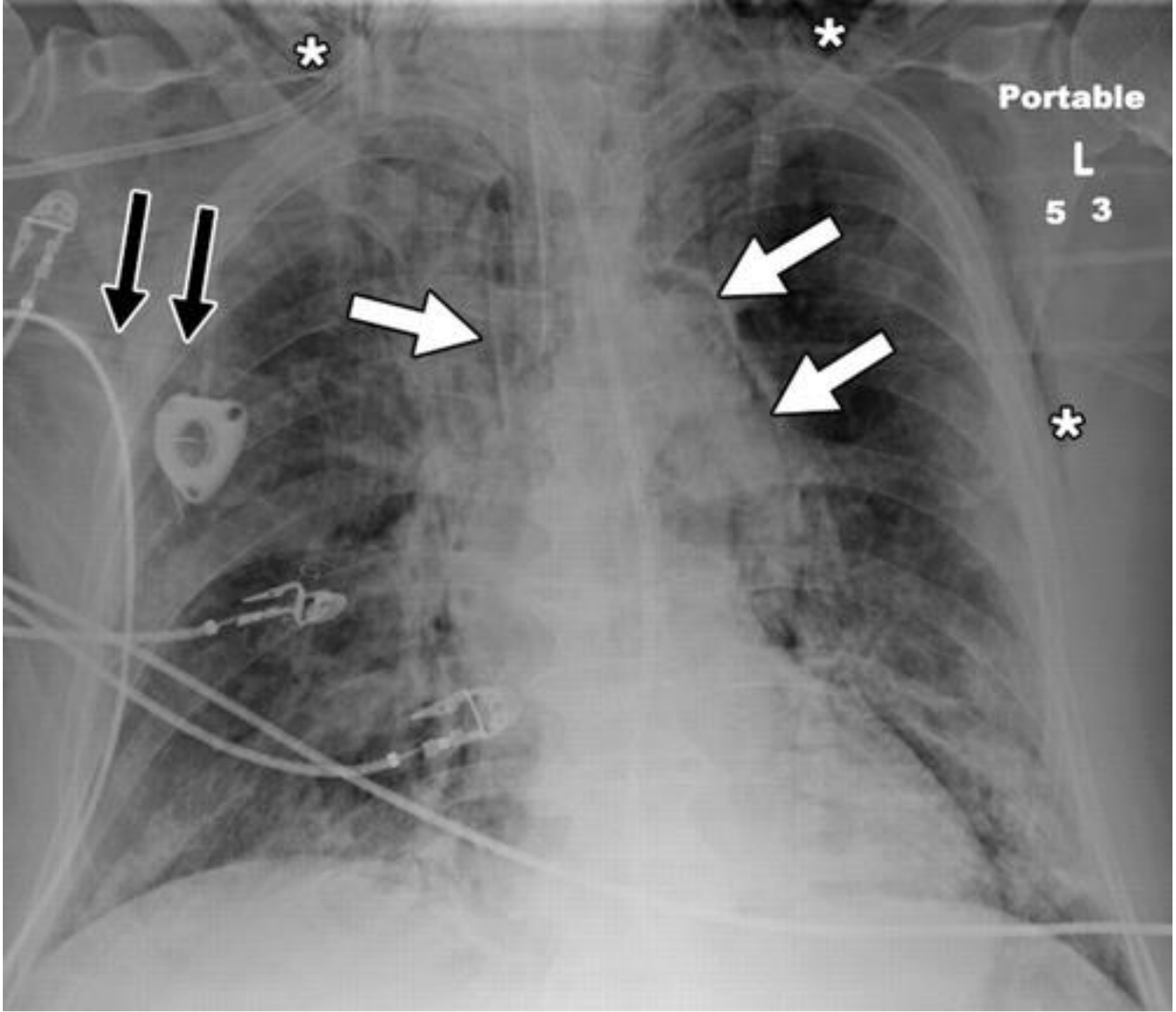
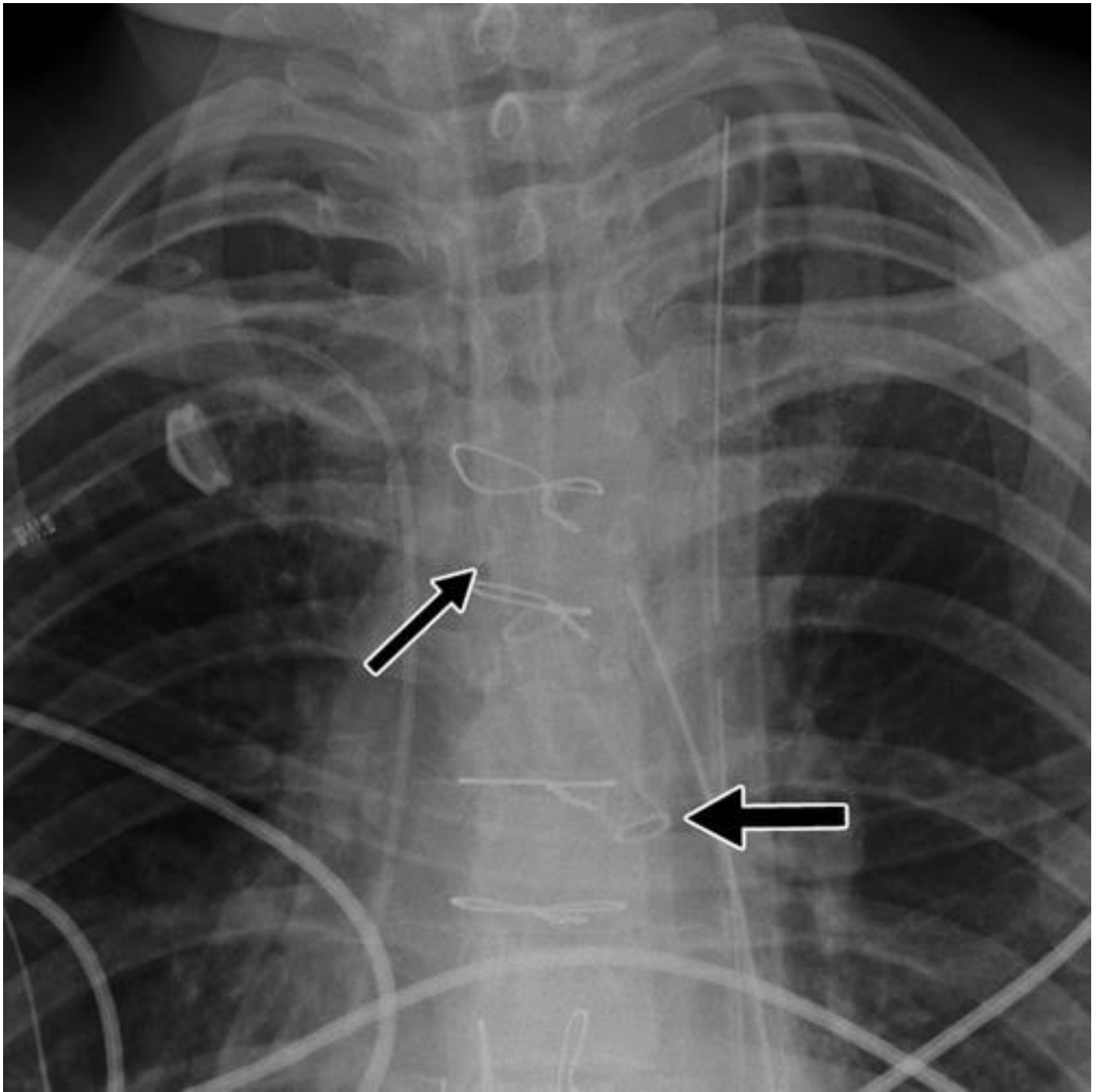

Portable
L
5 3

Tracheostomy tubes

- tip should be located at one-half to two-thirds of the distance from the stoma to the carina
- position is not changed by extension or flexion of head

Double-lumen ETTs

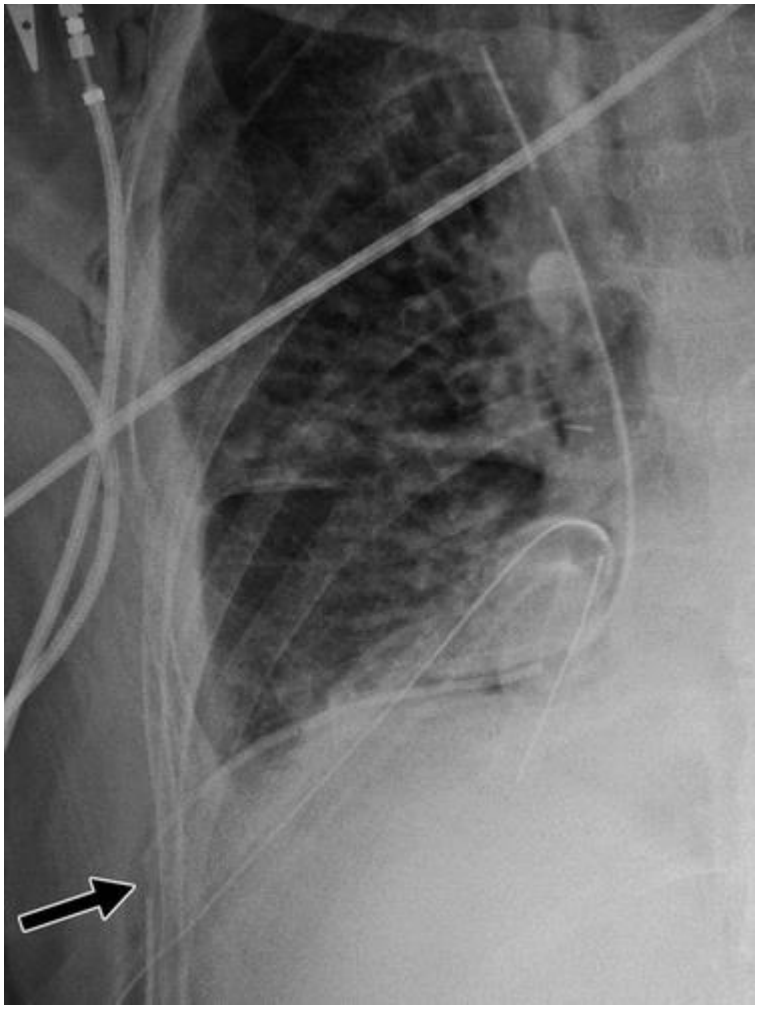
- ventilate one lung, to avoid spillage or contamination from one lung to the other
- allow unilateral bronchopulmonary lavage
- control the distribution of ventilation to each lung.



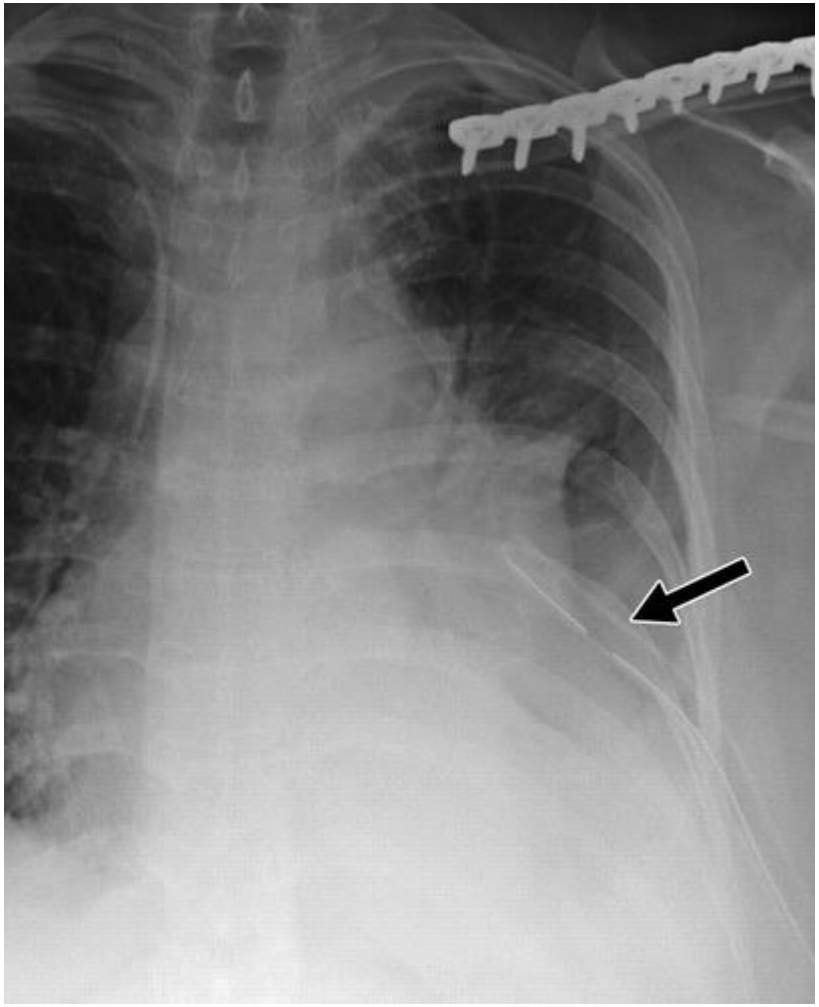
Ineffective drainage of chest tube

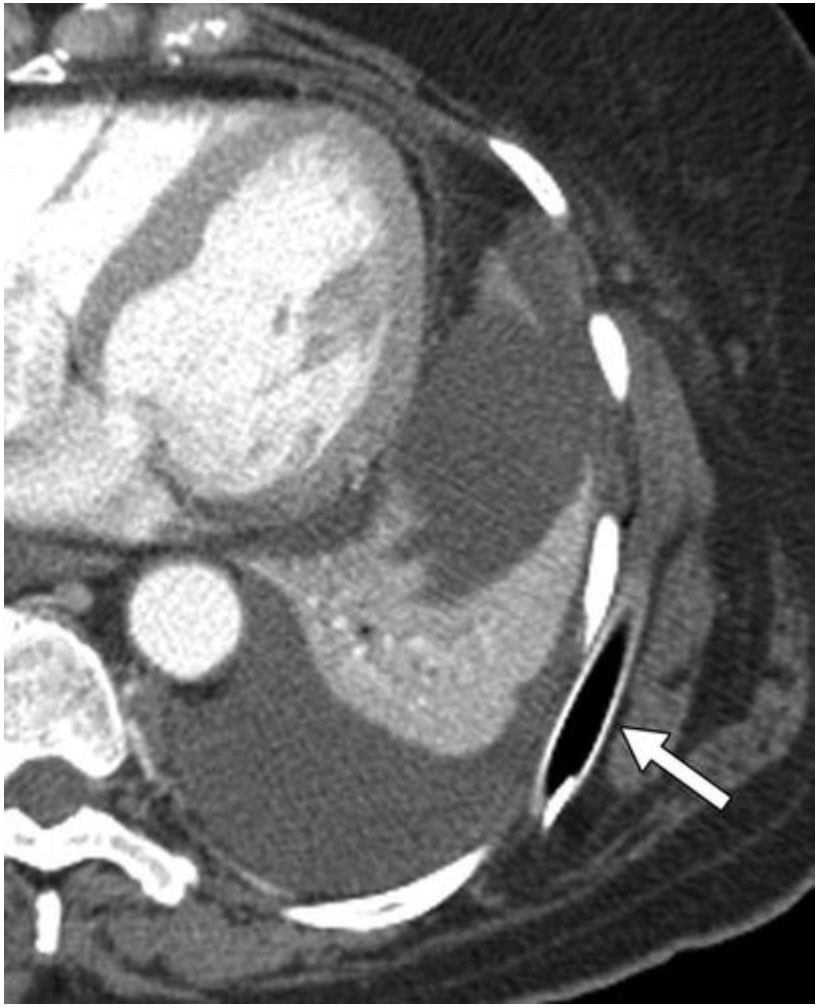
- Incomplete insertion of the tube
- Placement of the tube in the extrapleural soft tissues
- Intrafissural positioning of the tube
- Kinking
- Inadvertent advancement of the chest tube into the mediastinum
- placement of the chest tube through the diaphragm into the abdomen

Incomplete insertion of the tube

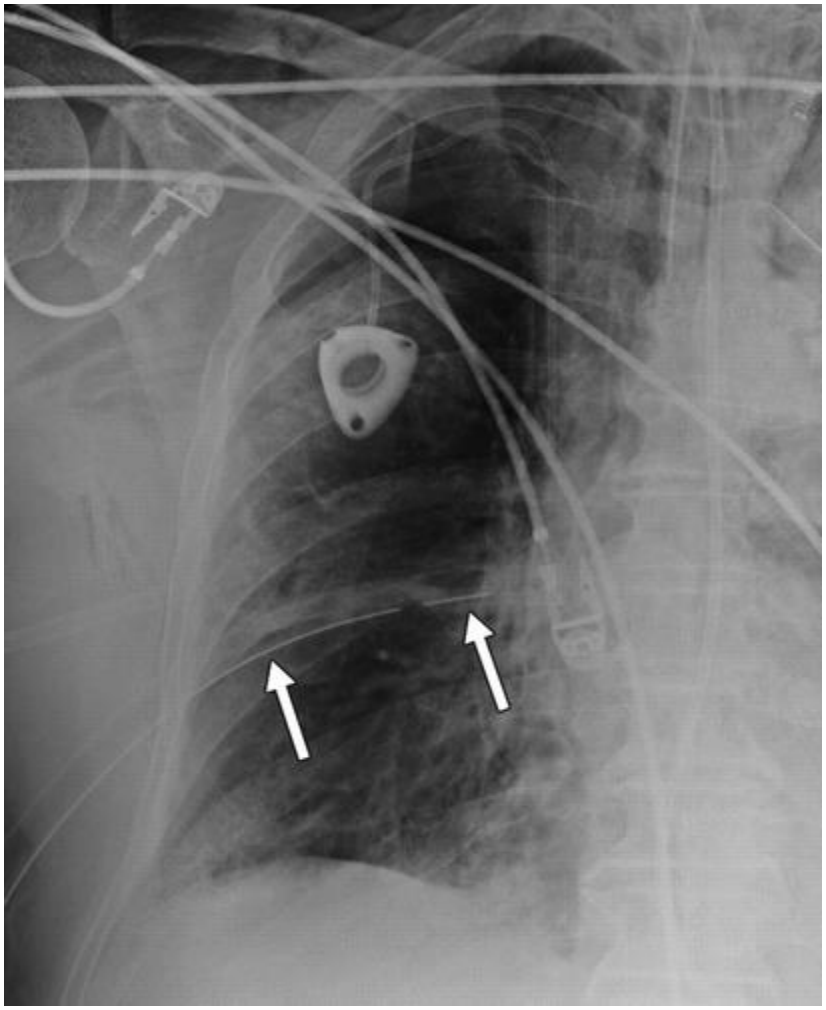


Placement of the tube in the extrapleural soft tissues

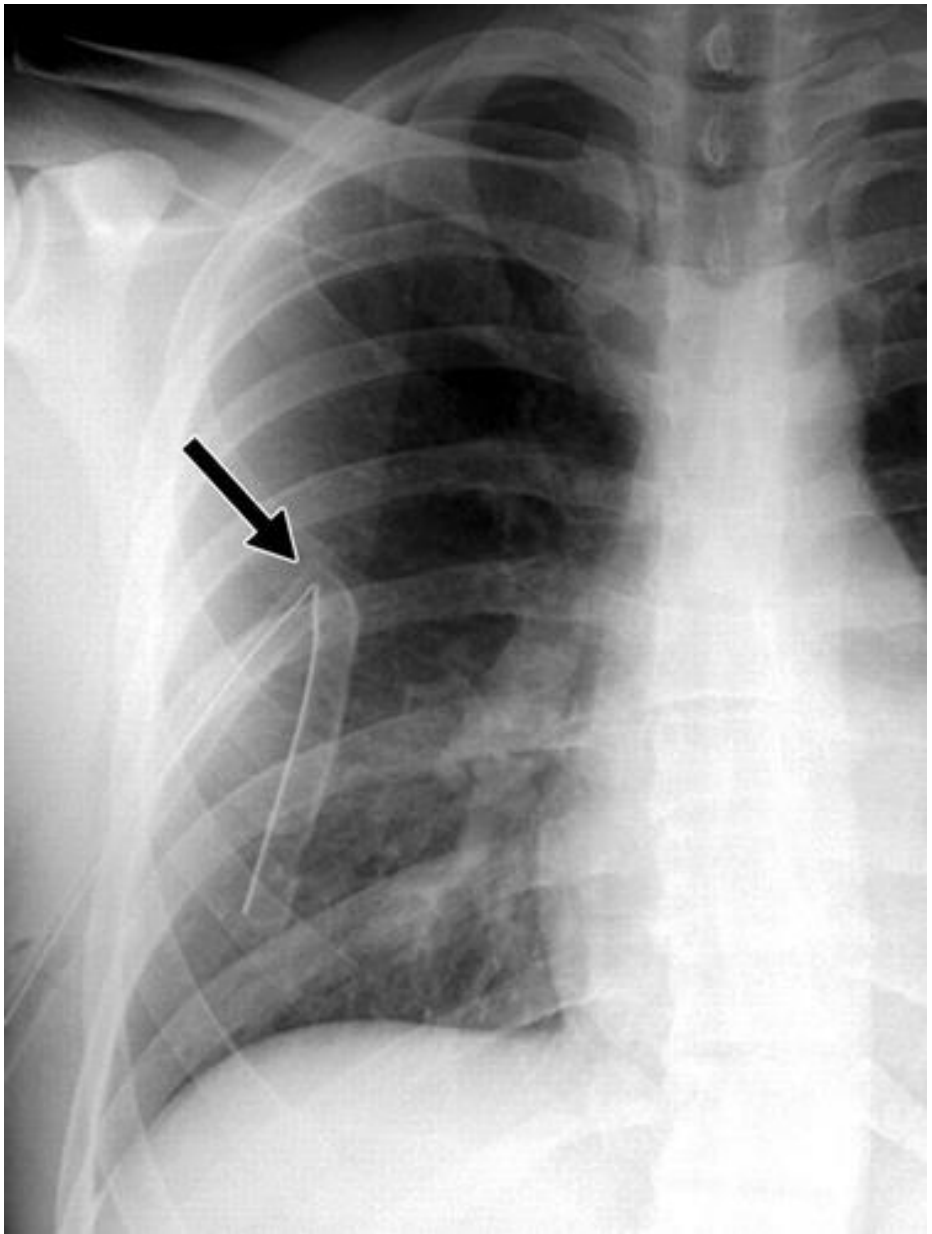




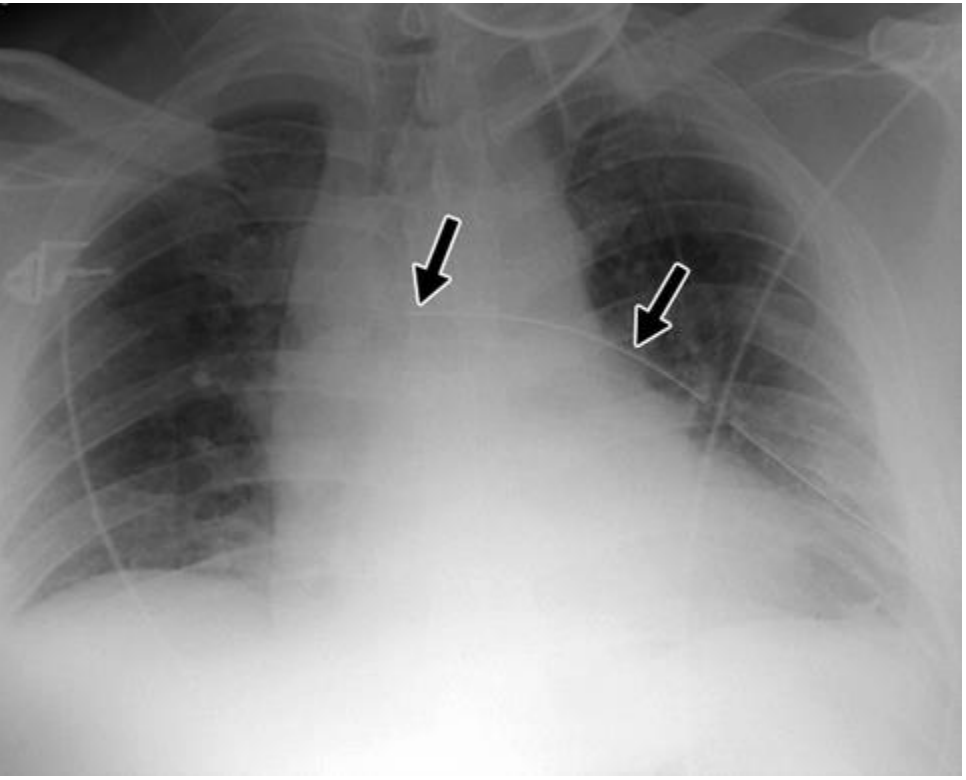
Intrafissural positioning of the tube

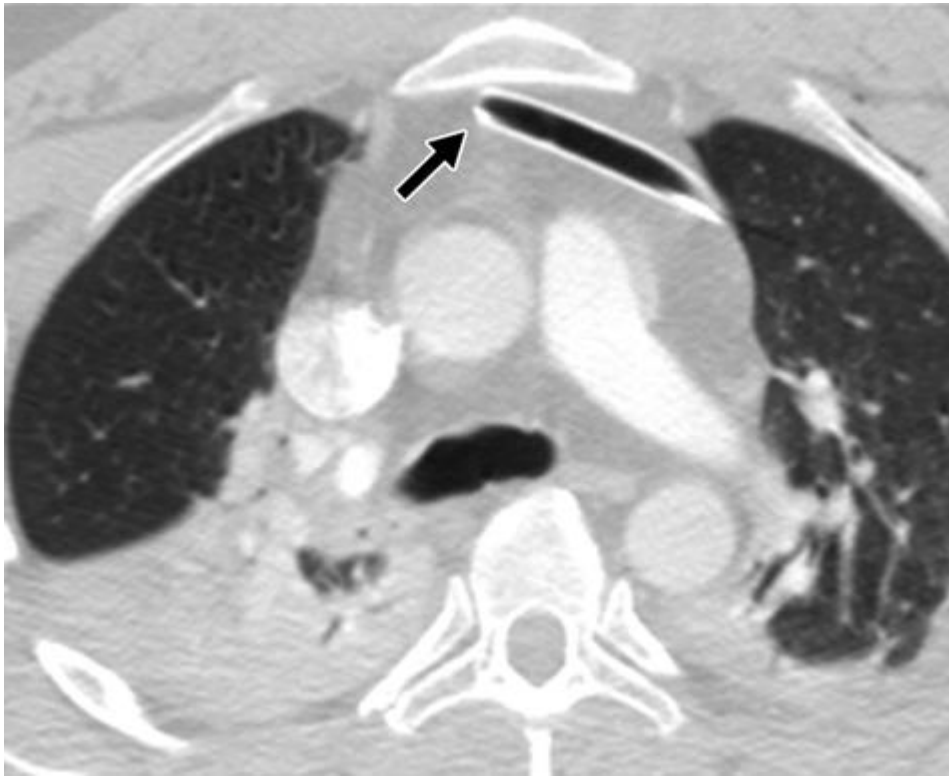


tube kinking

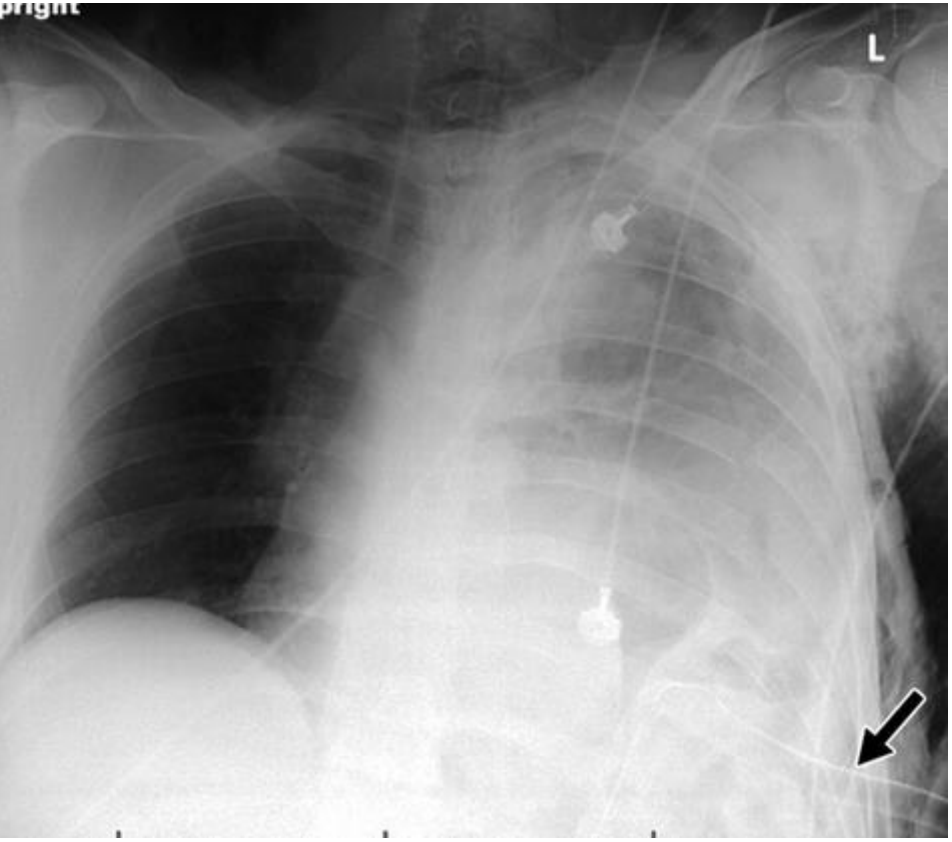


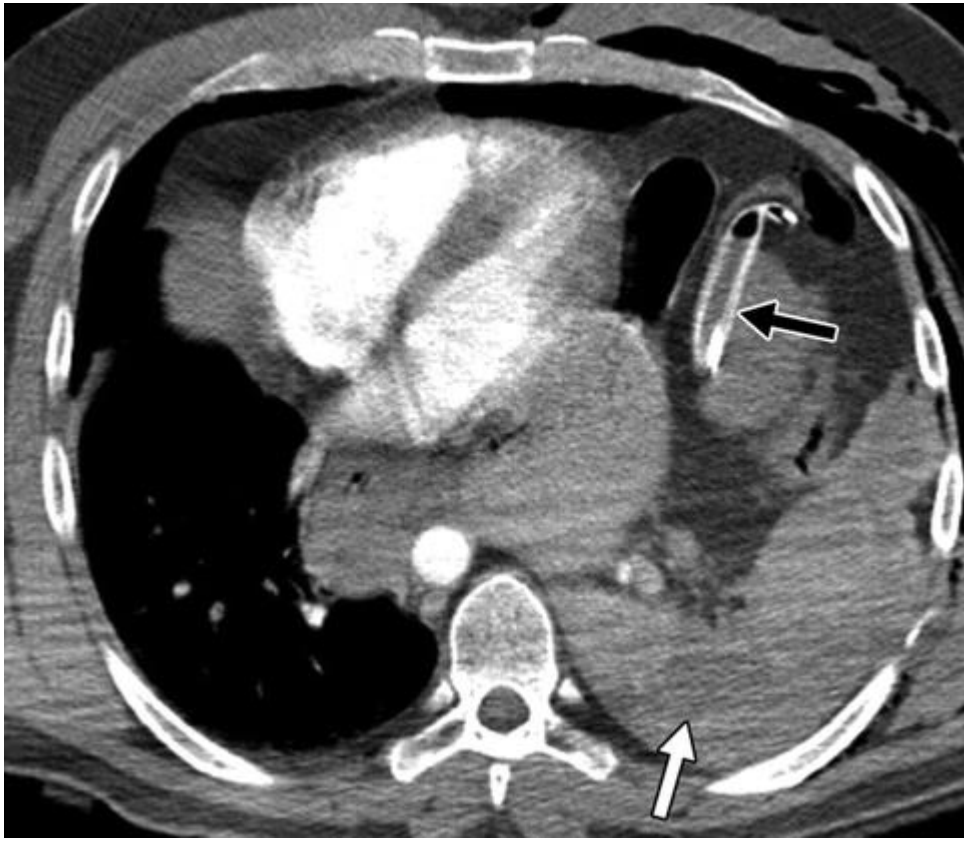
Inadvertent advancement of the chest tube into the mediastinum



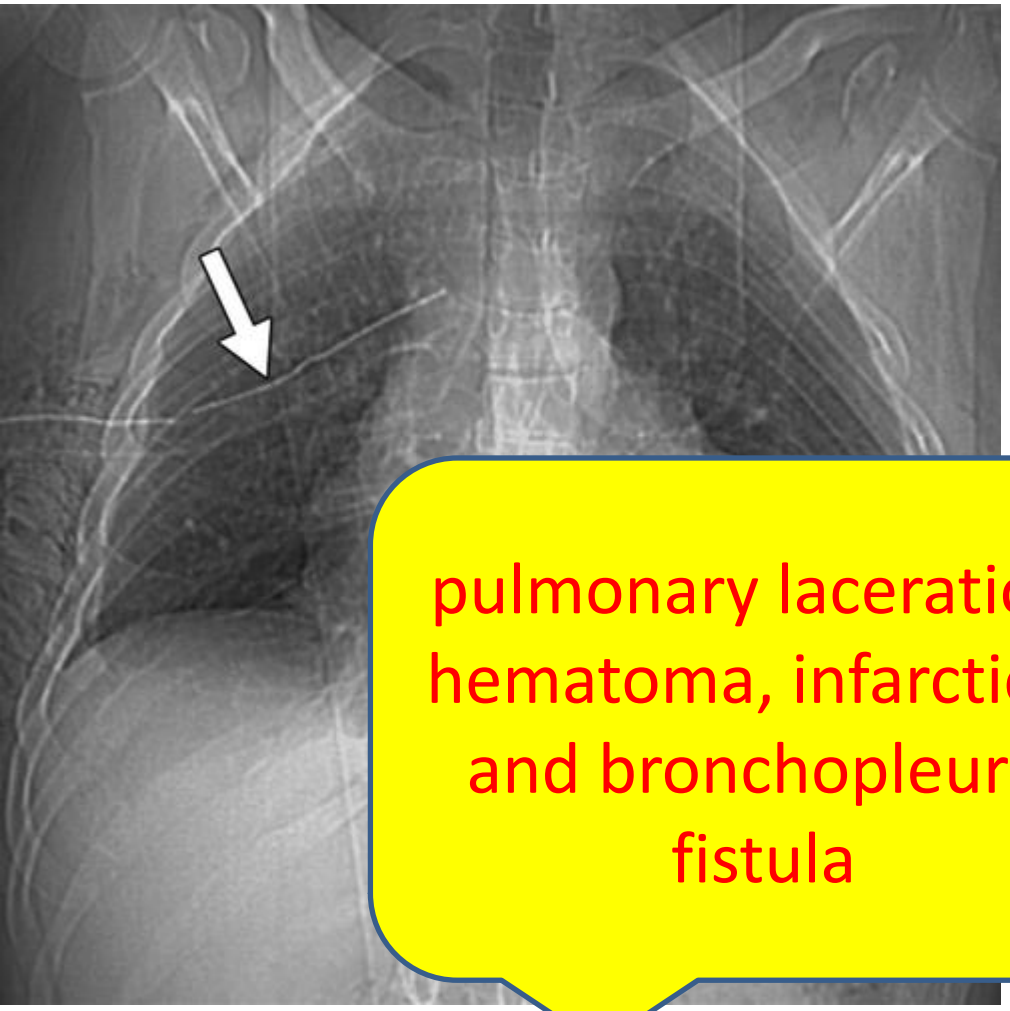


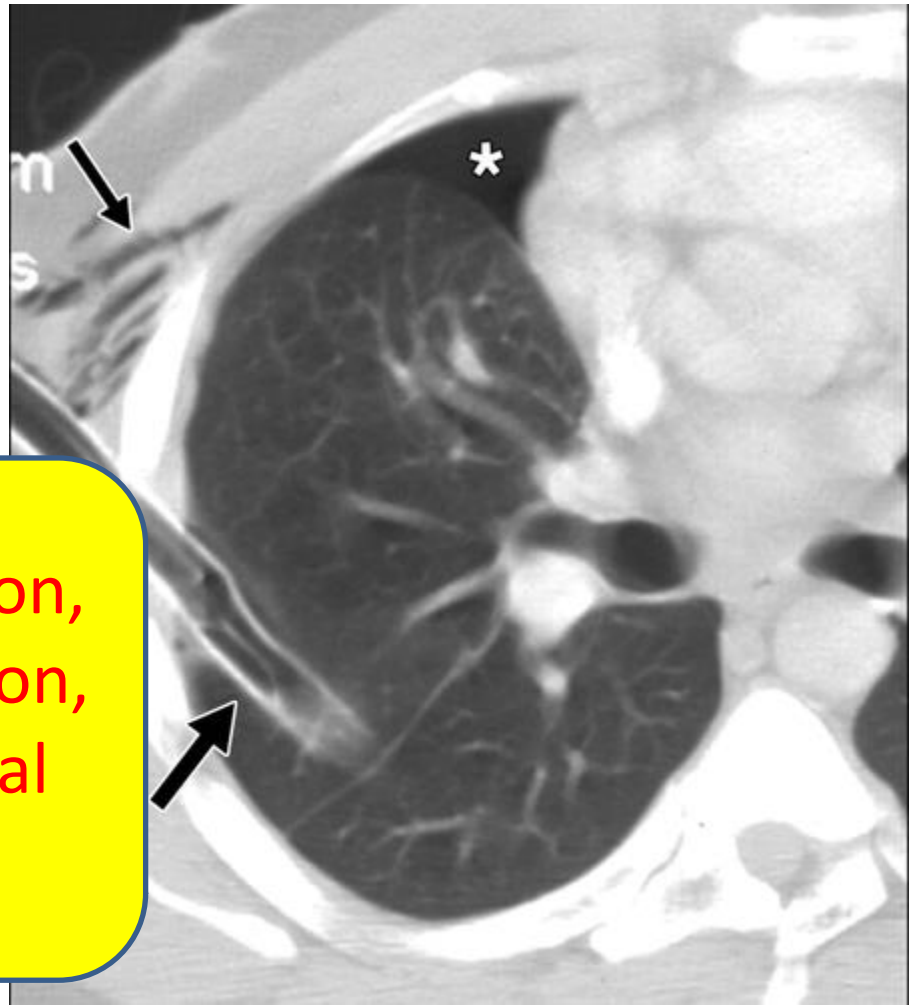
Placement of the chest tube through the diaphragm into the abdomen





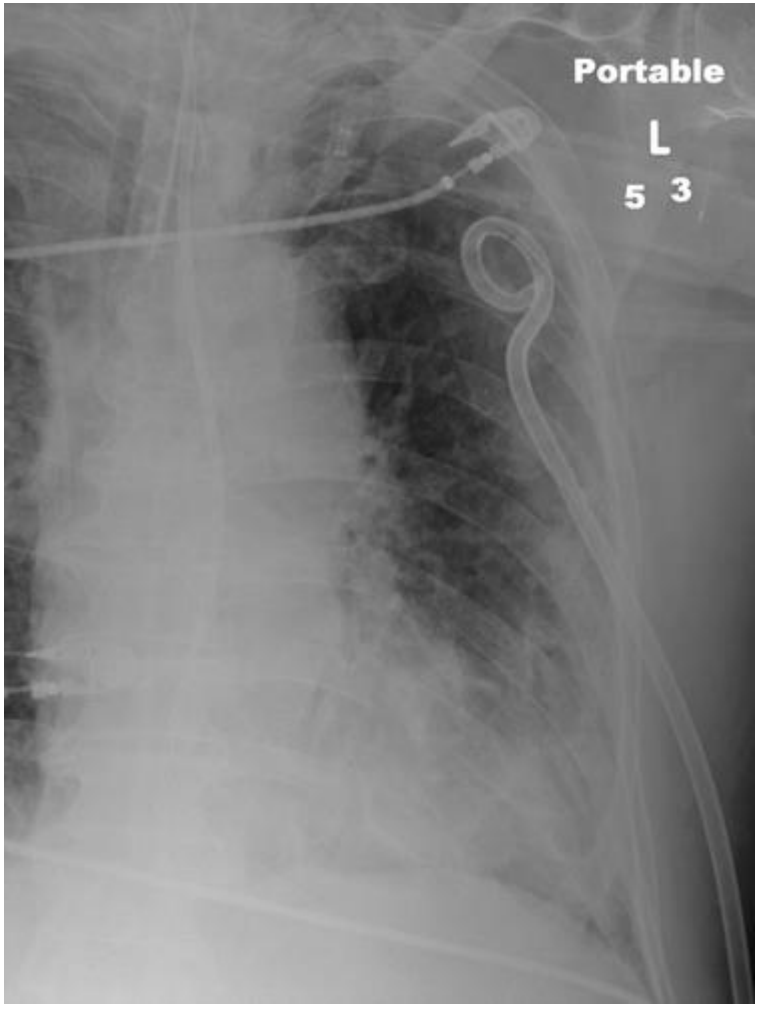
Inadvertent intraparenchymal positioning



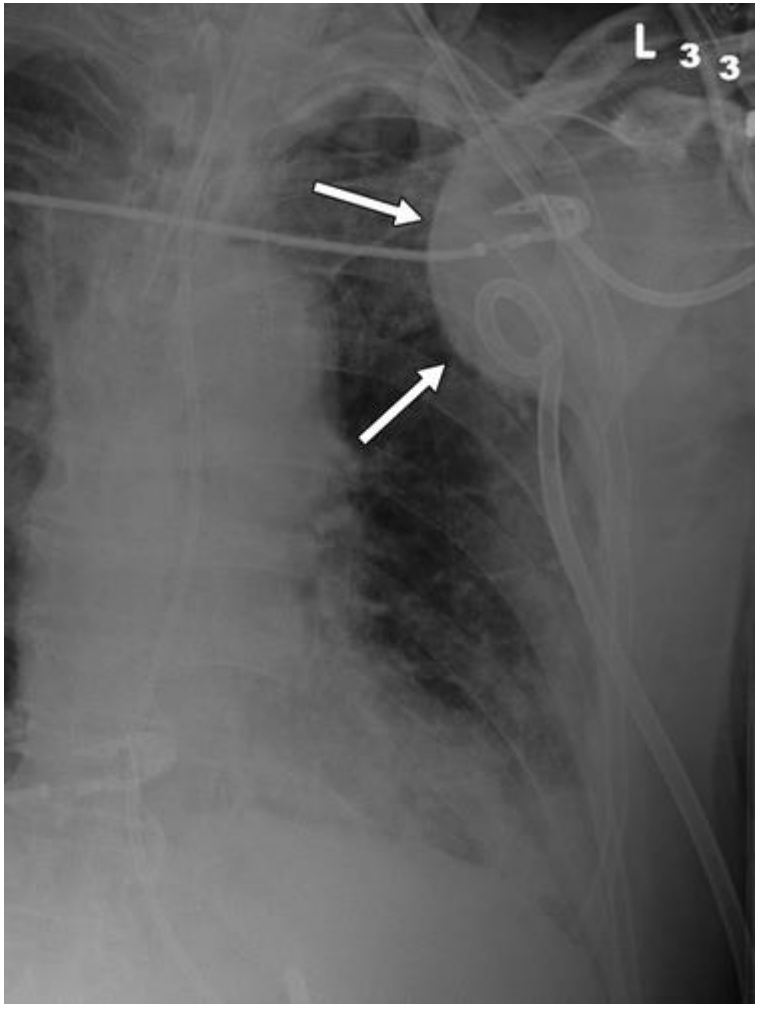


pulmonary laceration, hematoma, infarction, and bronchopleural fistula

Placement of small-bore pleural drainage catheter for evacuation of pneumothorax

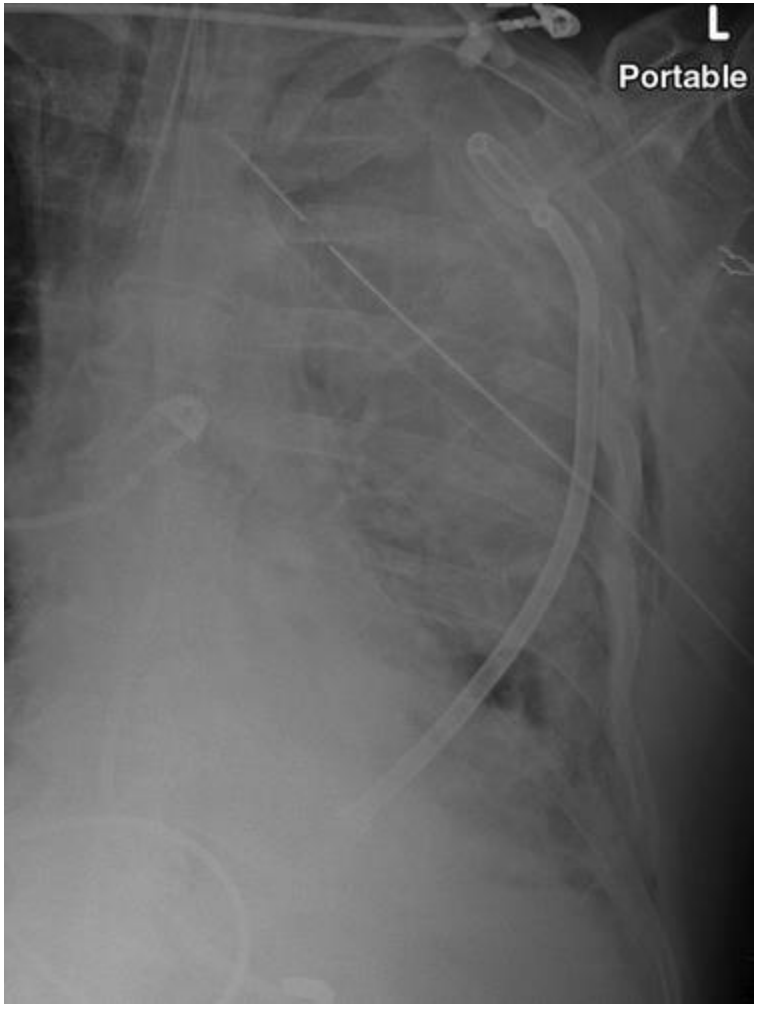


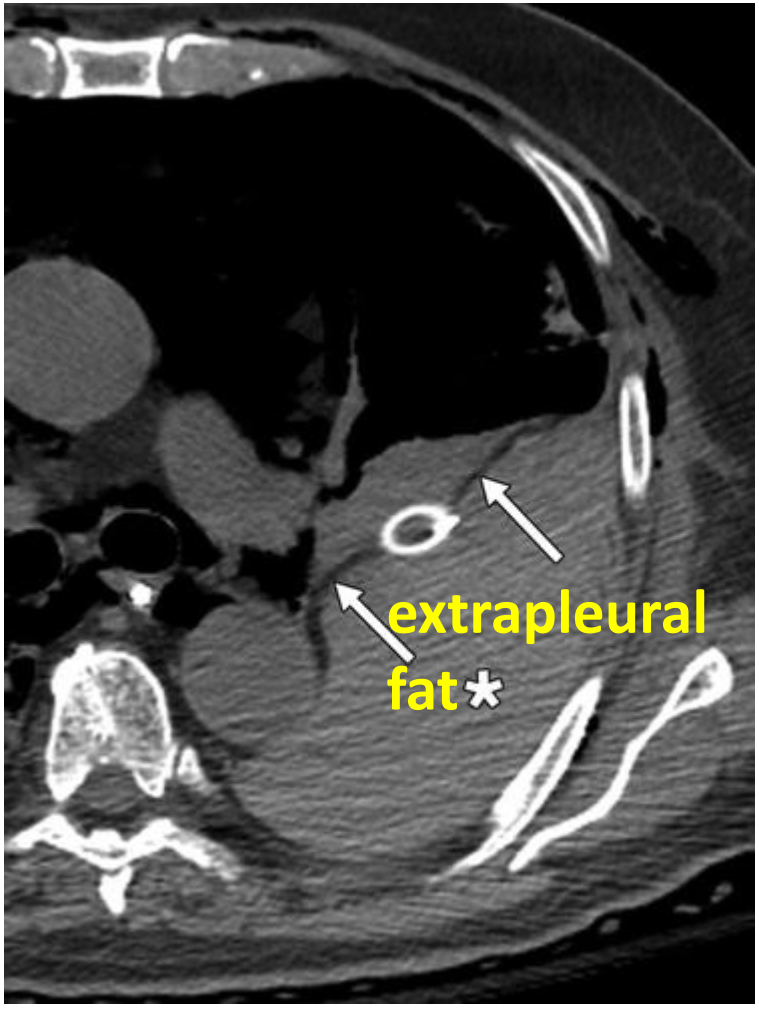
Day 1



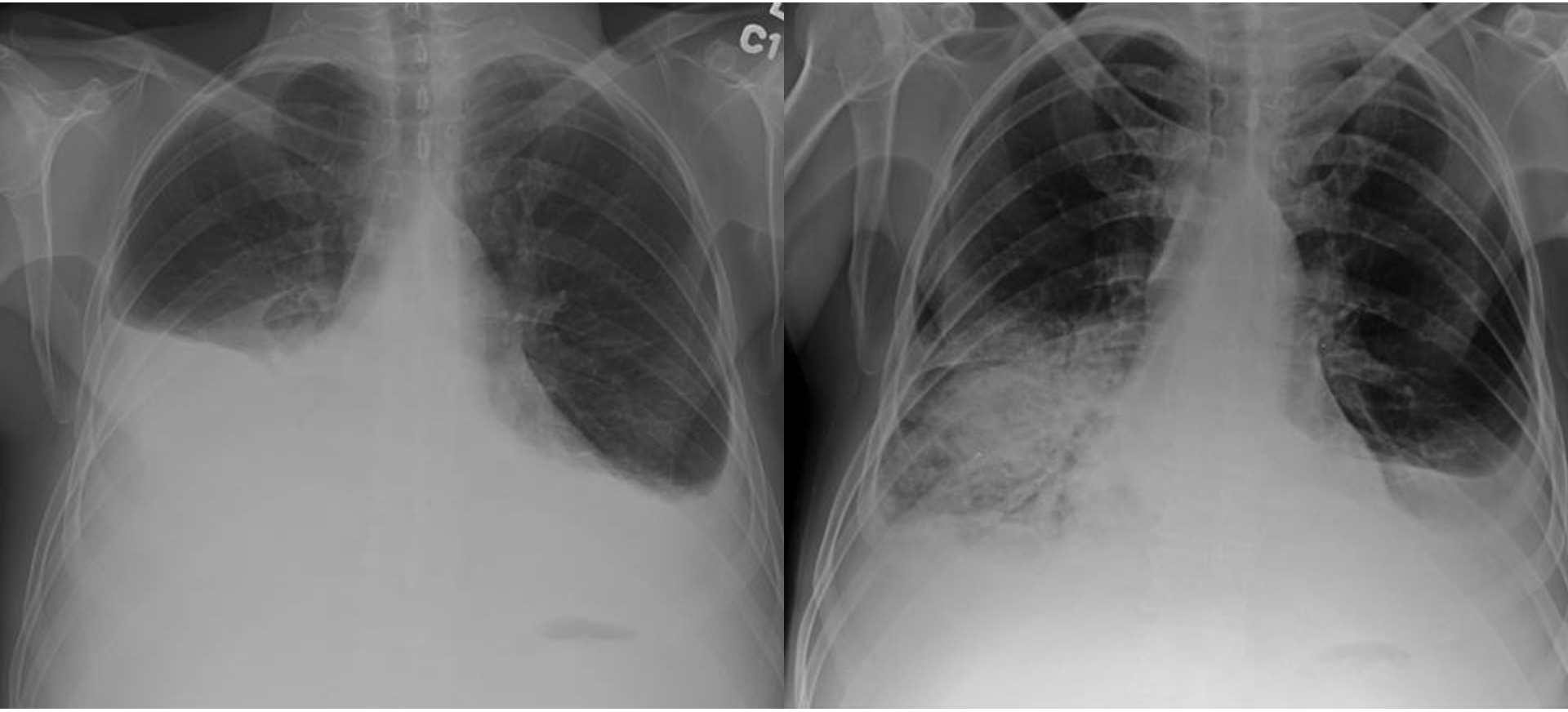
Day 2

Extrapleural hematoma



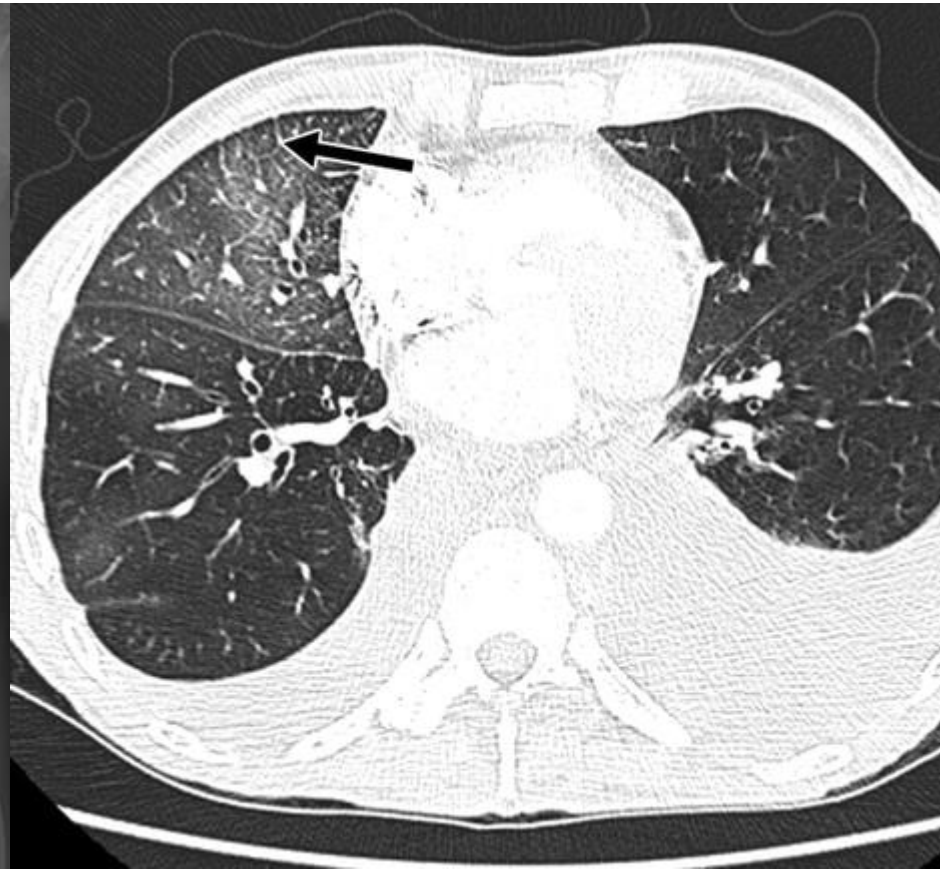


58-year-old woman with chylothorax



2 hours after thoracentesis
SOB

Reexpansion pulmonary edema



few days later

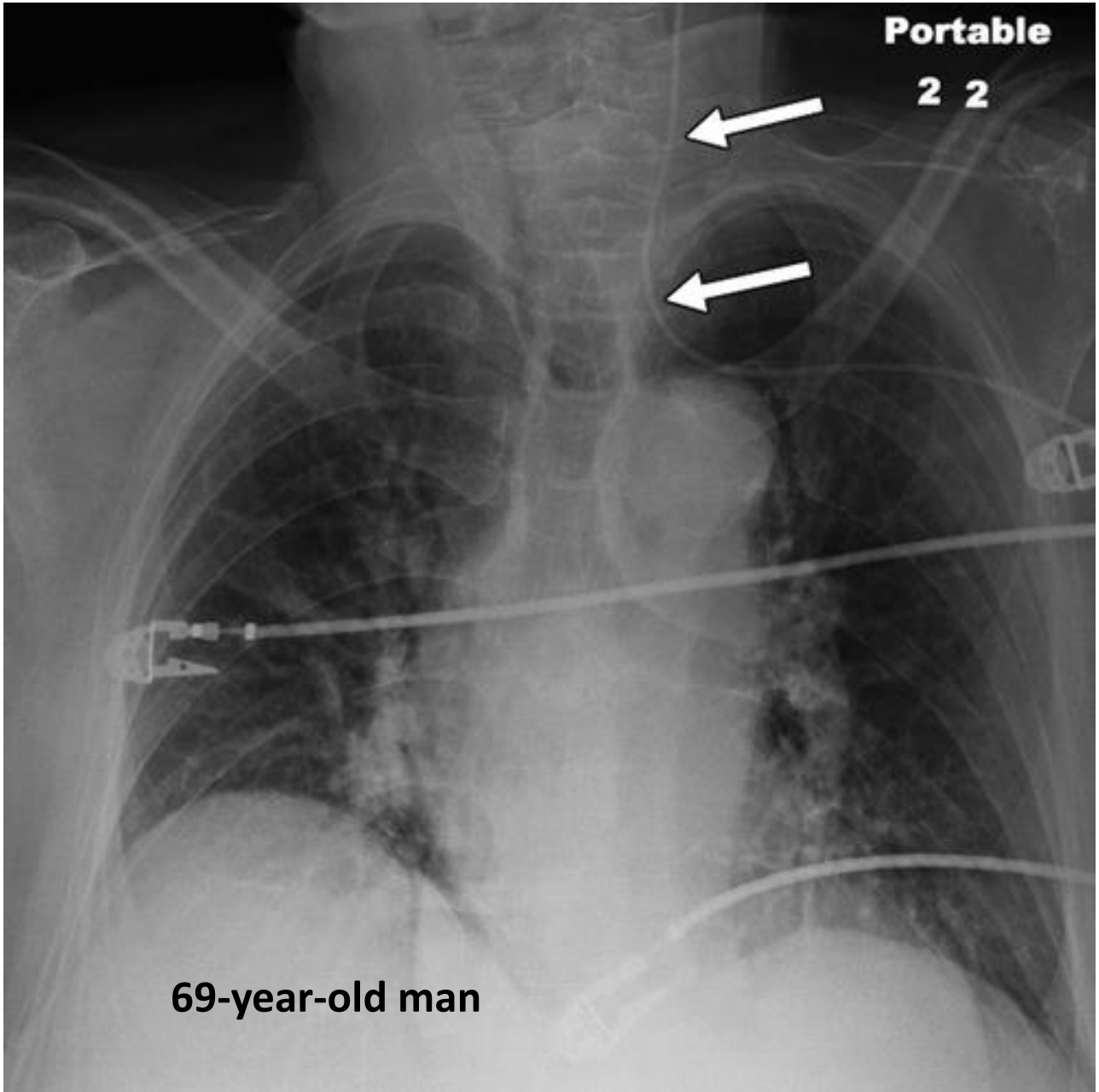
Reexpansion pulmonary edema

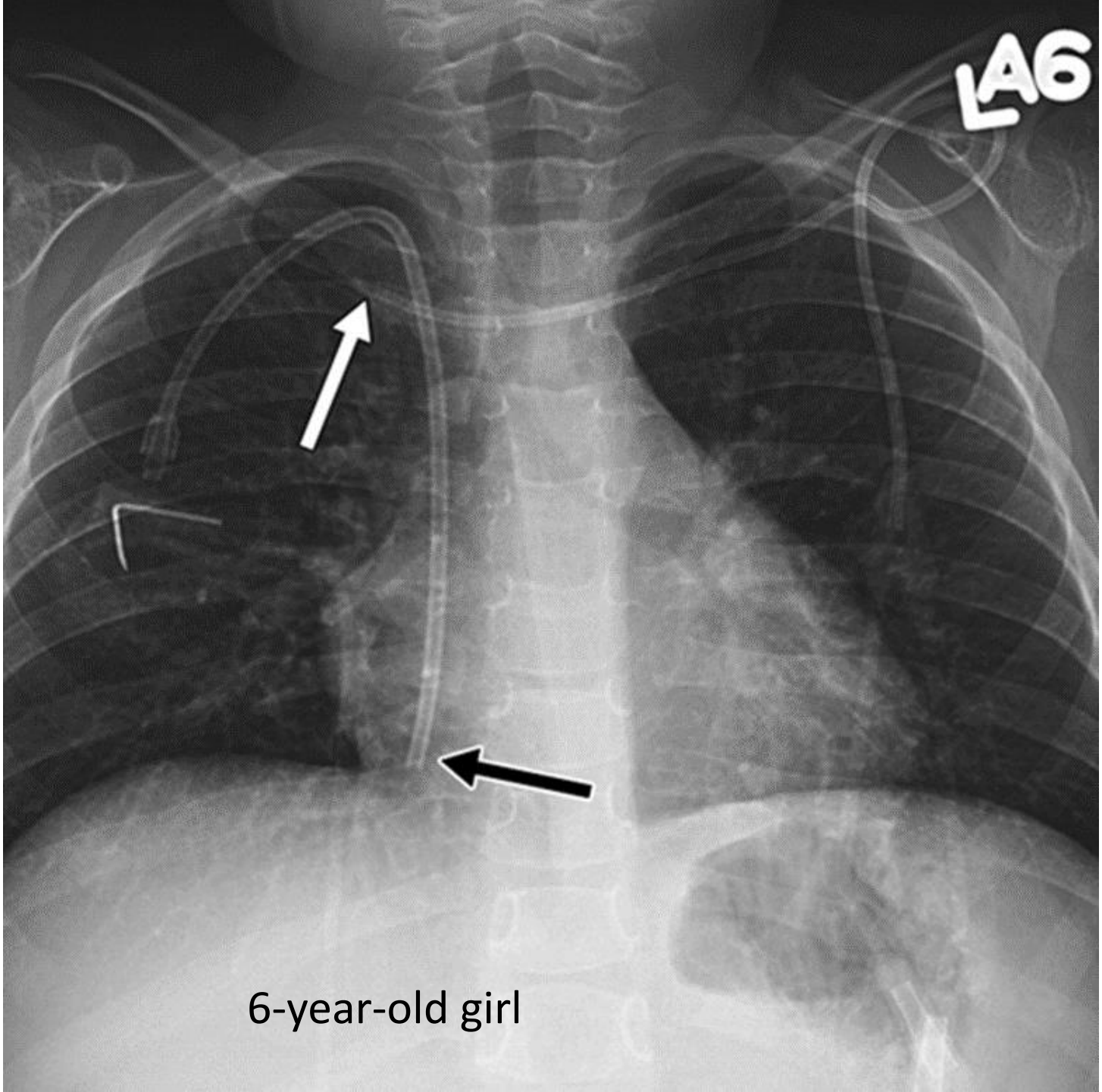
- rapid removal of air or fluid after prolonged atelectasis
- minimal symptoms to severe hypoxia and cardiorespiratory collapse
- appear within the first 2 hours after lung reexpansion, but may take up to 48 hours
- usually lasts 1-2 days, but may take several days to resolve
- CT findings include ground-glass opacities, consolidation, and interlobular and intralobular septal thickening
- related to increased pulmonary vascular permeability, surfactant depletion, and increased production of oxygen free radicals

Central Venous Catheters

- The CVC tip should be located in the superior vena cava (SVC), below the anterior first rib, slightly **above the right atrium** .
- tip of the CVC should not be placed in right atrium because of increasing the risks of **arrhythmia, myocardial rupture, and cardiac tamponade** .
- Similar position for dialysis catheters

peripherally inserted central catheter

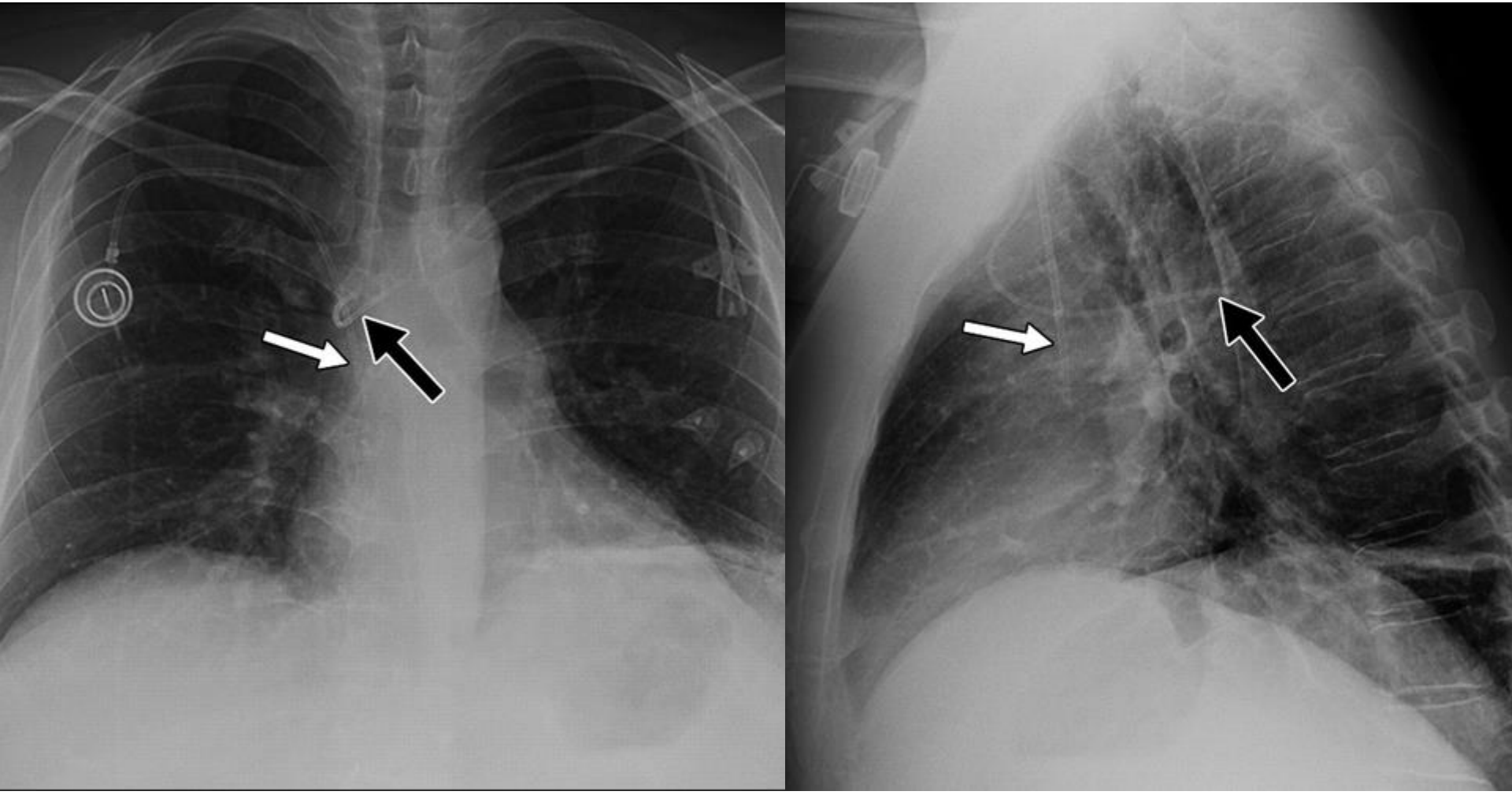



LA6
6-year-old girl

Misplaced central venous catheter in azygos arch

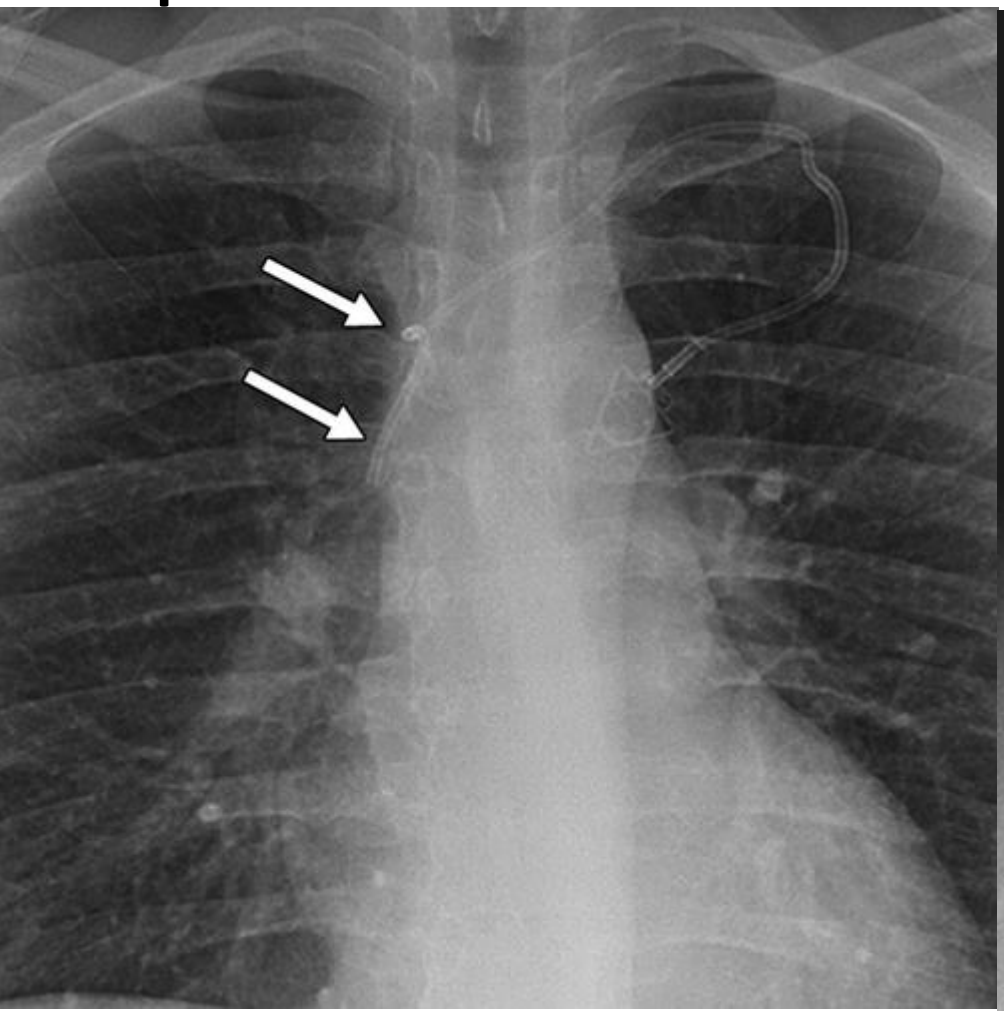
- A catheter in the azygos vein may be looped within the SVC at the **level of the junction of the trachea and the right main bronchus.**
- A lateral view showing the CVC coursing posteriorly along the arch of the azygos vein at **a level just below the aortic arch**

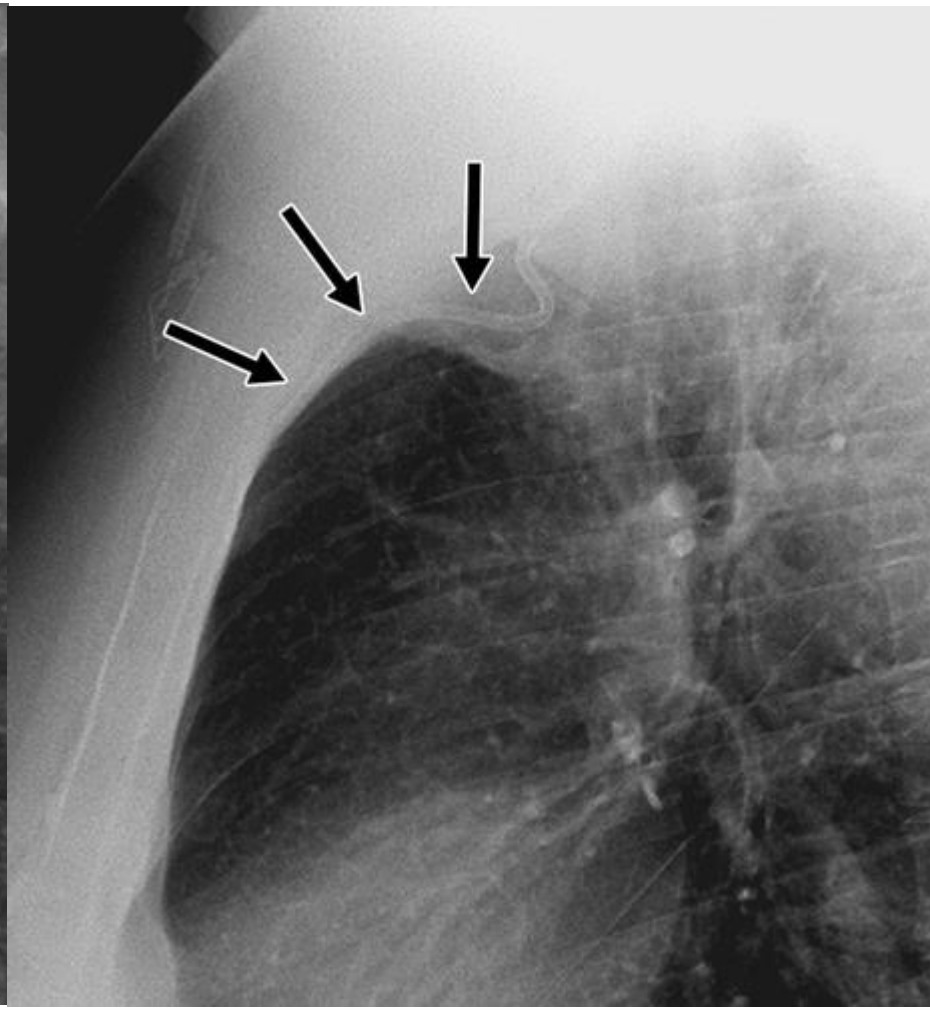
Misplaced central venous catheter in azygos vein



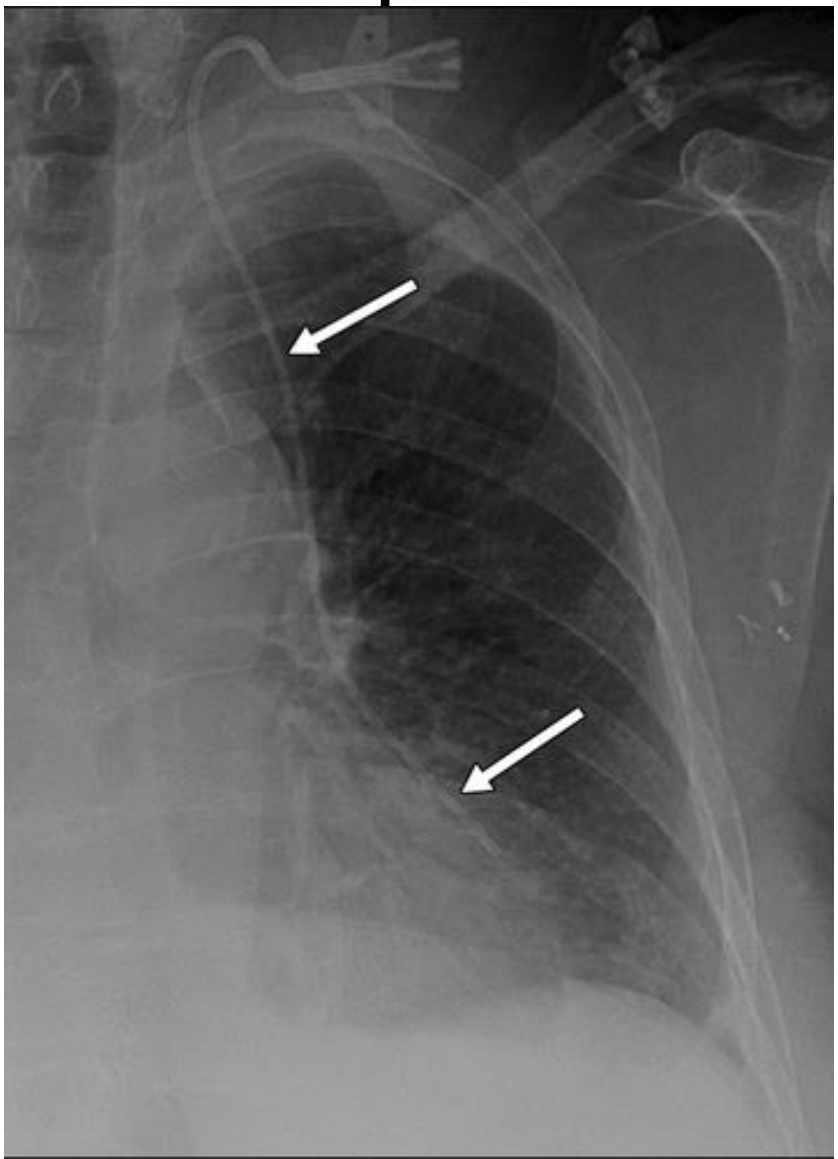
50-year-old man

Right internal mammary vein placement of central venous catheter

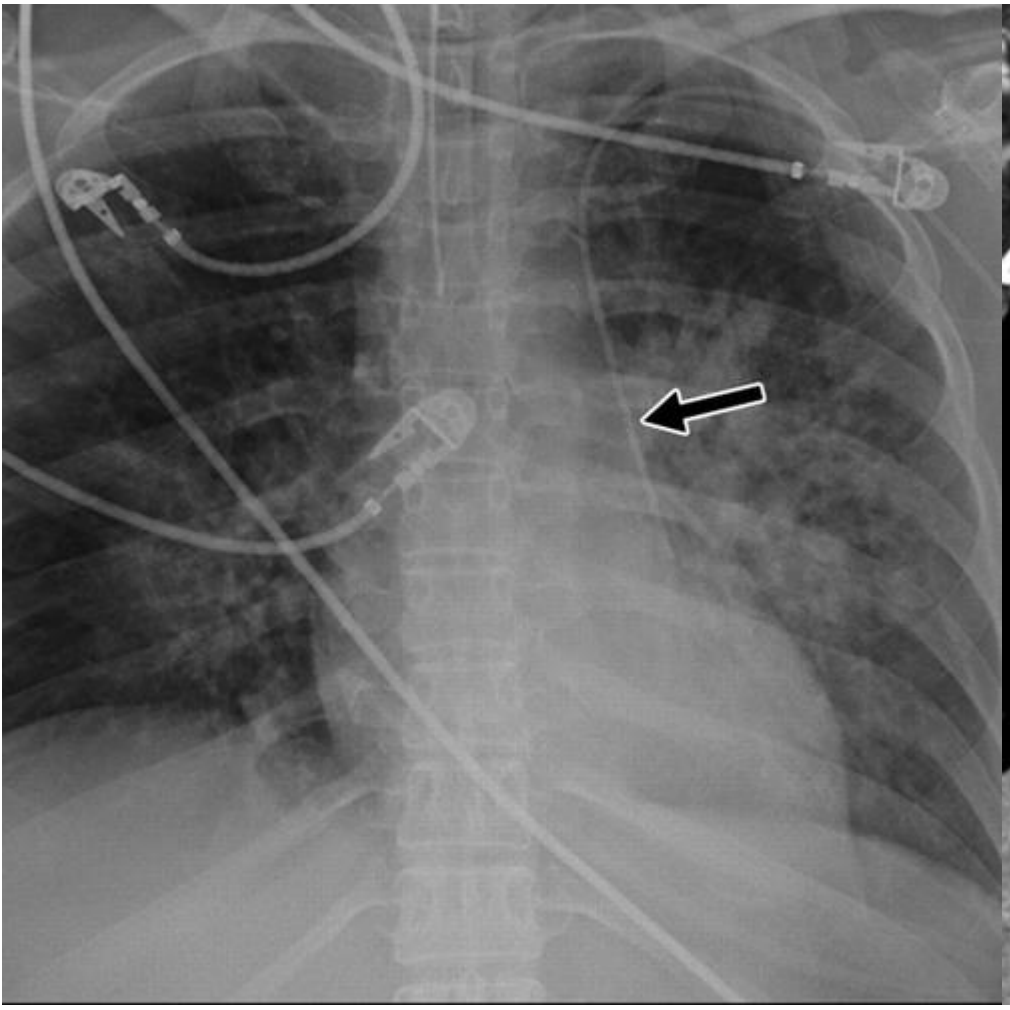




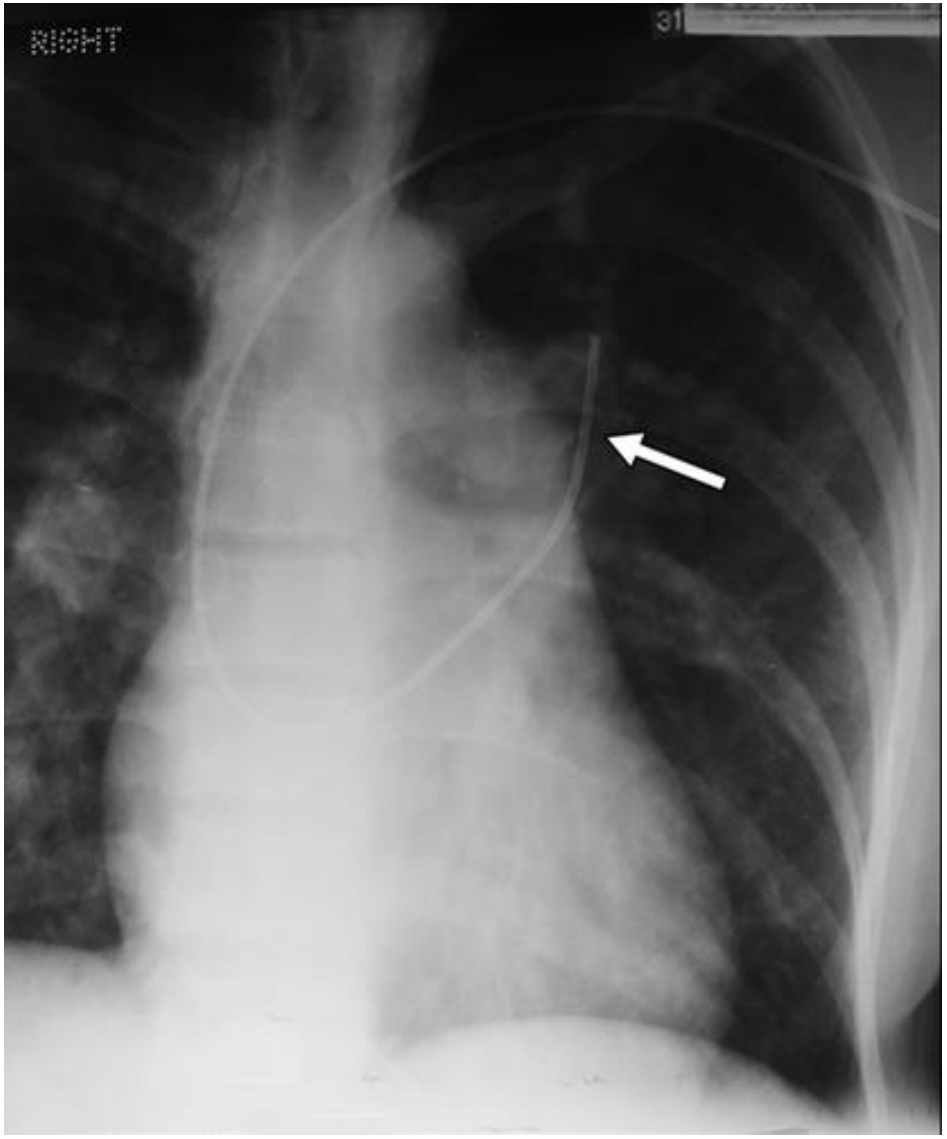
Misplaced central venous catheter in pericardiophrenic vein



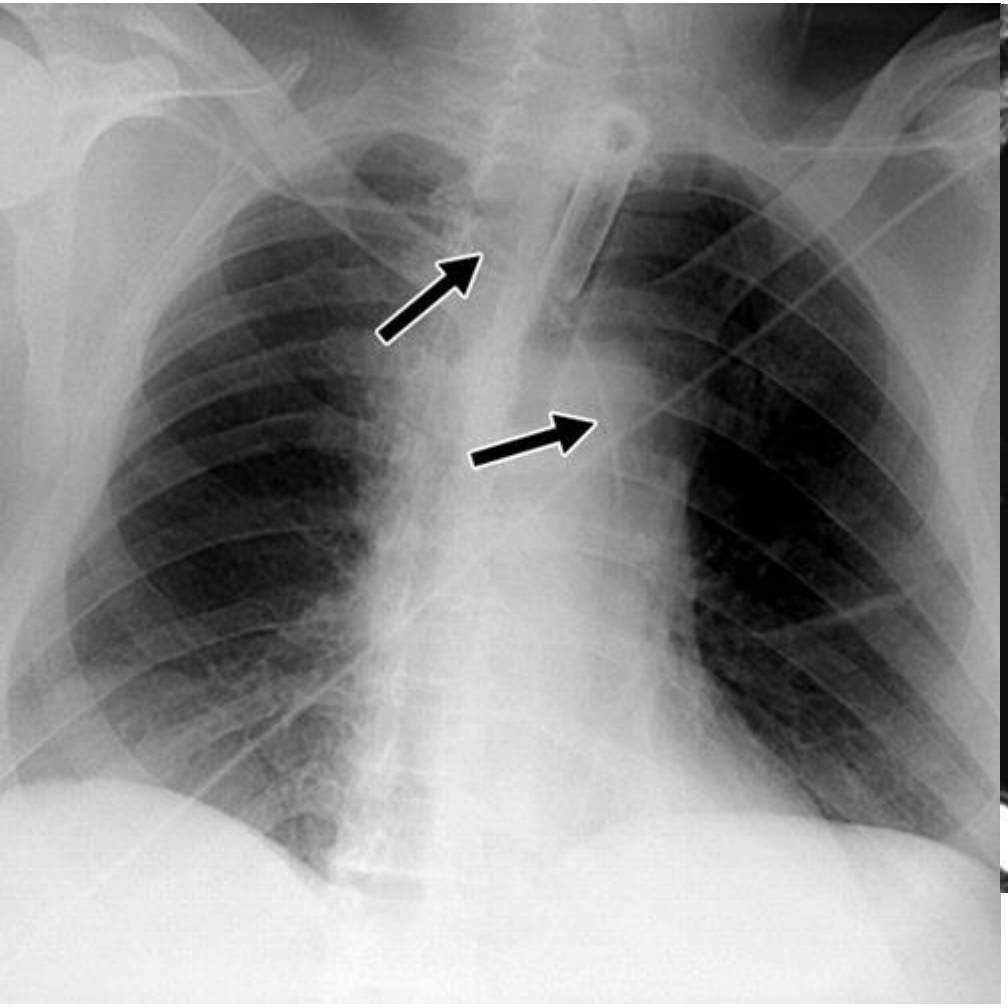
left superior vena cava (SVC) placement of central venous catheter

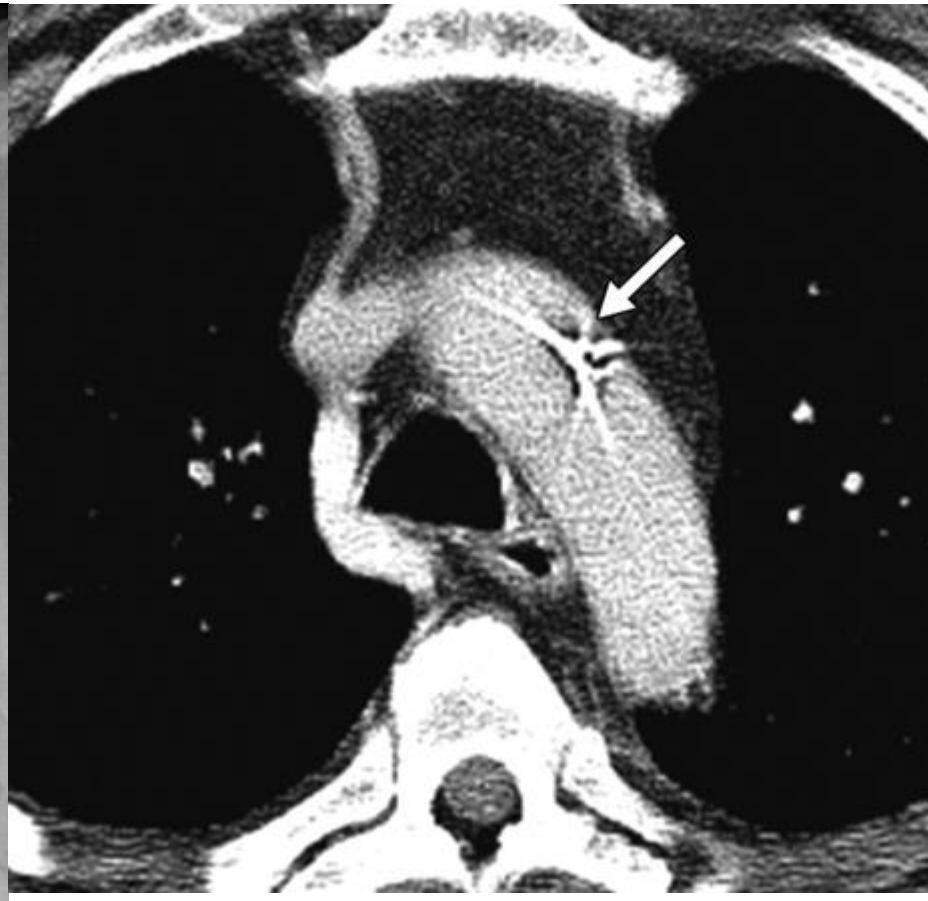


Atrial septal defect (ASD) and misplaced central venous catheter



Catheterization of the subclavian artery

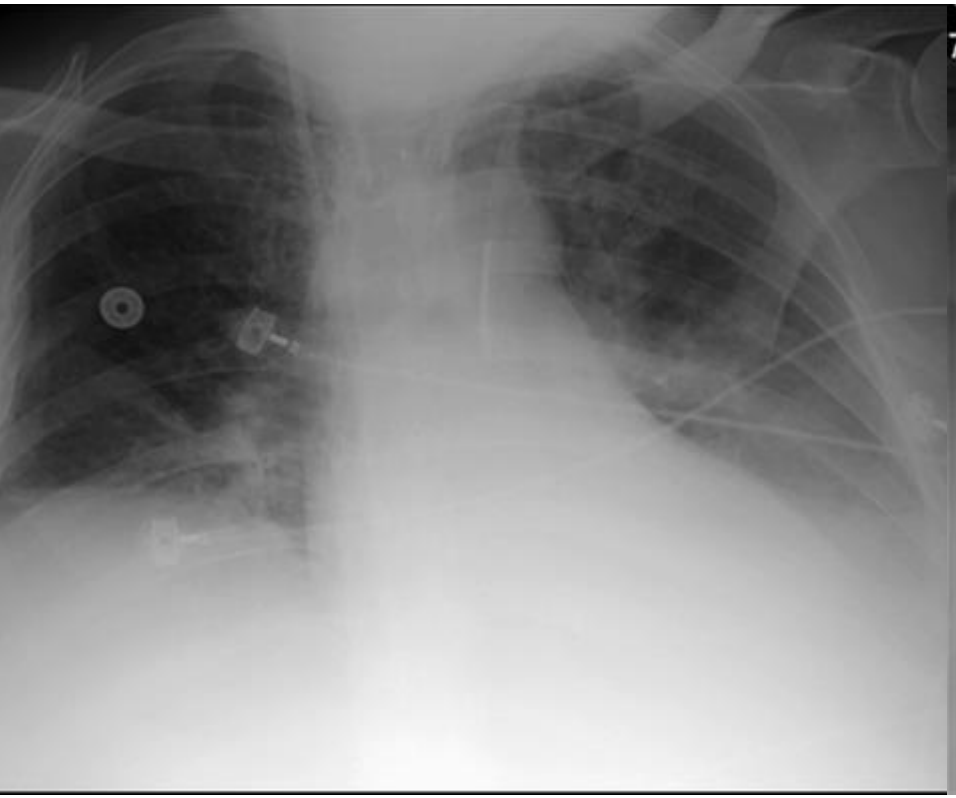


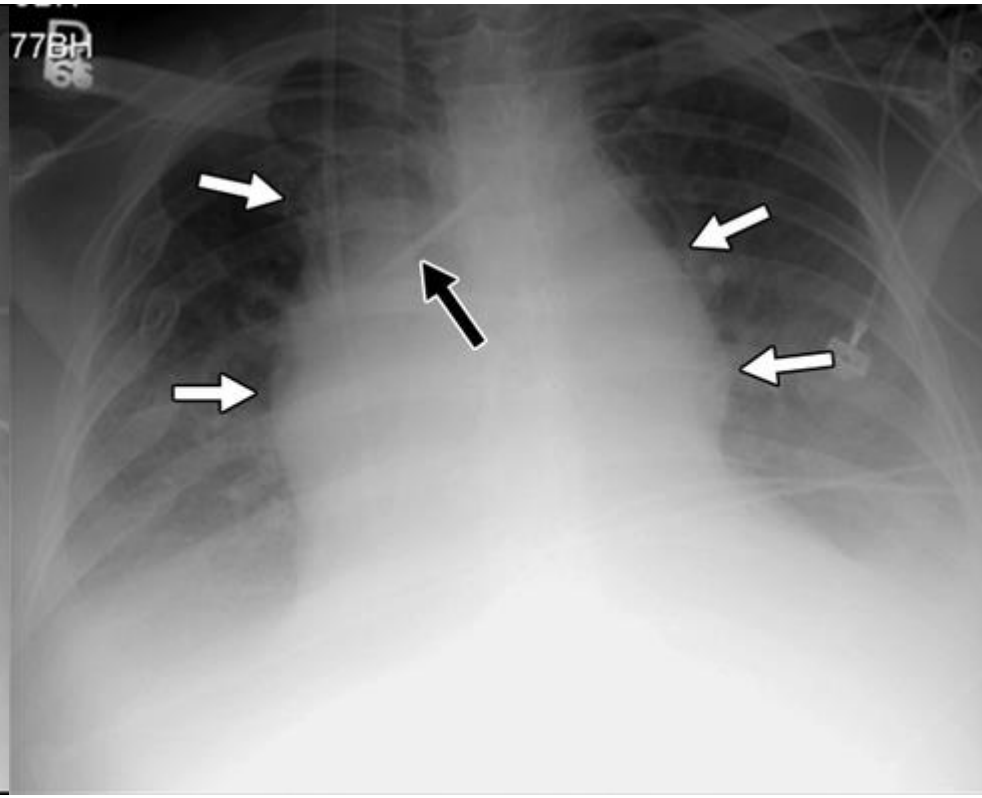


Vascular perforation caused by CVC

- Unusual trajectory of the catheter
- An apical cap due to extrapleural hematoma
- A new pleural effusion due to hemothorax
- Mediastinal widening due to mediastinal hematoma

Mediastinal hematoma after central venous catheter placement

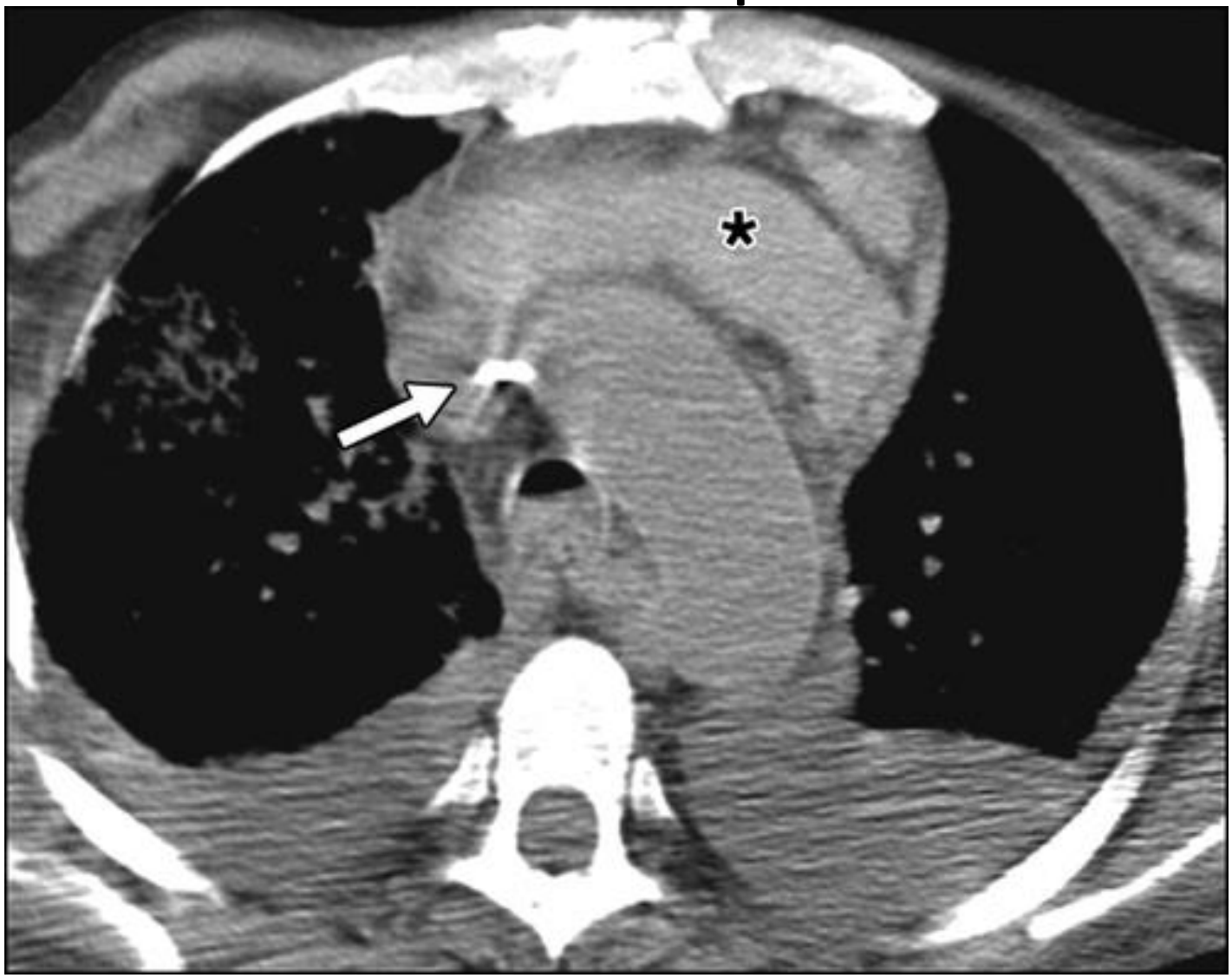




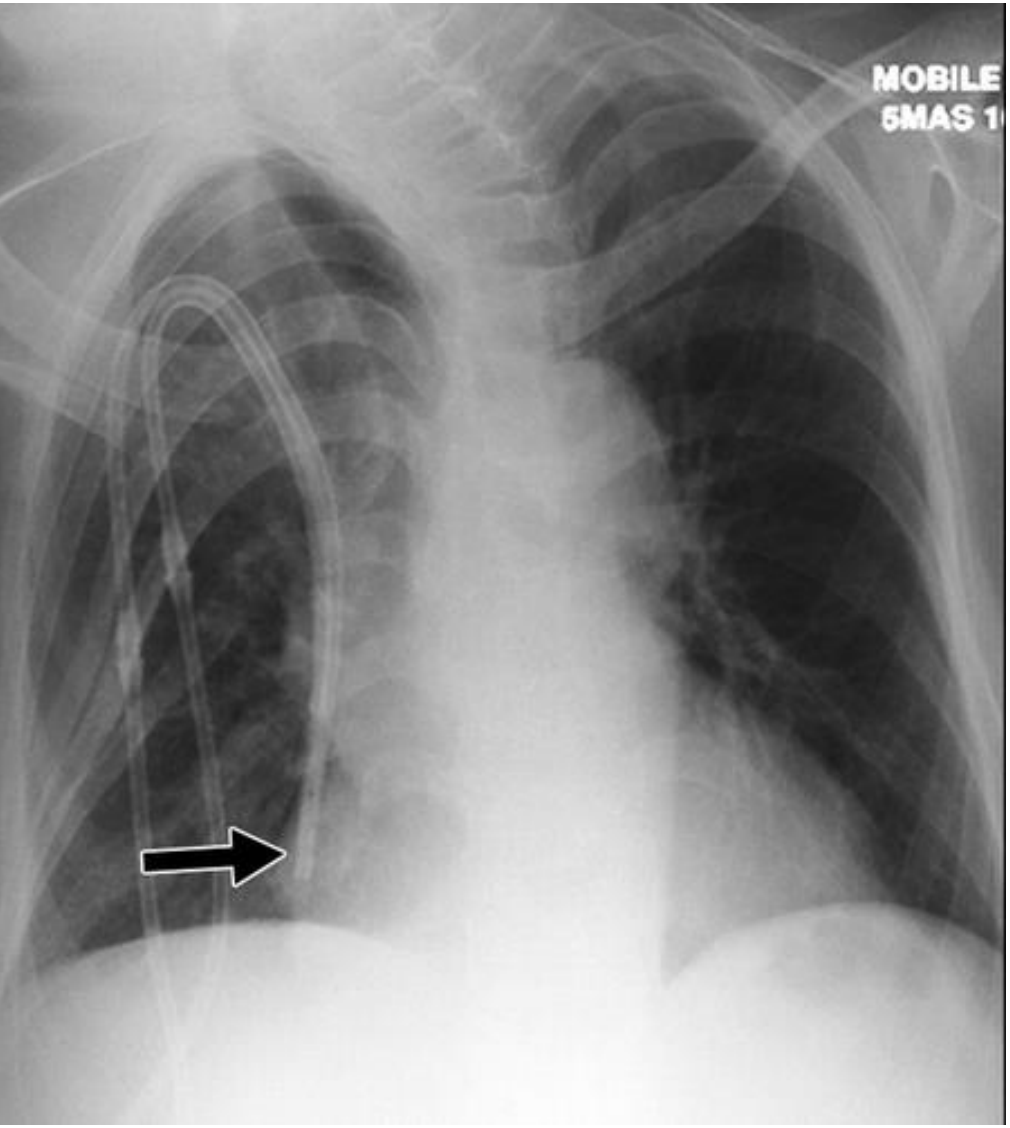
Before CVC

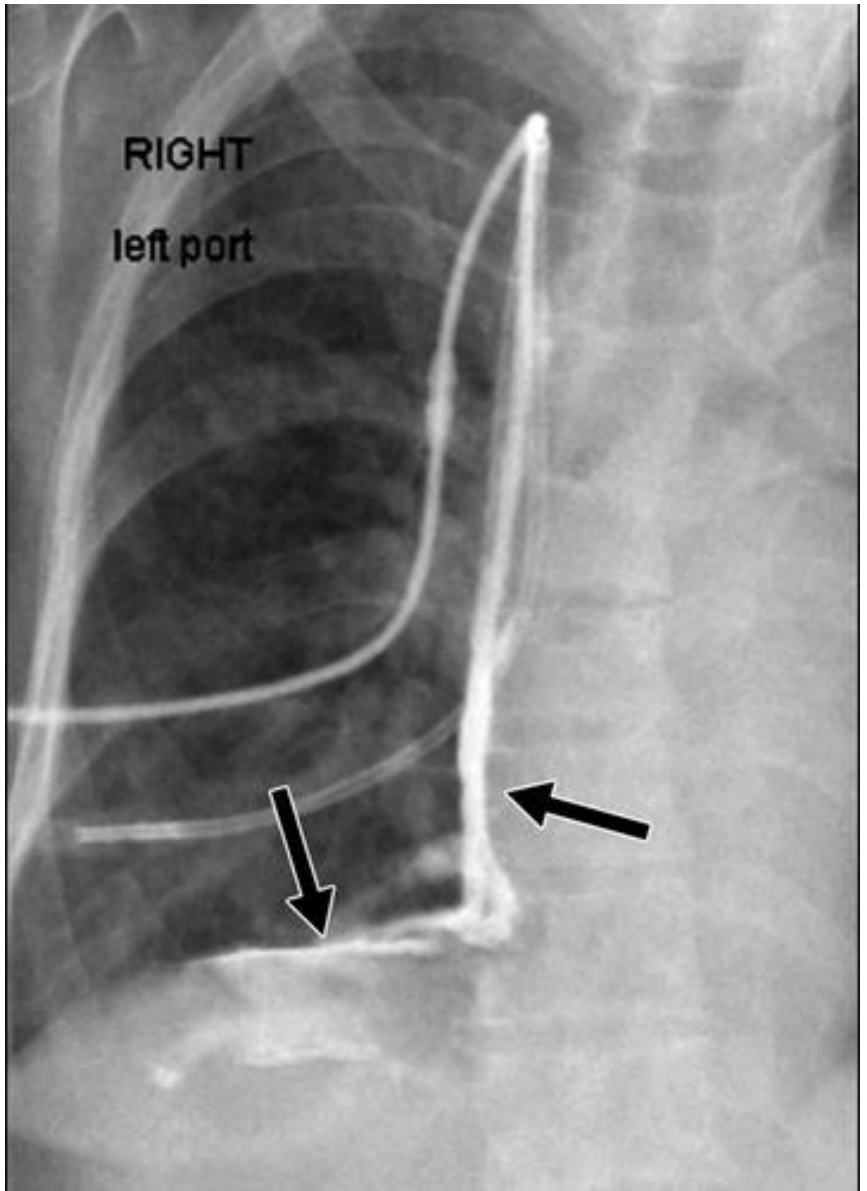
After left internal jugular CVC

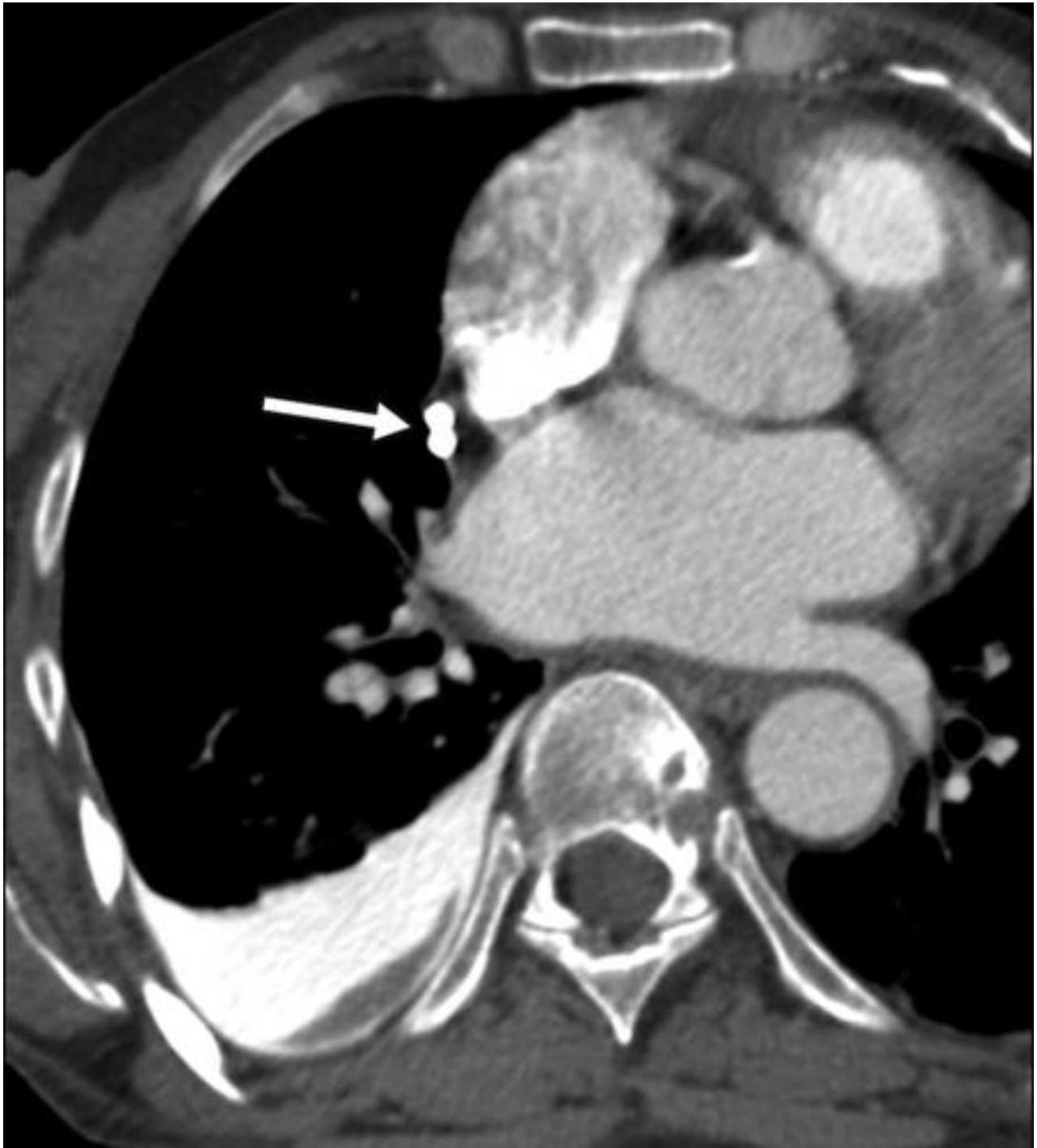
Mediastinal hematoma after central venous catheter placement



Extravascular placement of double-lumen dialysis catheter



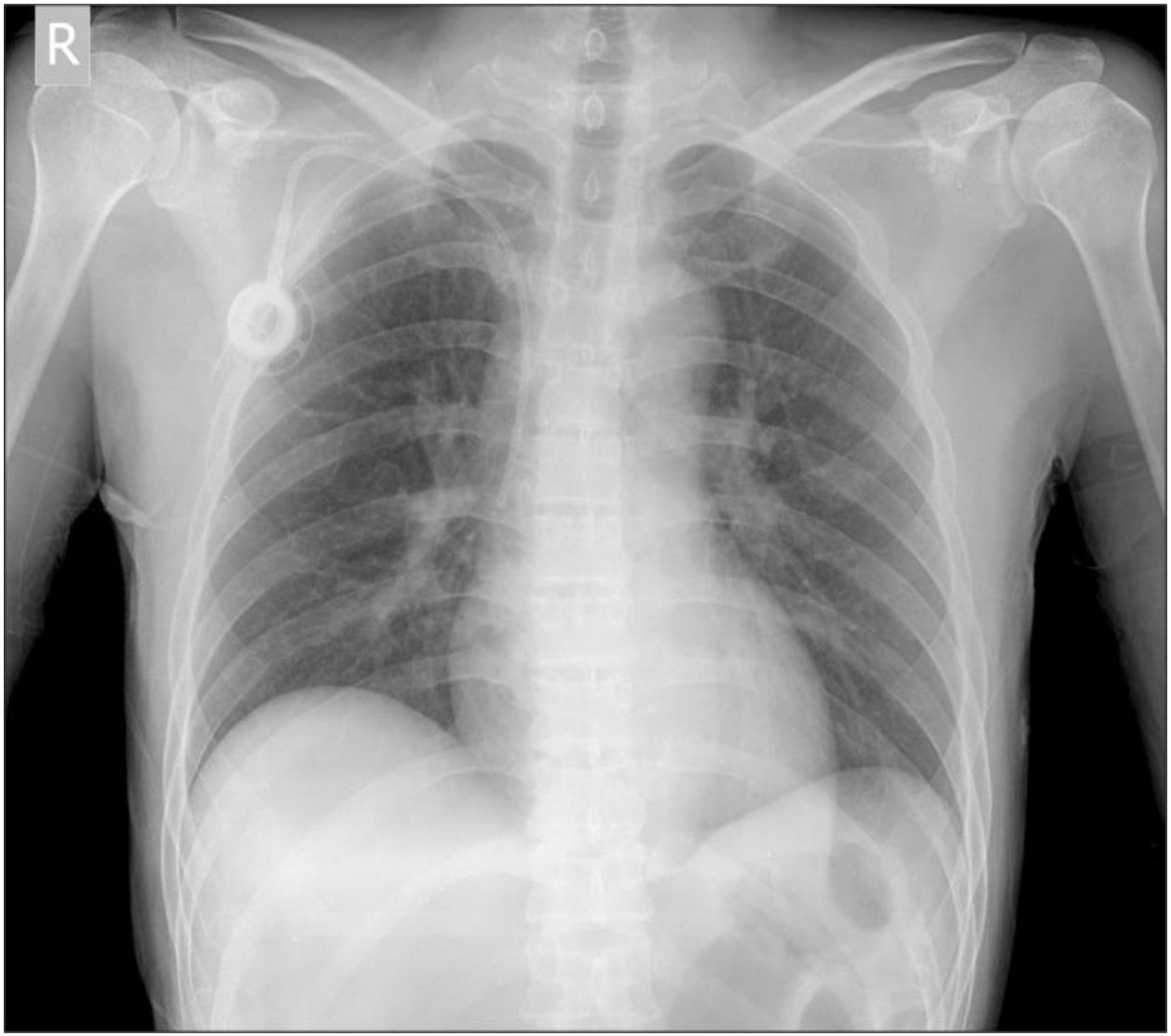




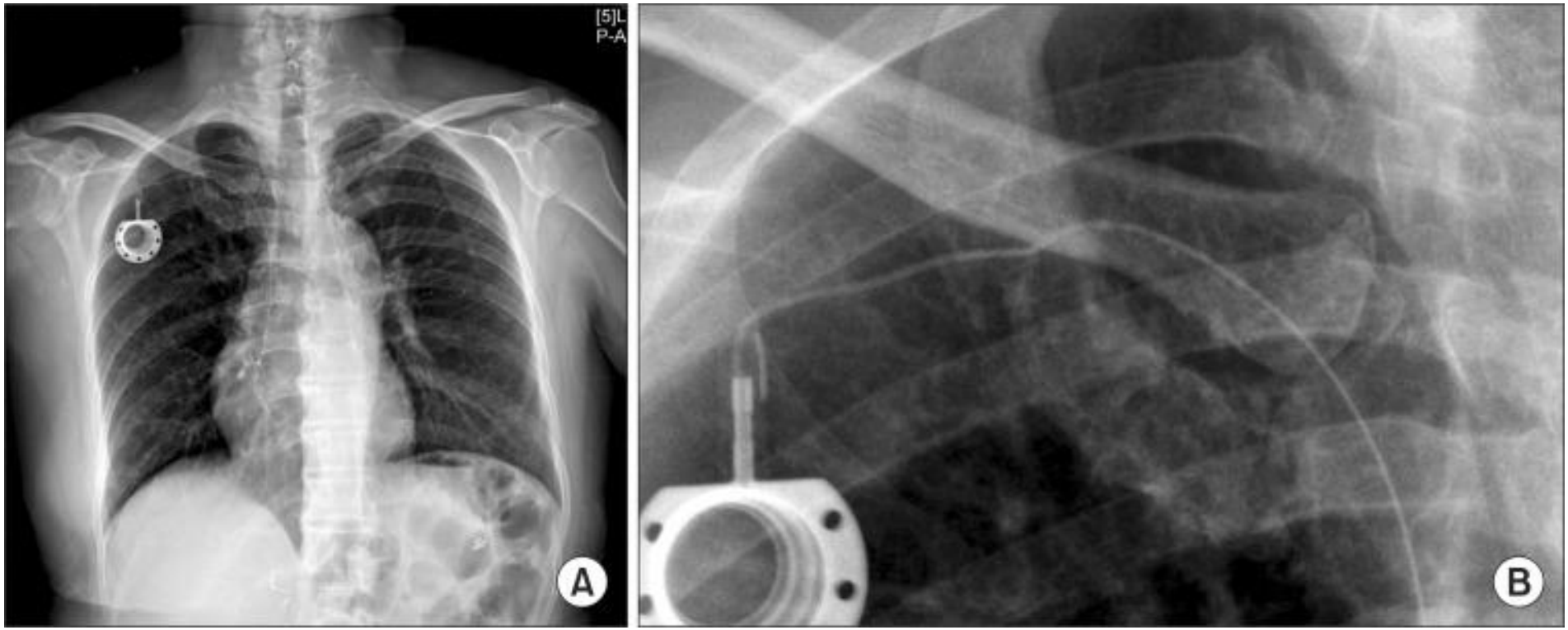
Pinch-off Syndrome導管被夾住症候群

- 導管被鎖骨及第一肋骨夾住
- 分為四級
- Grade 0：導管平順的經過第一肋骨及鎖骨交叉且無狹窄點
- Grade 1：導管經過第一肋骨及鎖骨交叉時產生任何角度的彎曲，但無狹窄點
- Grade 2：導管經過鎖骨下時產生狹窄點（真正的pinch-off syndrome）
- Grade 3：導管已被夾斷並在導管的遠心端產生栓塞

pinch-off sign grade 0

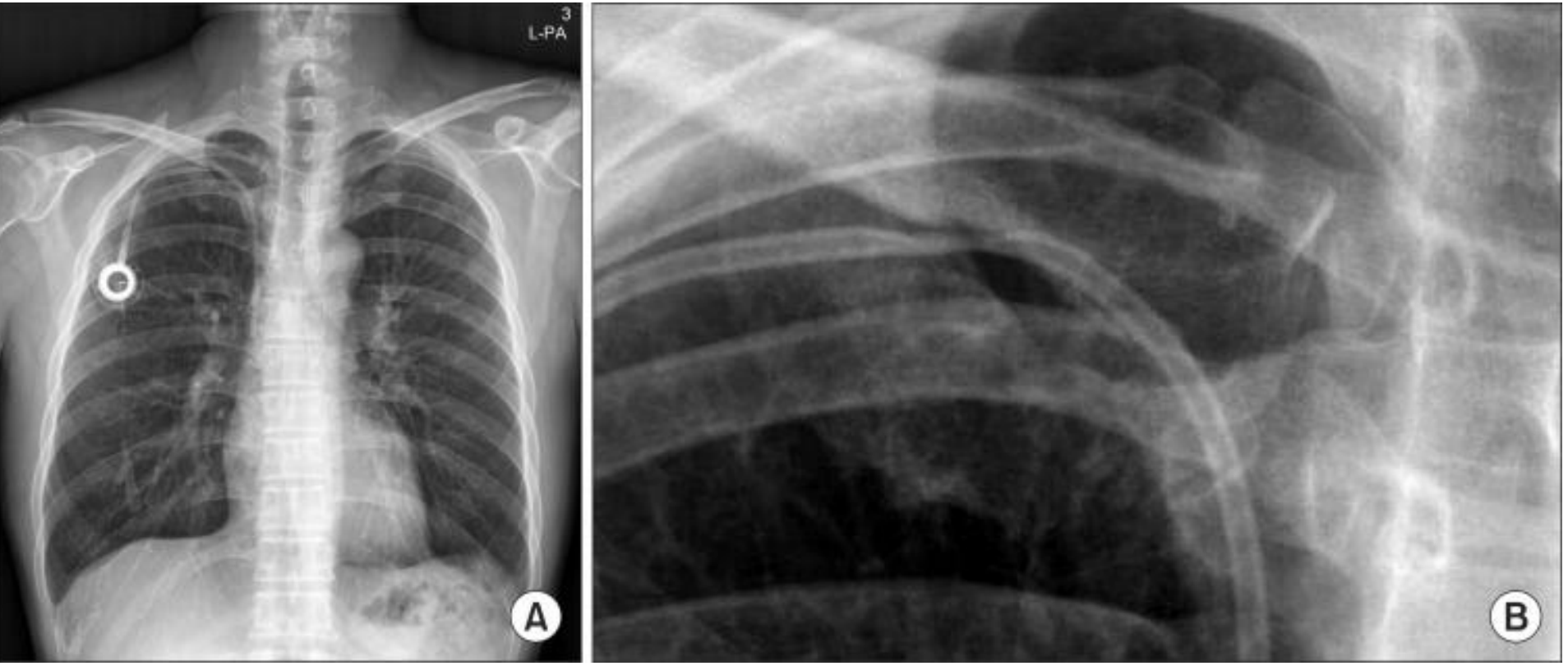


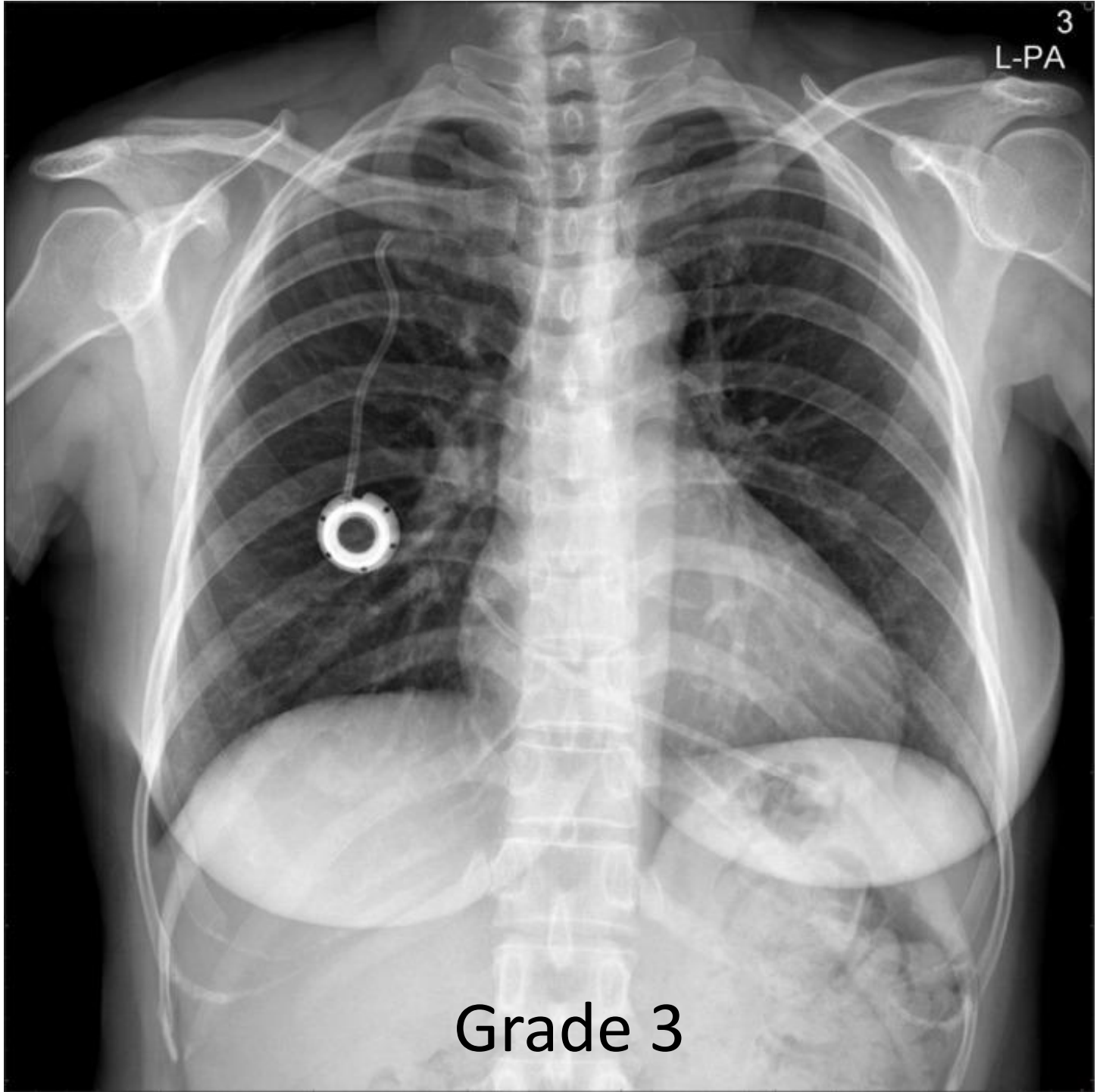
pinch-off sign grade 1



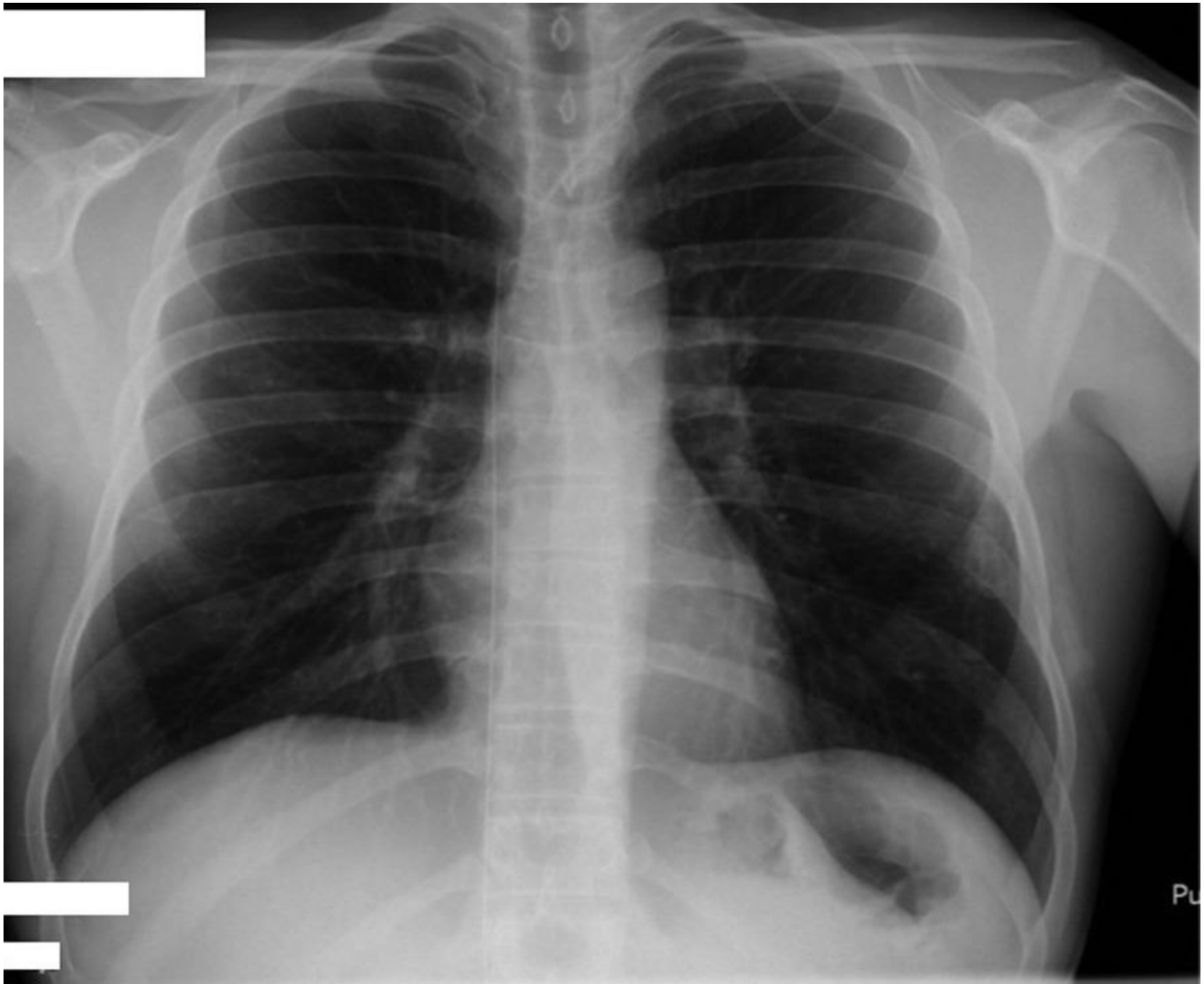
J Korean Surg Soc. 2013 Sep; 85(3): 139–144.

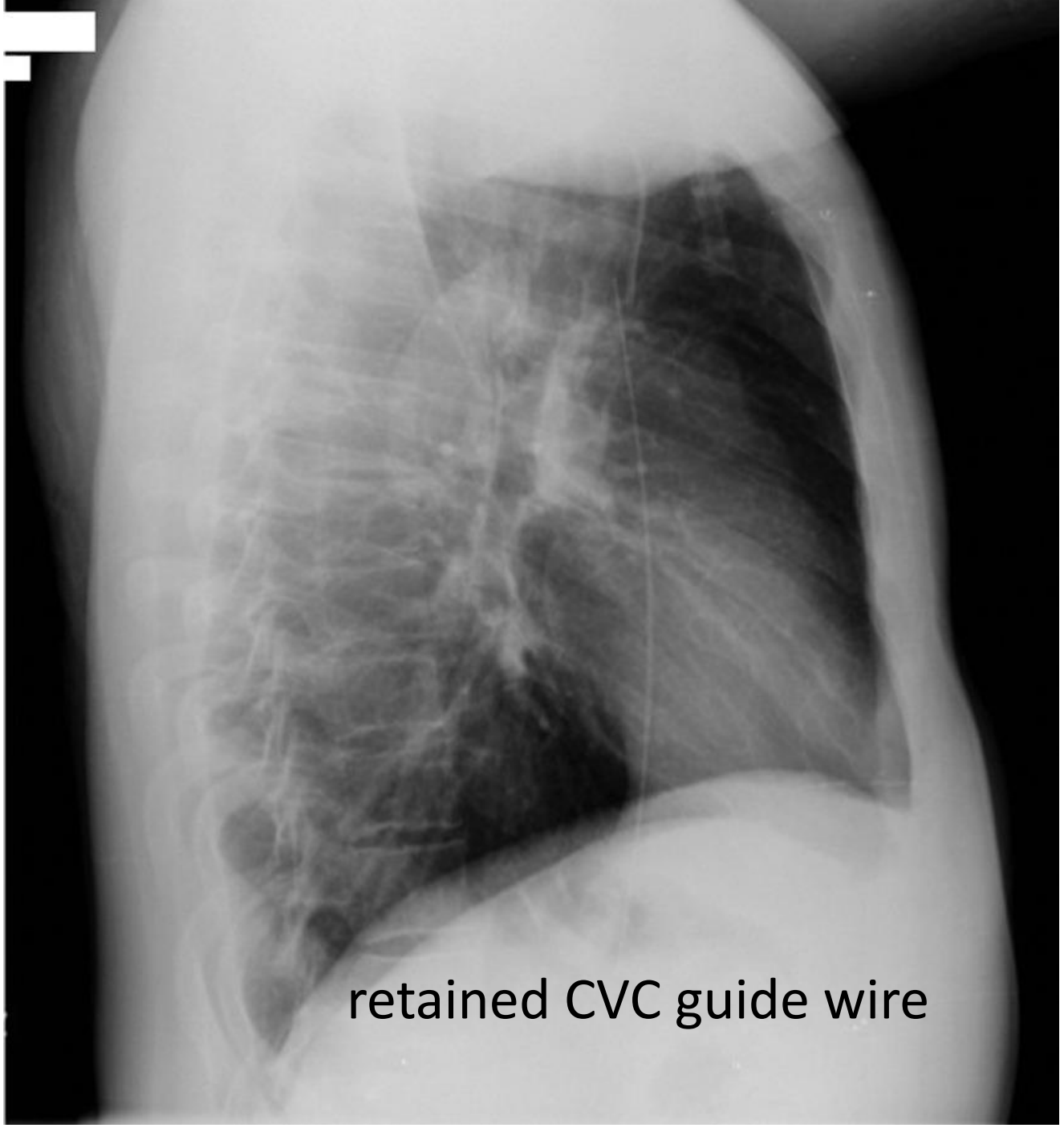
pinch-off sign grade 2





Grade 3




retained CVC guide wire

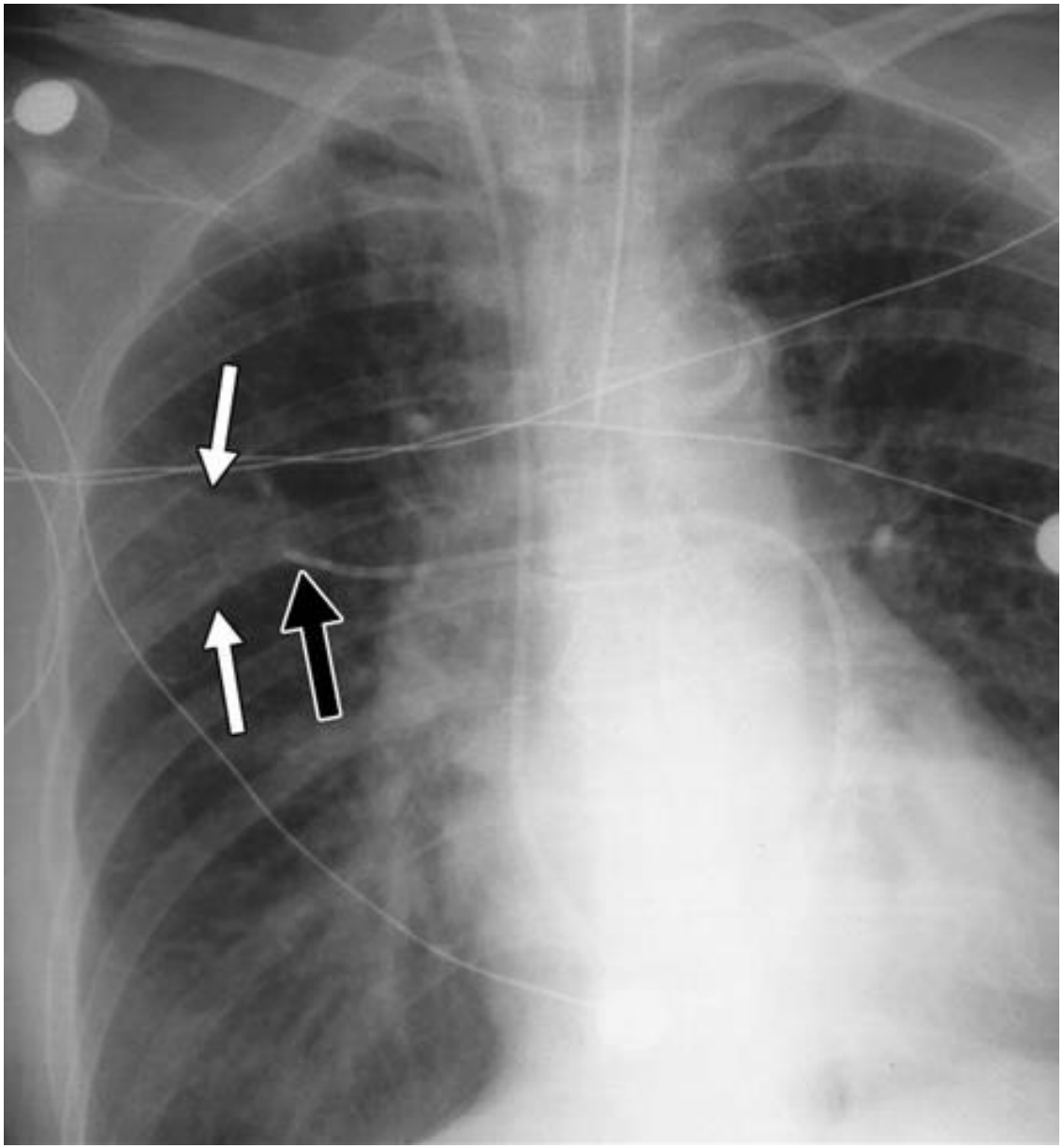
Pulmonary Artery Catheters

- the tip of the catheter is in the right or left main pulmonary arteries
- the tip should not extend beyond the proximal interlobar pulmonary artery (within 2 cm of the hilum)

Pulmonary infarction caused by occlusion of a pulmonary artery branch

- Catheter is too distal
- Persistent inflation of the balloon
- Clot formed around the distal tip of the catheter

PA catheter is too distal (> 2 cm lateral to hilum)

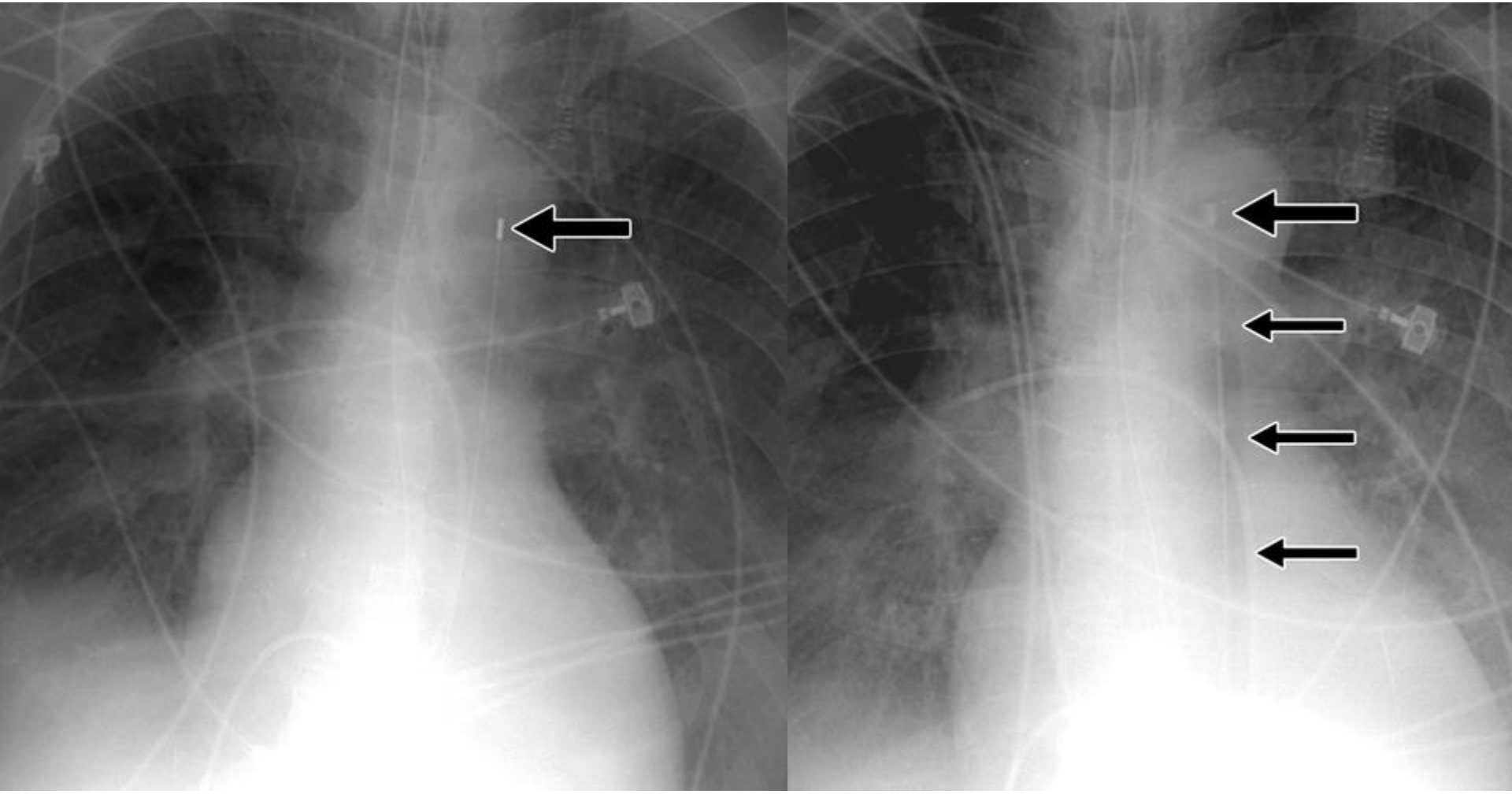


Pulmonary artery pseudoaneurysm after placement of PA catheter

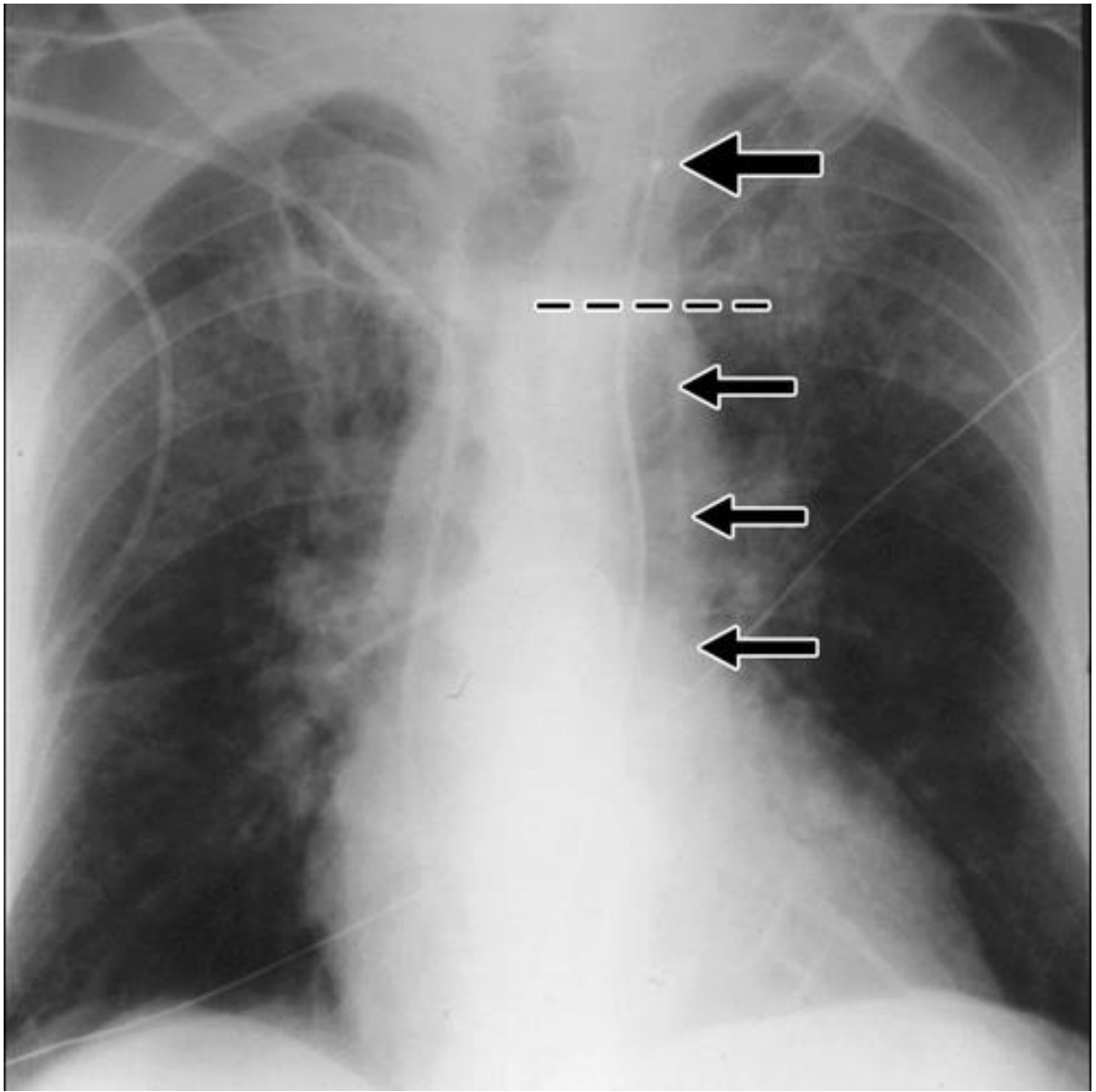
Intraaortic Counterpulsation Balloon Pump

- A catheter surrounded by an inflatable balloon approximately 25 cm long
- Introduced via the femoral artery
- Tip is in the descending thoracic aorta
- 2 cm distal to the origin of the left subclavian artery (just caudal to the aortic arch)

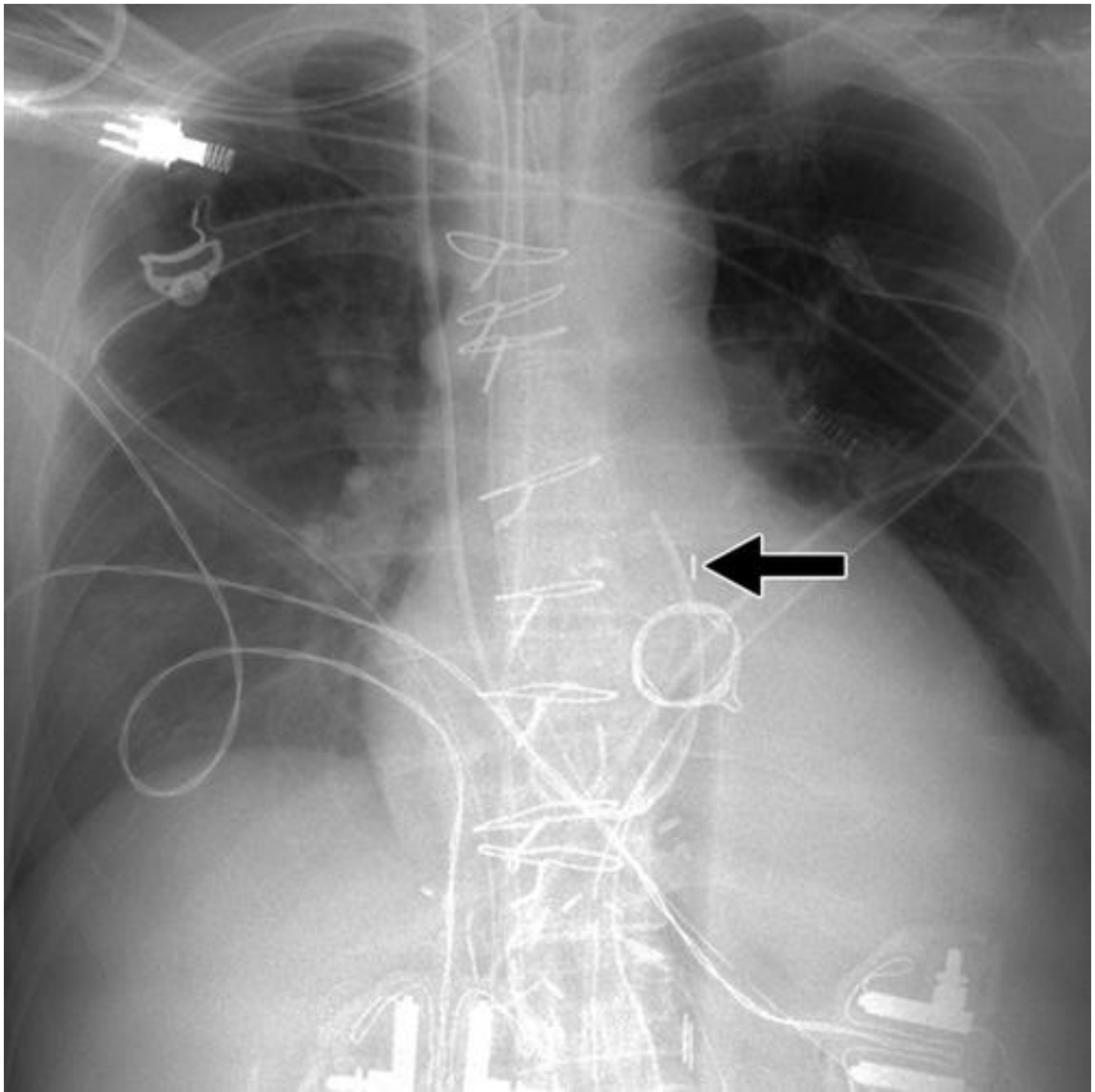
Inflated during diastole, deflated during systole



Cerebral ischemia caused by projected IABP over left common carotid artery



Obstruction of renal or mesenteric arteries by IABP in mid thoracic aorta



- ECMO

Table 1 Indications and Complications of VA and VV ECMO

TYPE	Indications	Common complications
Central VA	After failure to wean from cardiopulmonary bypass After sternotomy	Mediastinal haemorrhage More invasive May predispose to aortic stasis thrombus
Peripheral VA	When cardiac and pulmonary support is required	Large bore arterial cannulas may predispose to occlusion Malpositioned cannulas Carotid cannulation may contribute to stroke
VV ECMO	Direct support of gas exchange-respiratory failure; ARDS	Malpositioned cannulas DVT in the cannulated limb

Insights Imaging (2014) 5:731–742

Table 2 Imaging modalities in ECMO

Imaging modality	Uses	Key characteristic
Radiograph	Cannula positioning Pneumothorax and haemothorax Evaluation of quadrants for Murray scoring.	Initial study Widely available Comparison to priors for change
Echocardiography	During initial placement of ECMO cannulas	Evaluate recovery of cardiac function
Ultrasound ± Doppler	Evaluation of vascular patency Haemothorax Haematoma at cannulation site	Comparison of cannulated and non-cannulated vessels aids in evaluation of abnormal vascular waveforms
NCCT	Malpositioned cannulas Haematoma Stroke Pulmonary/Abdominal infection Aortic stasis thrombus	Maintain resting respiratory rate to minimise motion artefact
CECT	Pulmonary stasis thrombus Aortic stasis thrombus	Switch ECMO circuit to minimal flow status or stop the ECMO pump for the duration of the acquisition

NCCT non-contrast computer-aided tomography, *CECT* contrast-enhanced computer aided tomography

Insights Imaging (2014) 5:731–742

Table 3 Summary of common ECMO configurations

Optimal cannula tip position	Drainage cannula	Return cannula	Key characteristics
VA ECMO			
Central	Right atrium	Aorta	Direct insertion into the mediastinal vessels
Peripheral	Distal IVC or SVC, before the cavoatrial junction	Proximal femoral artery, axillary artery, subclavian artery	Insertion of cannulas in peripheral vessels
VV ECMO			
Femorofemoral	Distal IVC, at the level of the diaphragm	Right atrium via the same or opposite iliofemoral vein	Less recirculation and improved flow
Femoroatrial	Distal IVC, at the level of the diaphragm	Distal SVC/right atrium via the SVC	Optimal to minimise recirculation
Dual lumen, single cannula	IVC, below the diaphragm	Right atrium via the SVC	For urgent pulmonary support

IVC inferior vena cava, *SVC* superior vena cava, *DVT* deep vein thrombus

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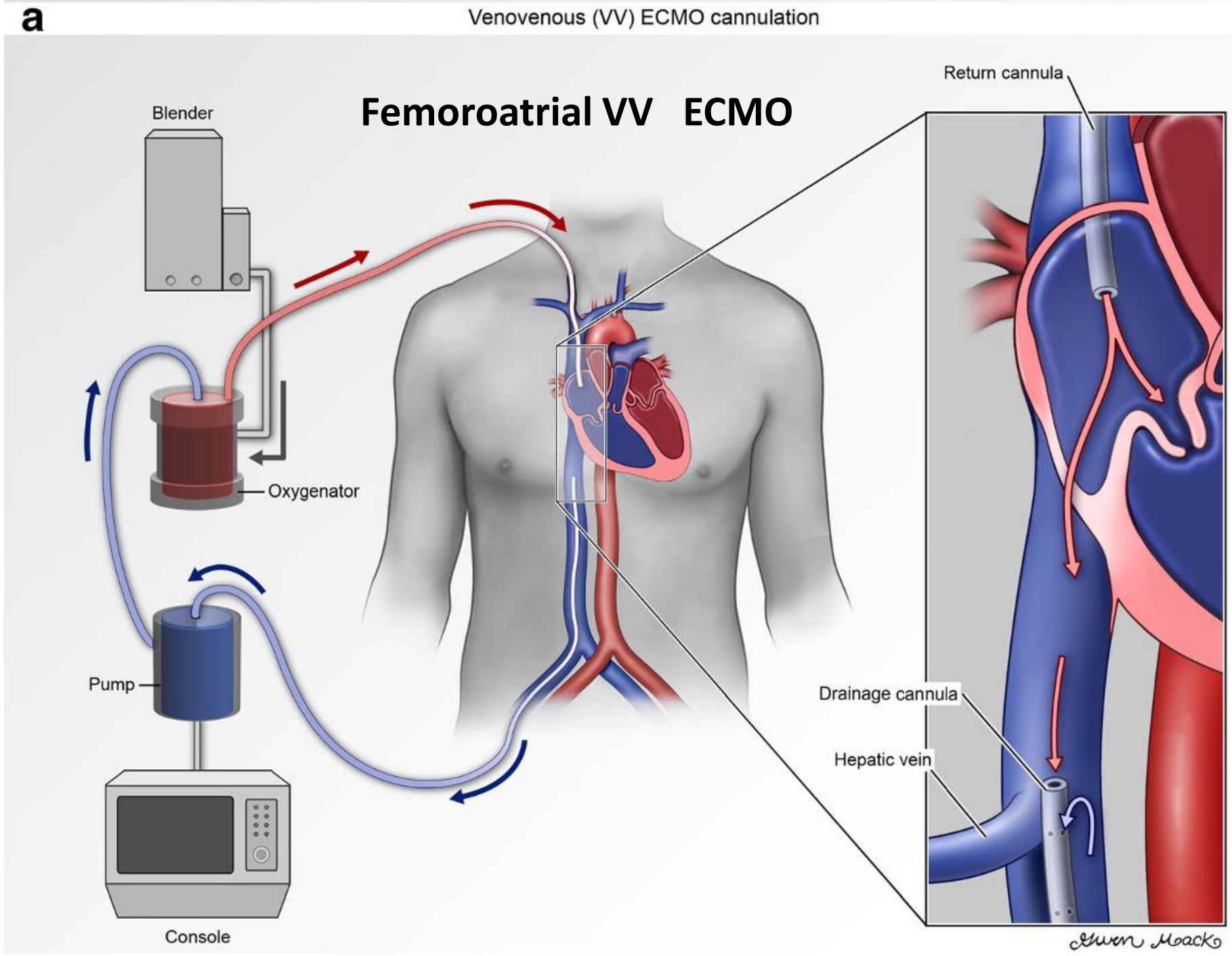

a
Venovenous (VV) ECMO cannulation
Femoroatrial VV ECMO
Blender
Oxygenator
Pump
Console
Return cannula
Drainage cannula
Hepatic vein
Gwen Moacko

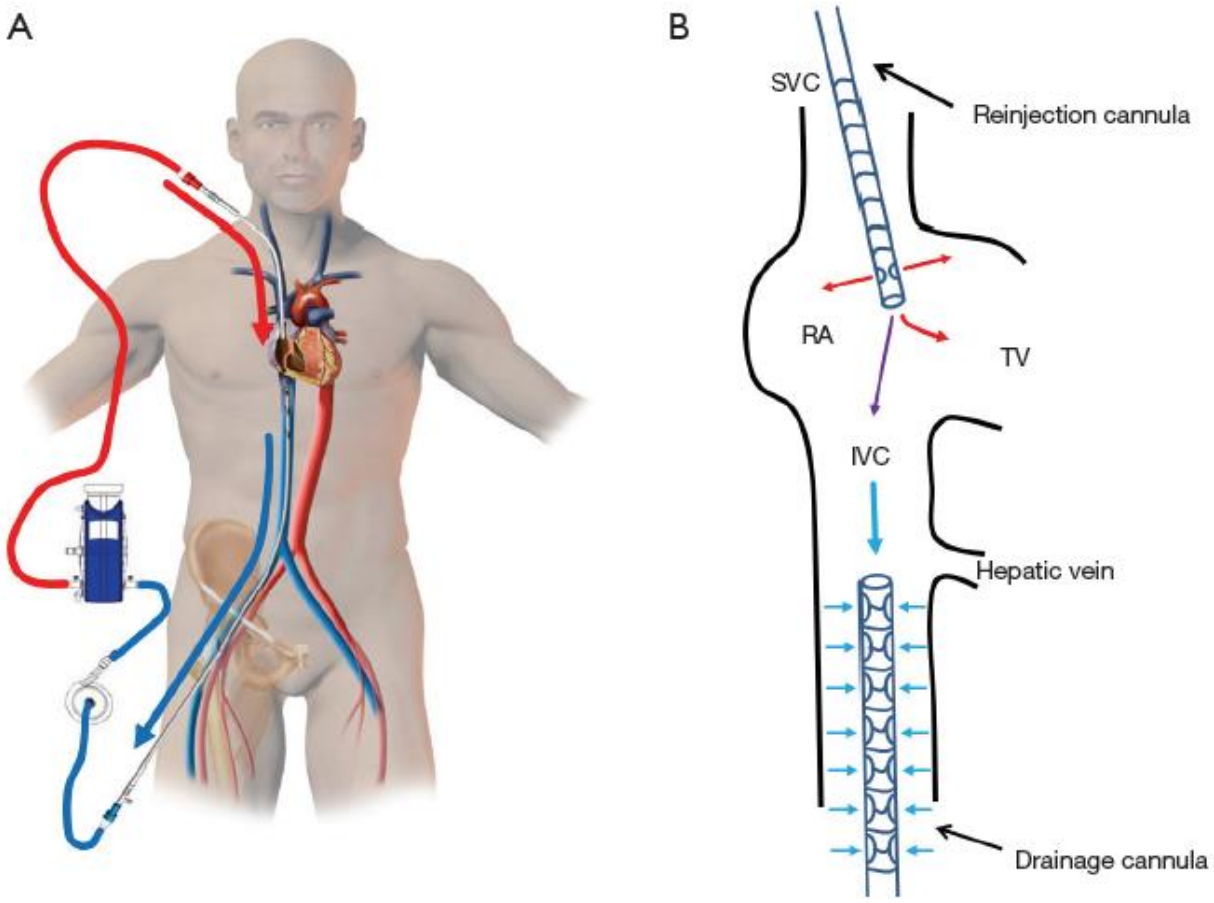
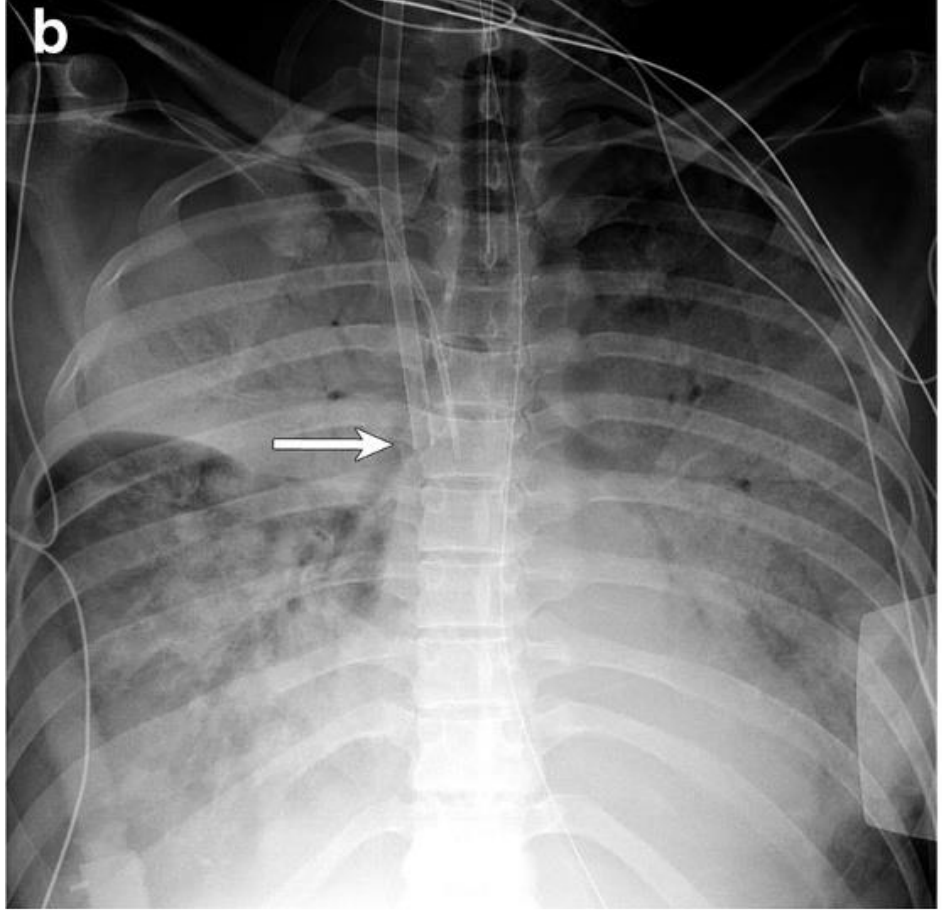
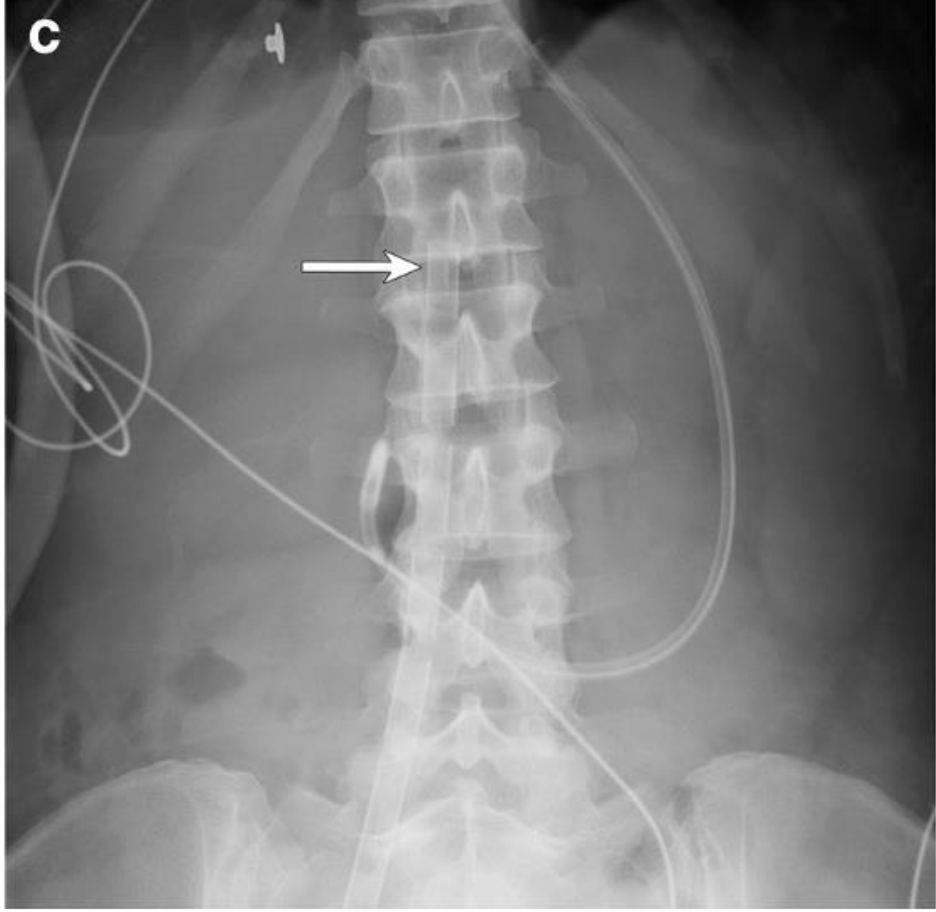


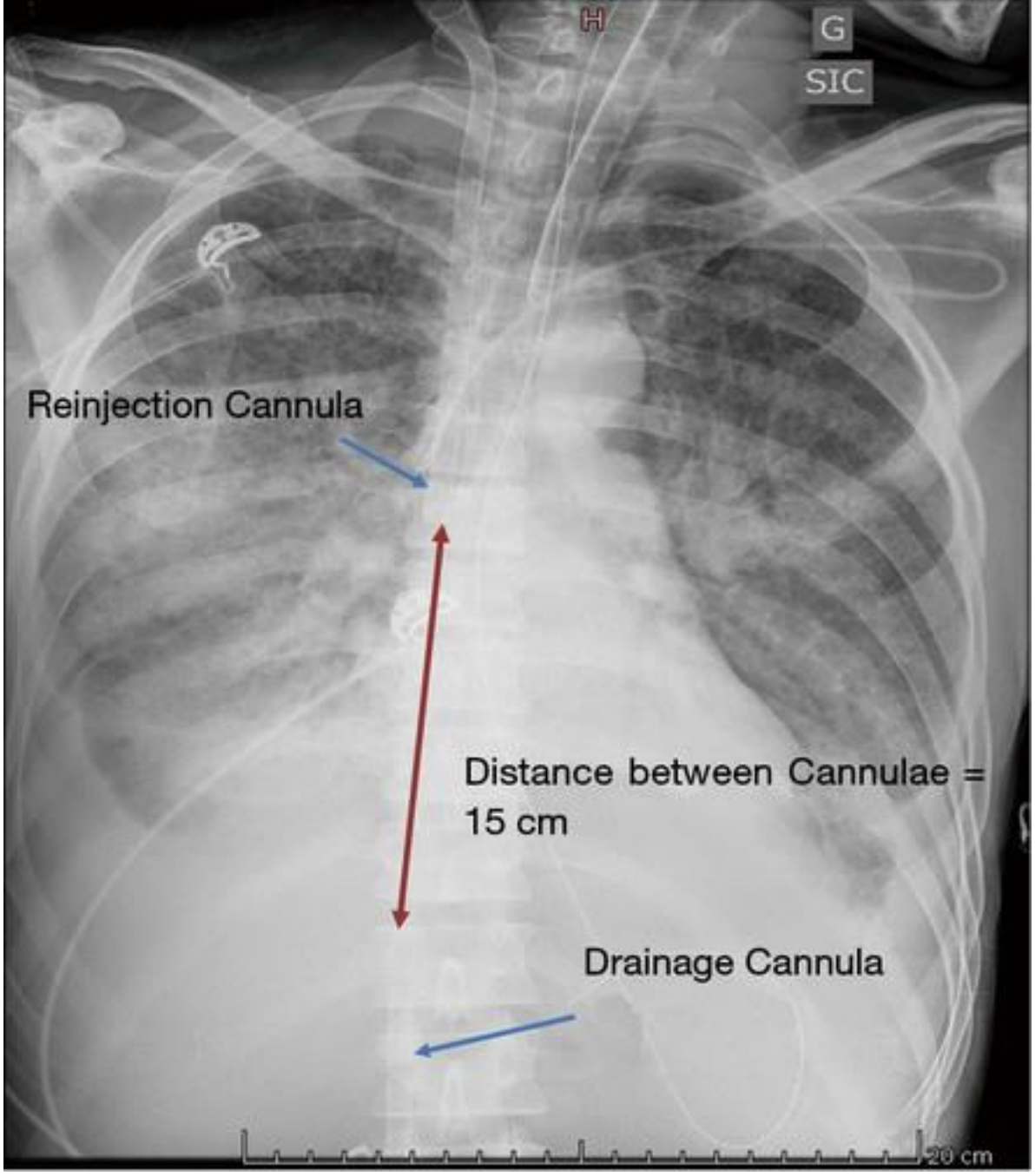
Figure 1 Classical double VV-ECMO cannulation. (A) Femoro-jugular VV-ECMO; (B) the venous drainage is achieved via a large multiport cannula introduced into the femoral vein and advanced at the junction between the inferior vena cava (IVC) and the right atrium (RA); the reinjection is performed via an arterial cannula introduced into the right internal jugular vein and advanced through the superior vena cava (SVC) into the RA, in front of the tricuspid valve (TV). VV-ECMO, veno-venous extracorporeal membrane oxygenation.

J Thorac Dis 2016;8(12):3762-3773





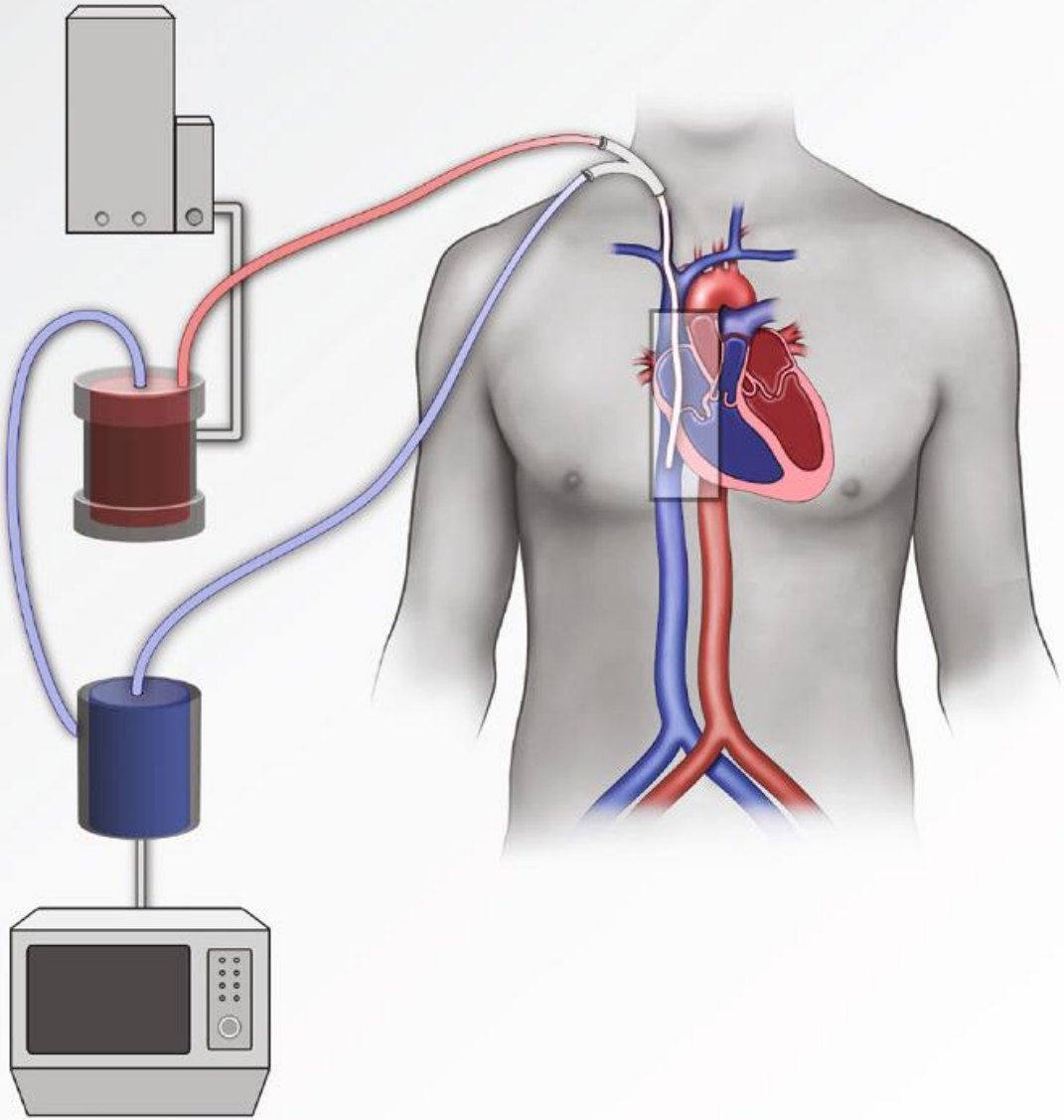
Insights Imaging (2014) 5:731–742

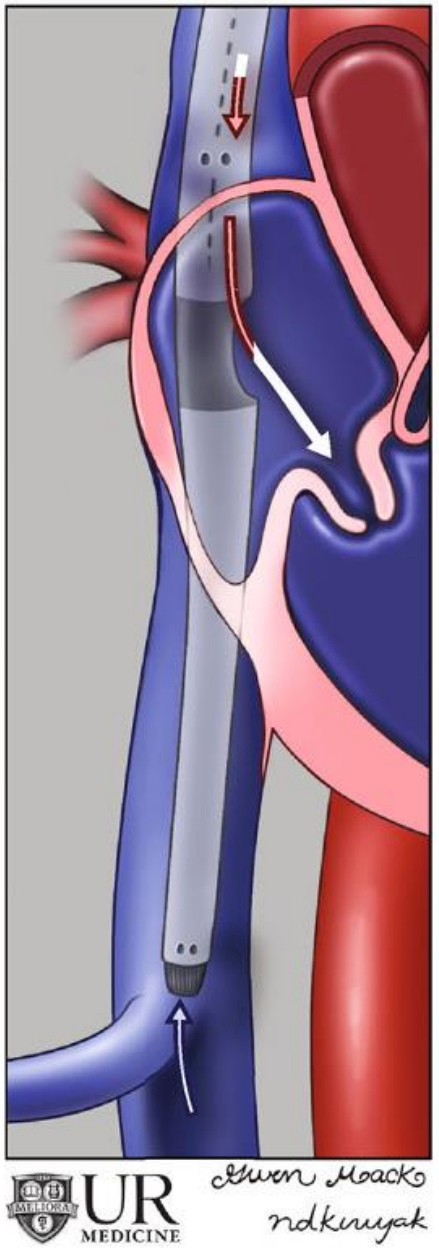


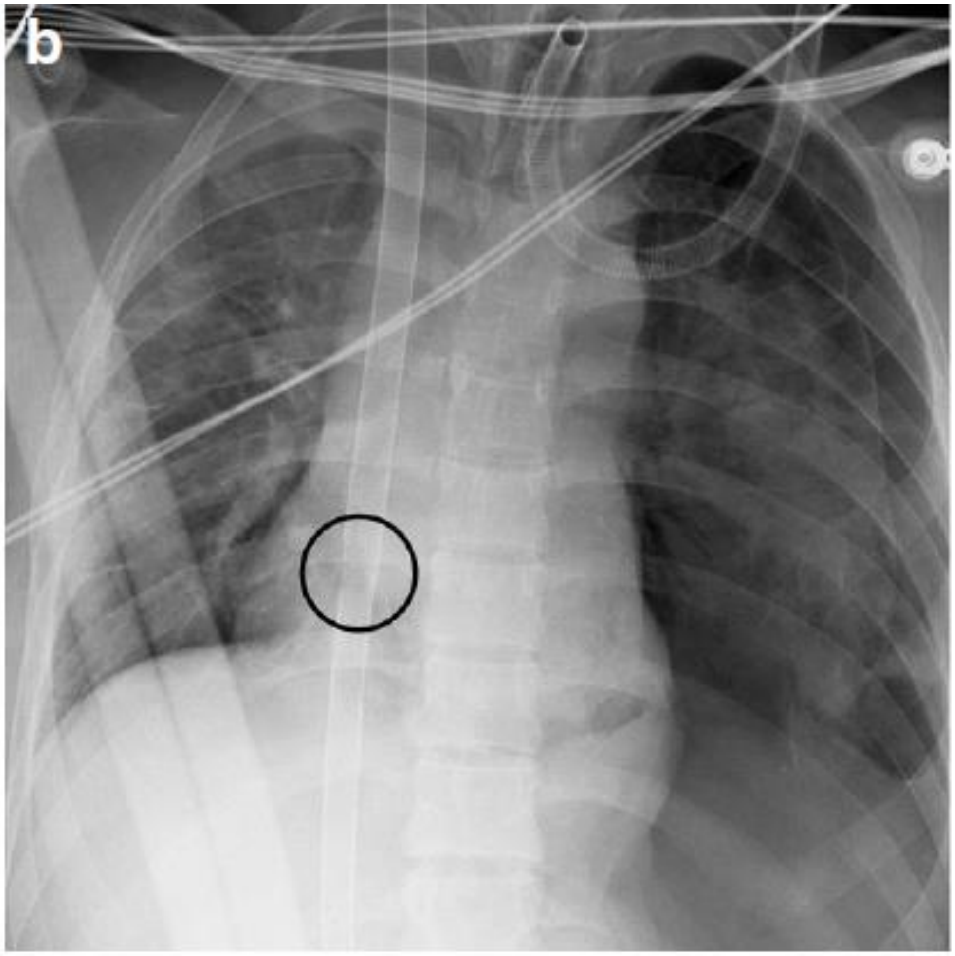
correct distance between drainage and reinjection cannulae

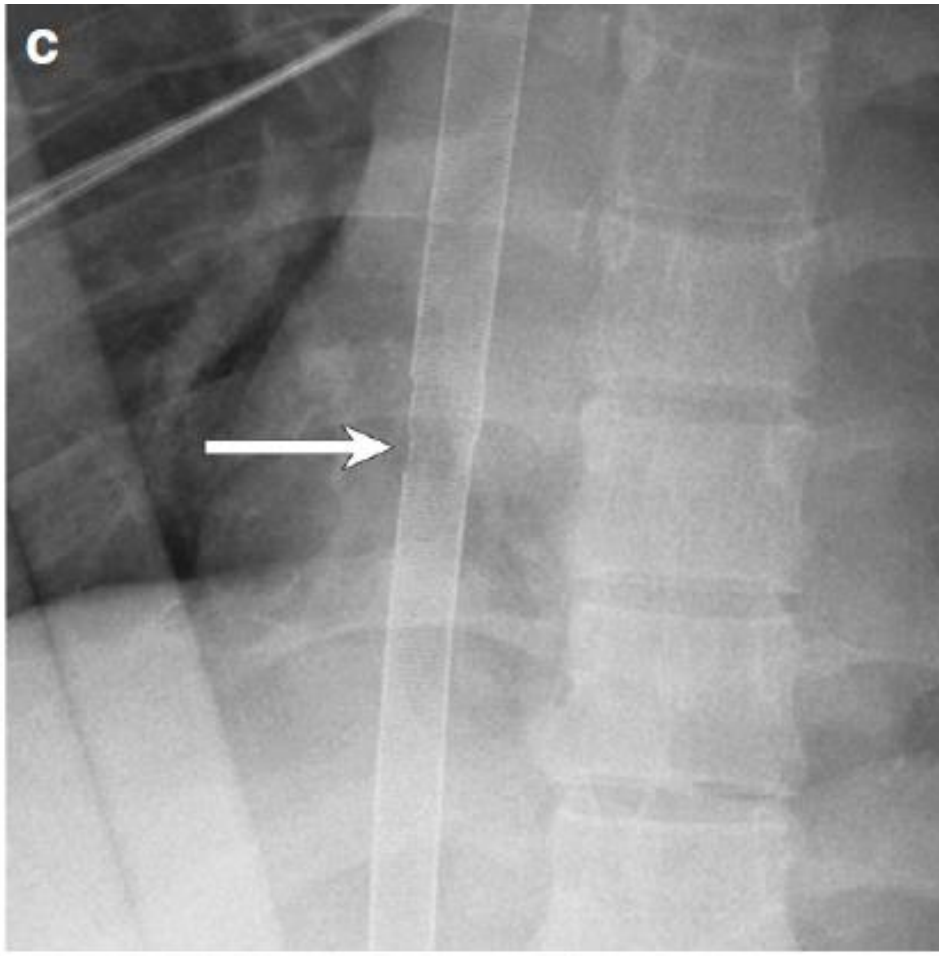
J Thorac Dis 2016;8(12):3762-3773

dual lumen, single cannula VV ECMO



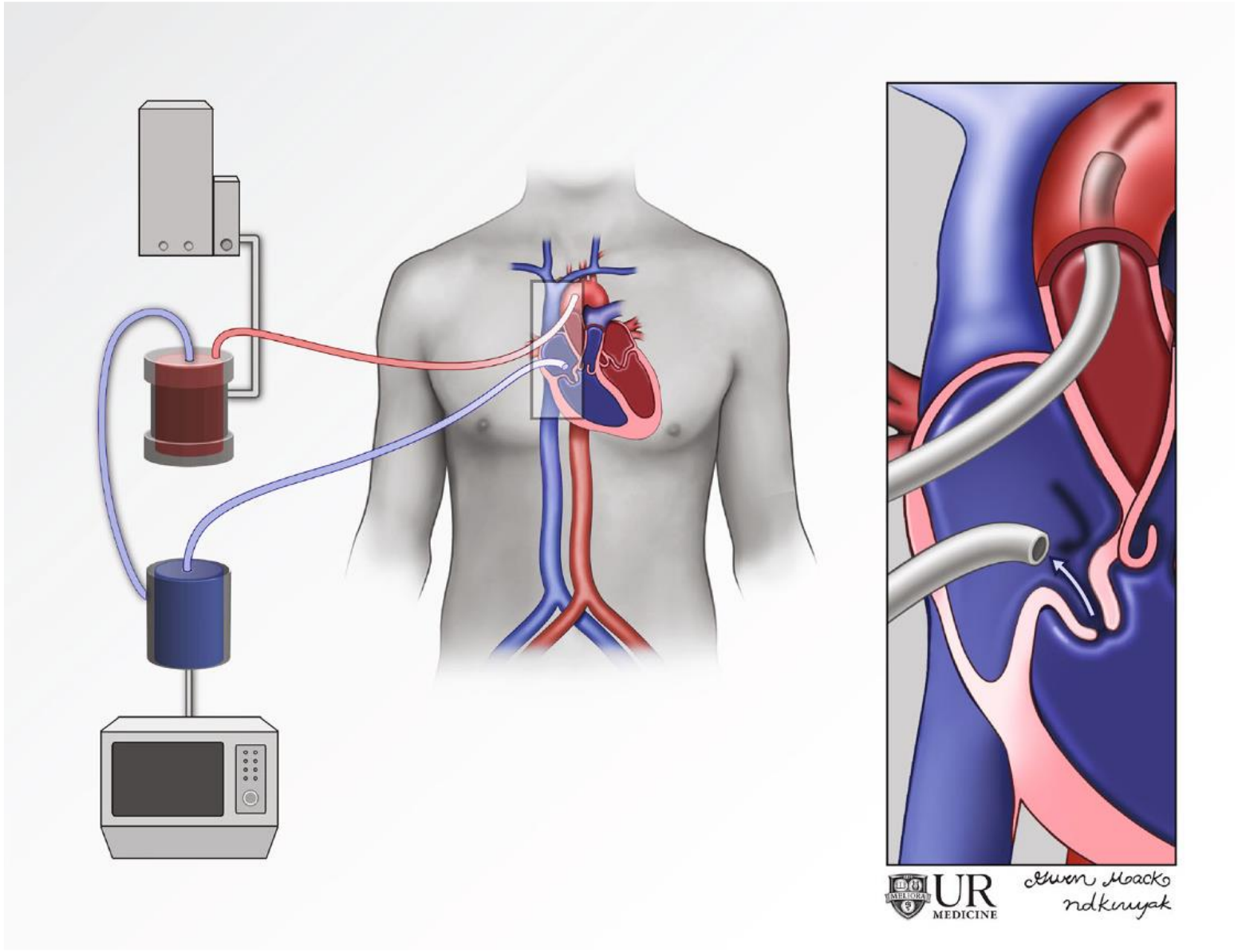


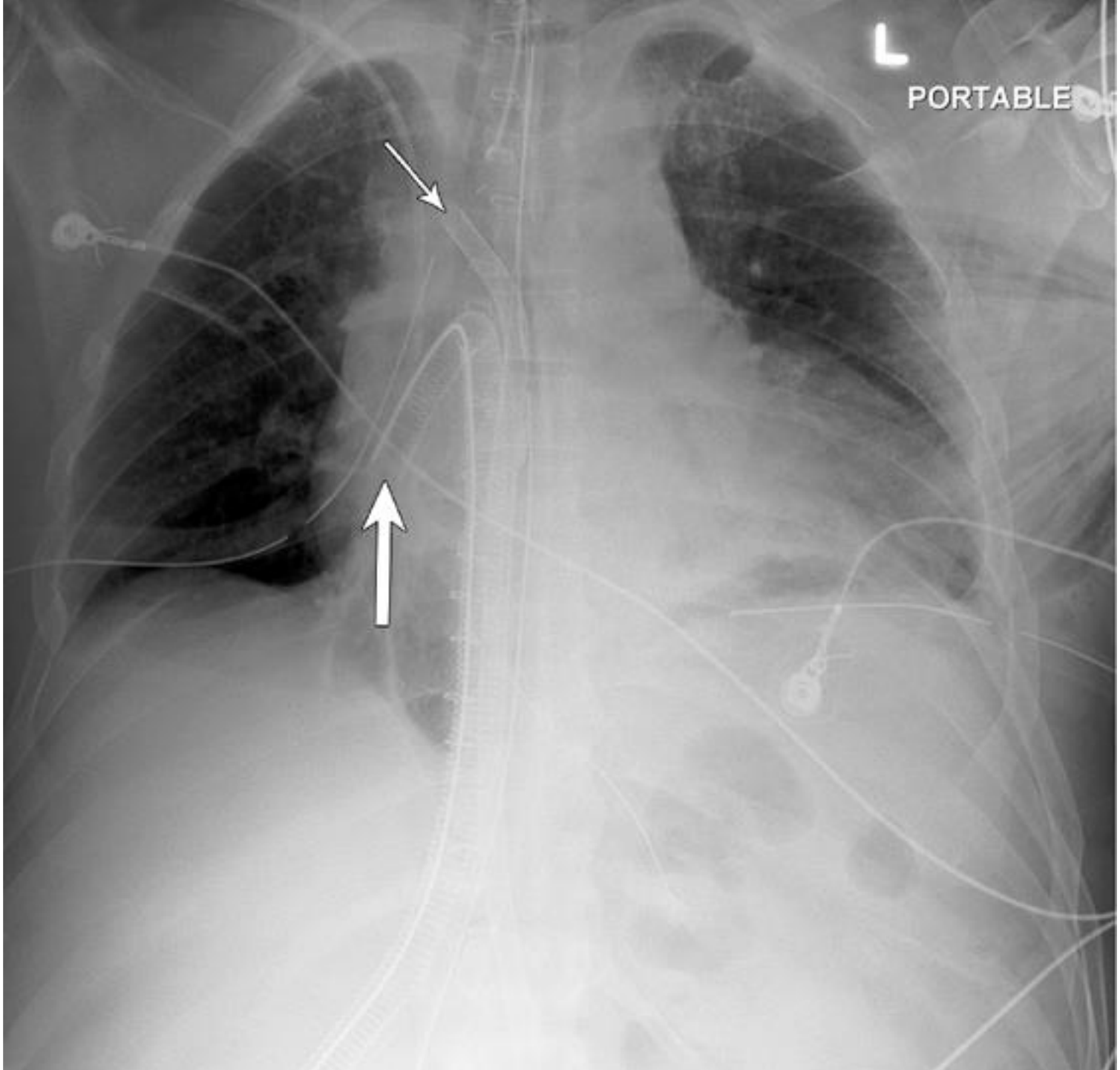




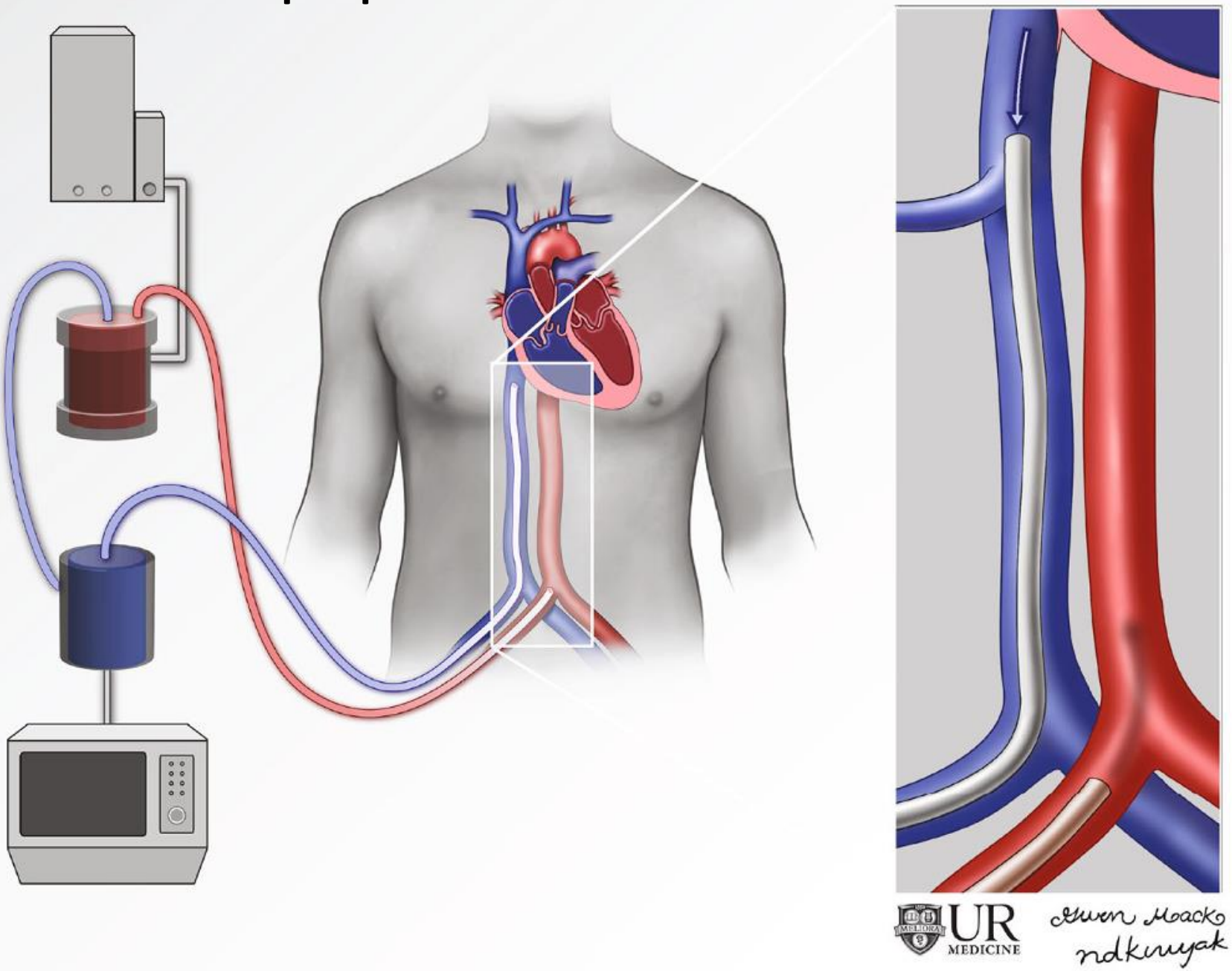
Insights Imaging (2014) 5:731–742

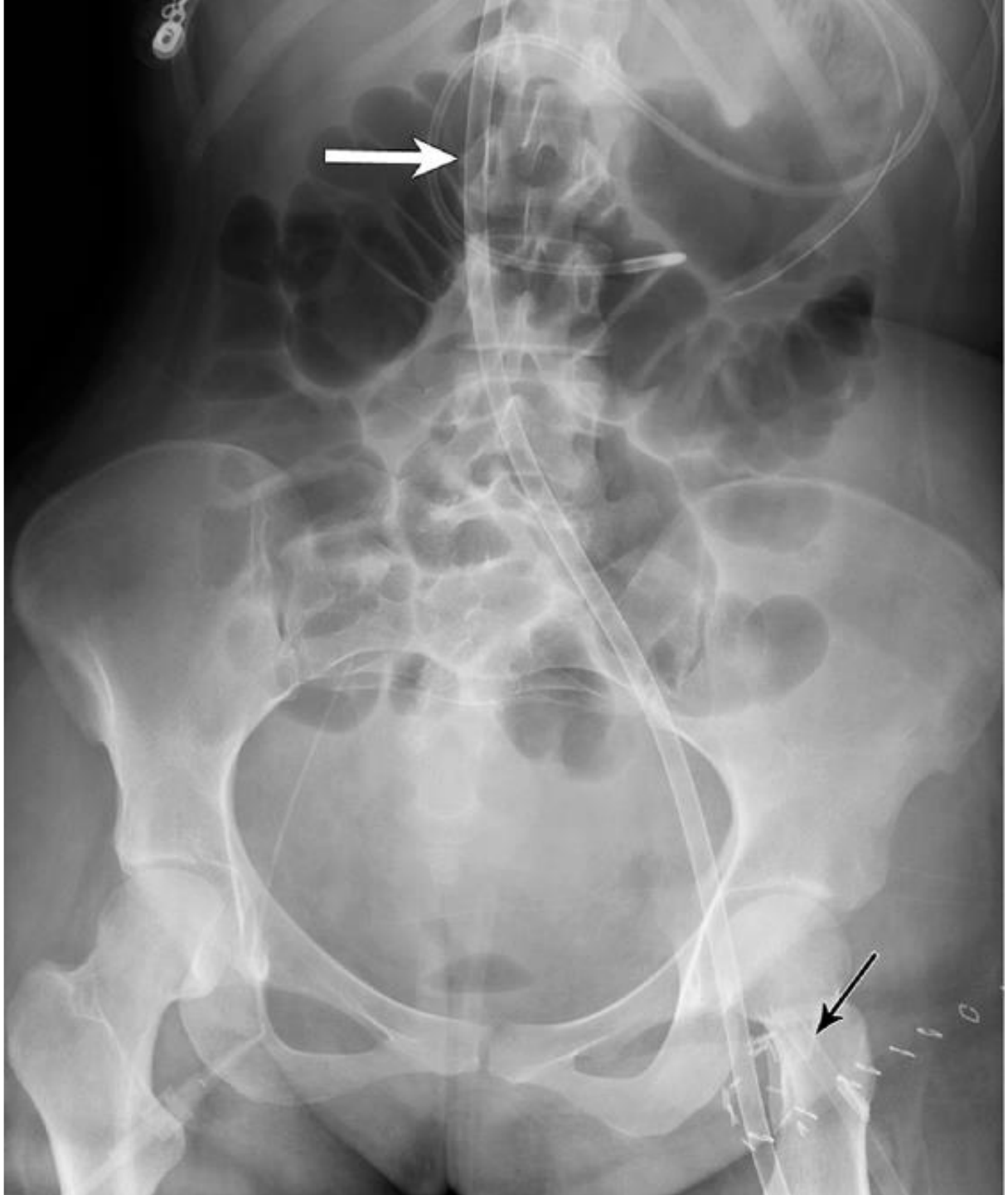
Mediastinal (central) VA ECMO



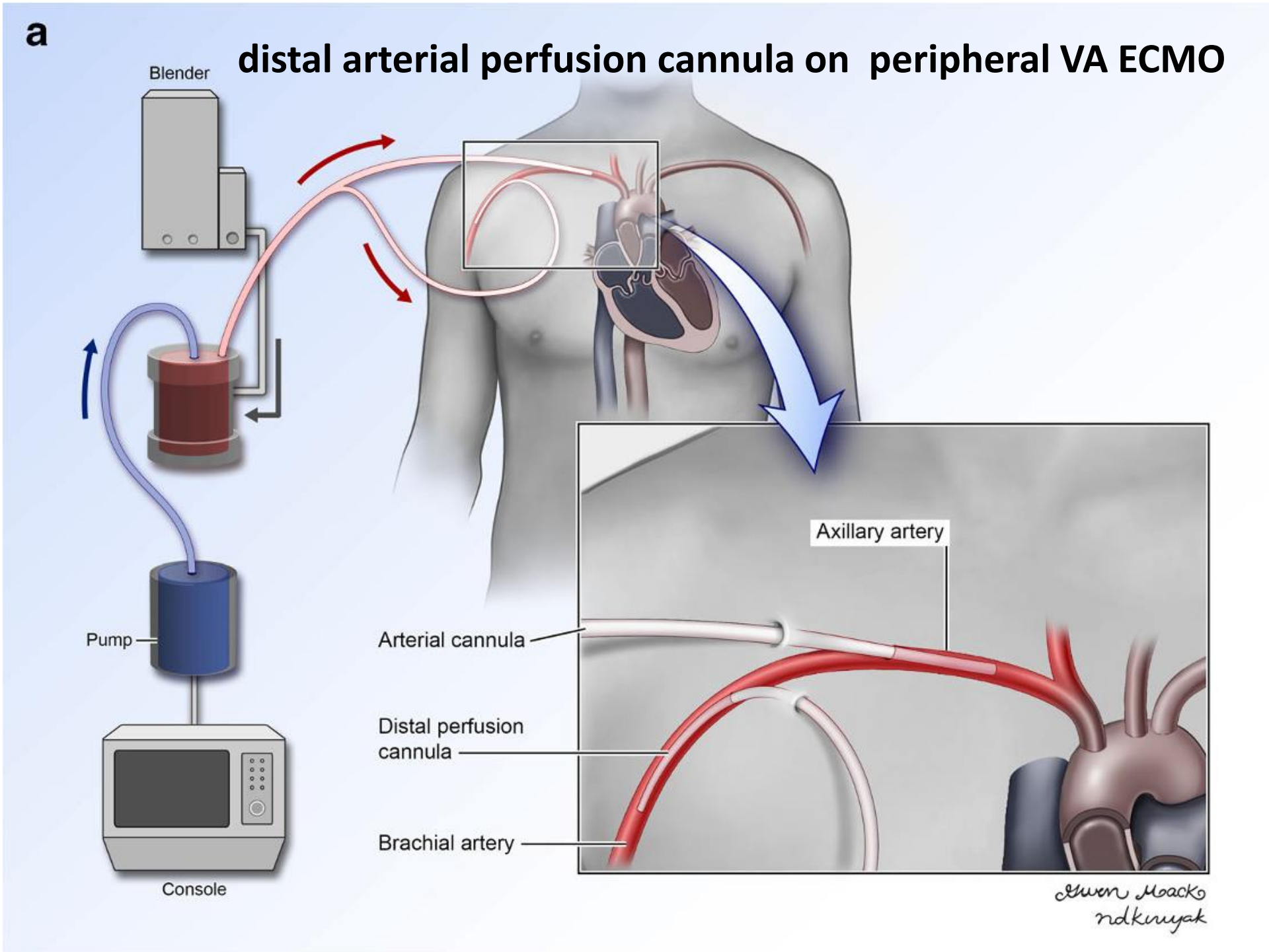

L
PORTABLE

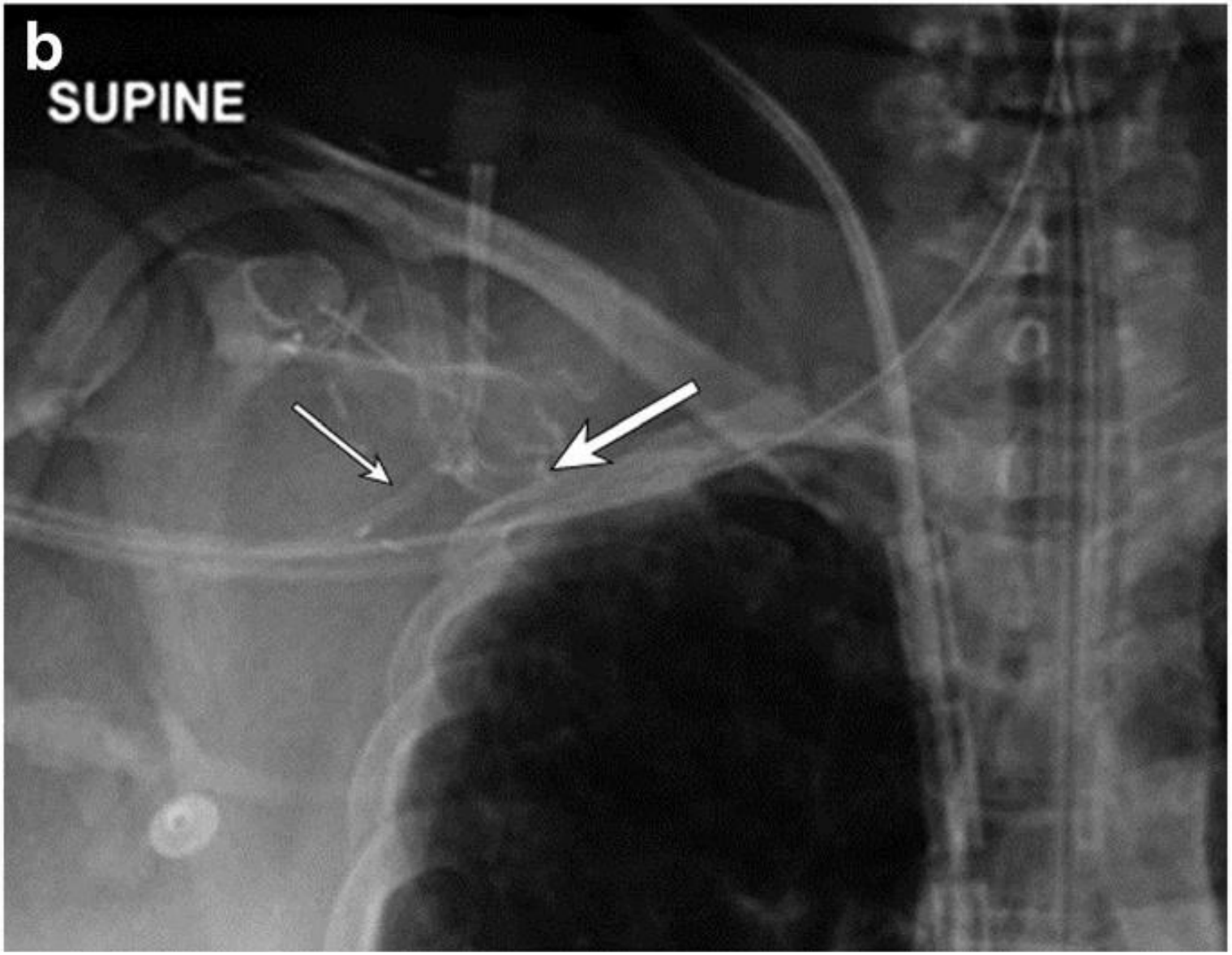
peripheral VA ECMO



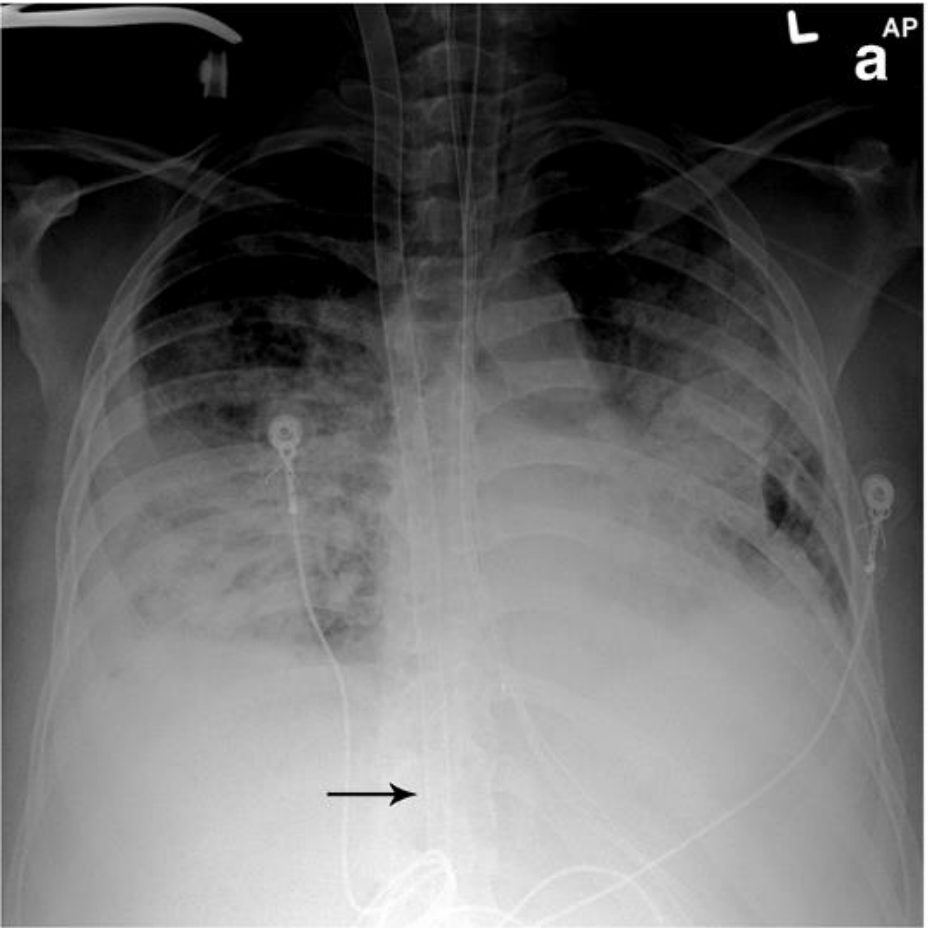


distal arterial perfusion cannula on peripheral VA ECMO

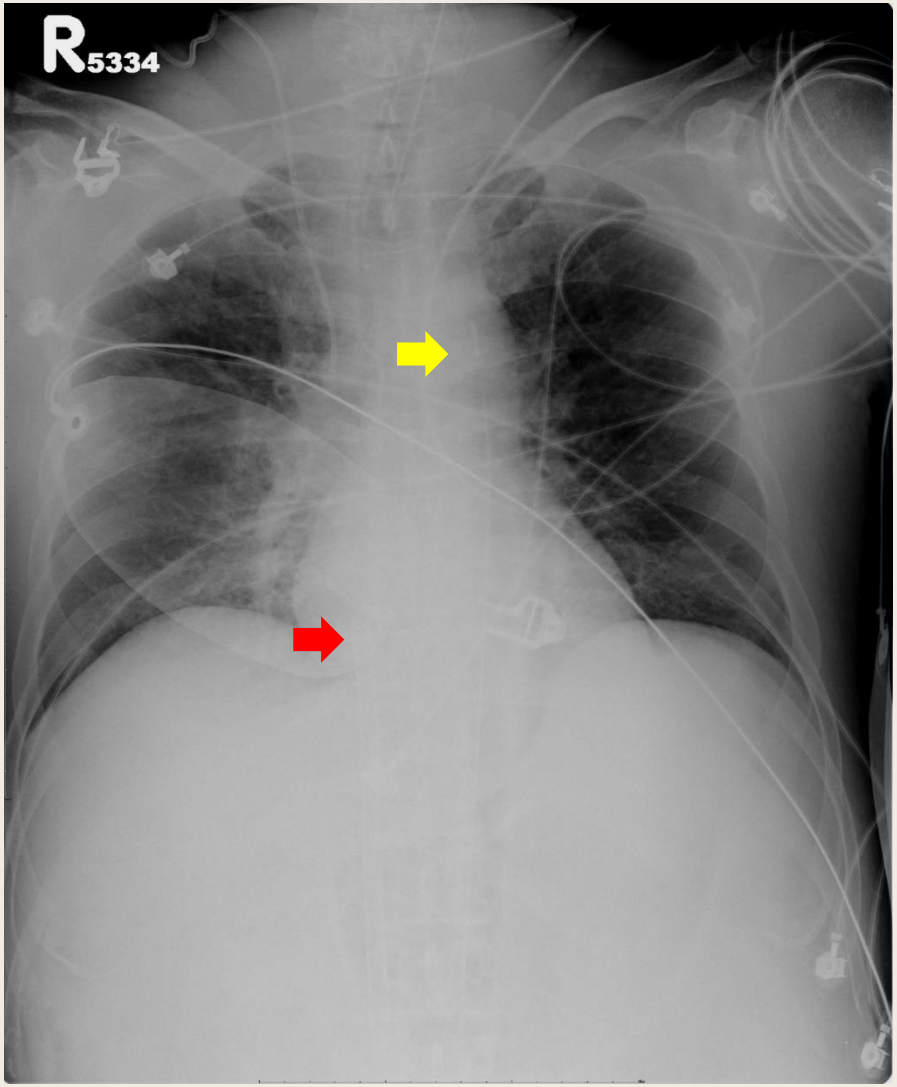



b
SUPINE

Malpositioned cannulas

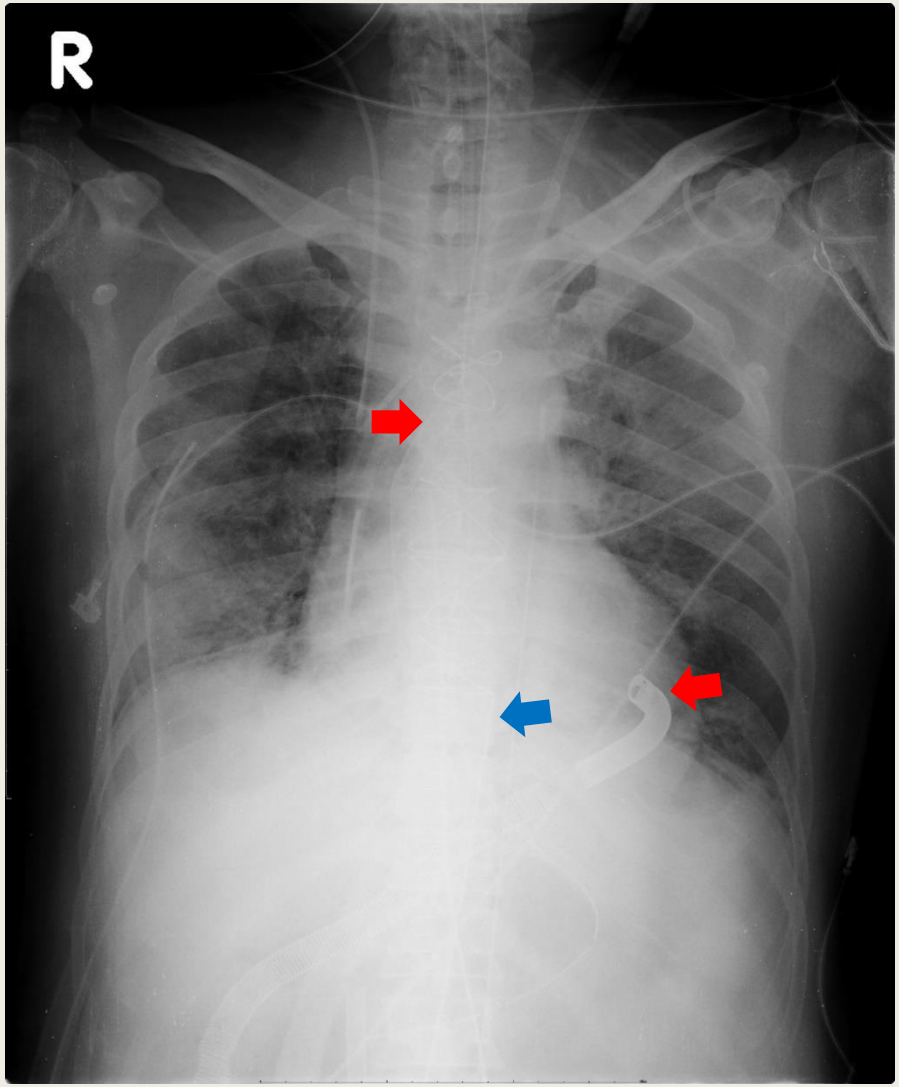


Insights Imaging (2014) 5:731–742



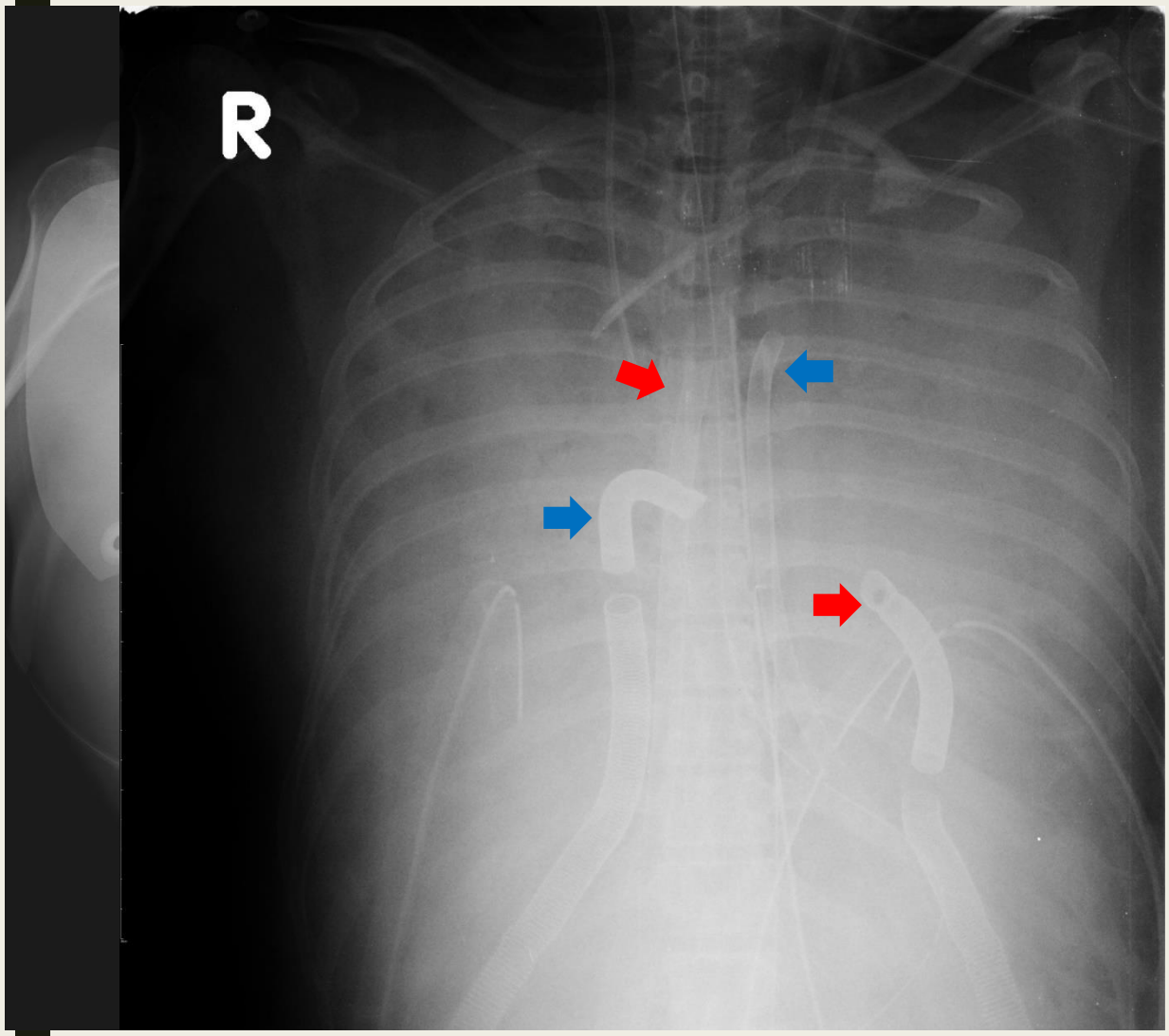
62 – year – old male with history of STEMI, just discharged

IHCA at ER s/p ECPR



58 – year – old male with history of STEMI, s/p emergent CABG, could not be weaned from VA-ECMO

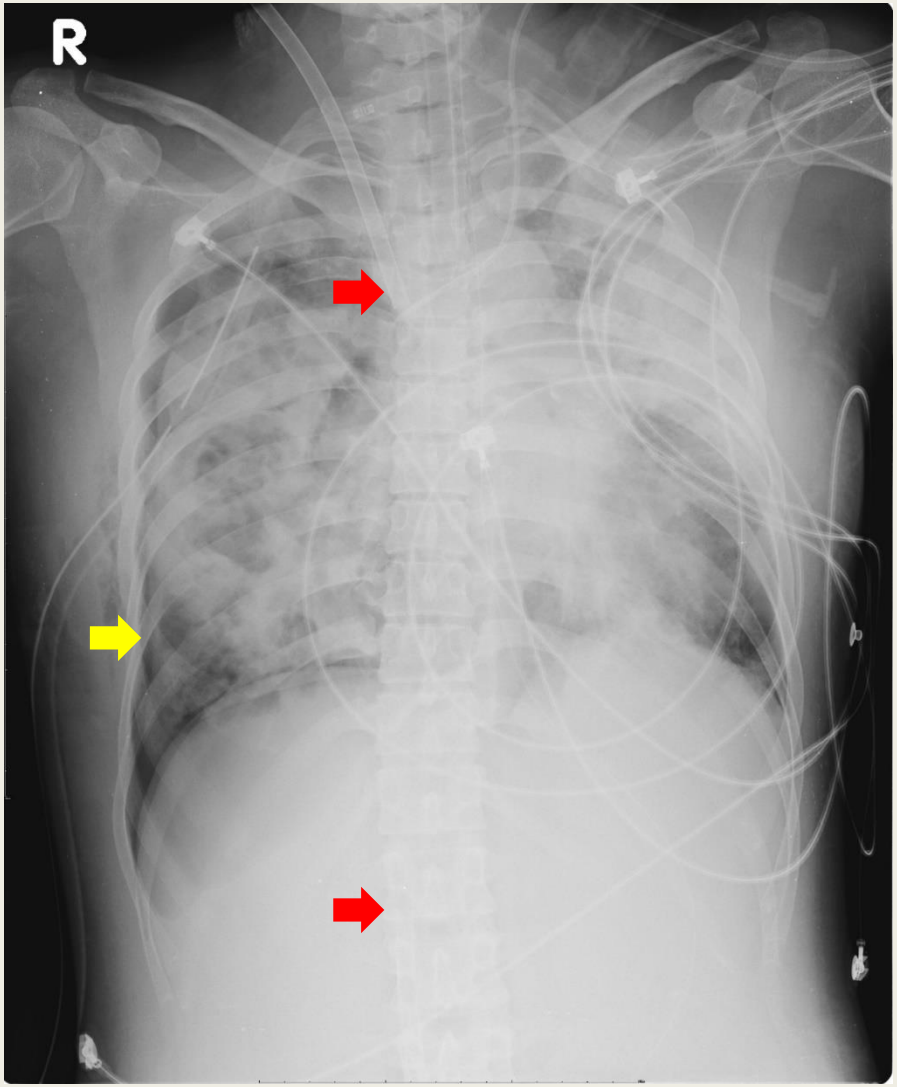
Shifted to LVAD with RV drain (陰陽海)



37 – year - old female

Acute myocarditis s/p VA-ECMO

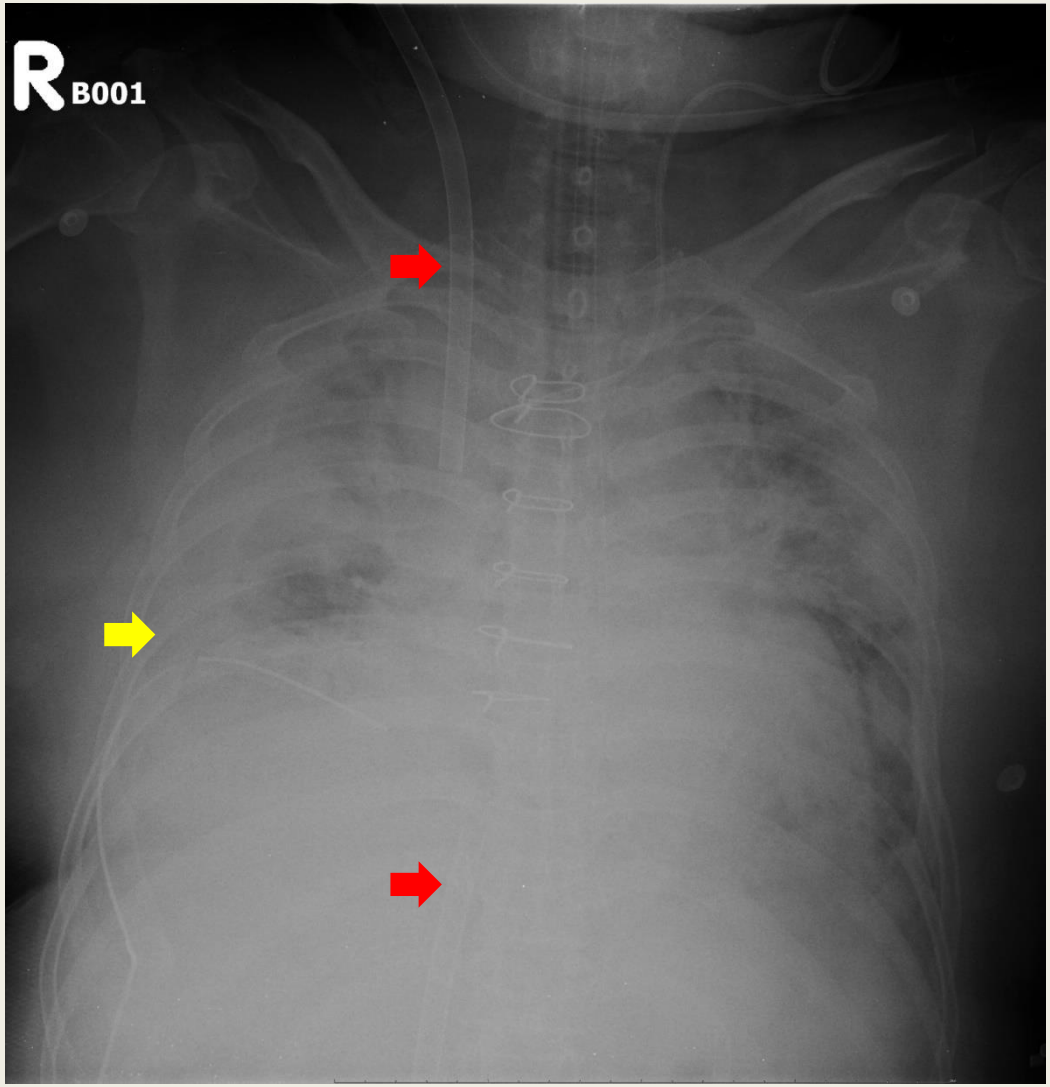
Bi-ventricular failure, shifted to BVAD + oxygenator



38 – year - old female

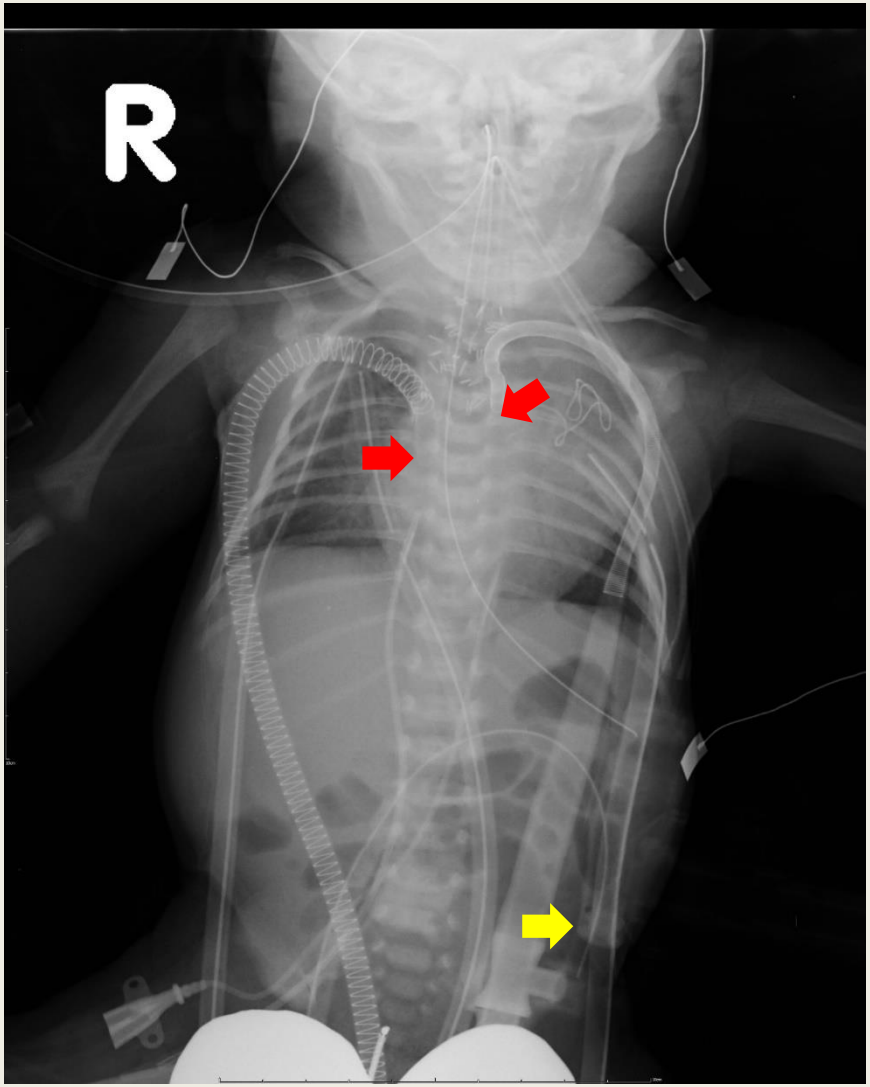
Flu B with secondary MRSA pneumonia and ARDS

s/p VV-ECMO



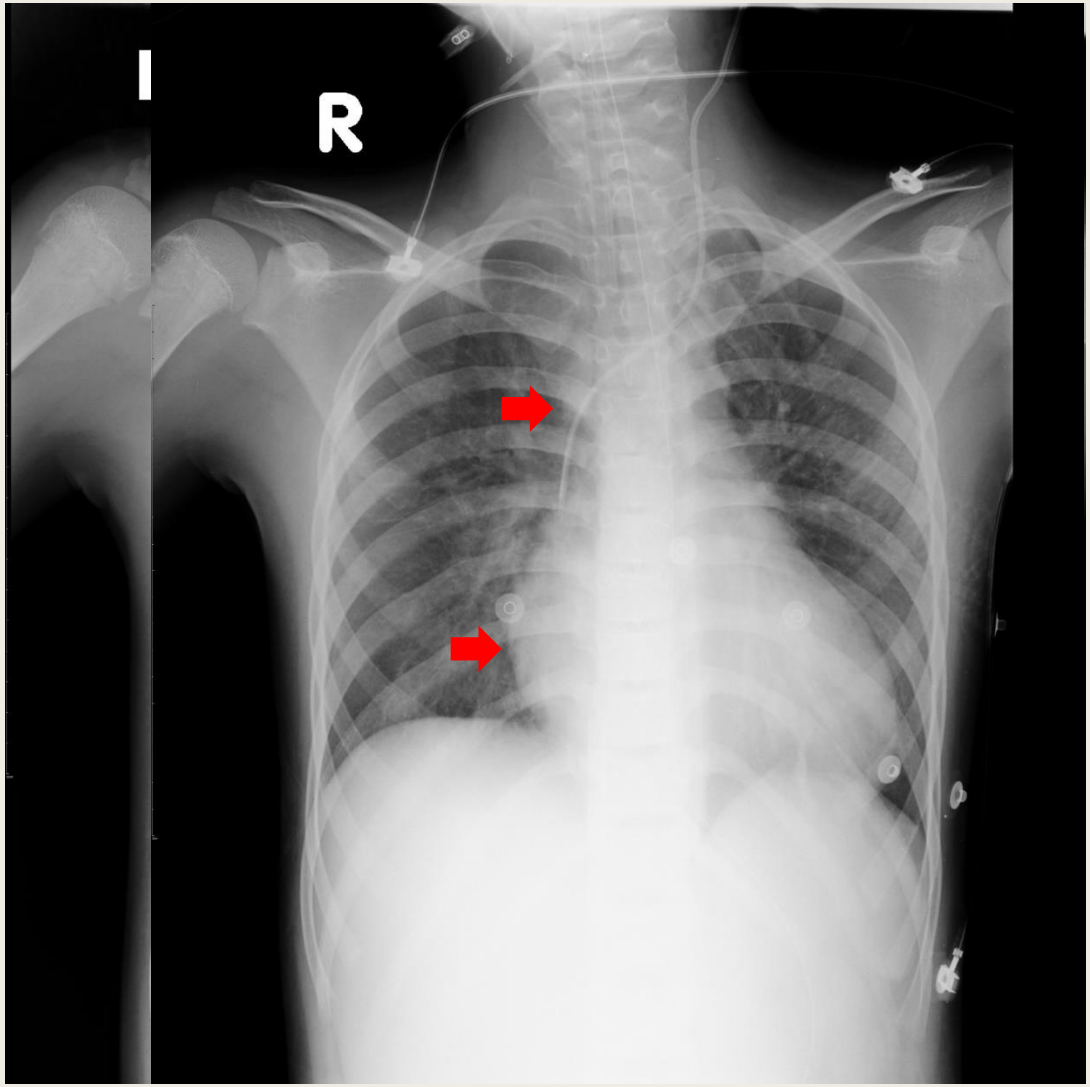
52 – year - old female

Flu A with ARDS, s/p VV-ECMO, oxygenation improving



Newborn girl

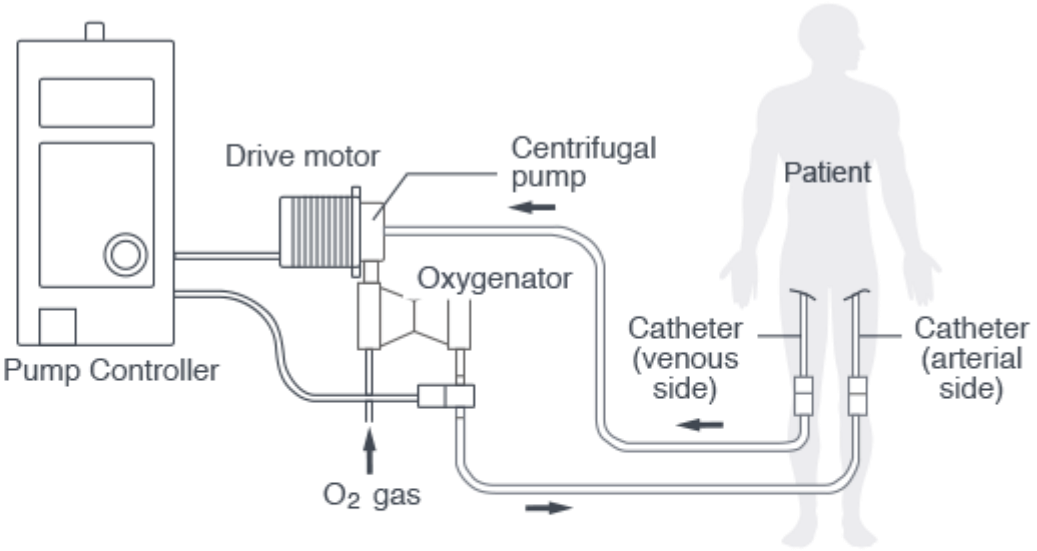
Interrupted aortic arch, type B, s/p Norwood stage I, under central VA-ECMO support



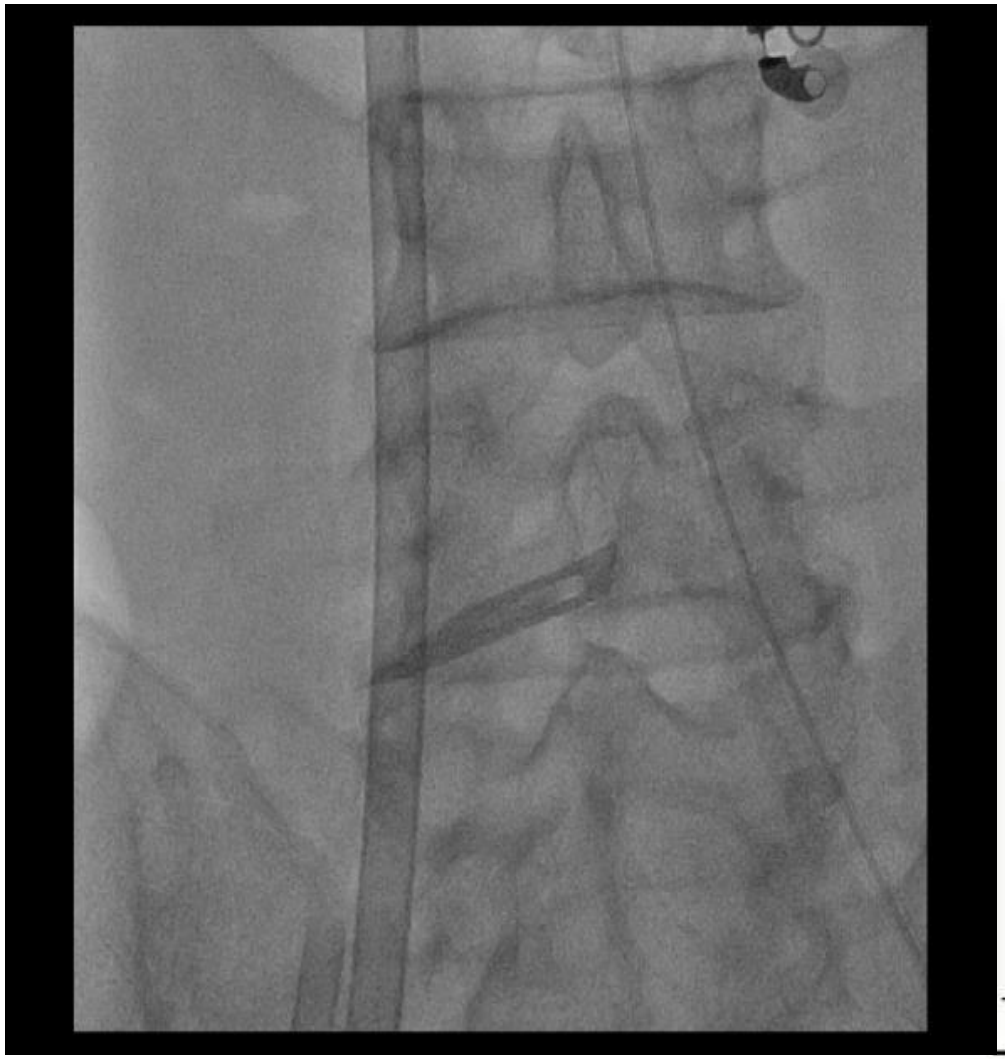
10 – year - old girl

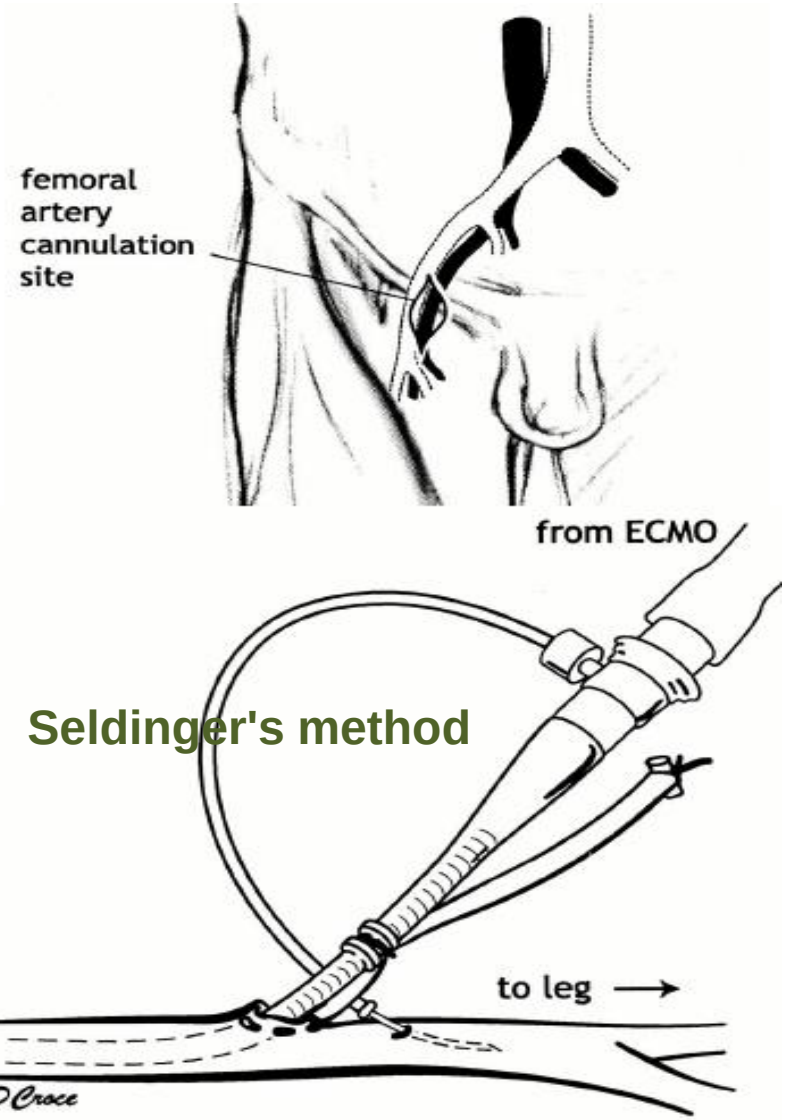
Ebstein anomaly with function pulmonary stenosis and RV failure

before / after ECMO

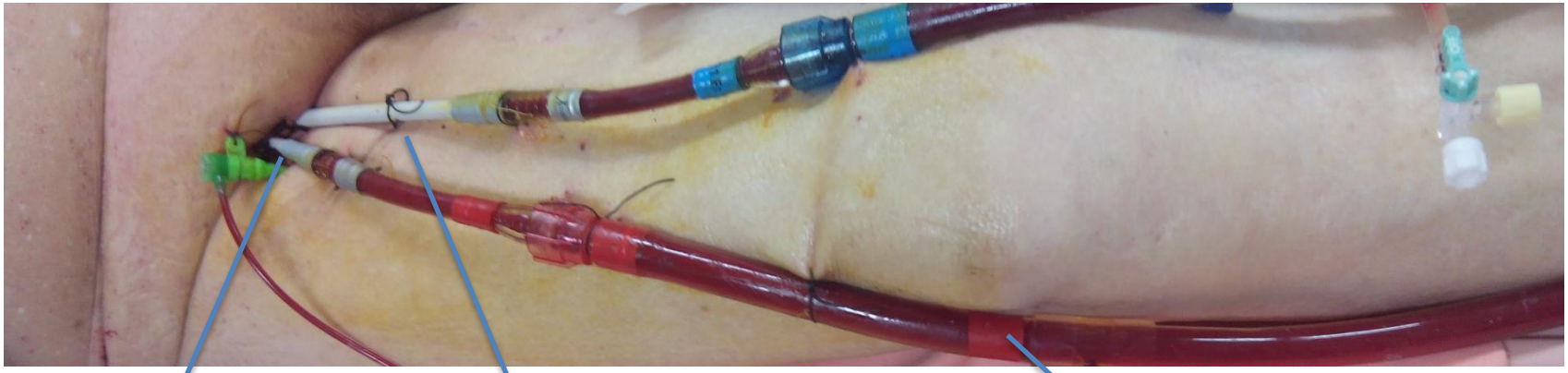

Drive motor
Centrifugal pump
Patient
Oxygenator
Catheter (venous side)
Catheter (arterial side)
Pump Controller
O_2 gas

天下第一關: 管子放不進去





Secure the vascular cannulae

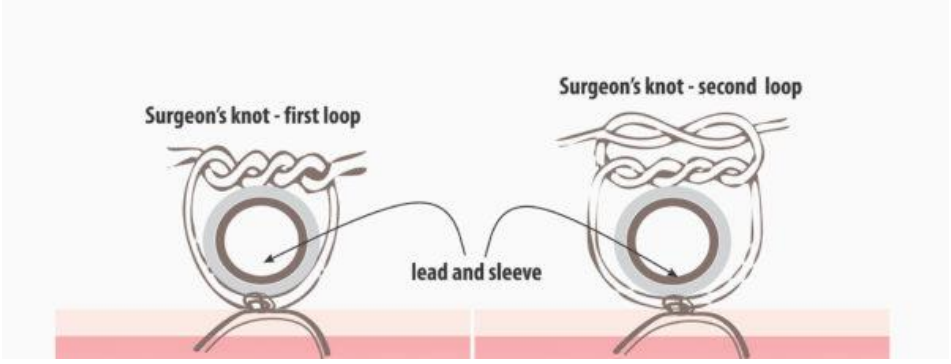


ㄇ字型suture, 小心鈎針, 避免傷到血管, 或管路. Tie緊可以減少很多puncture site oozing.

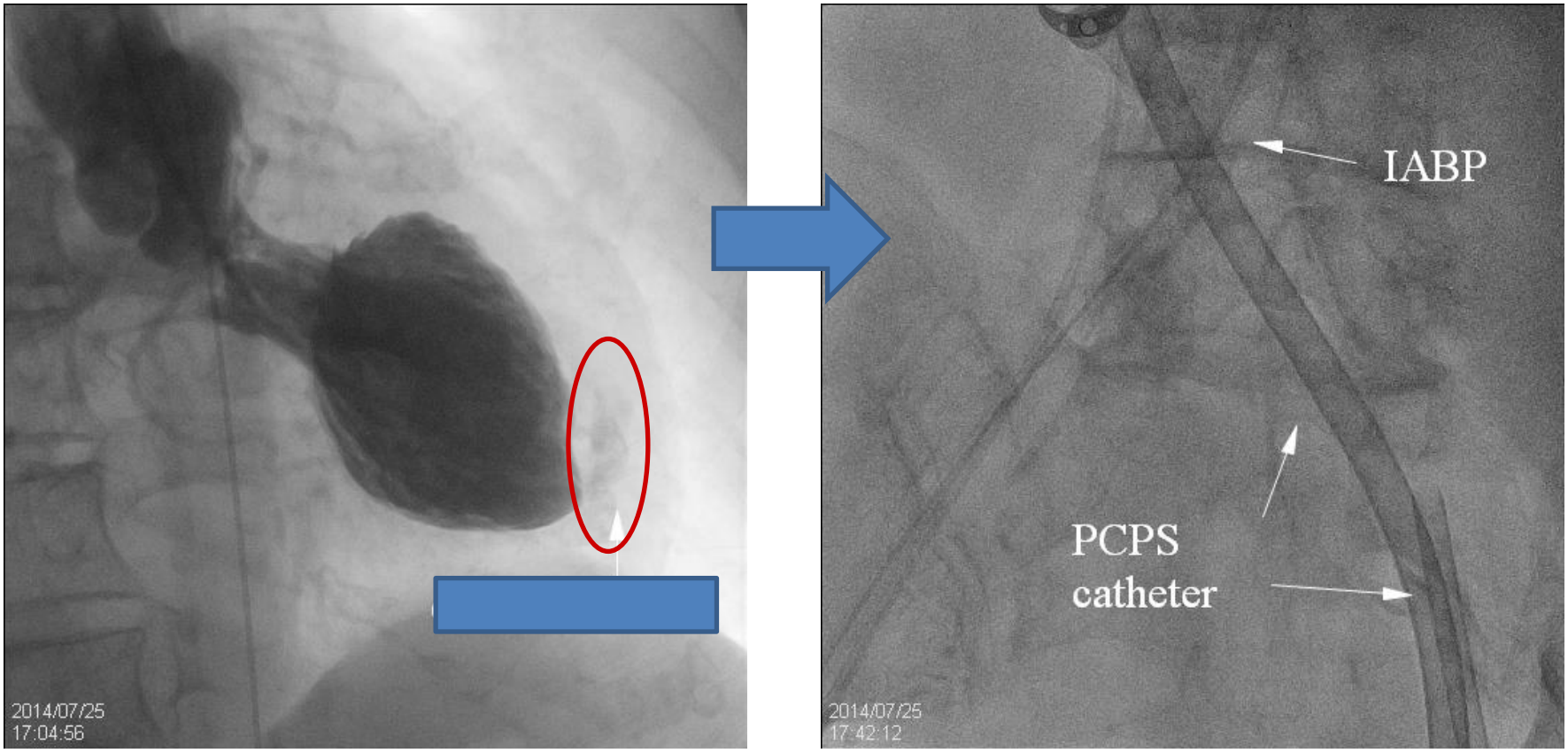
Roger method....要小心移位, 綁不緊的問題

固定針用anchor方式綁,一定要Tie緊, 盡量選擇在catheter有溝槽處tie線

Catheter應平放於病人的正面, 不應該固定在側邊, 避免不小心管路受壓迫



Post MI free wall rupture



PCPS+ IABP

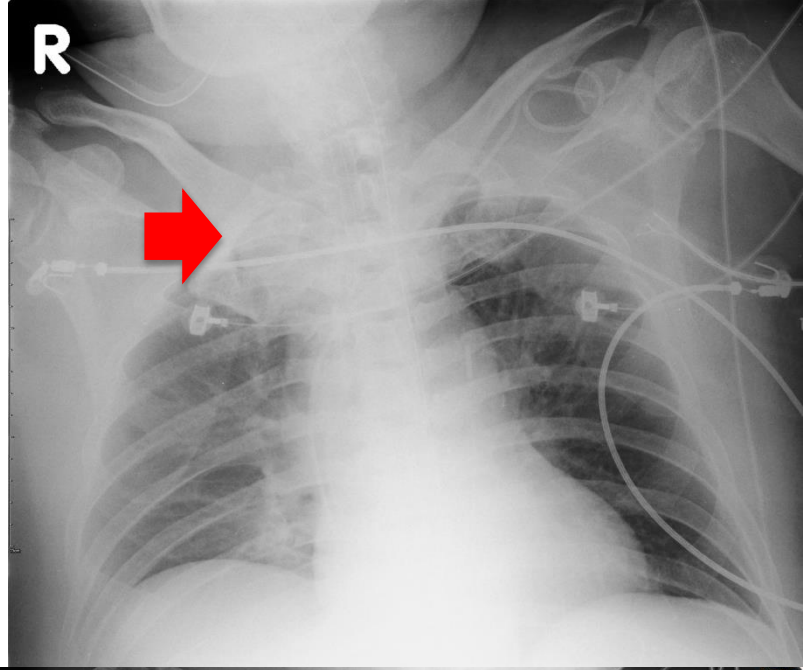
6 Fr pigtail for pericardiocentesis

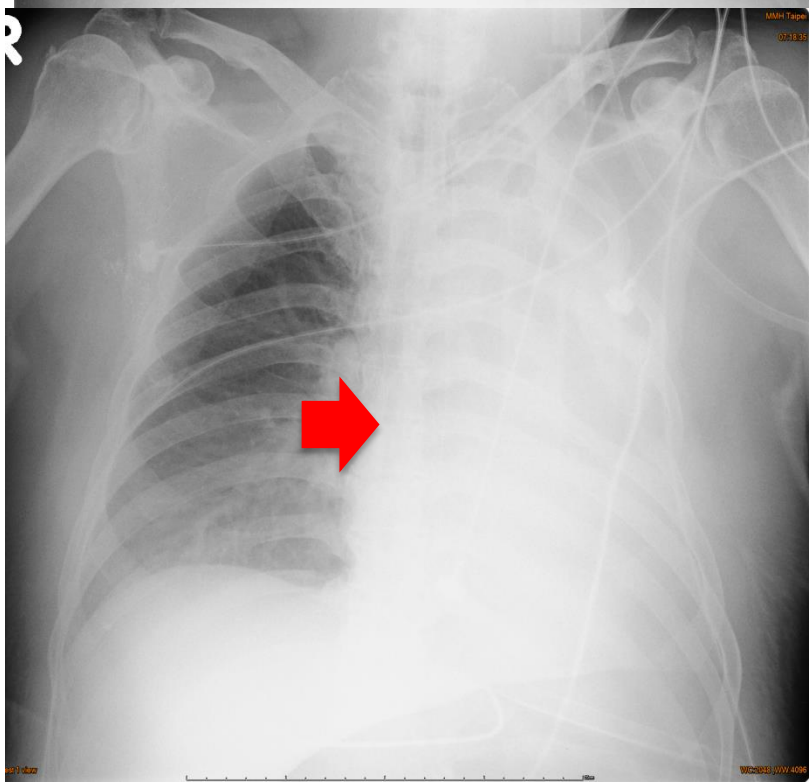
初階PEEP的使用&其重要性

- 病人多為coma or total sedation ➔ PEEP太低易造成lung collapse

- 一邊成人體型大約設在7-10 mmHg

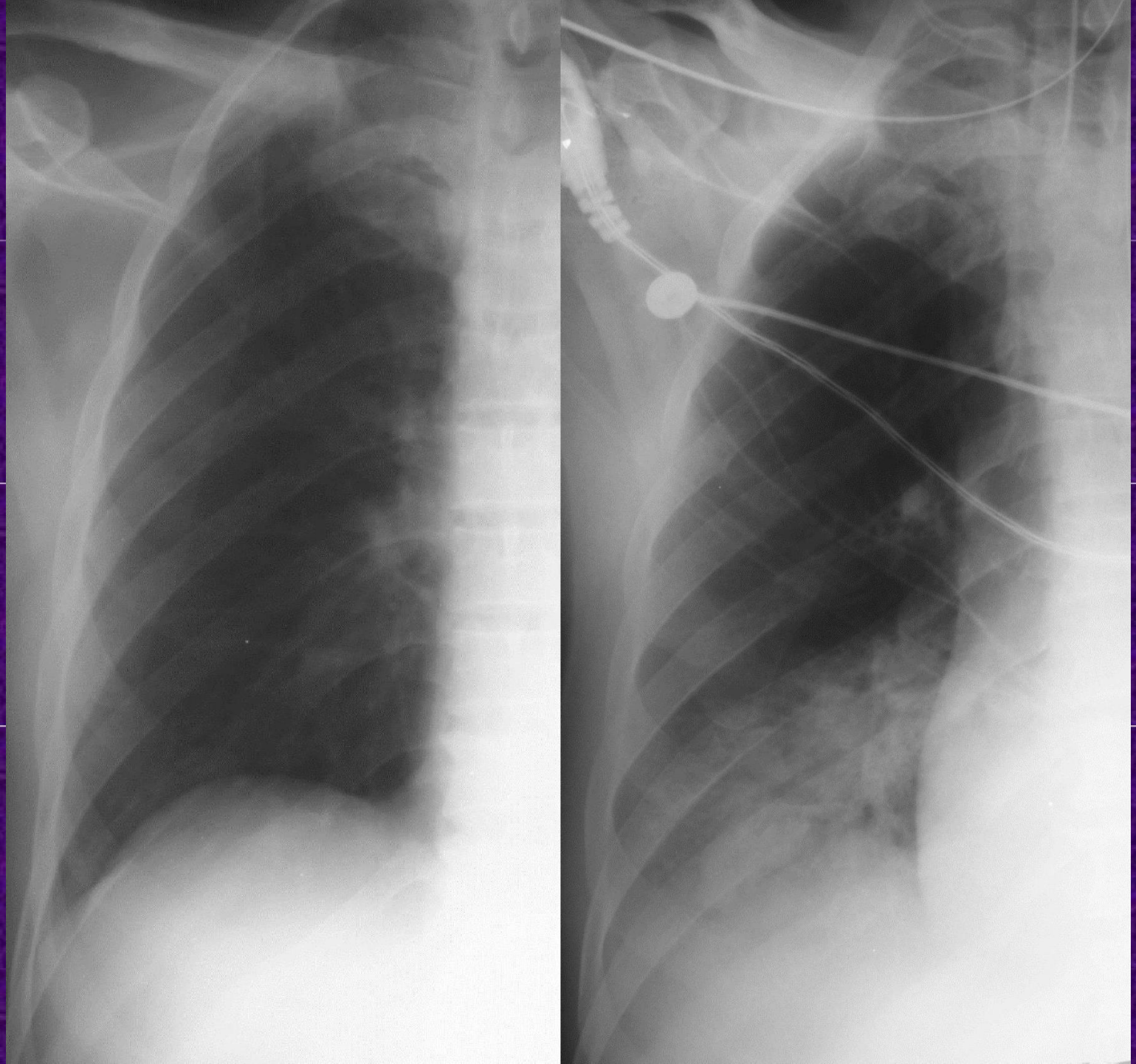
- Bronchoscopy to remove obstructed sputum or blood clot

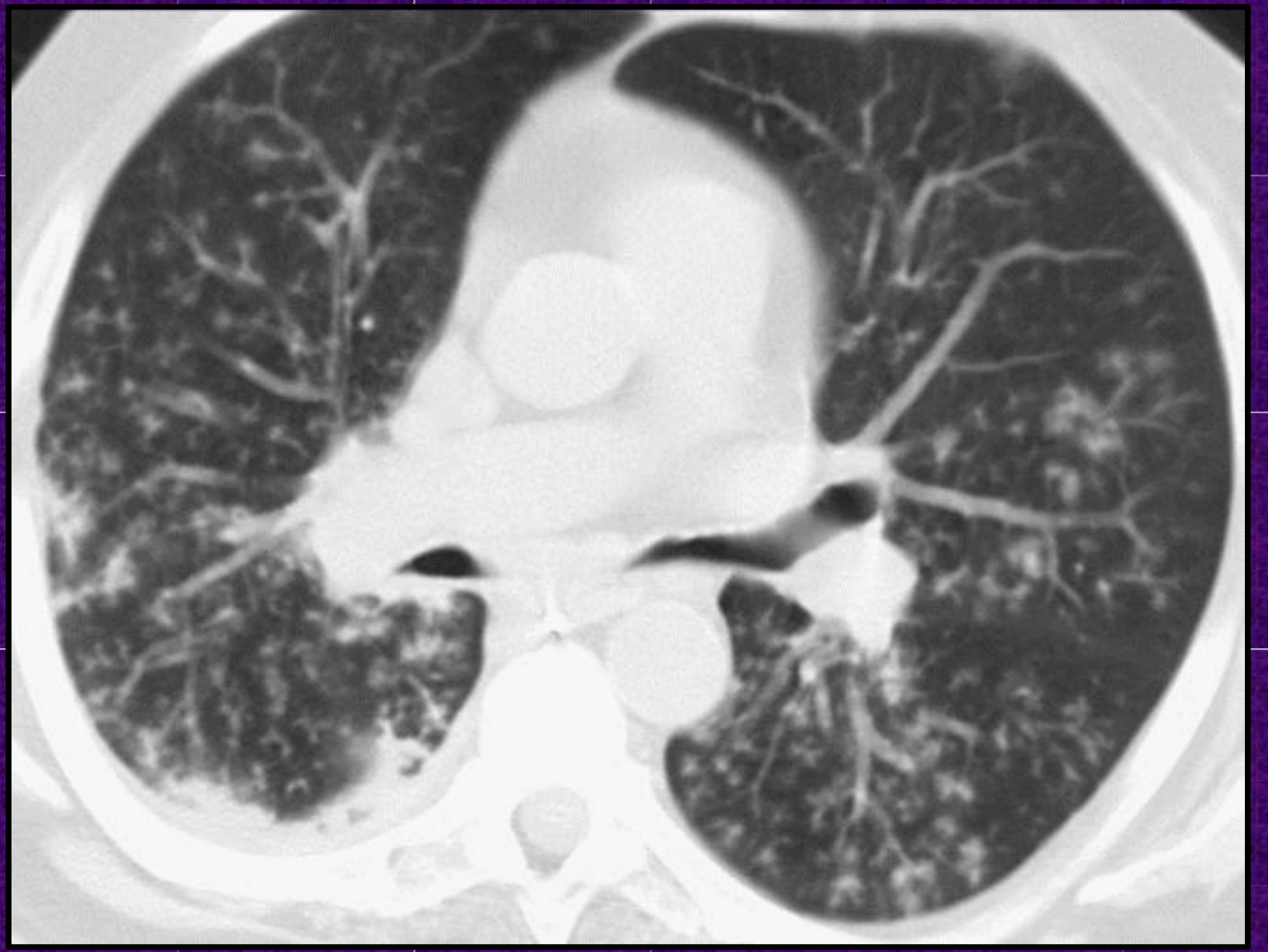


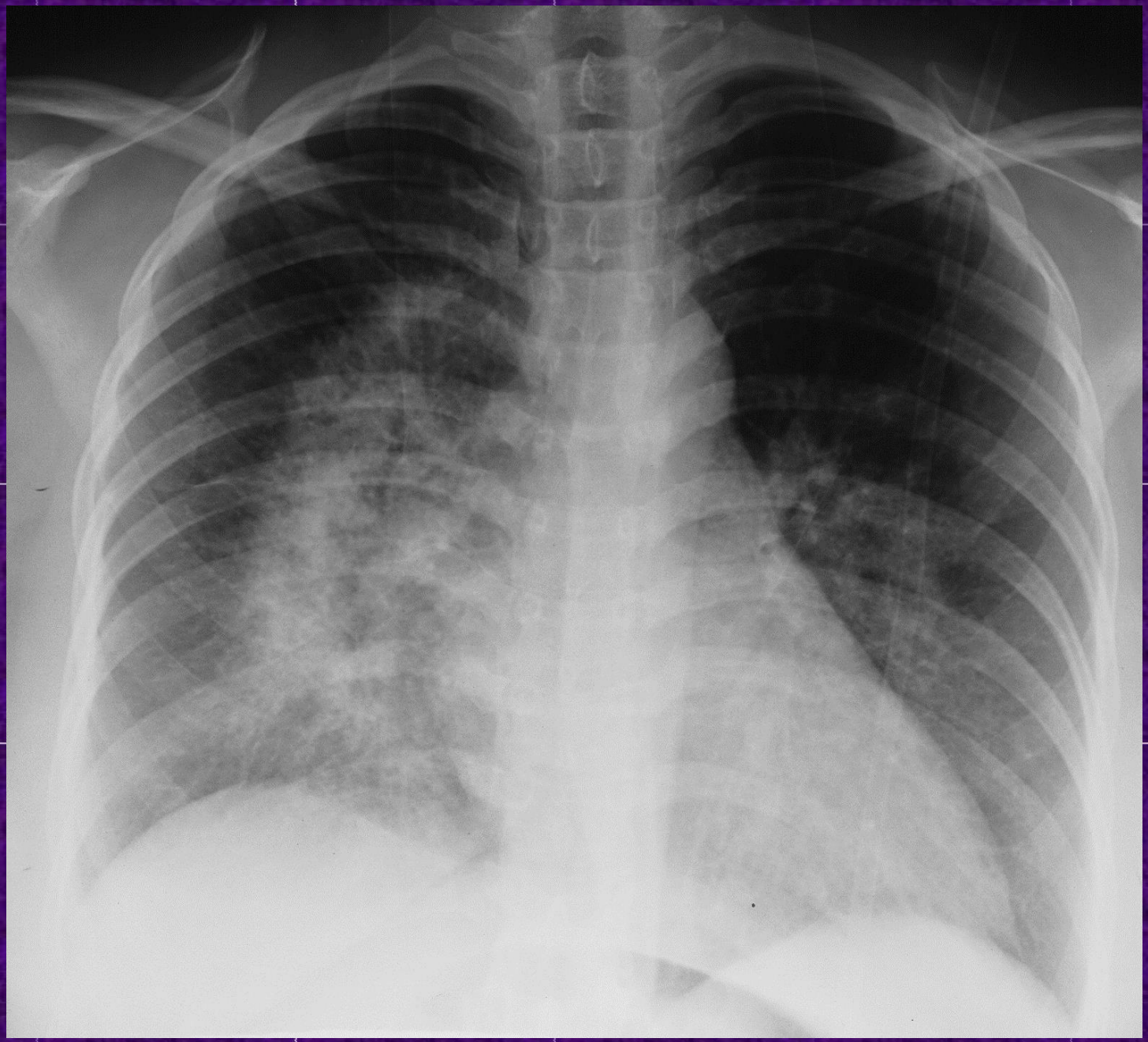


Aspiration pneumonia

- Multiple predisposing factors: post-anesthesia, obtunded, intubated, etc.
- CXR often changes over a few hours‟ time
- More common on the right than left
- Dependent portions of lung
  - Upright patients: lung bases predominate
  - Supine ICU patients: posterior upper lobes and superior segments of the lower lobes







Pulmonary Oedema

Pulmonary Oedema

- ? Upper lobe diversion ("cephalization")
- Infiltrates
  - Batswing
  - Diffuse

Interstitial Oedema

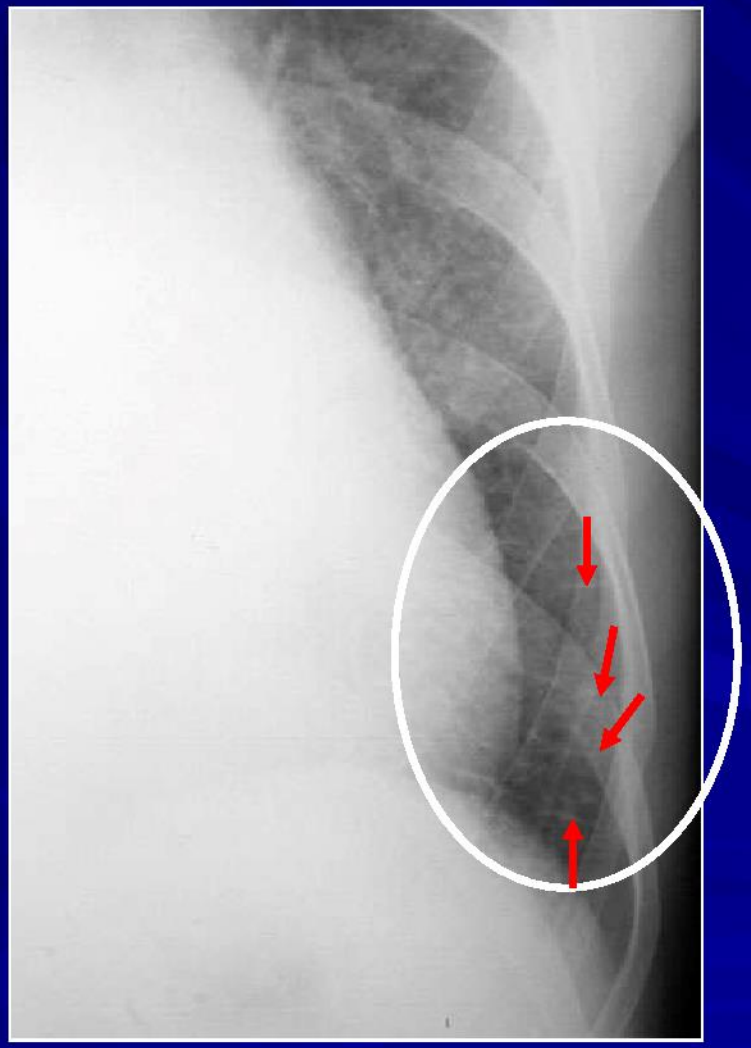
- Pleural effusions
- Septal lines e.g. Kerley B
  - Basal, 1-2 cm long, straight, 90^{o} to pleura
- Thickening of fissures
- Peribronchial cuffing

Left atrial pressure & CXR signs

Normal	5-10 mm Hg
Cephalization	10-15 mm
Kerley B Lines	15-20
Pulmonary Interstitial Edema	20-25
Pulmonary Alveolar Edema	> 25

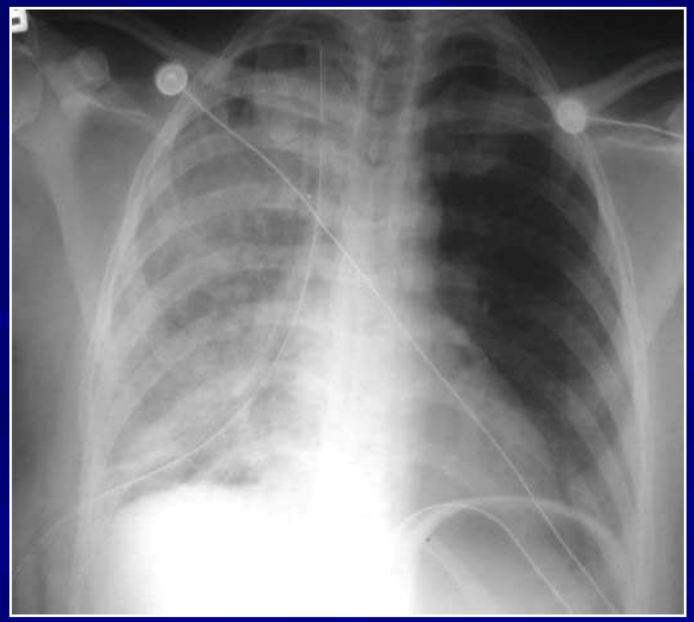
< 10% of cases of pulmonary oedema, usually in rapid onset oedema e.g. acute MR

Kerley B lines



Asymmetric pulmonary oedema

- Chronic lung disease altering vascular flow
- Acute MR - jet to right pulm vein often RUL
- Patient position (gravitational)
- Re-expansion



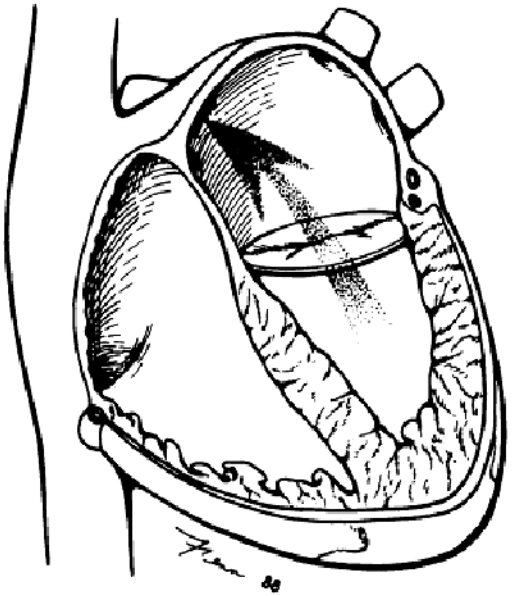
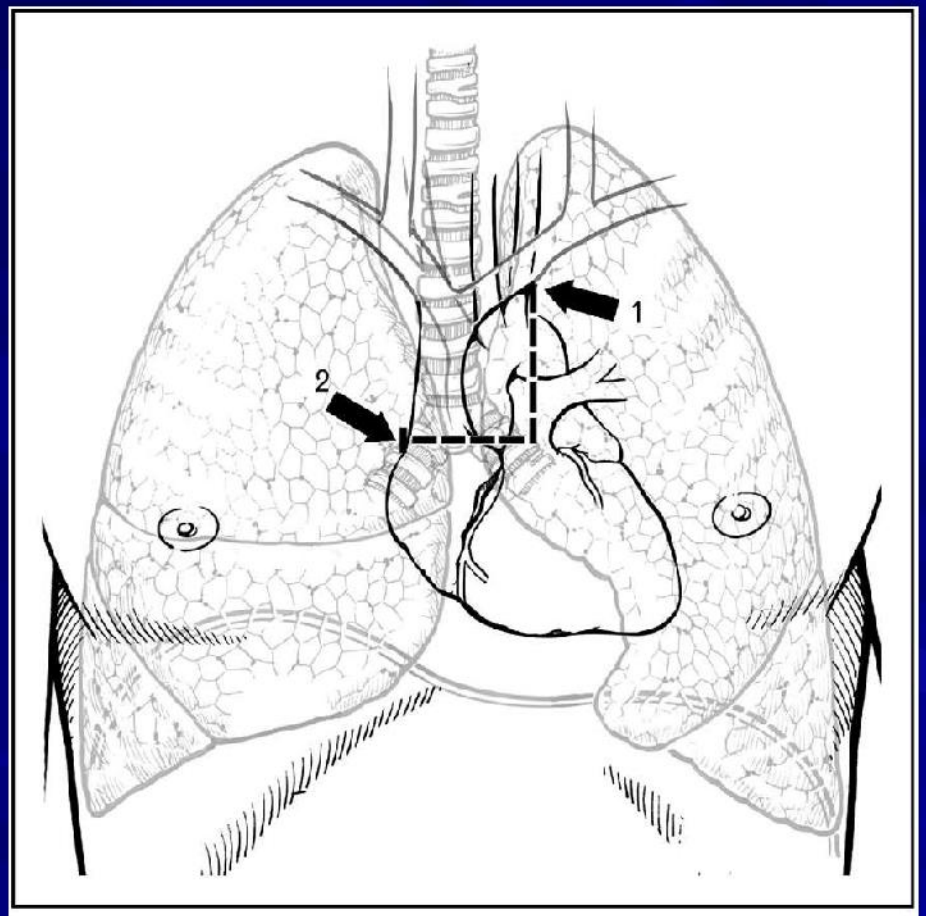


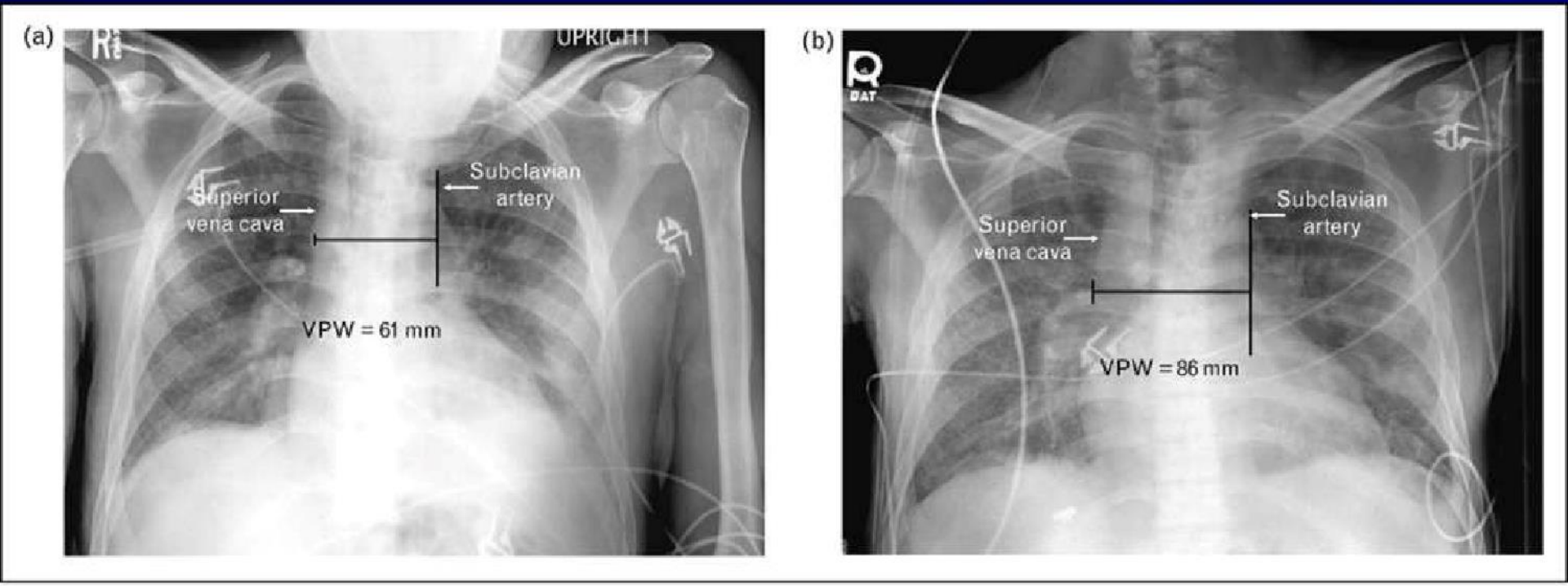
Figure 3. Drawing illustrates how mitral regurgitation might lead to right upper lobe edema. The vector of blood flow from the left ventricle to the left atrium may be directed at the right superior pulmonary vein, accentuating the forces for edema formation in the right upper lobe.

Vascular Pedicle Width in Pulmonary Oedema



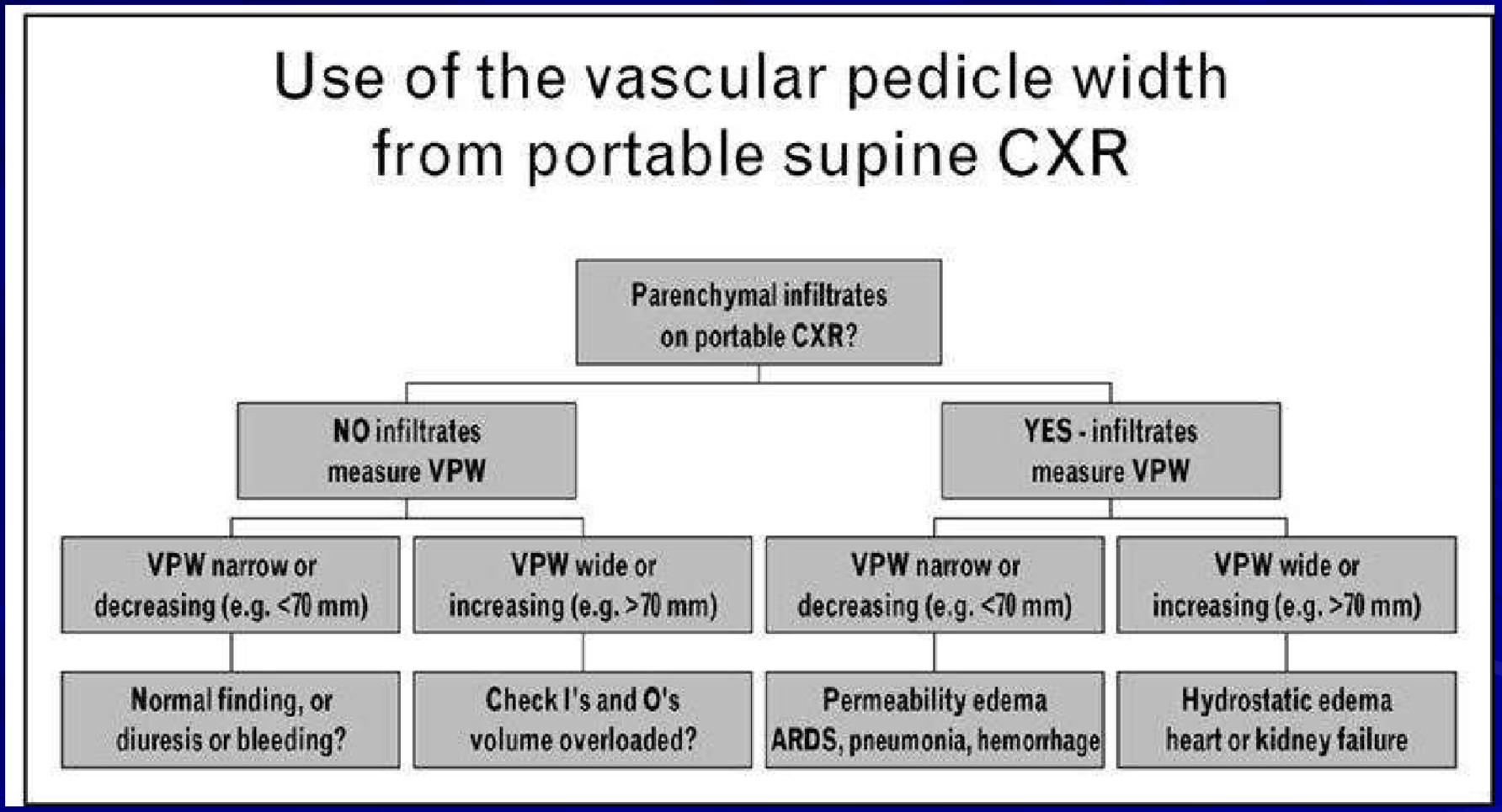
The vascular pedicle width is measured by (1) dropping a perpendicular line from the point at which the left subclavian artery exits the aortic arch and (2) measuring across to the point at which the superior vena cava crosses the right mainstem bronchus.

Vascular pedicle width and fluid status in pulmonary oedema



(a) A 53-year-old male with end-stage renal disease (anuria), hypertension, and dementia who was admitted for fever, altered mental status, hypoglycemia, and subsequent hypotension thought to be due to septic shock following hemodialysis with removal of 400 ml volume. This upright, portable, digital chest X-ray showed mild, diffuse interstitial lung disease and a moderate left pleural effusion. Both the cardiothoracic ratio (< 0.55) and vascular pedicle width (VPW; < 0.70 mm) were normal in appearance. His body weight at the time of the chest X-ray was 70.0 kg. (b) The same patient shown in (a) is shown here 12 h later after improvement of hypotension but with worsening oxygenation, requiring 100% non-rebreather. In the interim, he received 10 500 ml of net fluid intake and recorded a marked development of anasarca. His body weight at the time of this chest X-ray was 79 kg. On this semi-erect, portable, digital chest X-ray, the interstitial infiltrates were more prominent and both the cardiothoracic ratio (> 0.55) and the vascular pedicle width (86 mm) had increased markedly.

Using Vascular Pedicle Width



VPW/CTR as predictor of PCWP > 18

Criteria	Sensitivity	Specificity	PPV	NPV	Odds ratio
VPW ≥ 70 & CTR ≥ 0.55	54%	83%	76%	65%	3.2
VPW ≥ 70	69%	72%	70%	72%	2.5
CTR ≥ 0.55	63%	50%	56%	57%	1.3

Abnormal Air Collections

- Subcutaneous emphysema
- Pneumomediastinum
- Pneumothorax
- Pulmonary interstitial emphysema

Pneumomediastinum

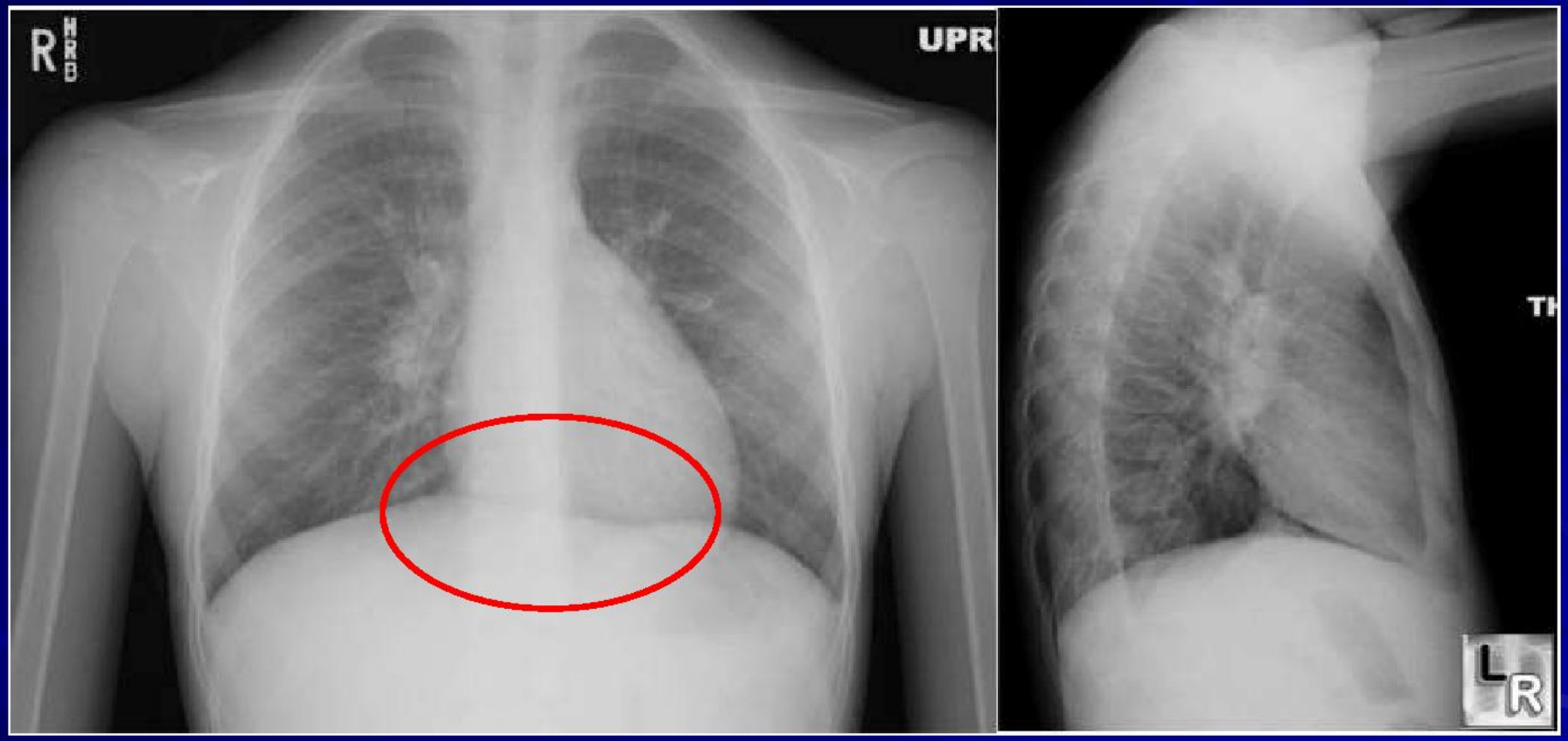
- Sources of air
  - *Intrathoracic*
    - Trachea and major bronchi
    - Esophagus
    - Lung
    - Pleural space
  - *Extrathoracic*
    - Head and neck
    - Intraperitoneum and retroperitoneum

CXR Signs of Pneumomediastinum

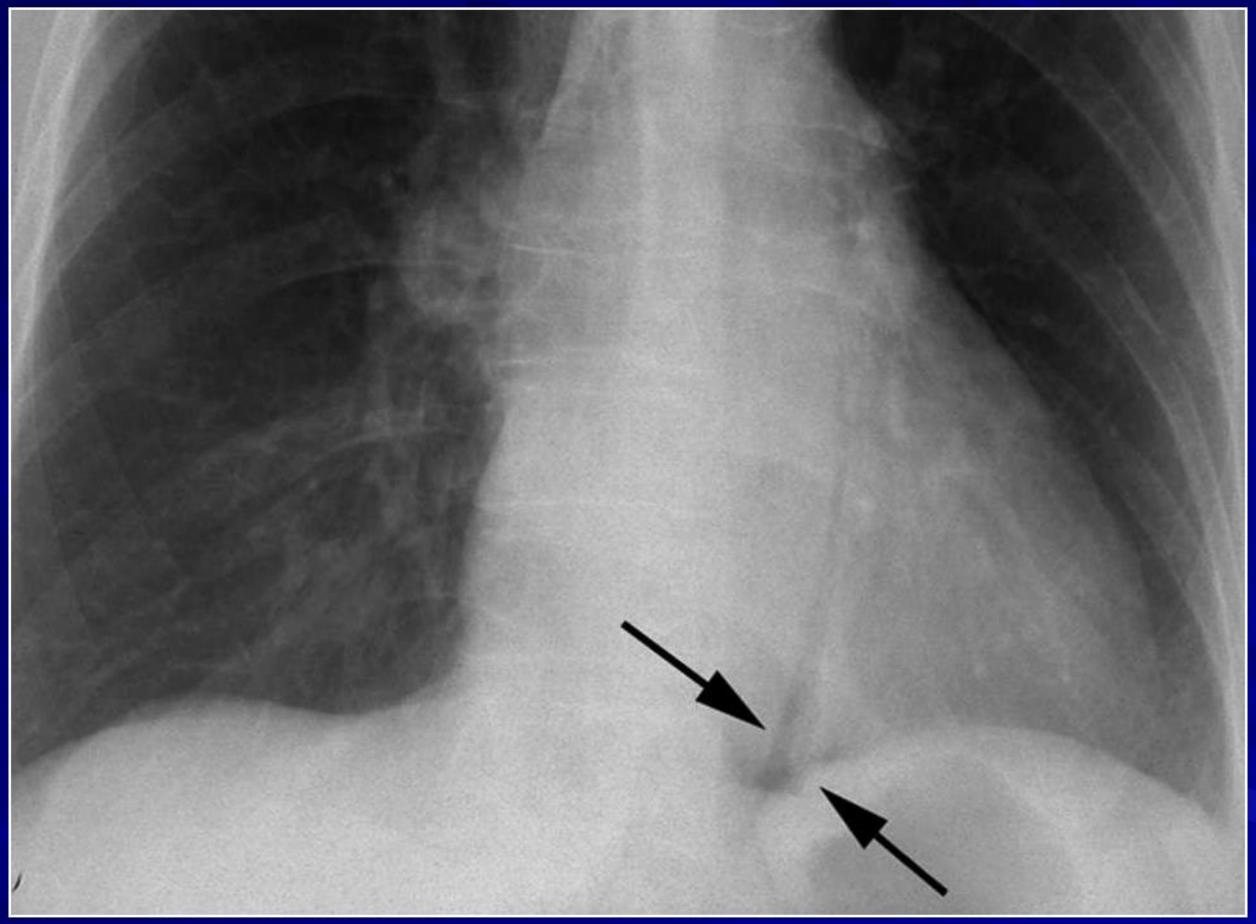
- Thymic sail sign (infants/young children)
- Tubular artery sign (AP film)
- “Ring around the artery” sign (lateral film)
- Double bronchial wall sign
- Continuous diaphragm sign
- Extrapleural air
- Naclerio’s V sign

- Linear density parallel to heart border
- Dissection of air into neck
- Dissection of air into chest wall

Continuous diaphragm sign

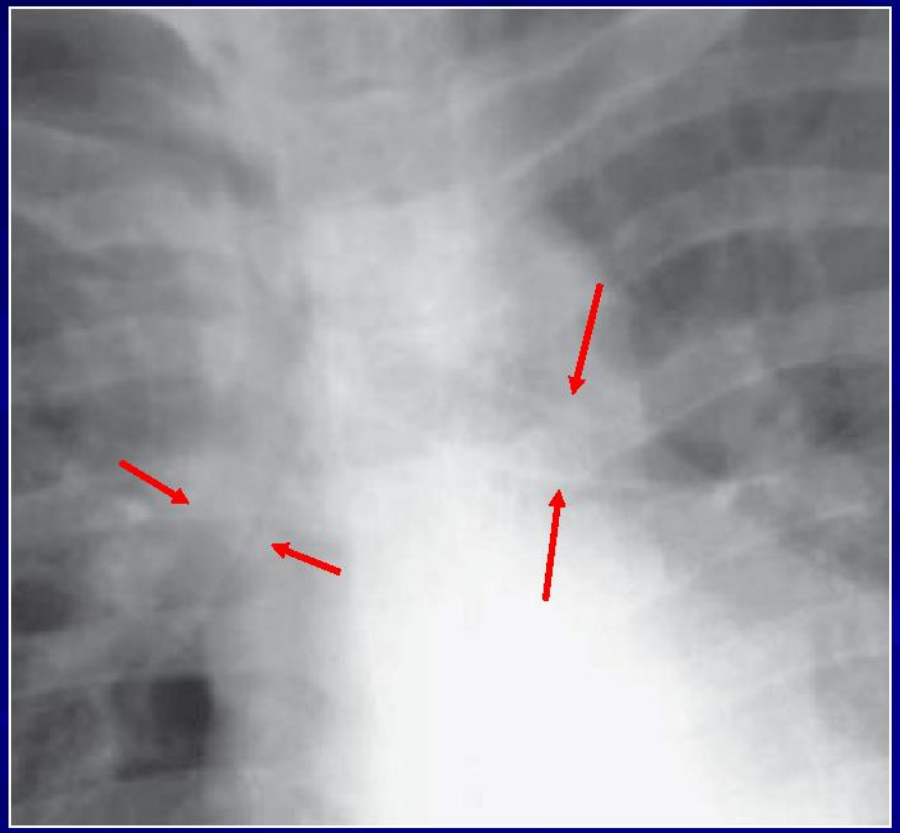


Naclerio's V sign



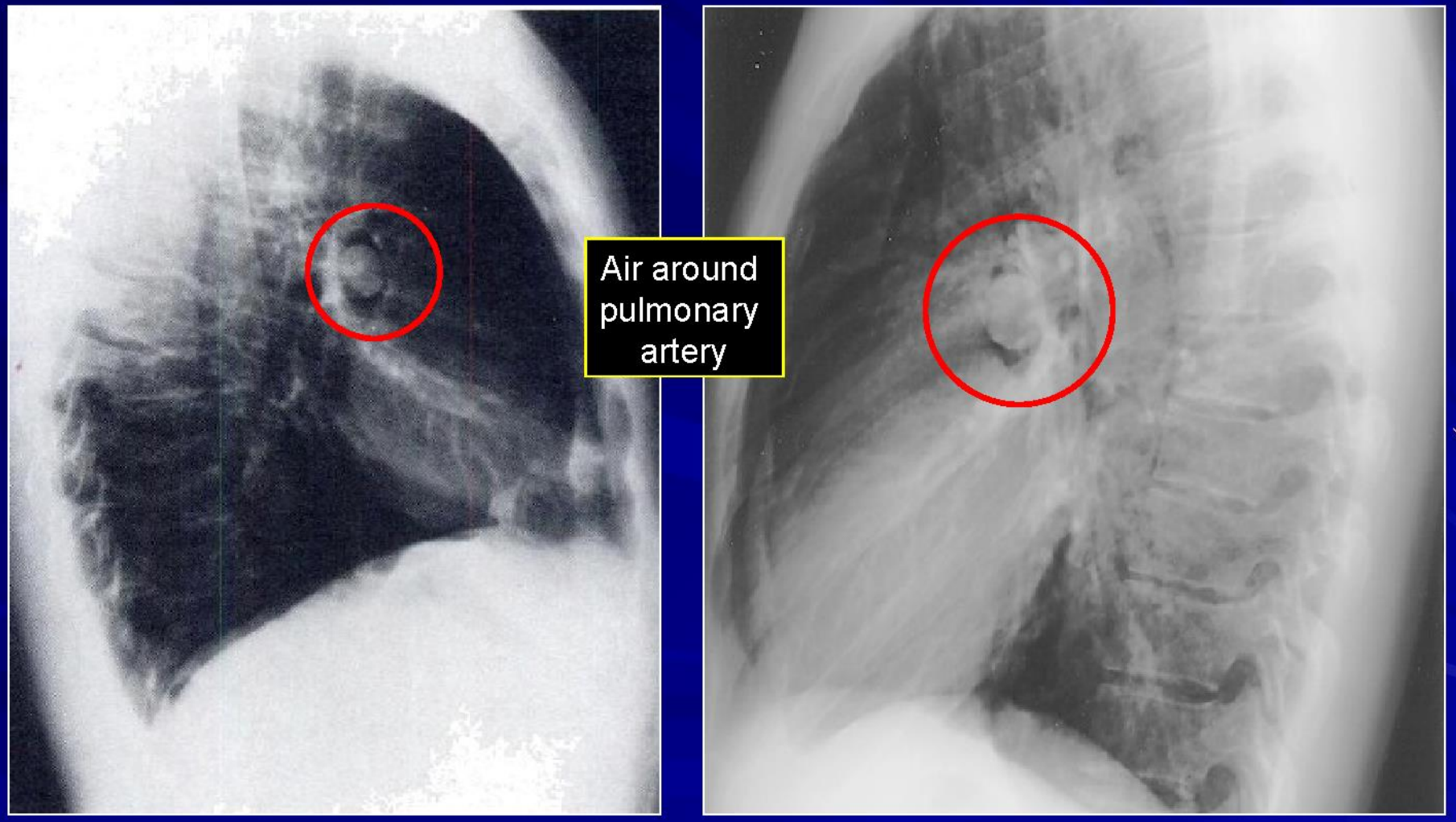
Lucent band of gas extending along descending aorta and intersecting band of gas that extends along medial left hemi-diaphragm, together forming "V'

Double bronchial wall sign

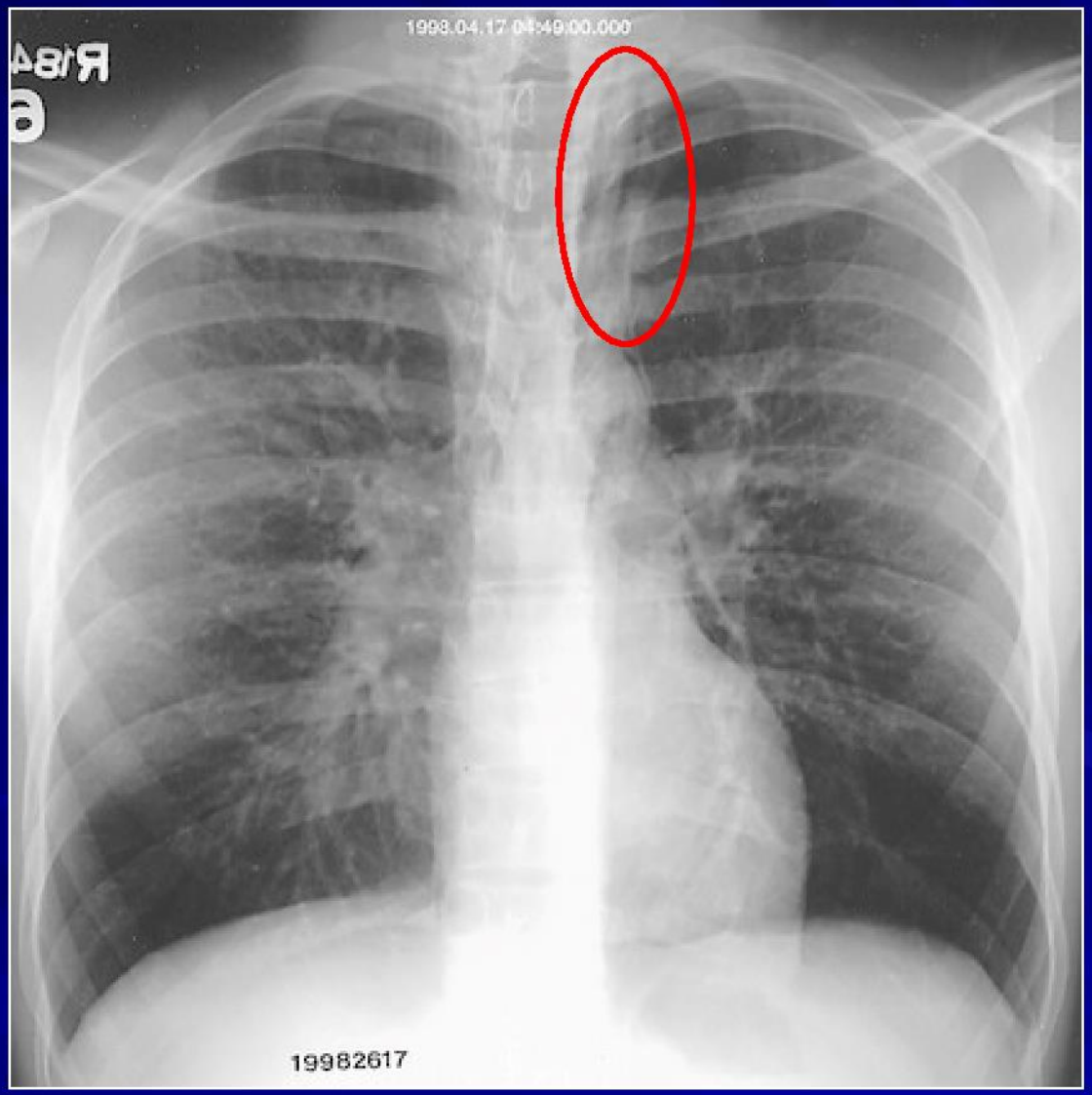


Air on both sides of bronchial wall makes full wall visible

“Ring around the artery” sign



Tubular artery sign

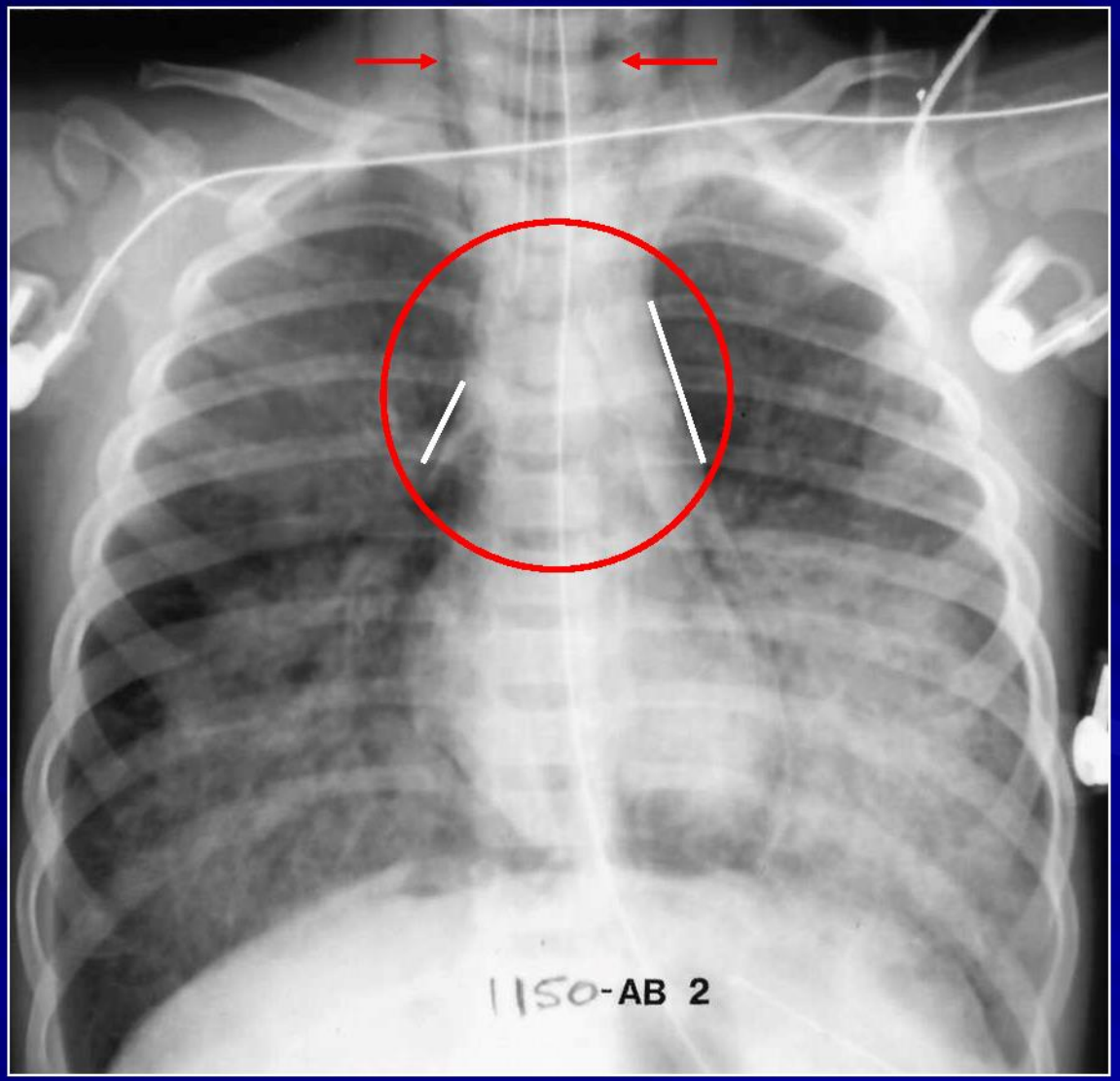


Air outlining left subclavian & left carotid

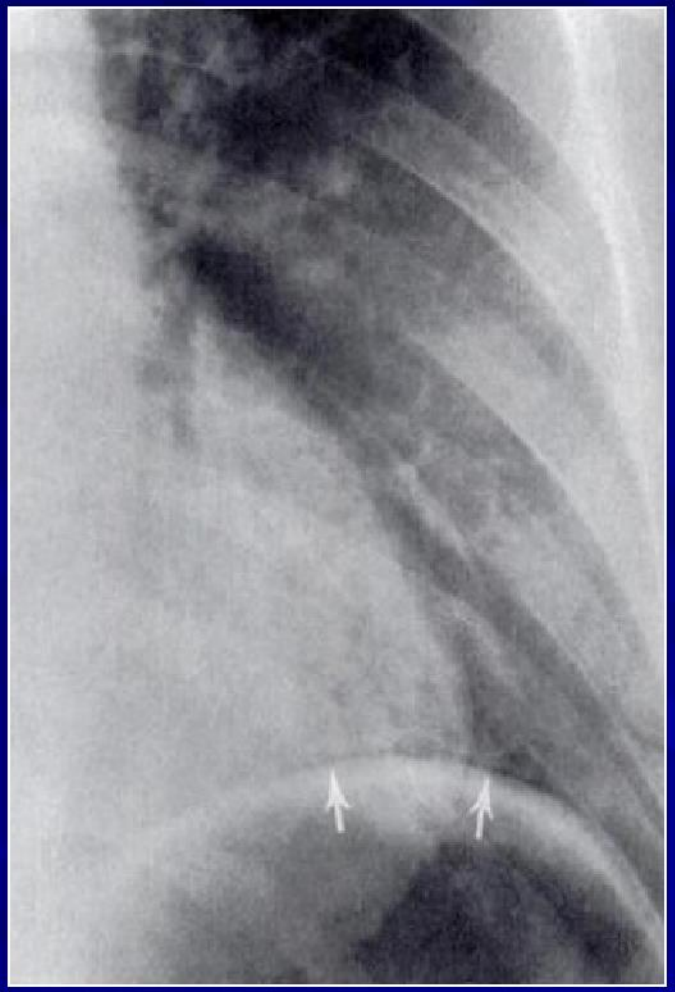
Thymic sail sign

Thymus outlined by air

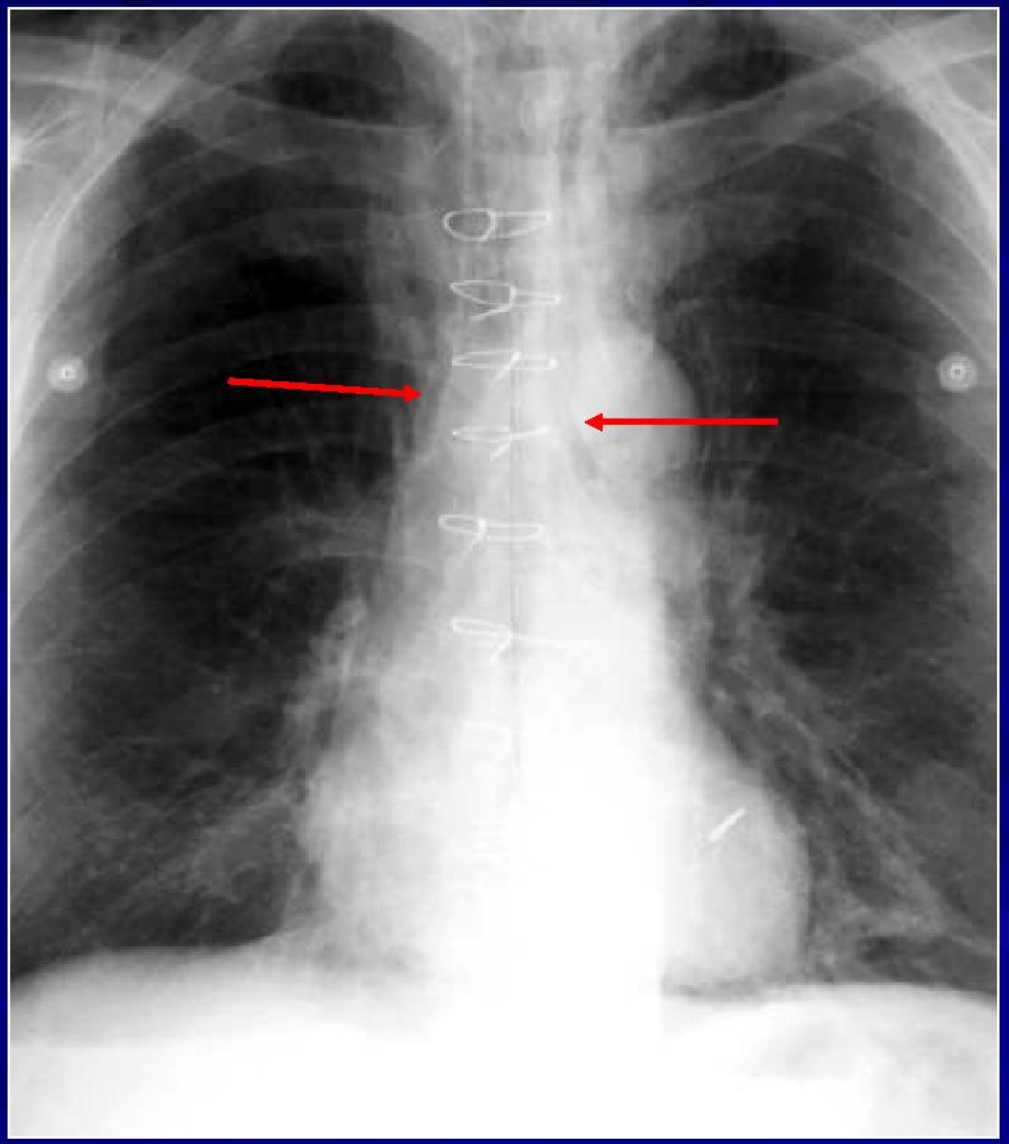
Also air tracking up into neck



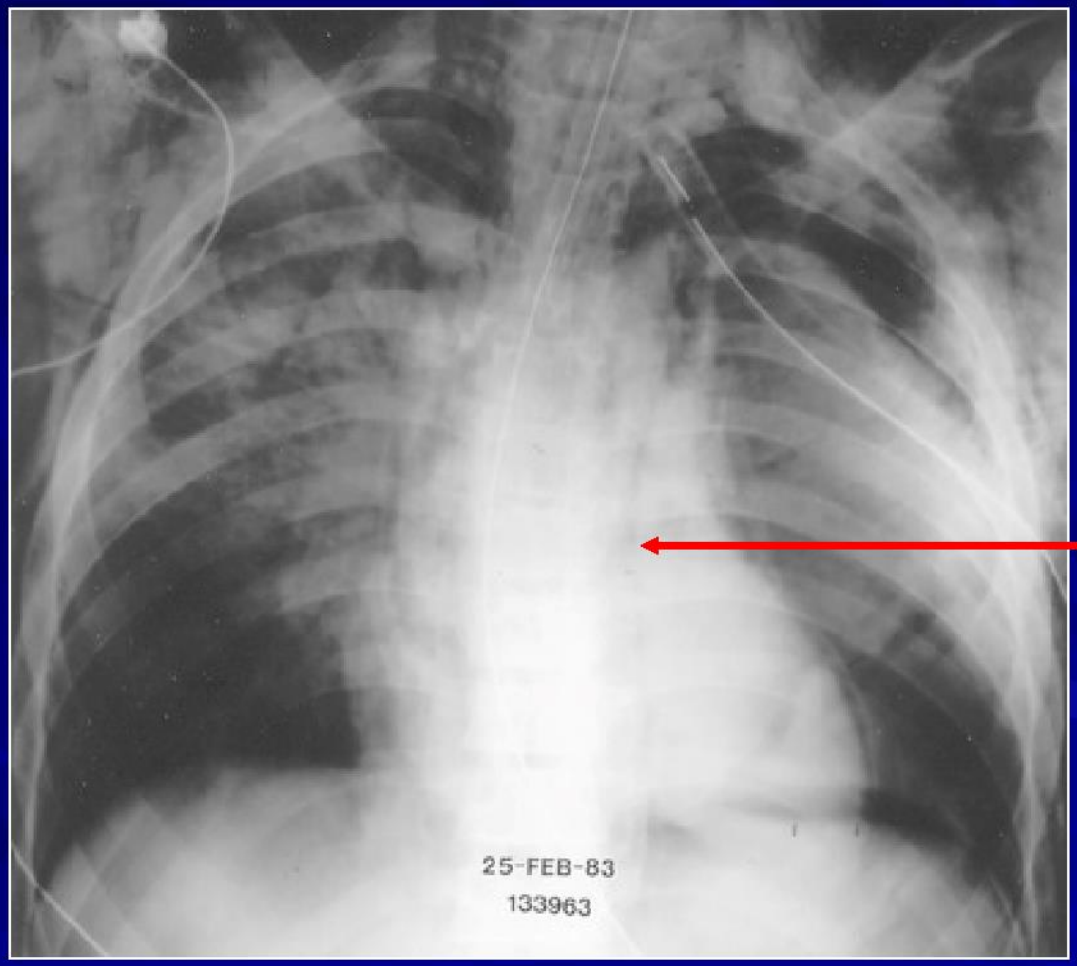
Extrapleural air



e.g. pleura peeled off diaphragm



Mediastinal air



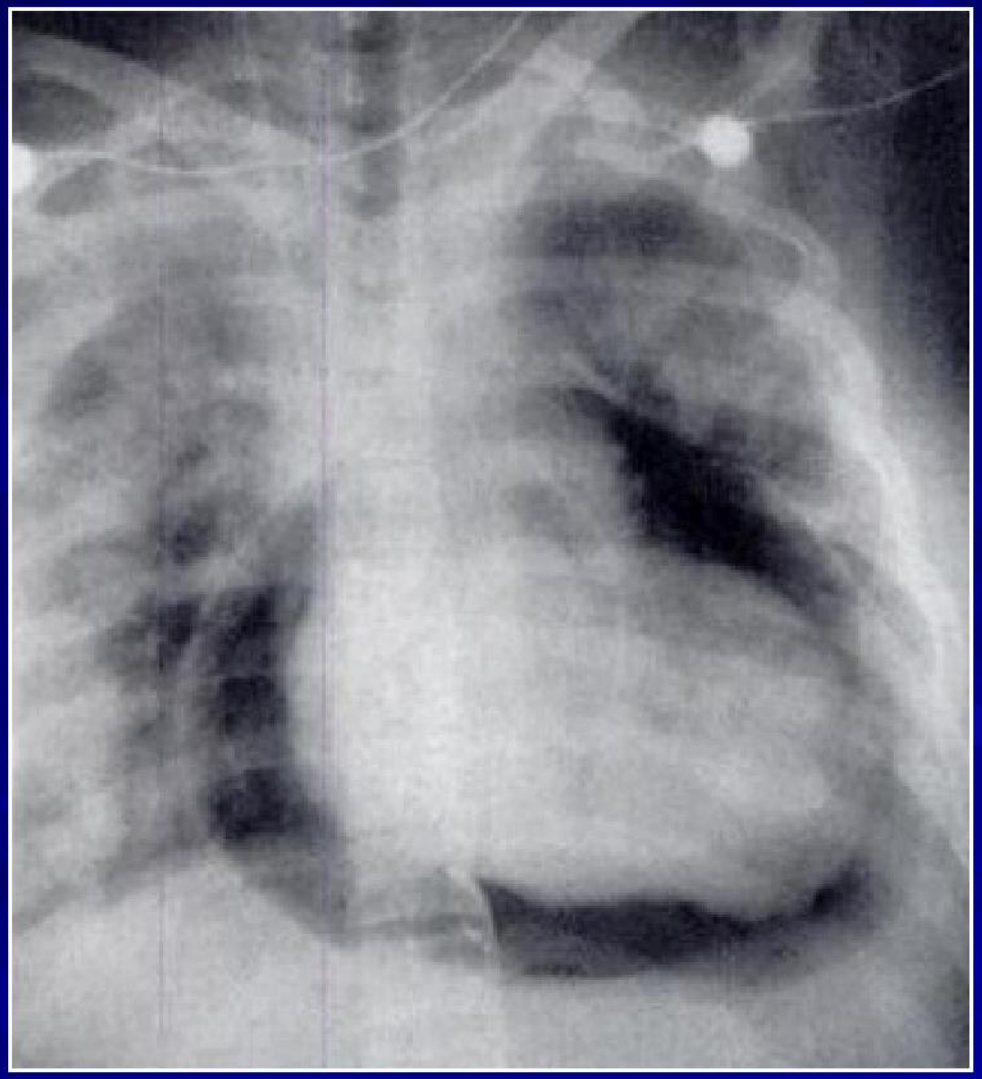
Mediastinal air running parallel to descending aorta

Pneumomediastinum vs pneumothorax

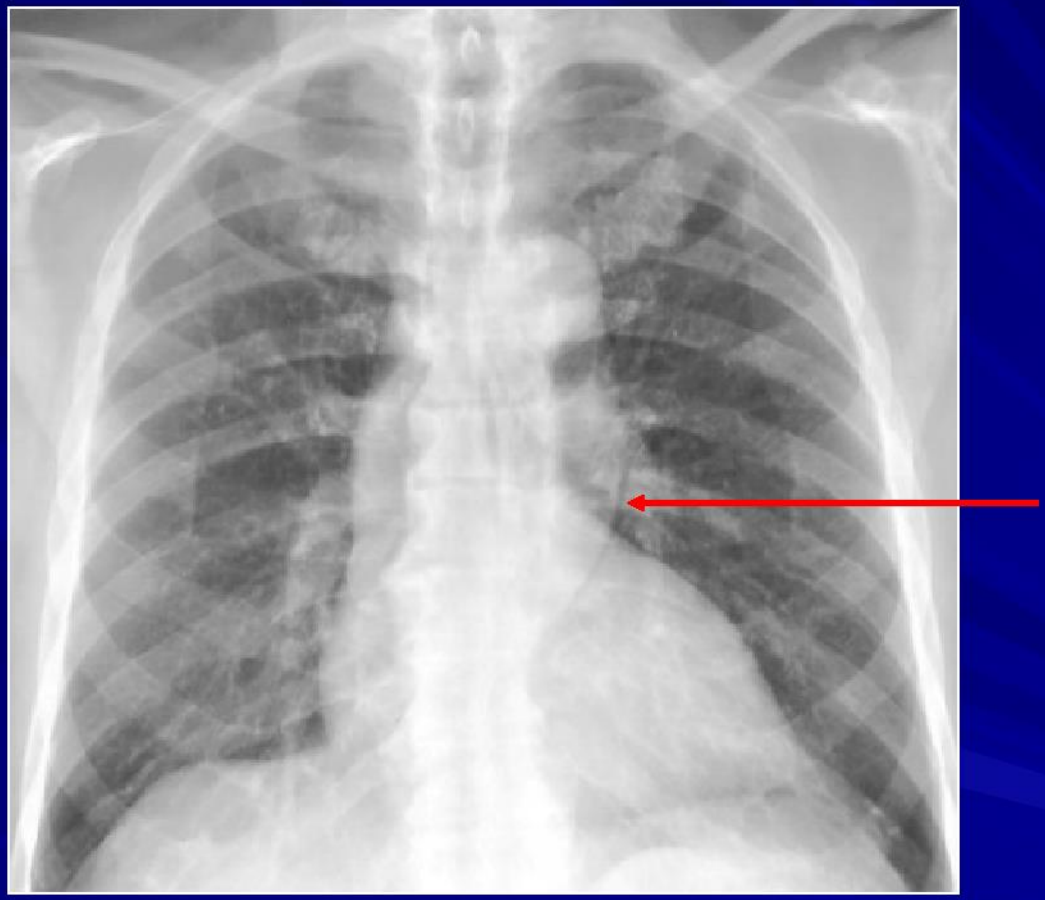
TABLE 2: Pneumomediastinum Versus Pneumothorax

Feature	Characteristic	
	Pneumomediastinum	Pneumothorax
Configuration of gas	Multiple thin, lucent streaks; can be confused with pneumothorax when streaks extend along diaphragm, over lung apex, or behind sternum	Apical lucency (upright); medial basal lucency (supine); deep-sulcus sign (supine)
Distribution	Outlines mediastinal structures (pulmonary artery, aorta, esophagus, and airway)	Never outlines mediastinal structures; anteromedial (supine); apical (upright)
Change in distribution with change in patient position?	No	Yes

Pneumopericardium



Pitfalls – Mach band effect

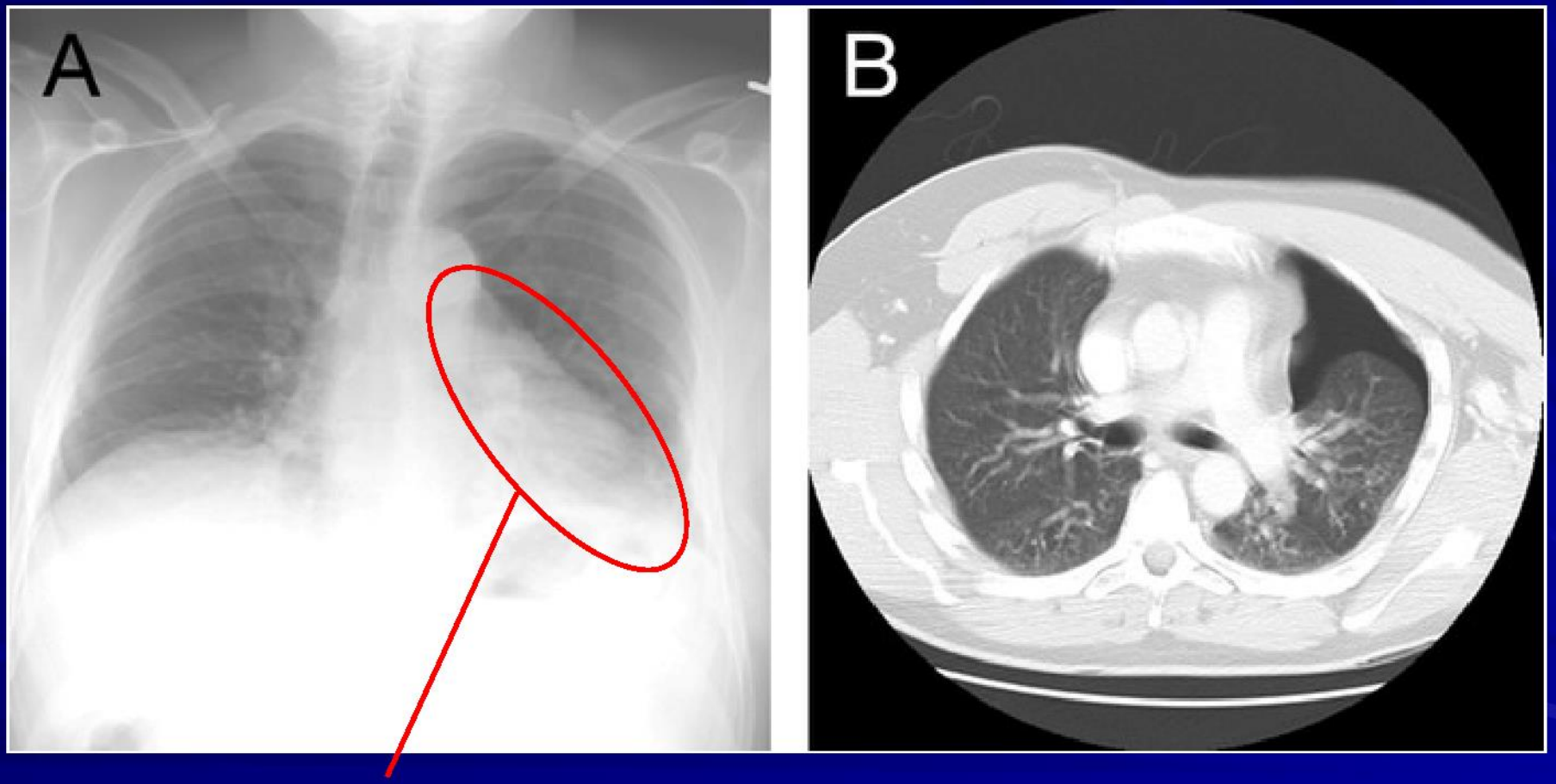


"The Mach band effect is associated with convex surfaces, appearing as a region of lucency adjacent to structures with convex borders. The absence of an (associated) opaque line, which is typically seen in pneumomediastinum, can aid in differentiation"
Zylak C. Pneumomediastinum Revisited. Radiographics 2000; 20: 1043-1057.

Pneumothorax

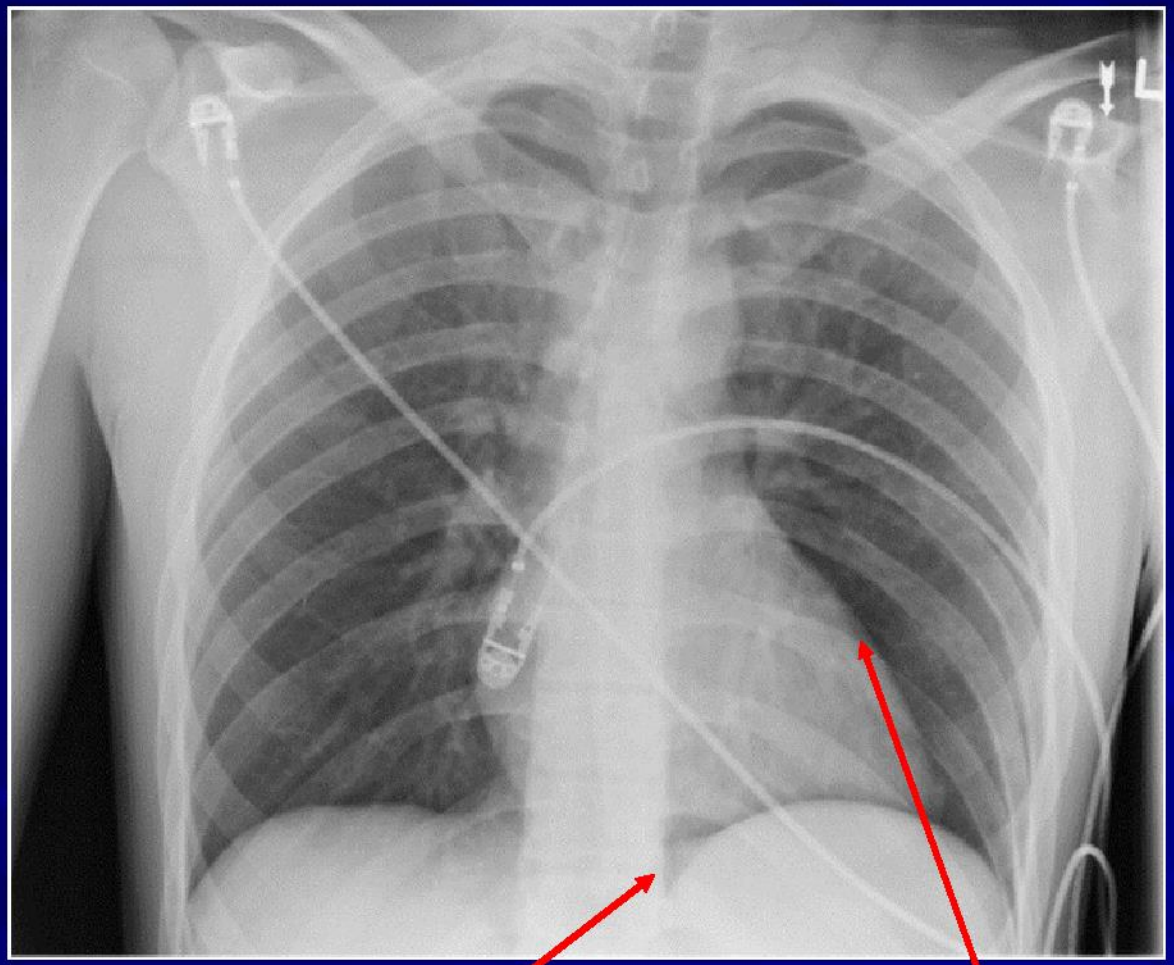
- Apicolateral visceral pleural line
  - Generally requires erect/semi-erect film
  - Skin fold may be mistaken for pleural line
- Lack of lung markings outside line
  - Caution in COPD/bullous disease
  - Bullae generally convex
- ICU CXR often supine/semi-erect
  - Different criteria for diagnosis
  - Often subtle
  - WATCH OUT!

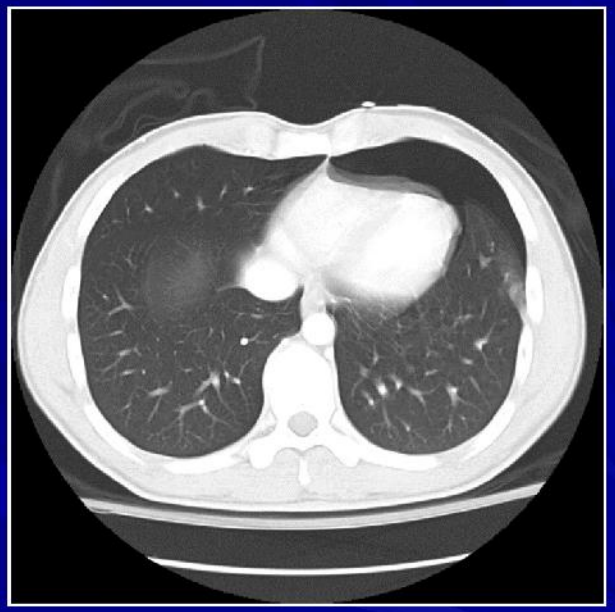
“Occult” pneumothorax



Crisp cardiac silhouette with increased lucency

Occult pneumothorax II





Cardiophrenic sulcus highly visible

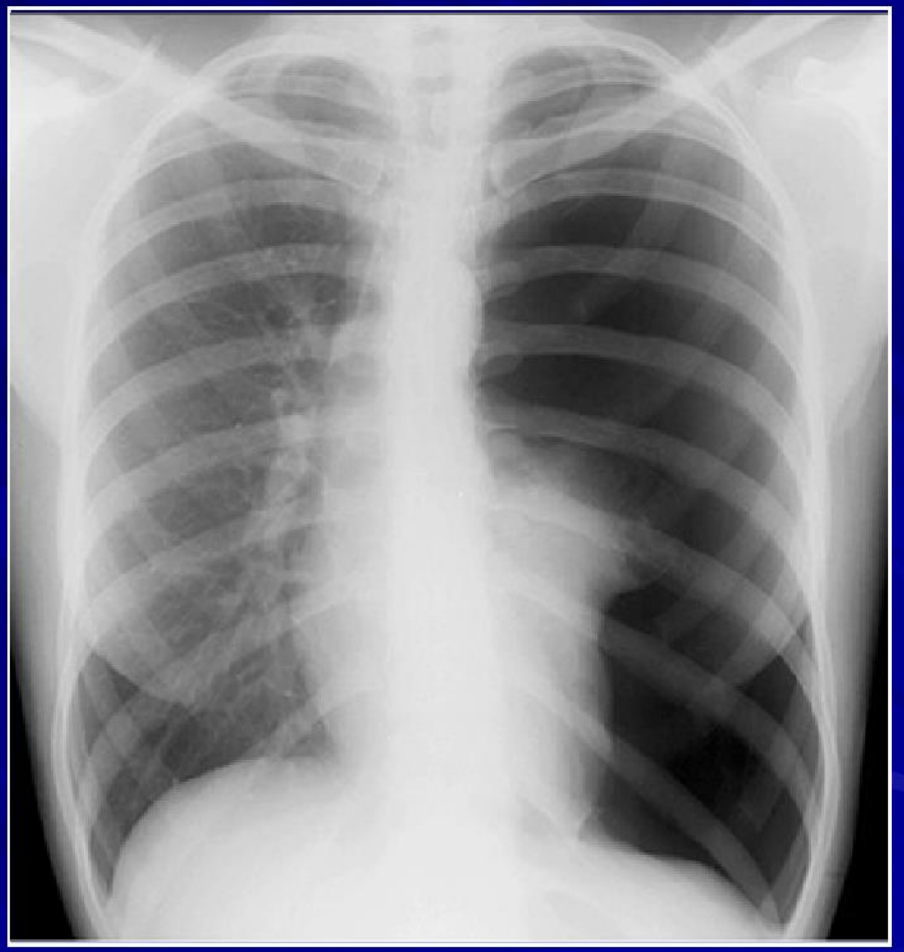
Crisp heart border

Potential signs of pneumothorax

- Pleural line with absent markings
- Double diaphragm sign
  - Visible anterior costophrenic recess interface
- Sharpened cardiac silhouette & apex
- Hyperlucent hemithorax
- Inferior edge of collapsed lung
- Deep sulcus sign
- Depressed diaphragm
- Apical pericardial fat
  - Discrete lobulated densities (1-1 .5cm) adjacent to cardiac apex

Tension pneumothorax

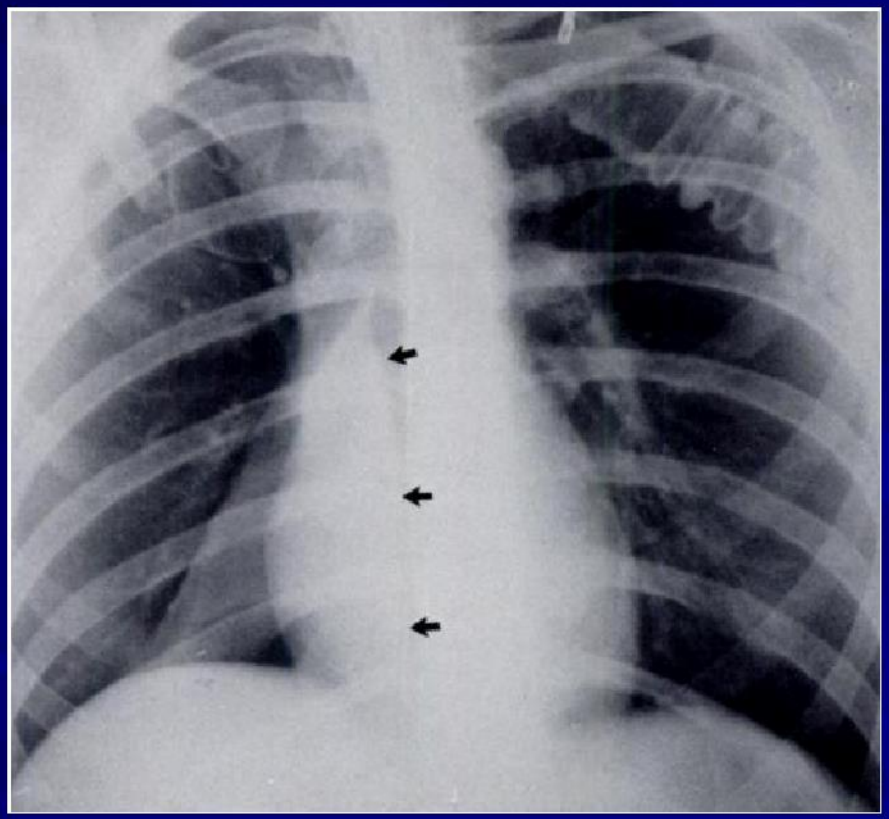
- Flattening of heart border
- Flattening of adjacent vascular structures e.g. SVC
- Mediastinal shift - AWAY
- Diaphragmatic inversion

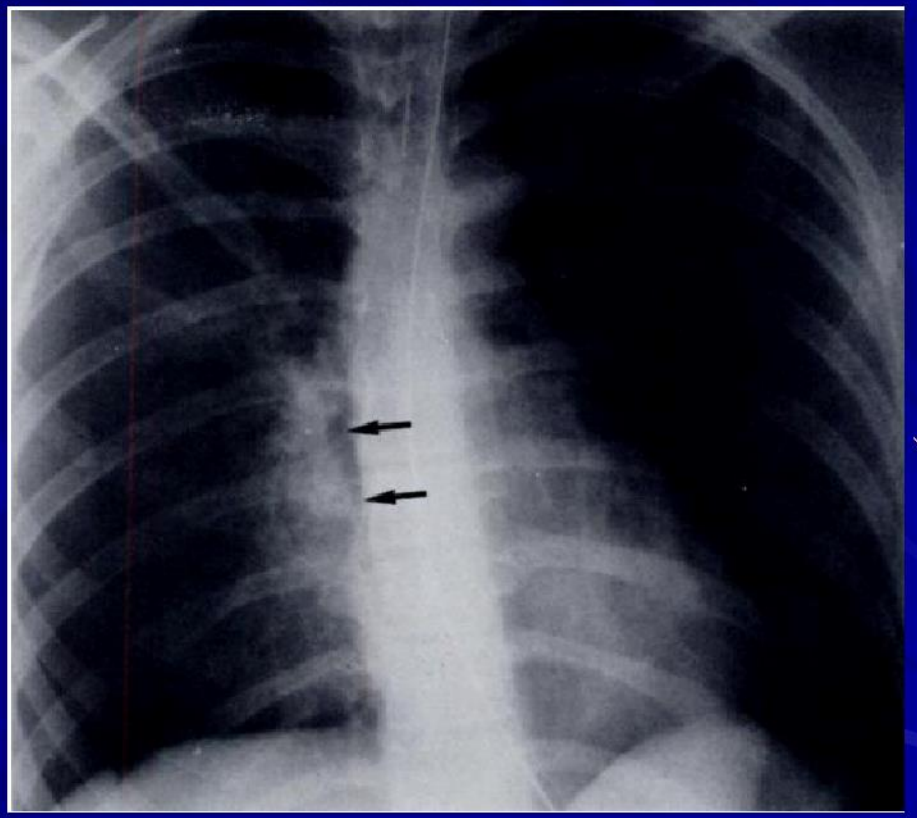


Pneumothorax in Supine Patients

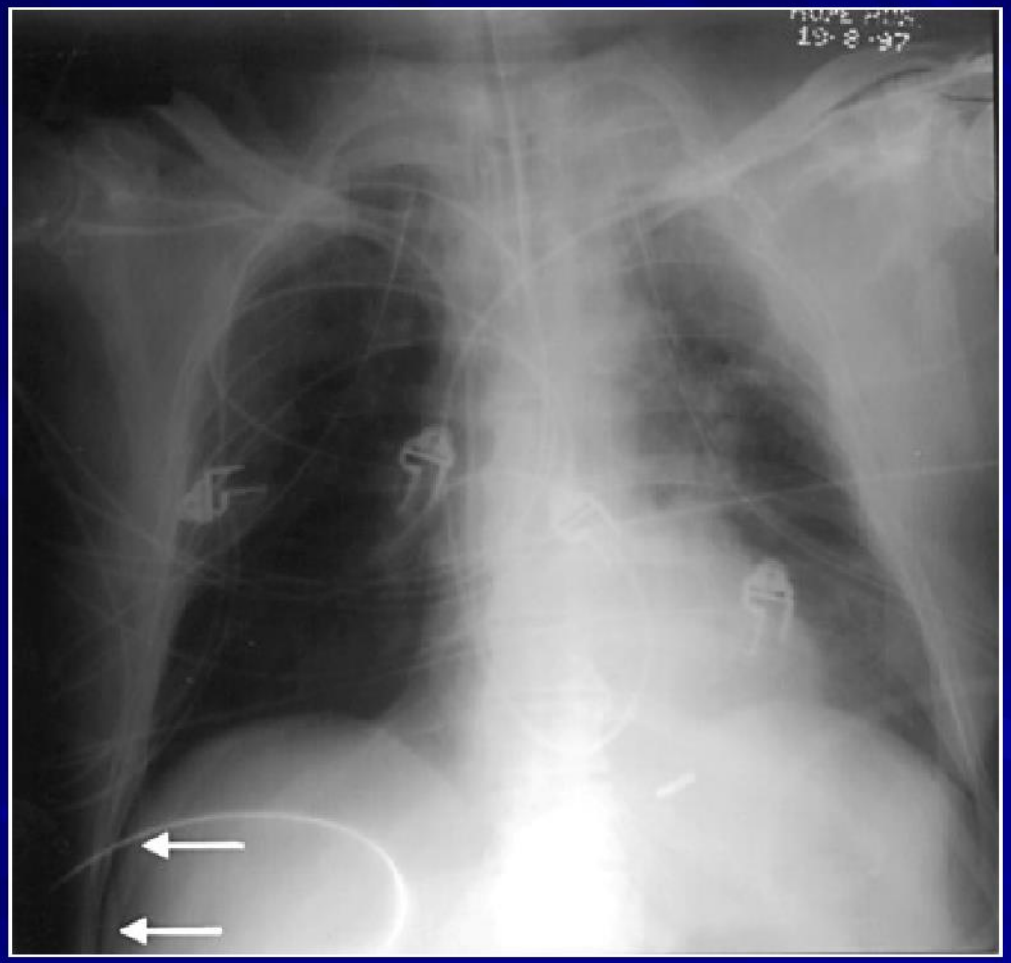
- Anteromedial - unusually sharp outline of:
  - Mediastinal vascular structures
  - Heart border
  - Cardiophrenic sulcus
- Posteromedial
  - Lucent band outlining mediastinal surface of a collapsed lower lobe
  - Increased visibility of paraspinous line & descending aorta
  - Increased visibility of posterior costophrenic sulcus
- Subpulmonic
  - Hyperlucent upper abdominal quadrant
  - Deep costophrenic sulcus (“deep sulcus” sign)
  - Sharp hemidiaphragm despite opacification in lower lobe of lung (if consolidated)
  - Visualisation of inferior surface of consolidated lung

Posteromedial Pneumothorax





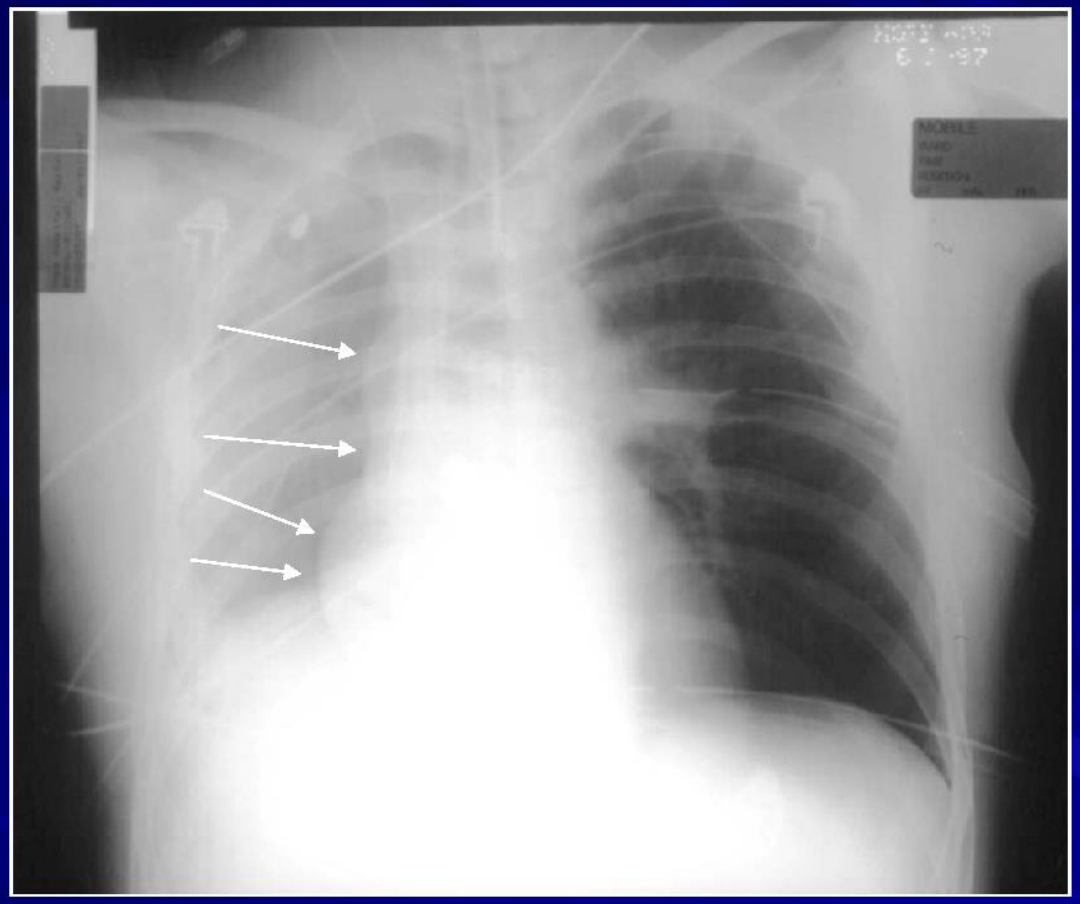
Subpulmonic pneumothorax



Deep sulcus, lucent RUQ

Rankine, J. J et al. Postgrad Med J 2000;76:399-404

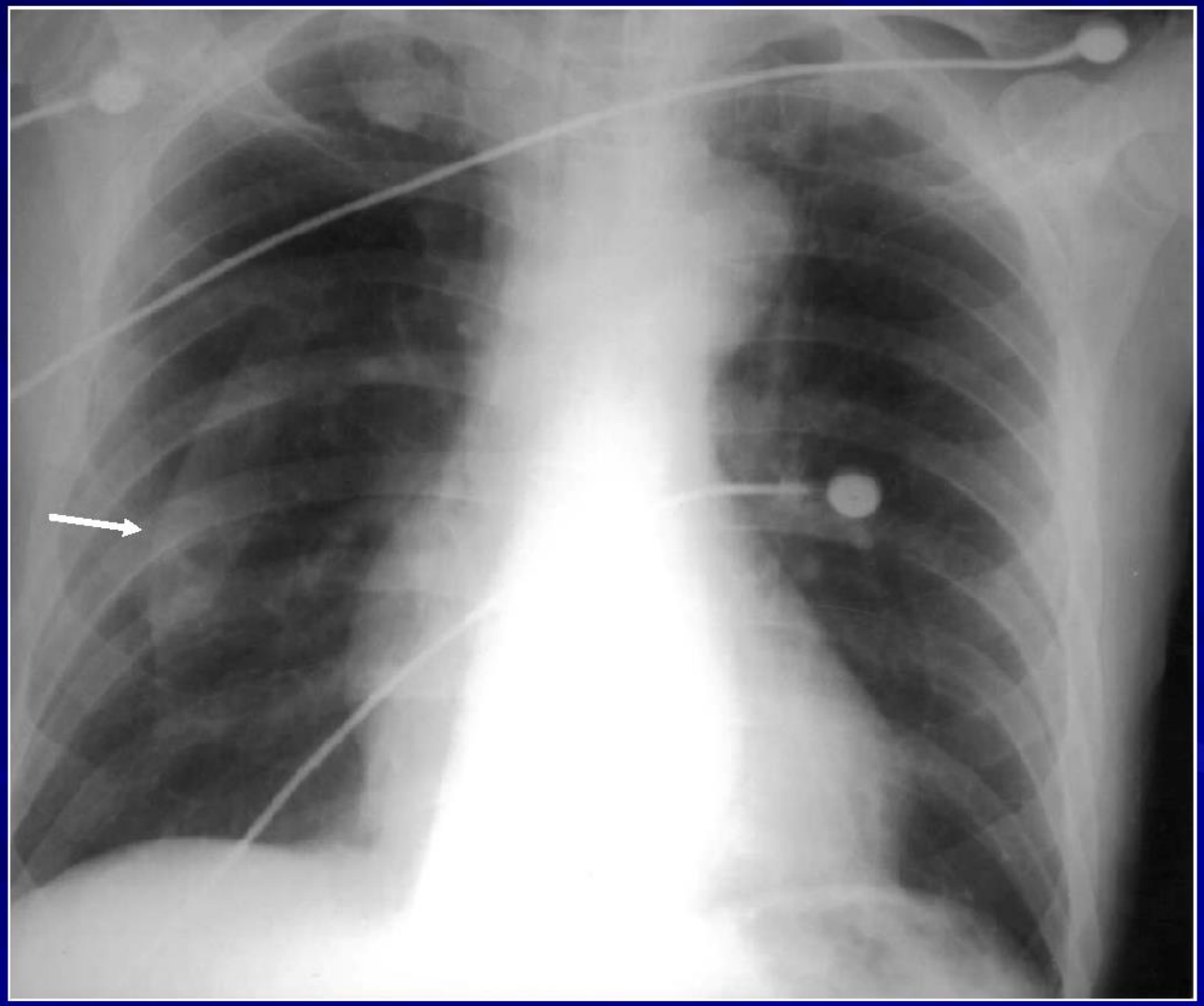
Anteromedial pneumothorax



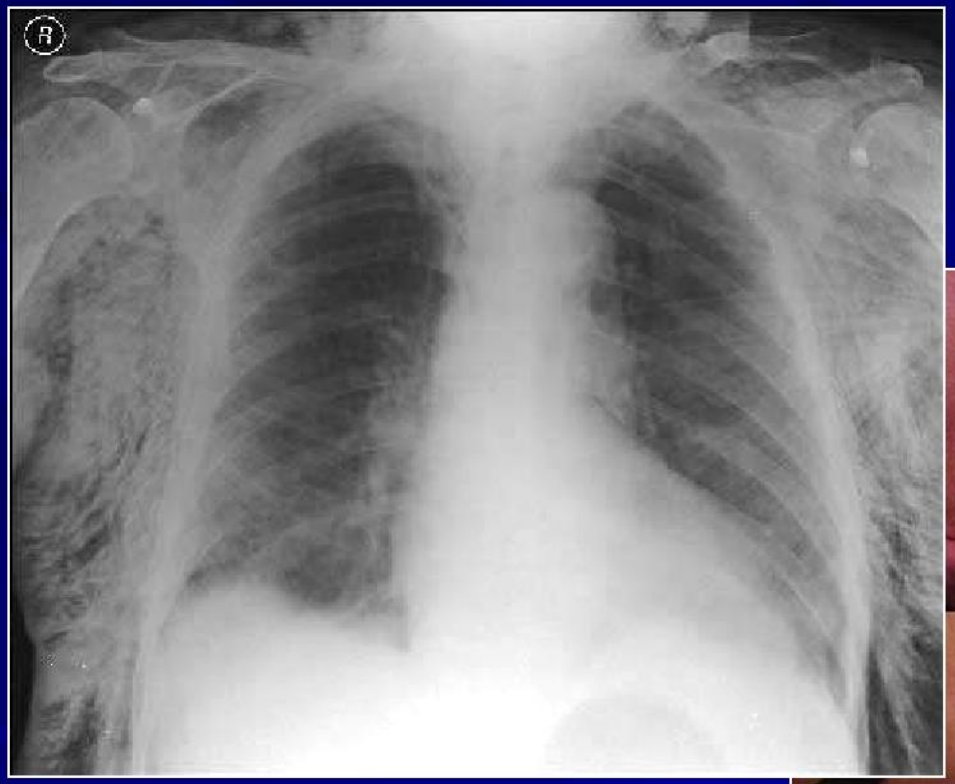
Sharp outline of mediastinum and right heart border. Right hemithorax has concurrent consolidation and effusion

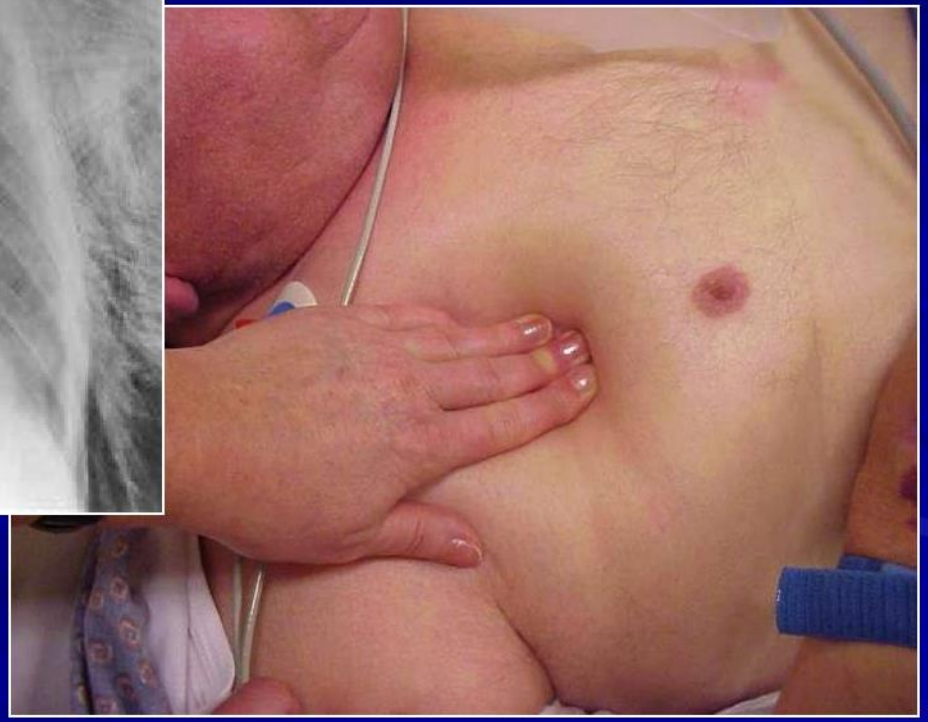
Rankine, J. J et al. Postgrad Med J 2000;76:399-404

Mimics - Skin fold



Subcutaneous emphysema





The chest radiograph in heart disease

Assess the technical adequacy of the film

- Adequate exposure? The spine and disc spaces should be just visible behind the heart.
- Not rotated? The medial ends of the clavicles should be equidistant from the spinous processes.
- Adequate inspiration? The dome of the diaphragm should lie between the anterior ends of the fifth and seventh ribs in the midclavicular line. The lungs can appear more opaque with poor inspiration, and the heart may appear enlarged.

Identify and assess the position of medical devices

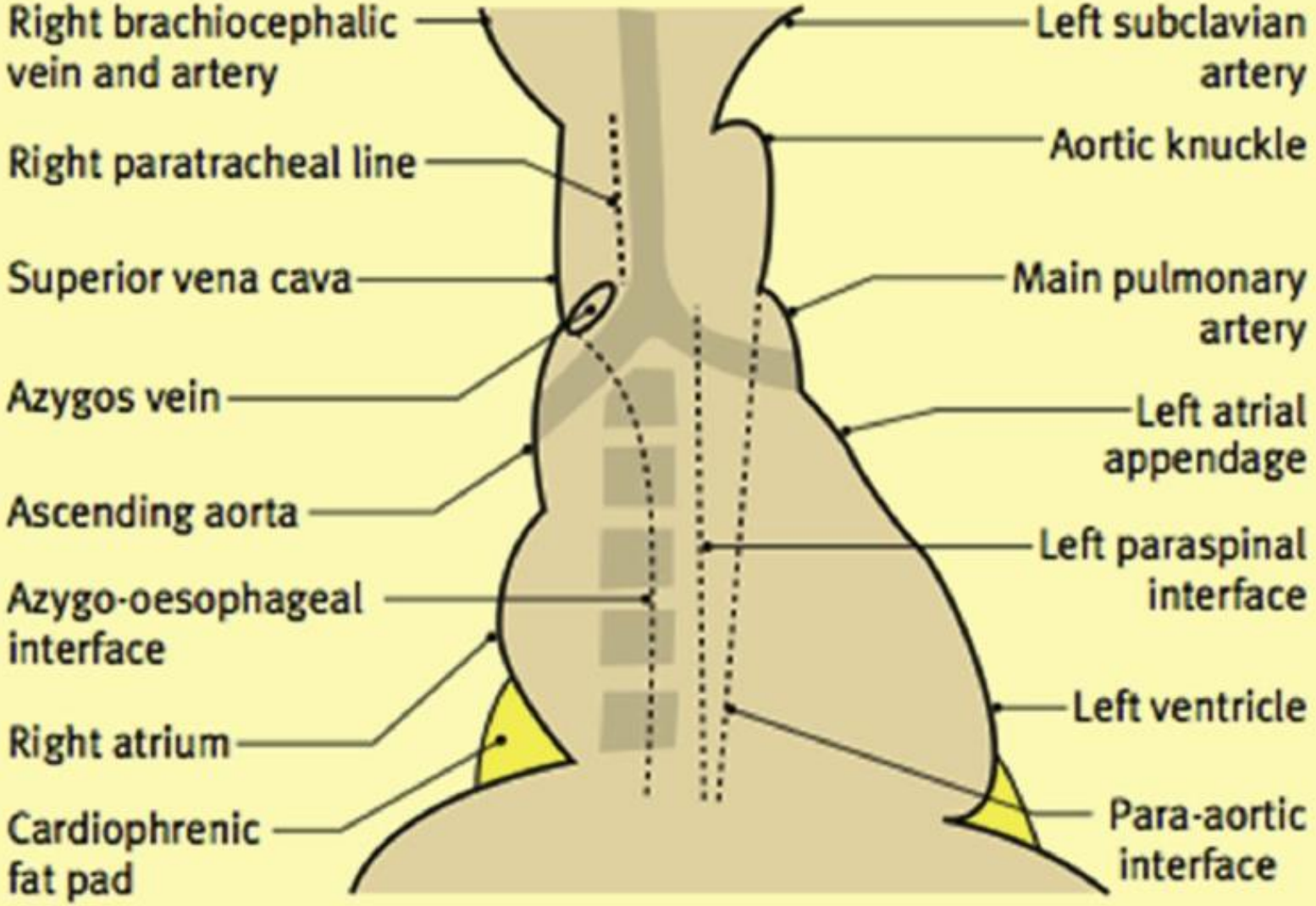
- e.g. drains, catheters, pacemakers, valve prostheses
- unknown devices or foreign bodies (e.g. swabs, broken pacing wires).

Suspect cardiac disease if:

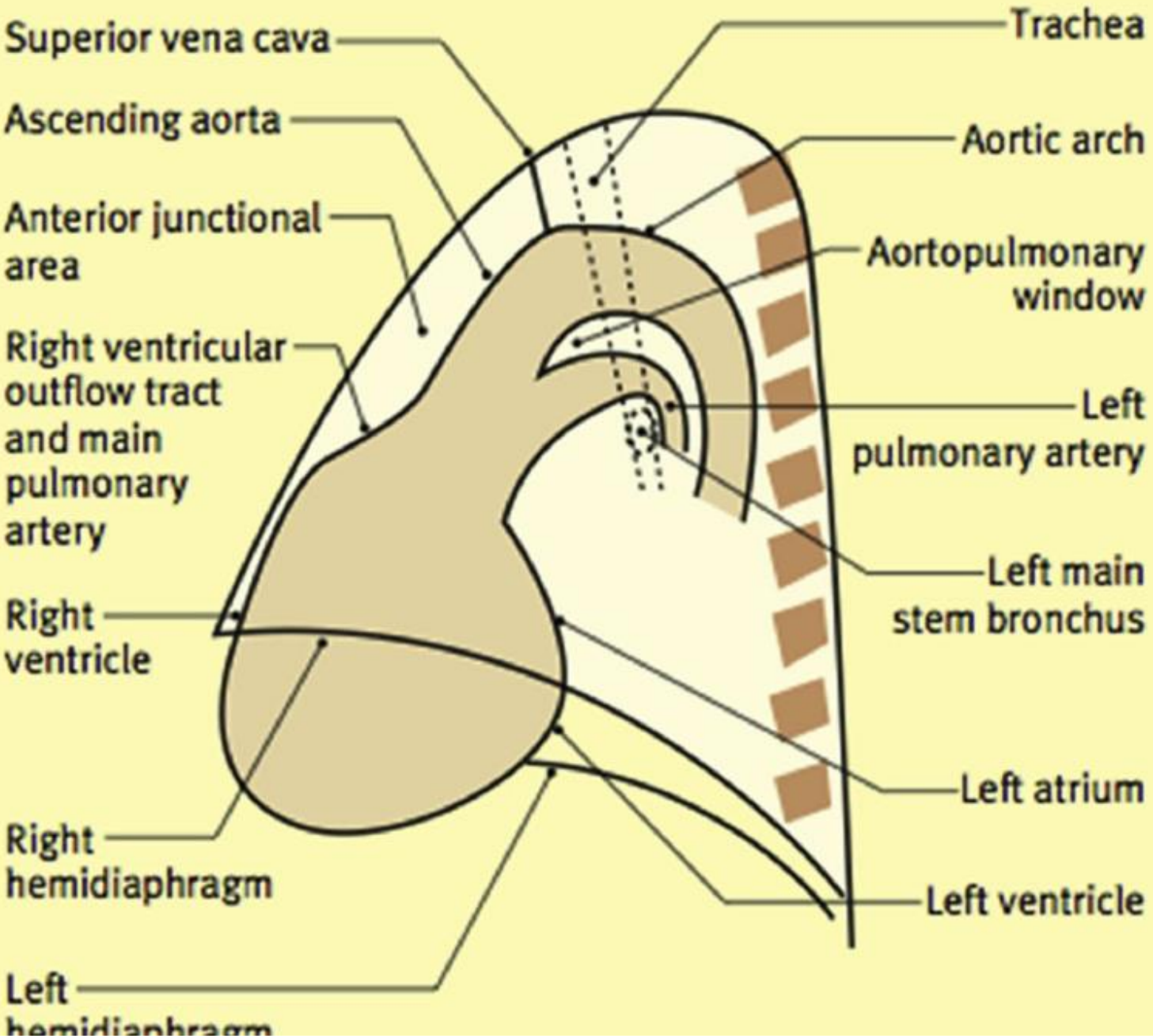
- Previous cardiac surgery is evident (e.g. sternal wires, coronary artery vein graft clips, or valve prostheses)
- Mediastinal silhouette is altered (e.g. small aortic knuckle in patients with an atrial septal defect)
- Pulmonary arteries are enlarged (e.g. secondary to an intracardiac shunt)
- Pulmonary edema is present.

a

Mediastinal silhouette and major lines and interfaces seen on a frontal chest radiograph



Principal features on a lateral chest radiograph



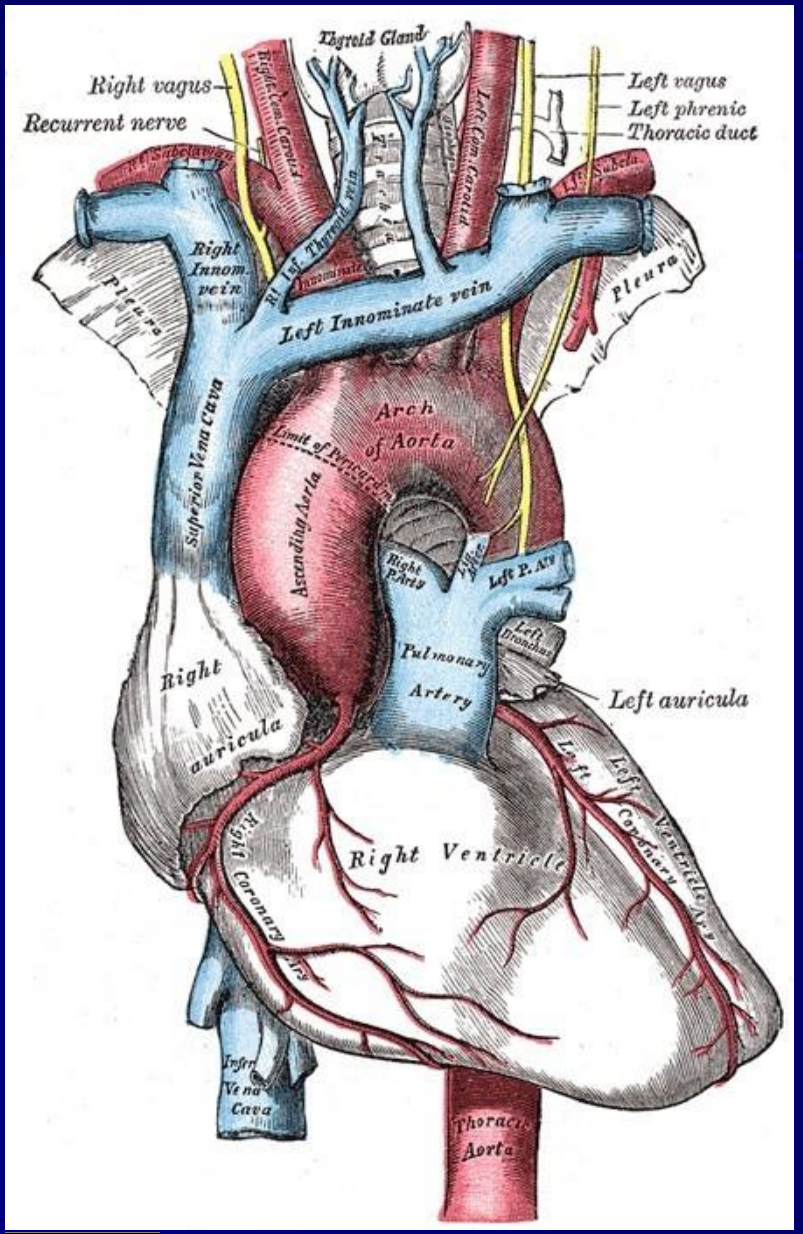
Normal Cardiac Contours

L

AV

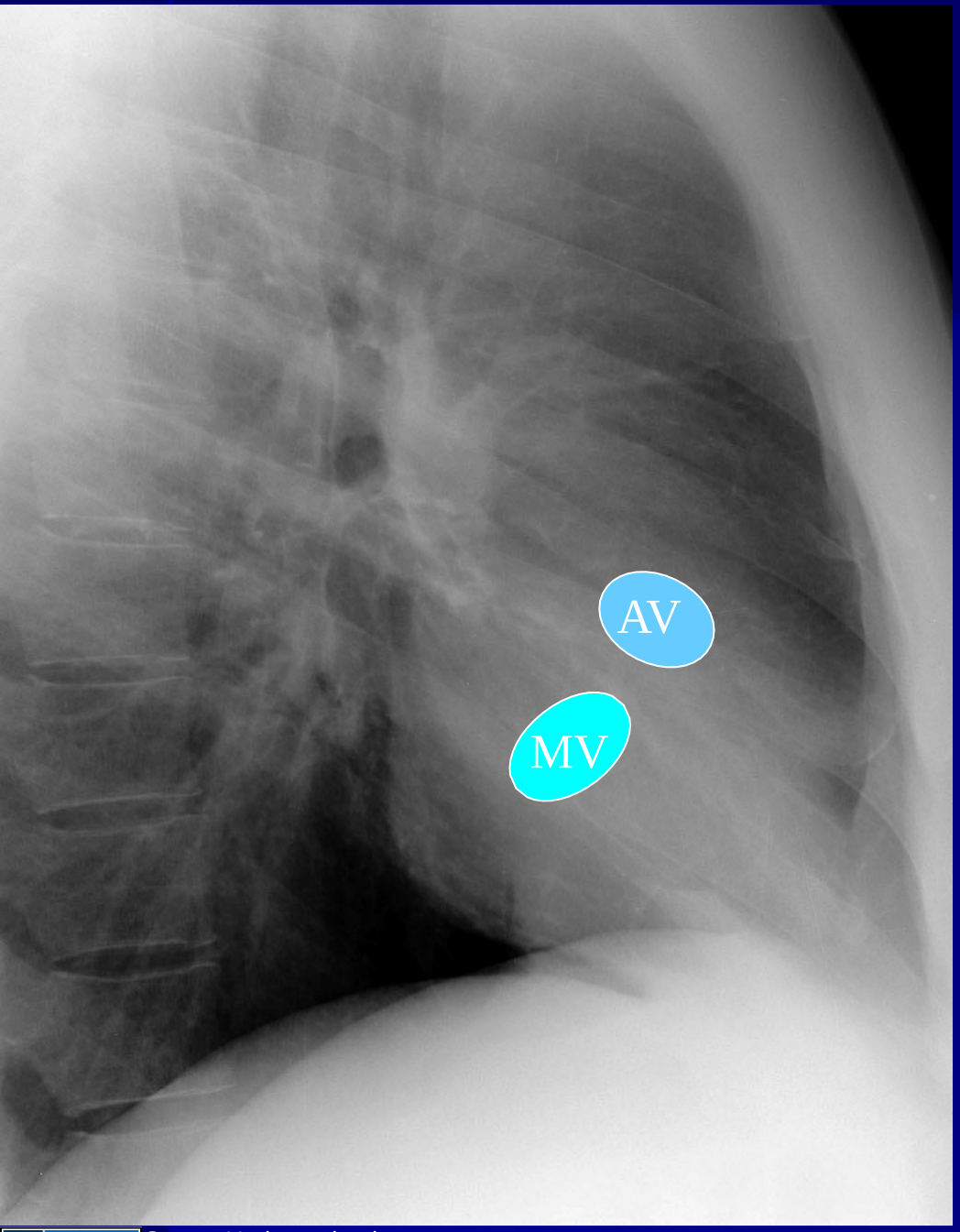
MV

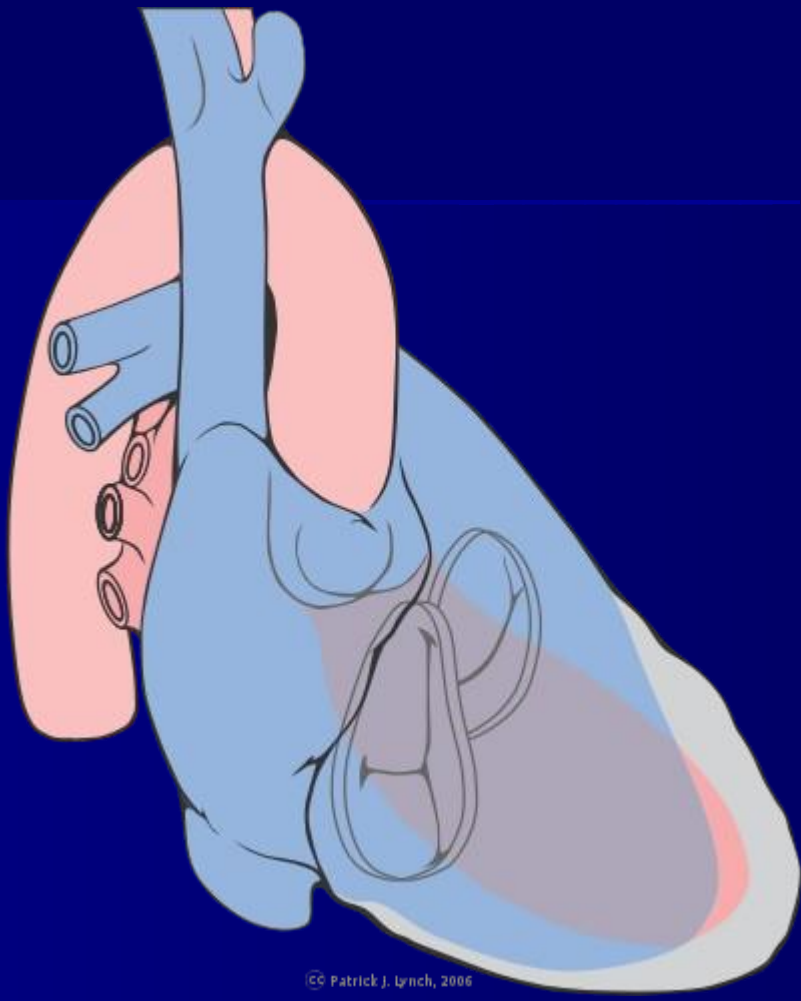
normal frontal view



PD-EXP Gray's Anatomy, wordpress

normal lateral view

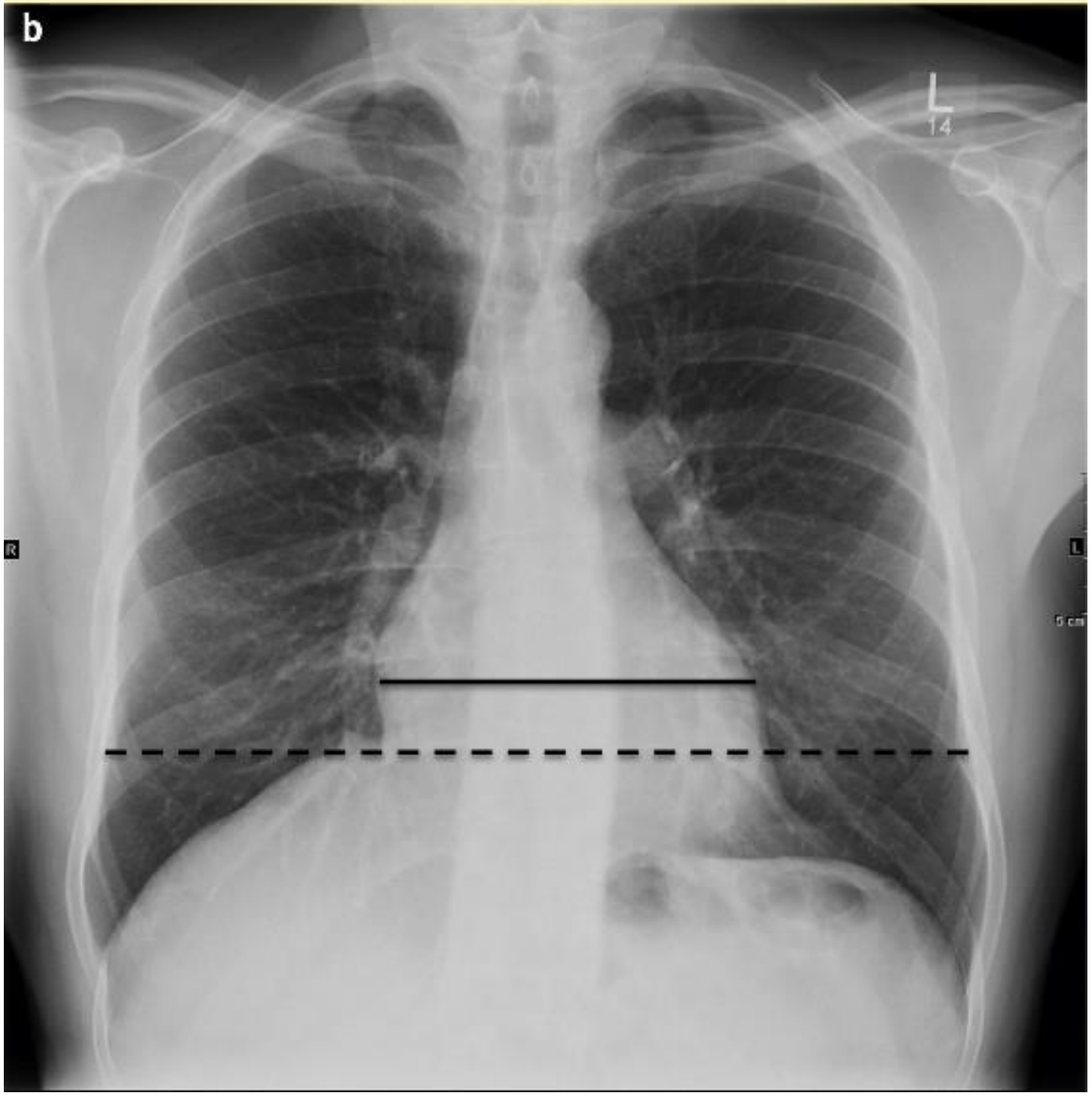




Abnormal Cardiac Contours

Cardiac enlargement

- The size of the cardiac silhouette can be assessed on a PA chest radiograph
- transverse cardiac diameter – less than 13.5 cm in 90% of men and 12.5 cm in women
- cardiothoracic ratio – up to 0.5 in adults and 0.6 in neonates


b
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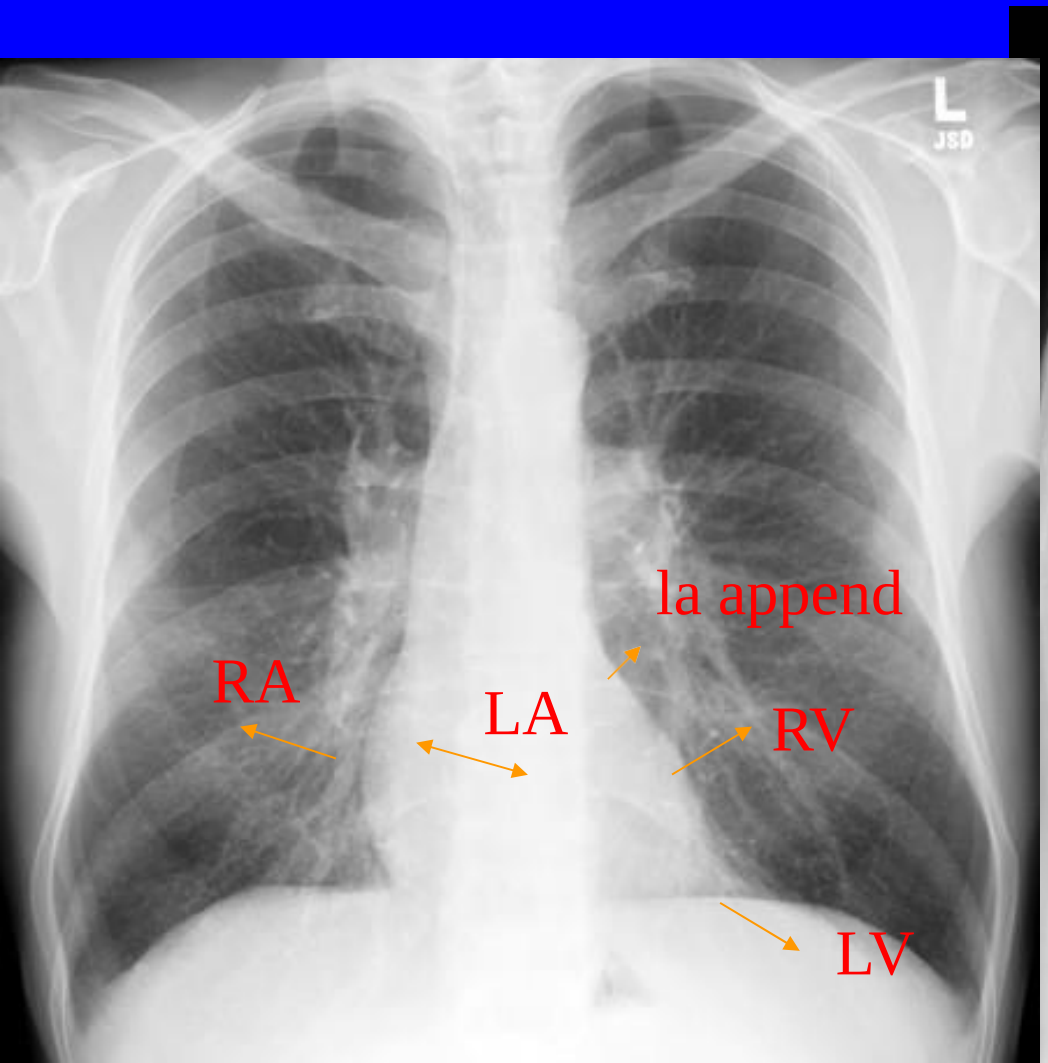
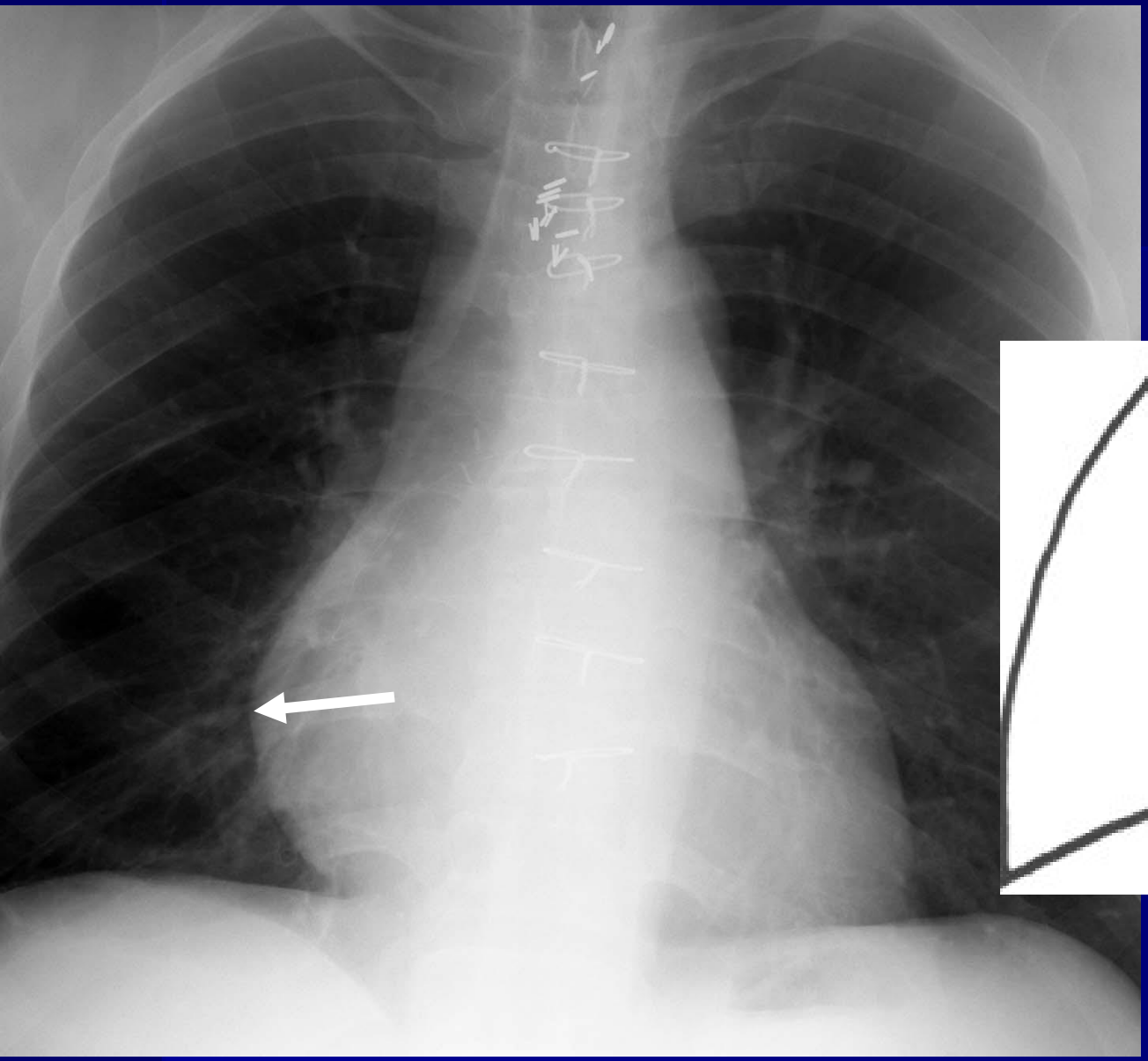
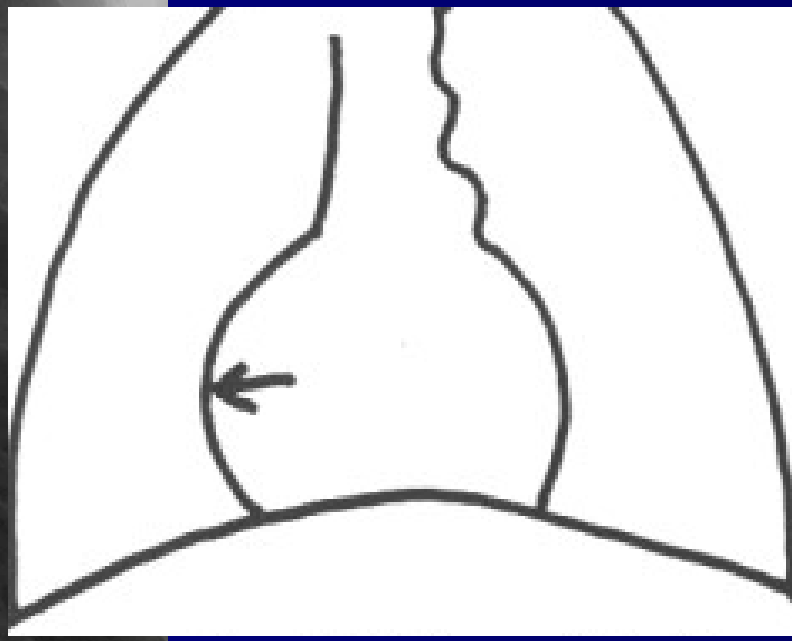
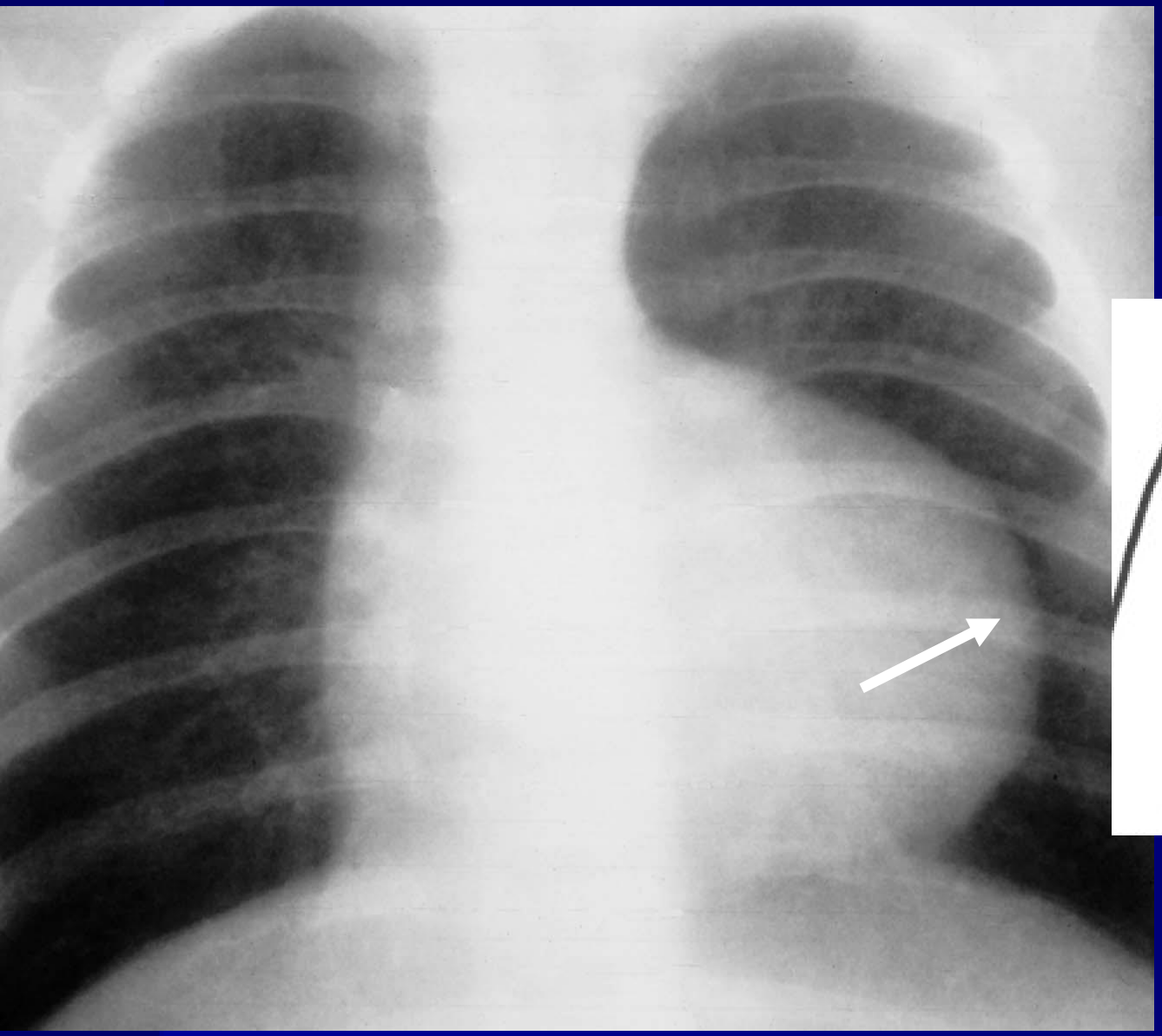
Chamber Enlargement



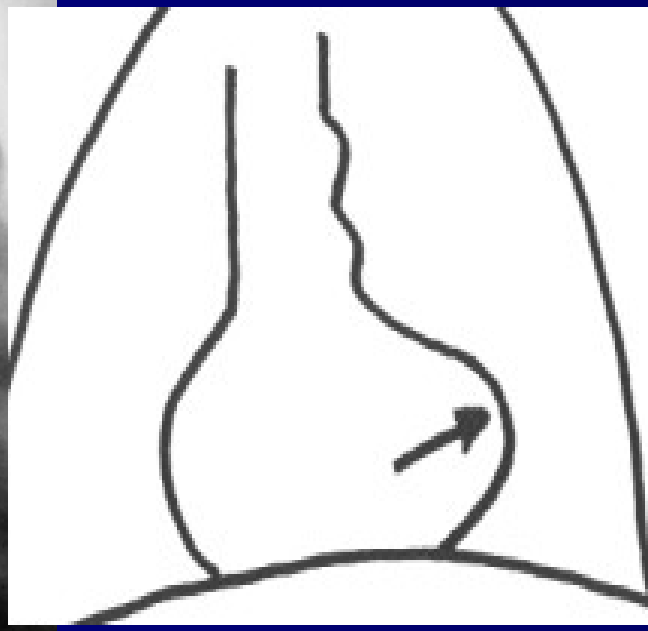
Enlarged Right Atrium

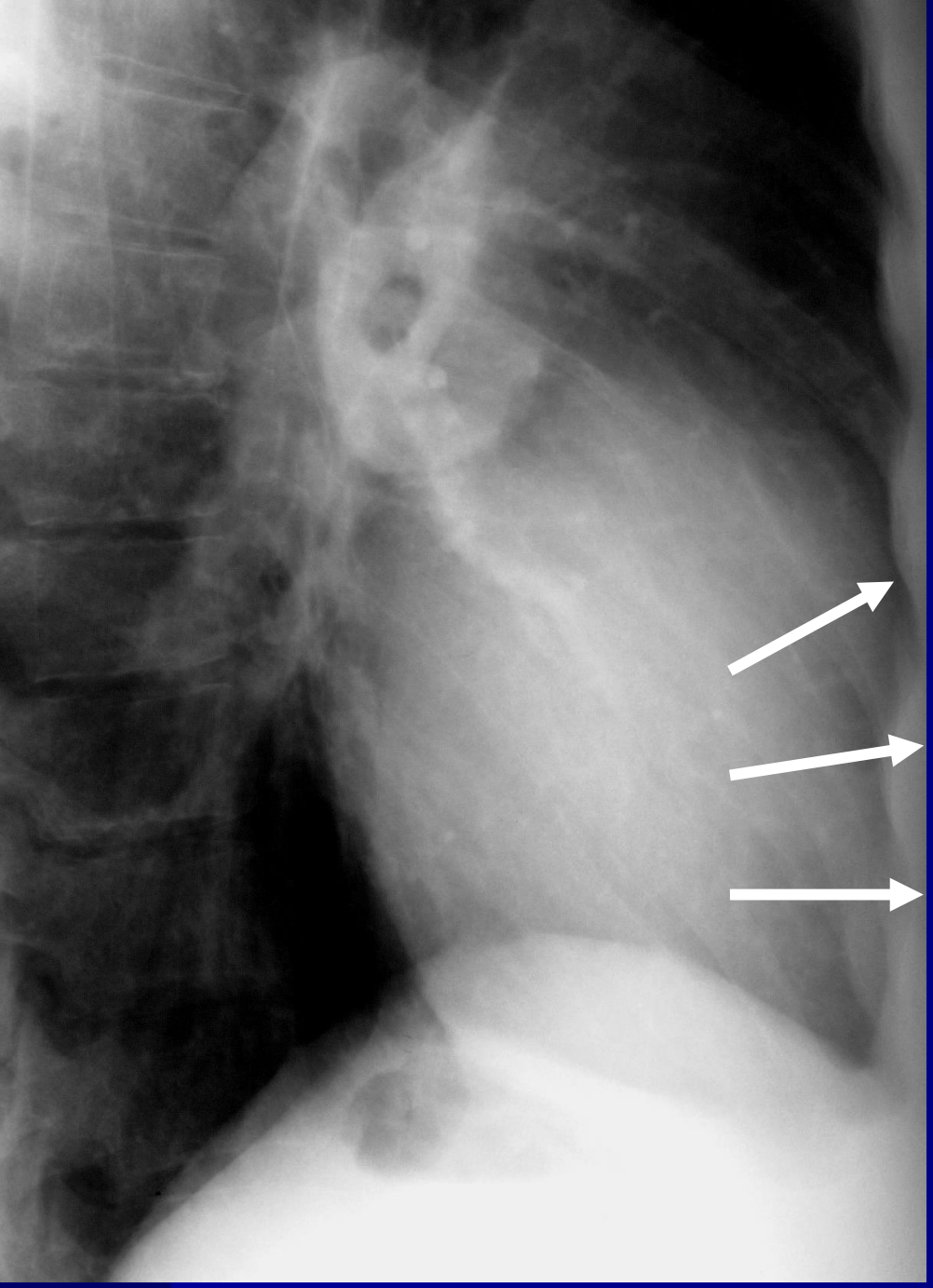




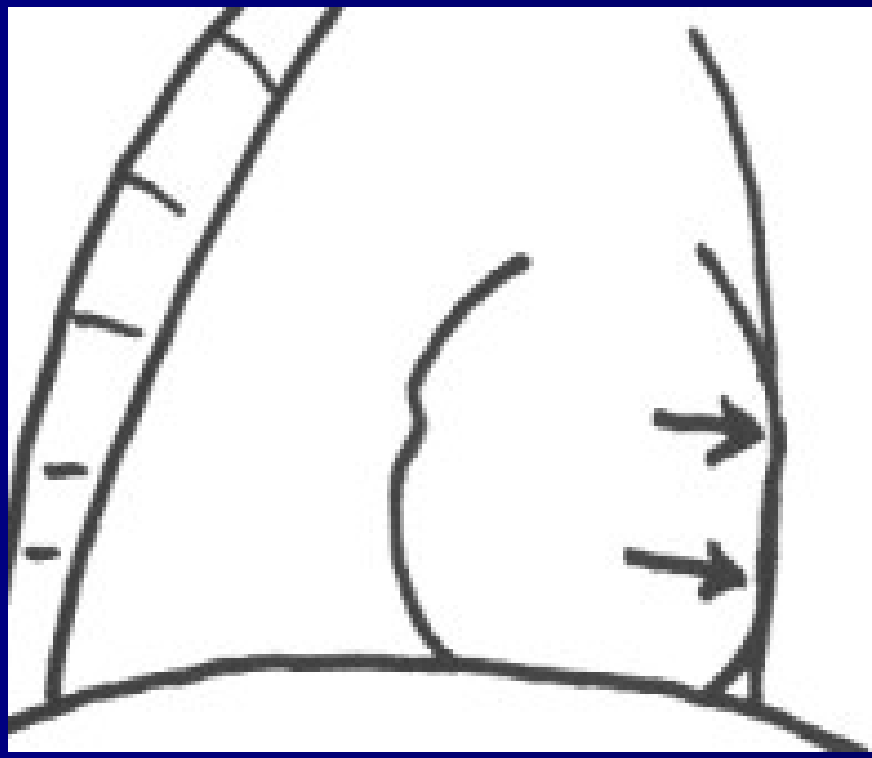


Enlarged Right Ventricle



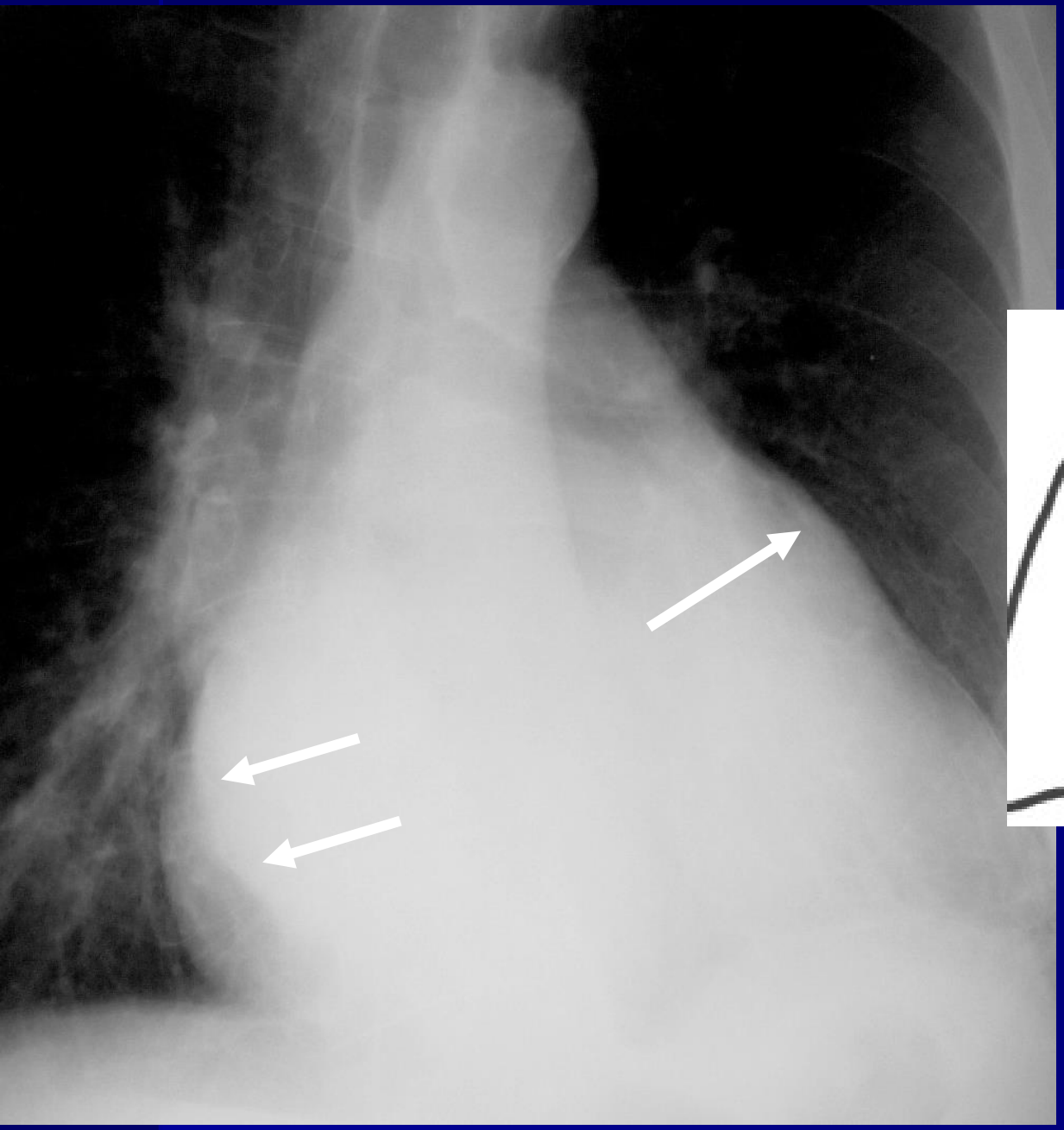


Enlarged Right Ventricle (lateral CXR)

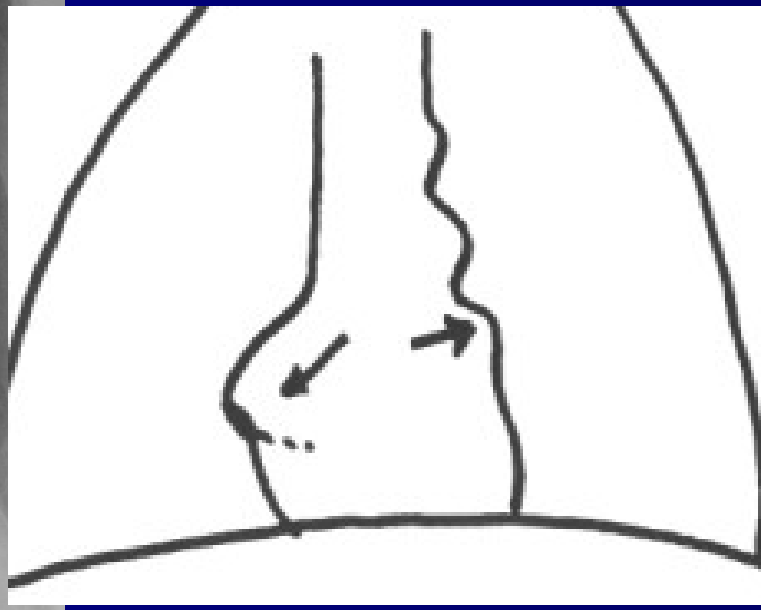


Left atrial enlargement

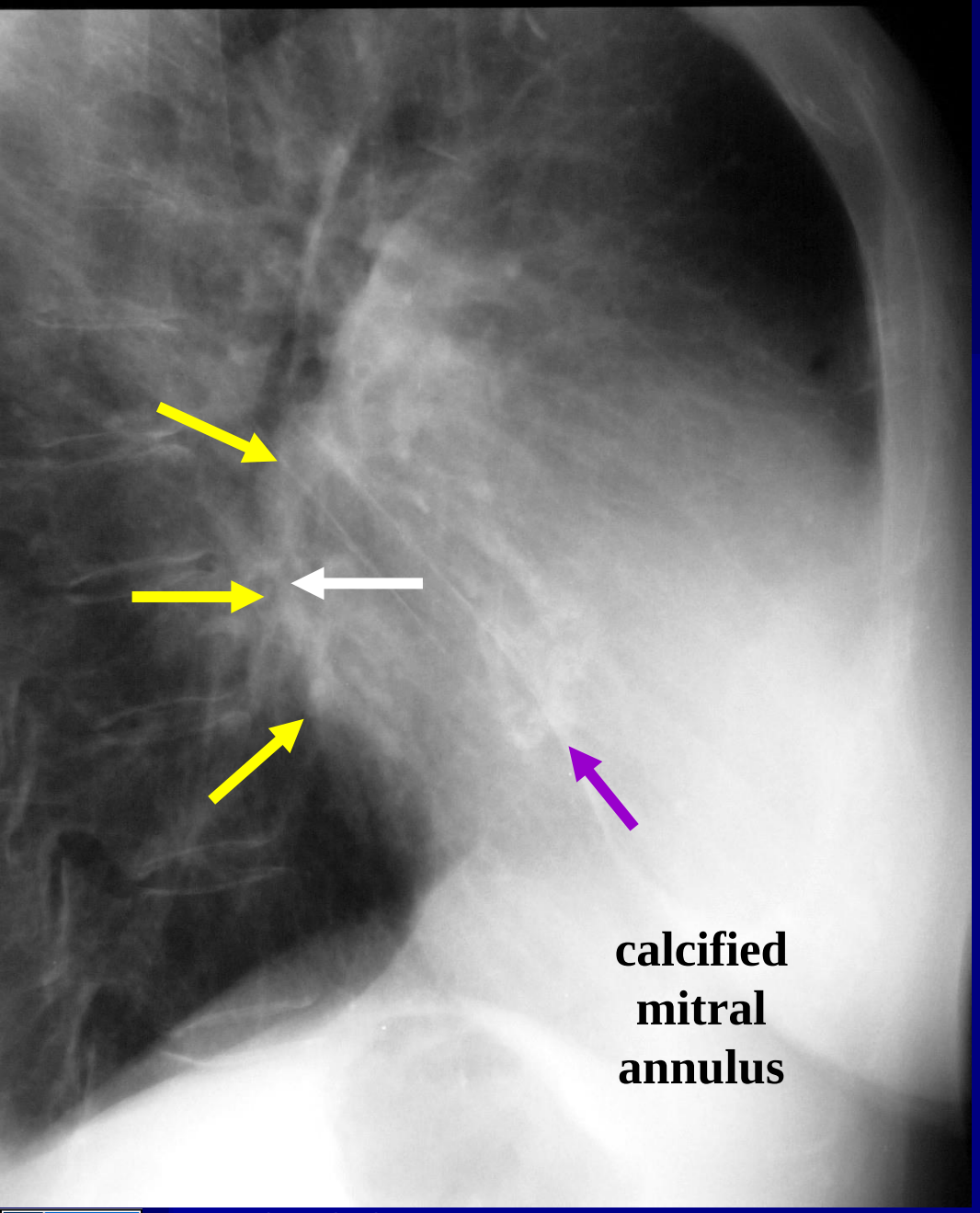
- left atrium is projected over the midline below the carina on the PA chest radiograph.
- An enlarged left atrium must be at least 2.5 times its normal size to be detected.
- elevation of left main bronchus with splaying of the carina
- double right heart border, displaced to the right
- enlarged left atrial appendage, which is most suggestive of rheumatic heart disease.

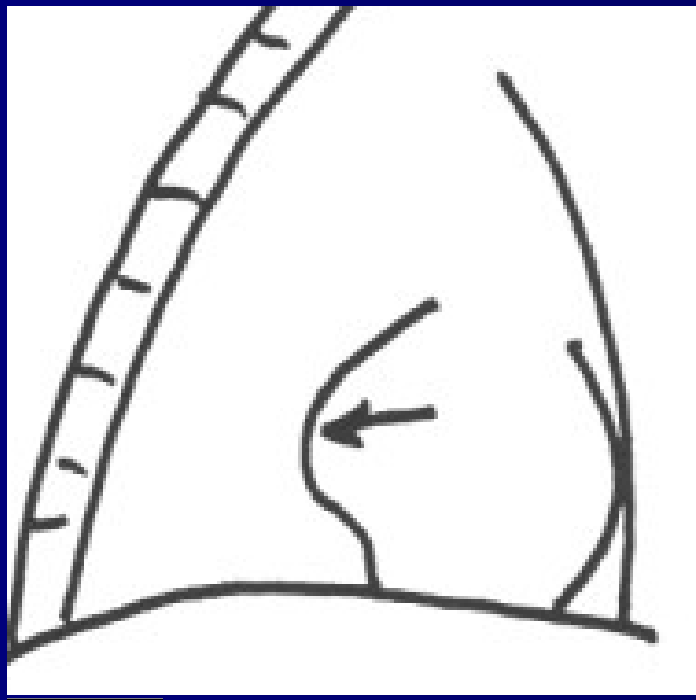


Enlarged Left Atrium



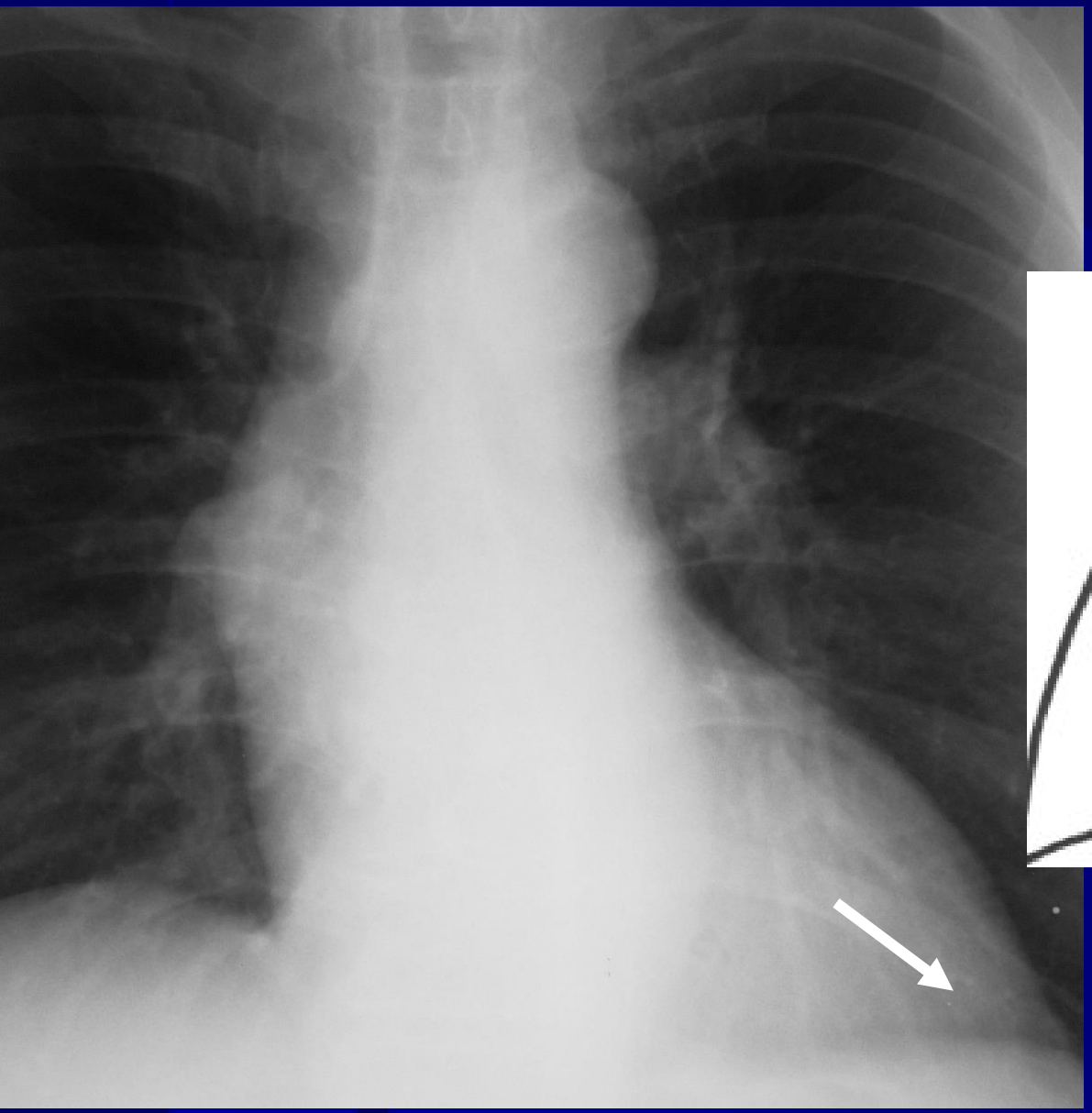
Enlarged Left Atrium



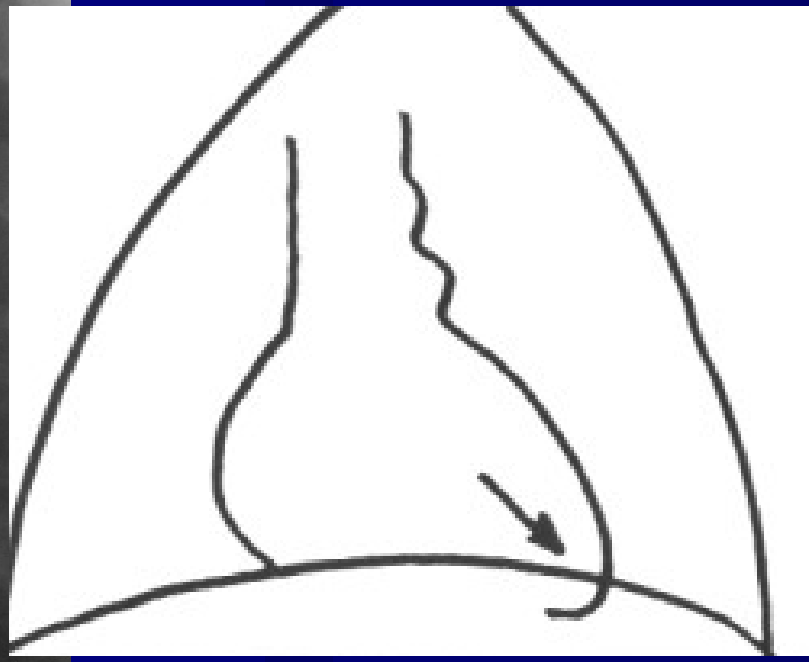


Left ventricular enlargement

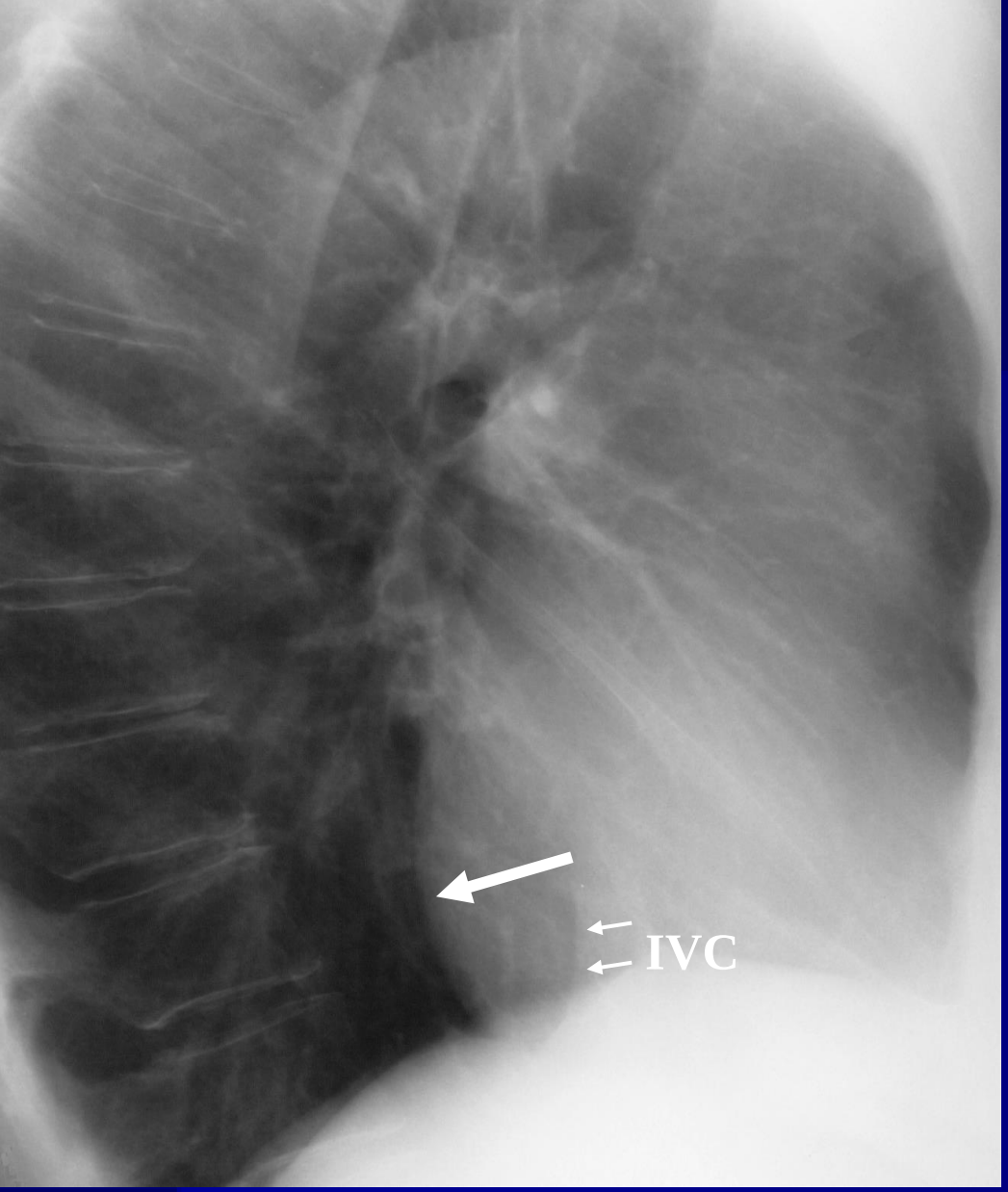
- left ventricle forms the left heart border and the cardiac apex.
- rounding of the cardiac apex (early)
- downward and leftward elongation of the ventricular axis
- most commonly secondary to cardiac ischaemia.
- Other causes included aortic valve disease, mitral regurgitation, hypertension and cardiomyopathy

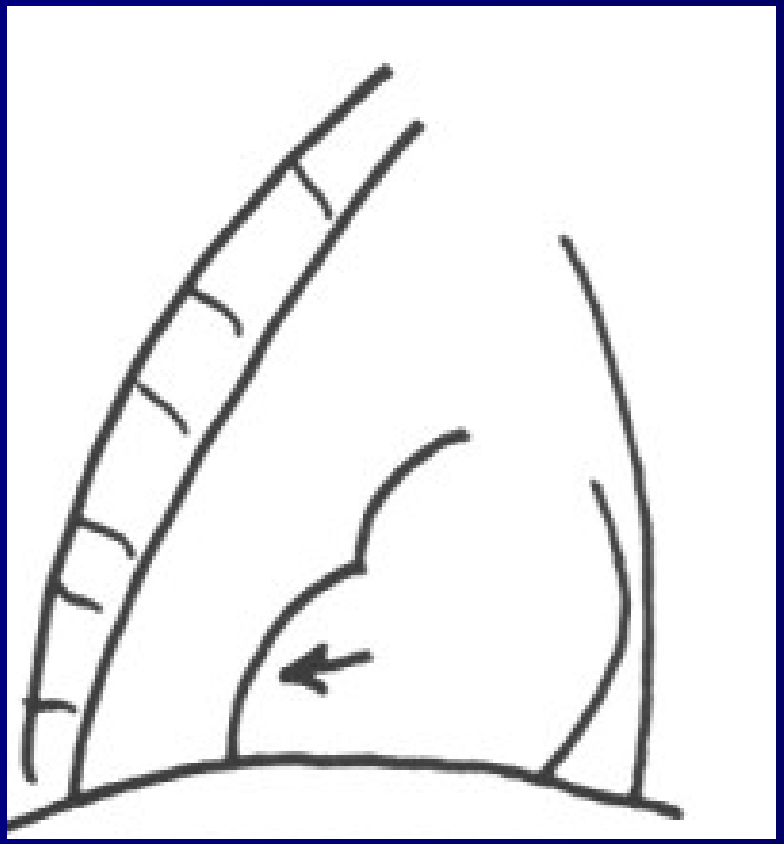


Enlarged Left Ventricle

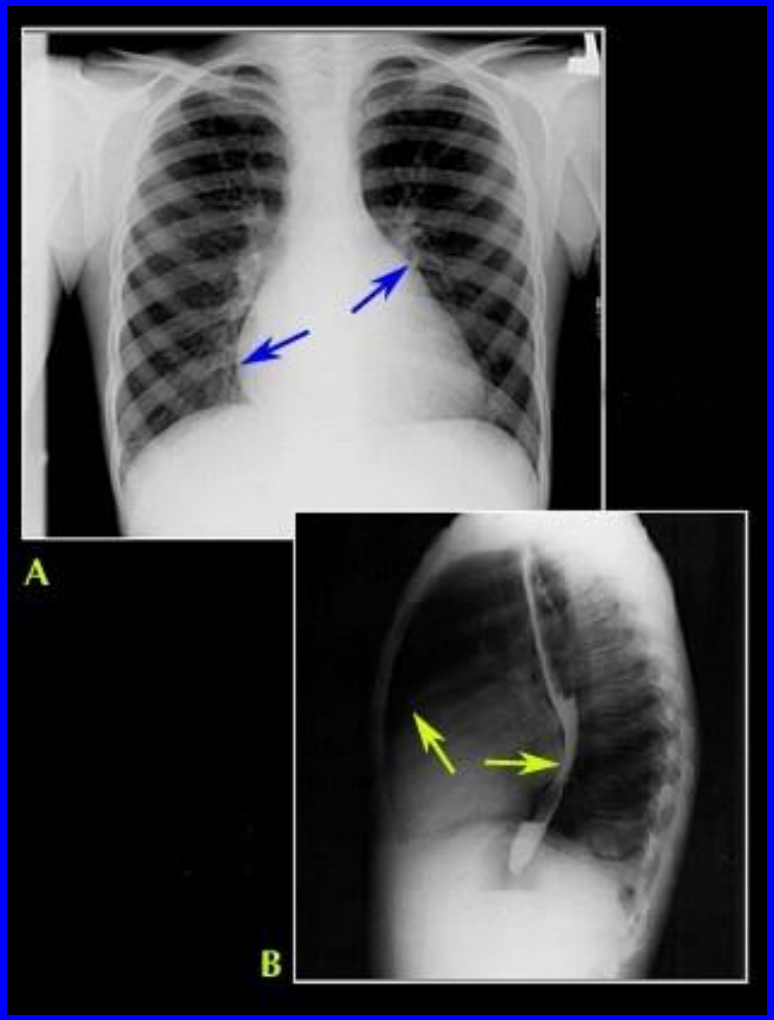


Enlarged Left Ventricle

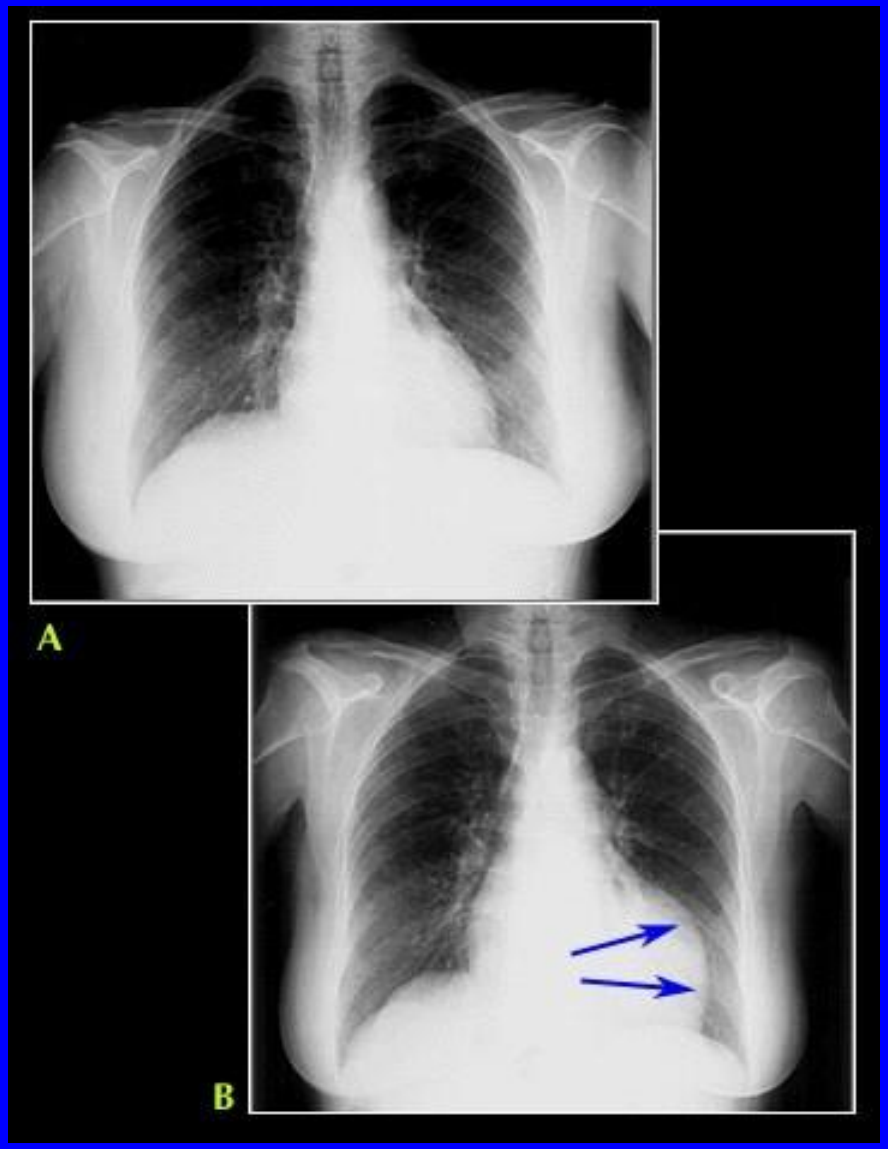




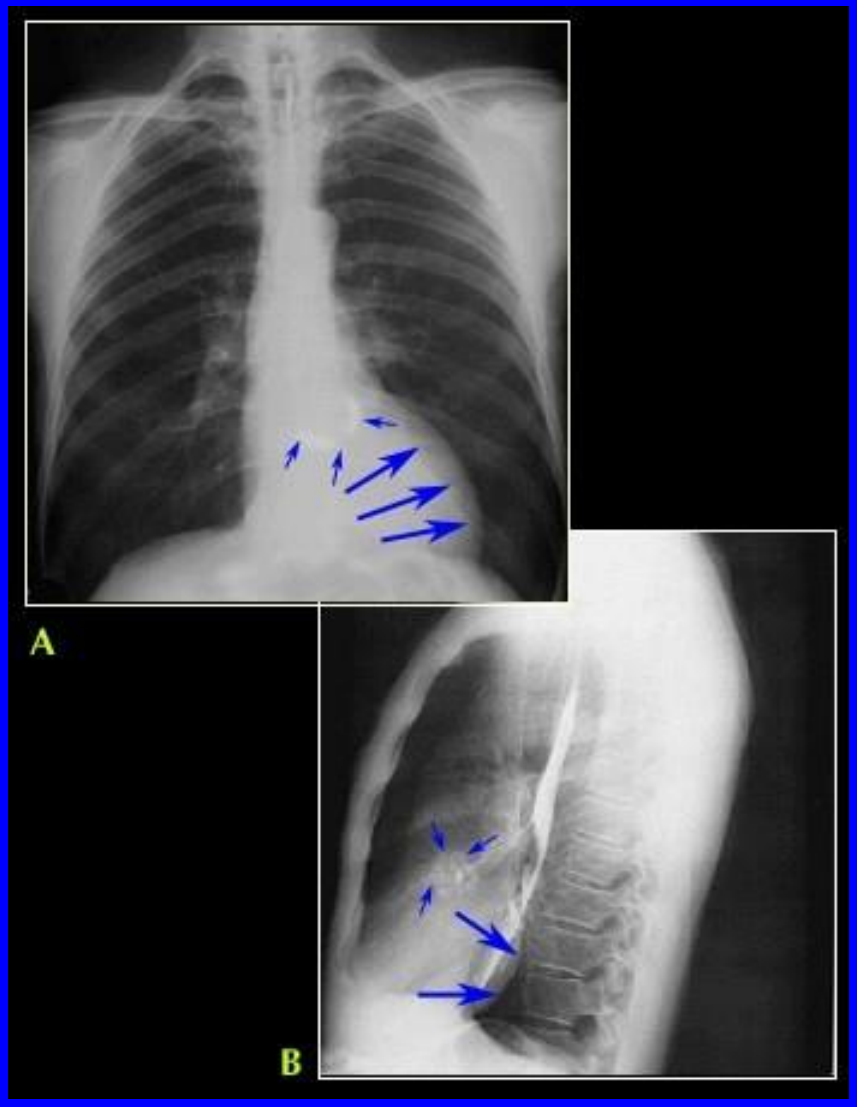
Cardiac Contours: enlarged RA, LA, and RV in mitral stenosis



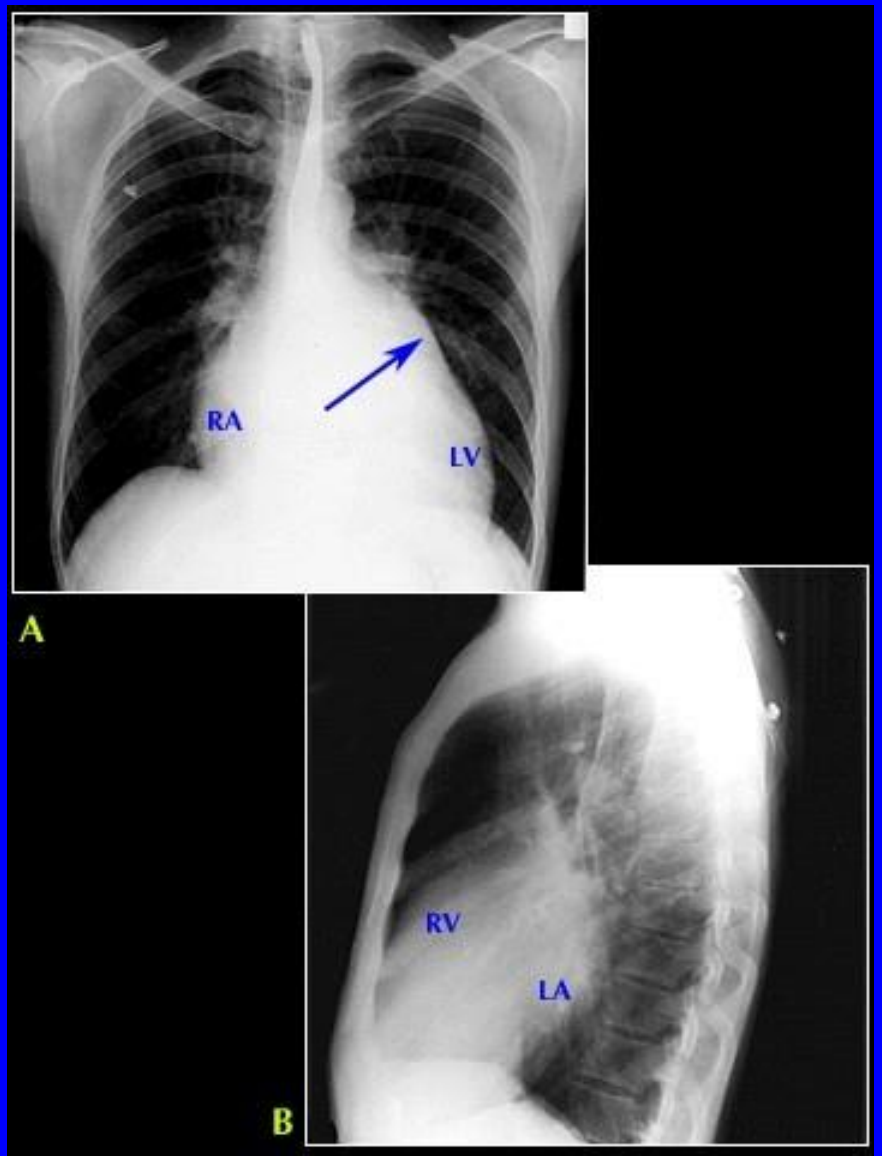
New enlarged LV due to aneurysm



Aortic Valve calcified due to AS

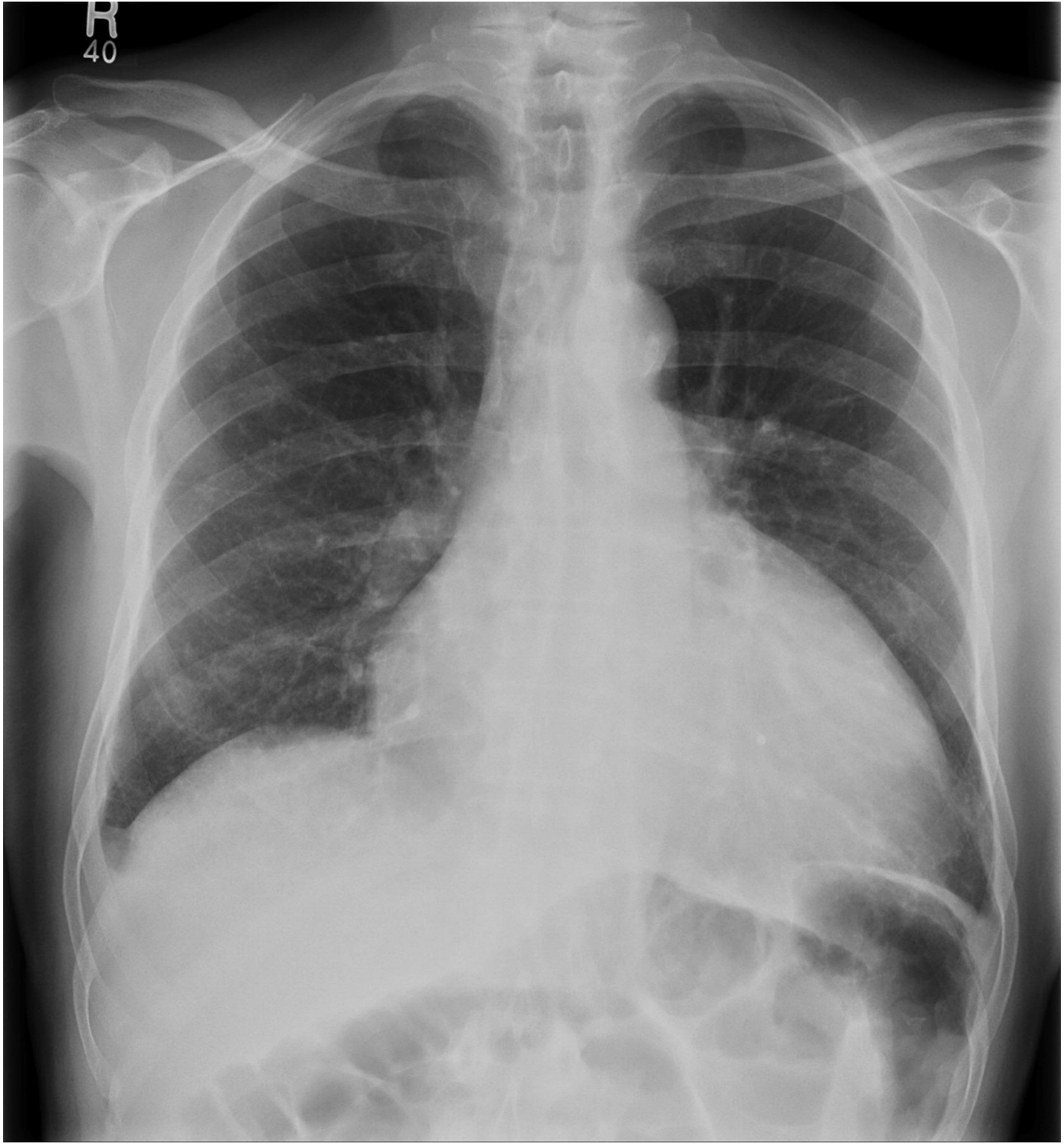


4 chamber enlargement due to MS/MI

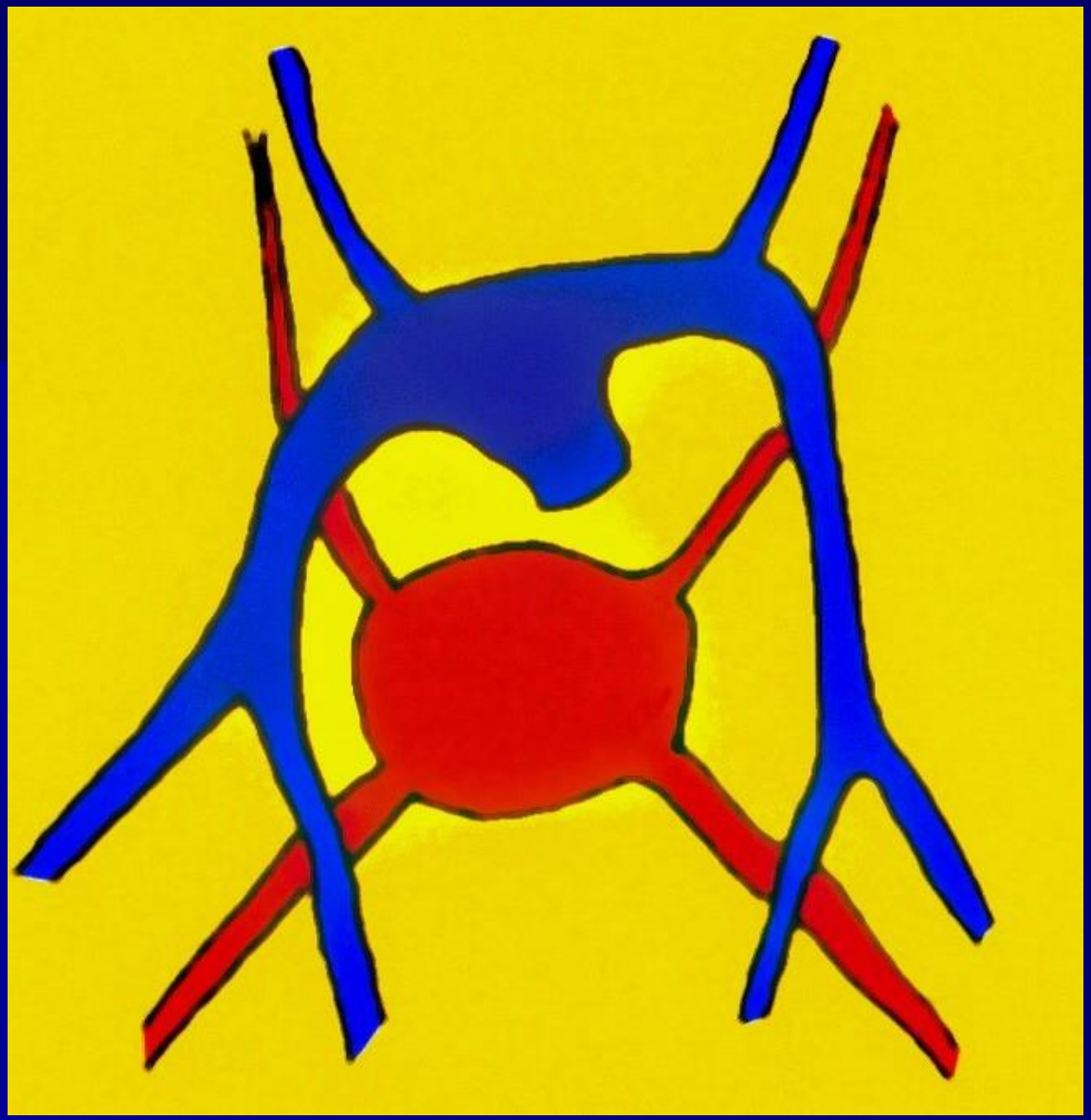


Pericardial effusion

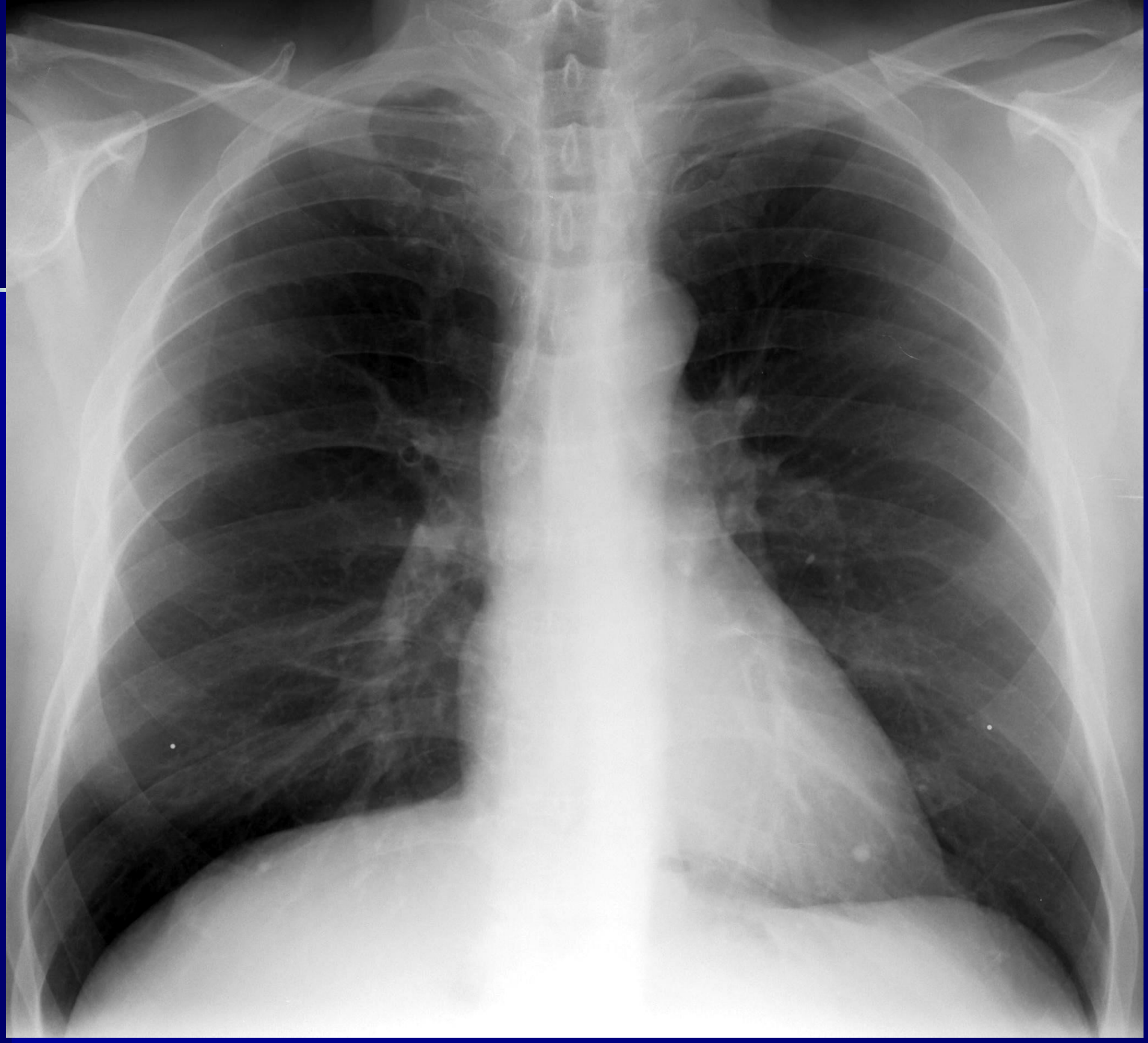
- A sudden enlargement of the cardiac silhouette
- a globular configuration or cardiac enlargement with diminution of the pulmonary vessels suggests pericardial effusion

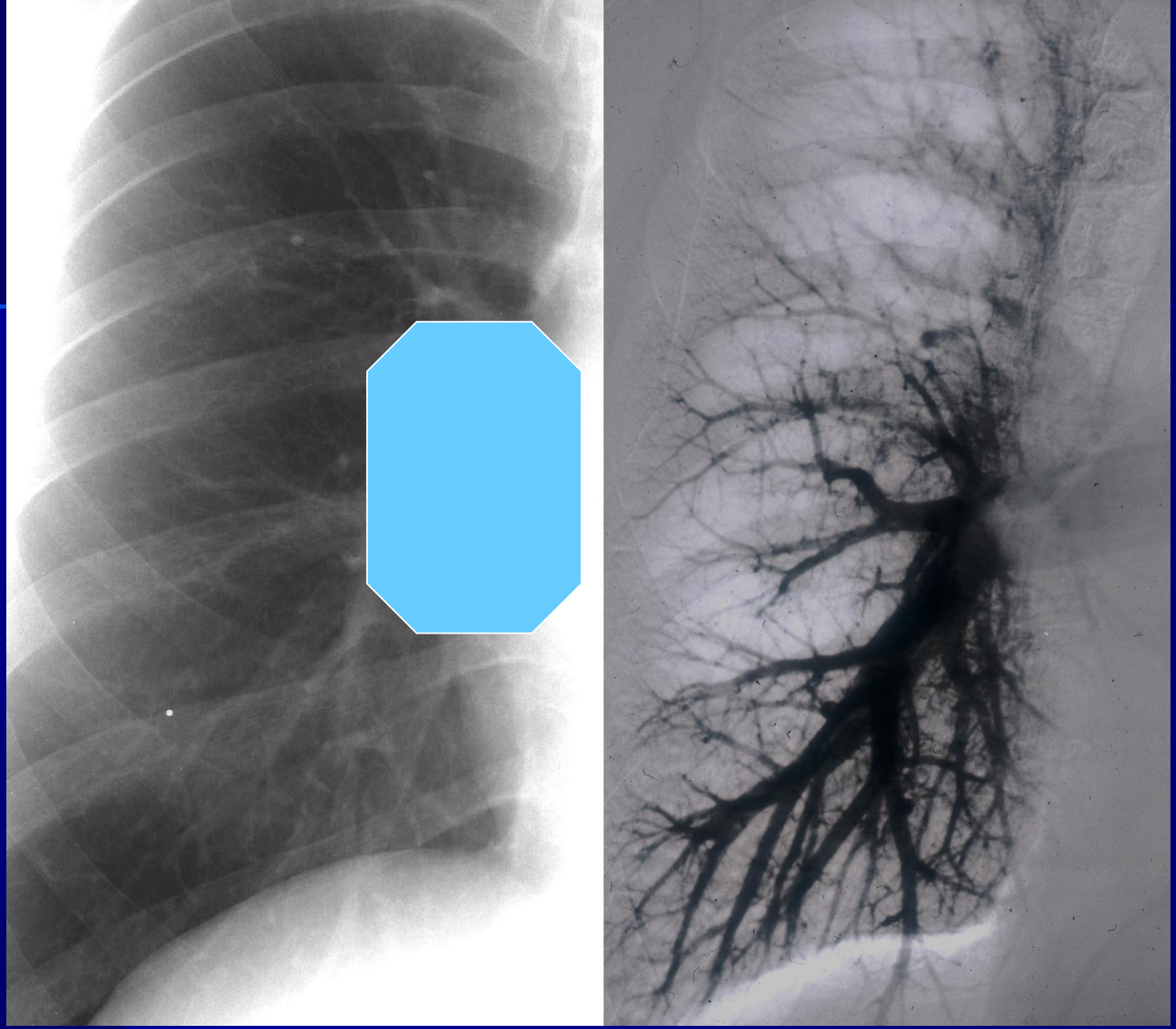

R
40

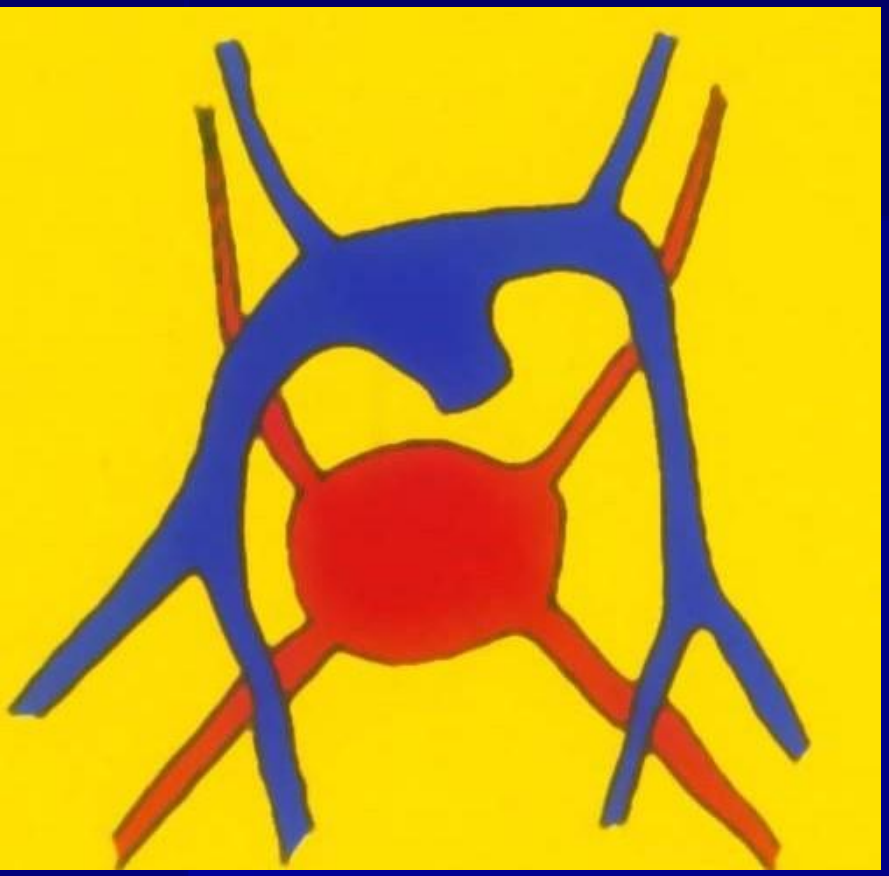
Pulmonary Blood Flow



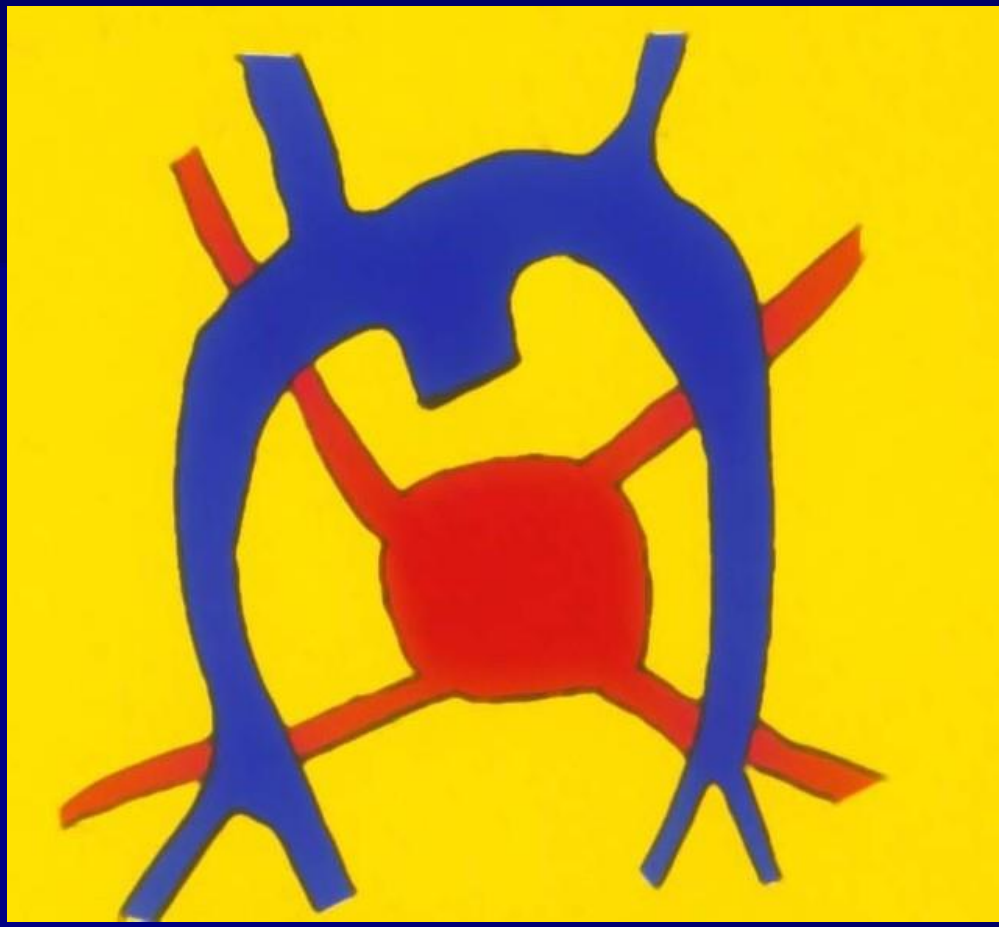
Normal Flow Pattern



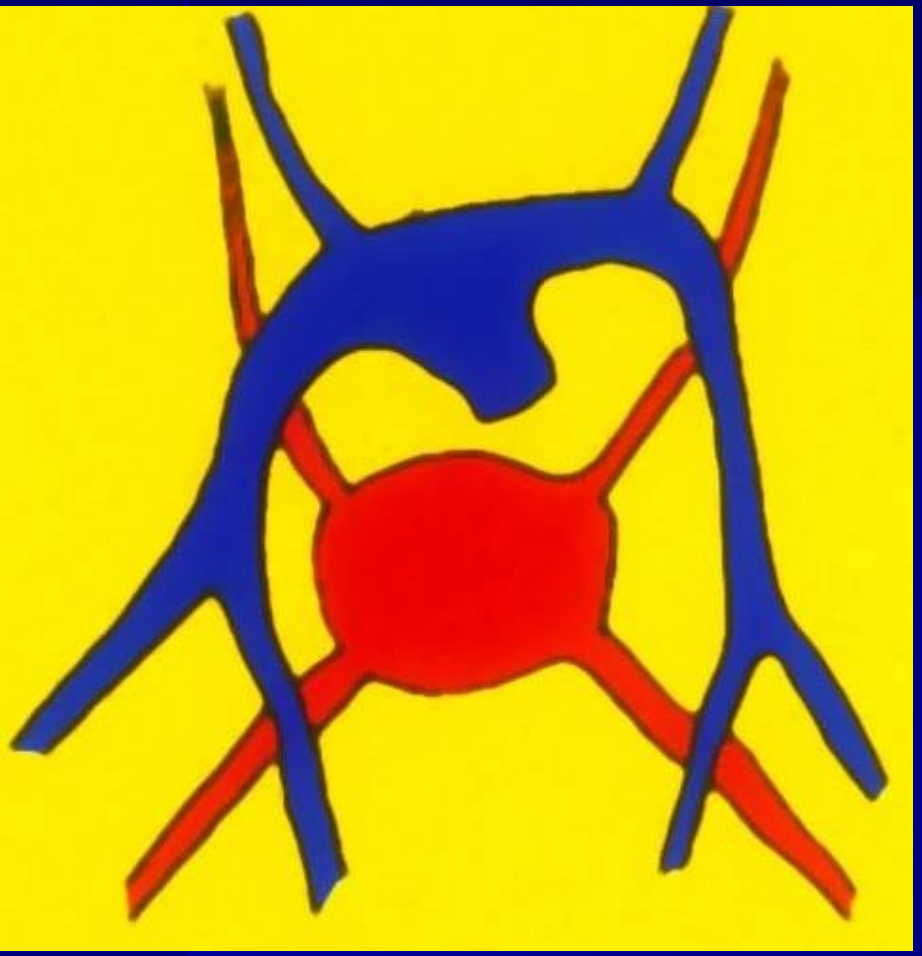




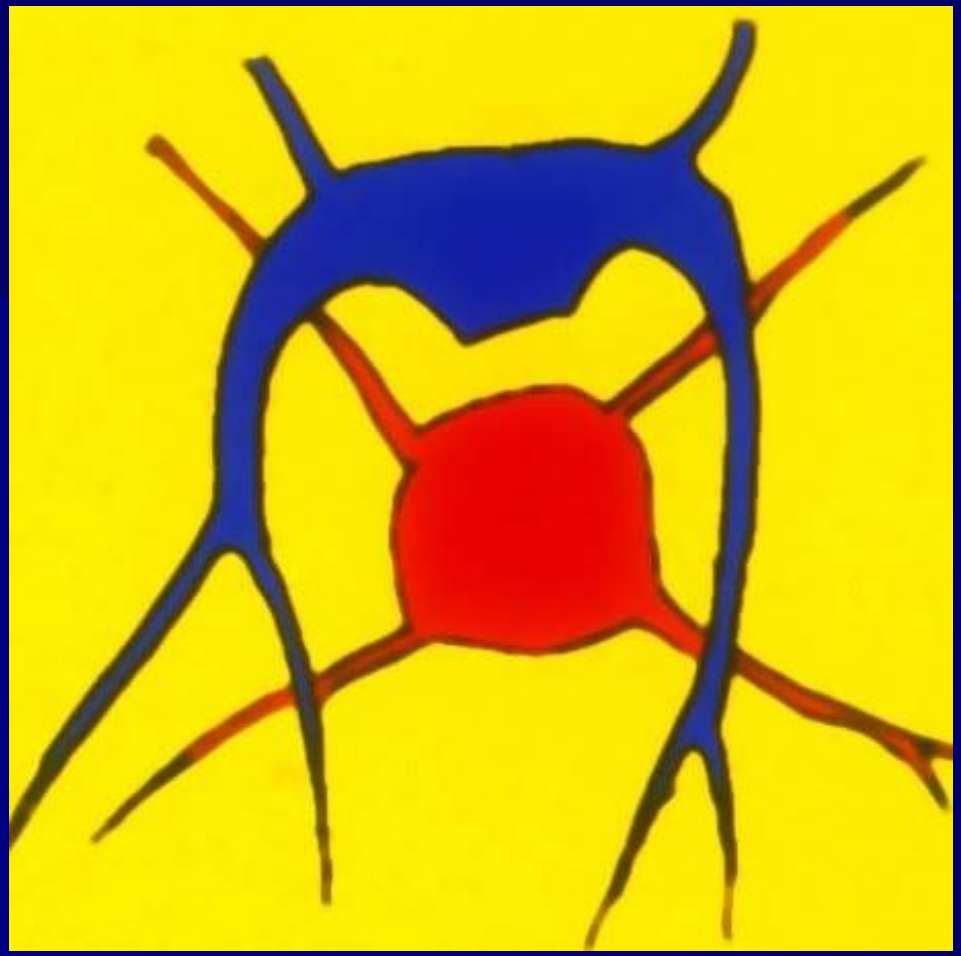
Normal Flow



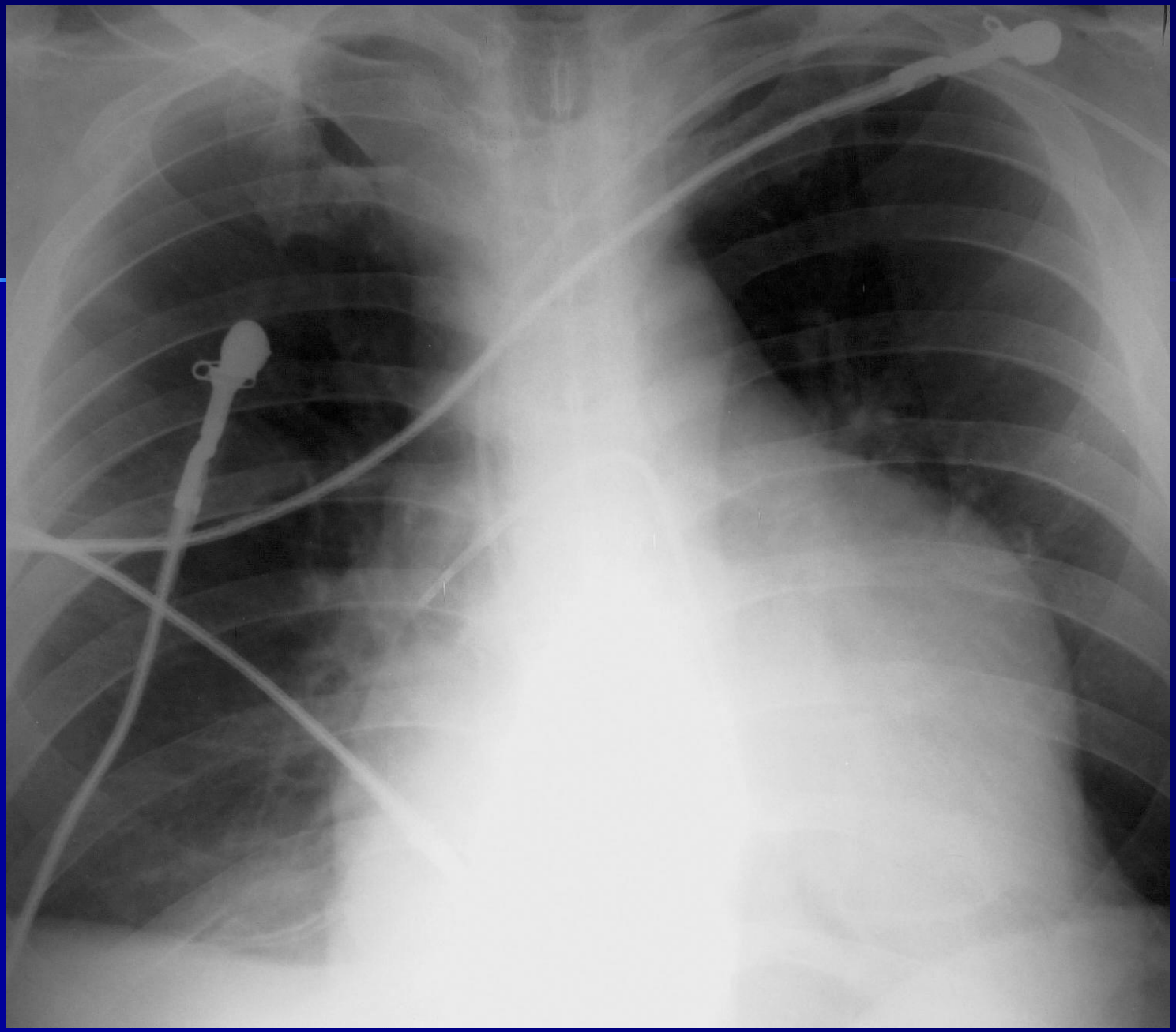
-Increased Flow

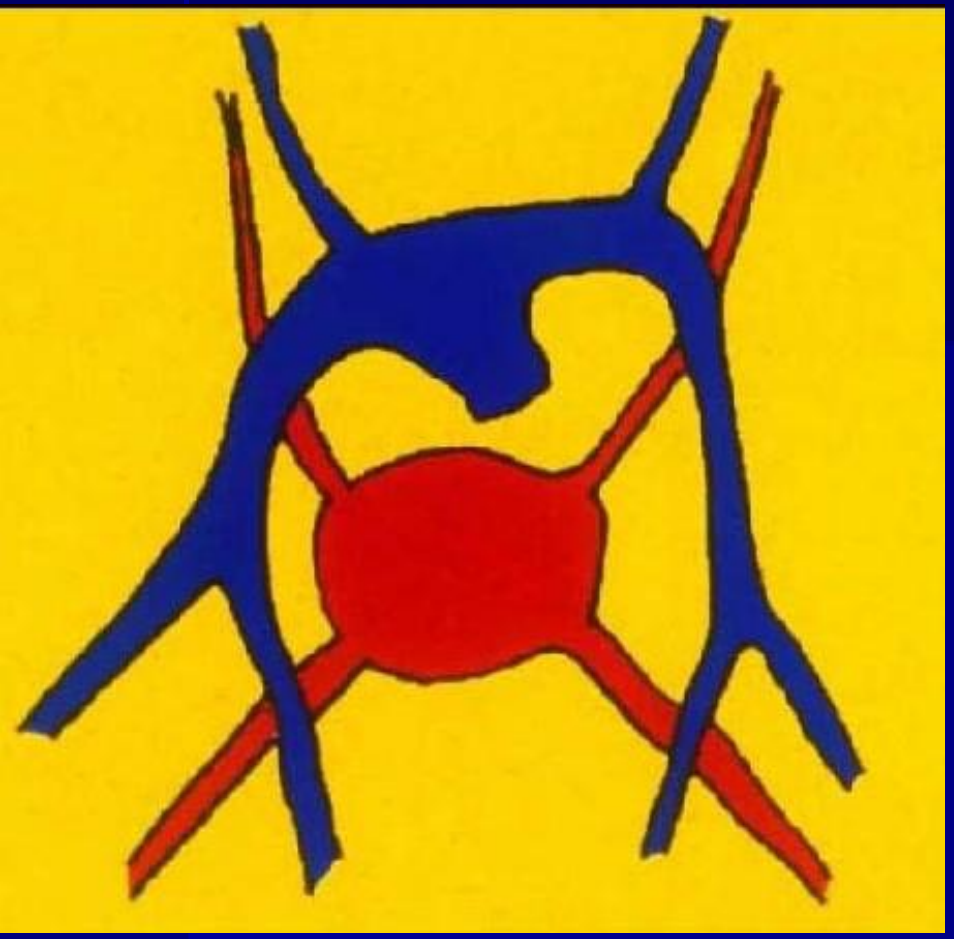


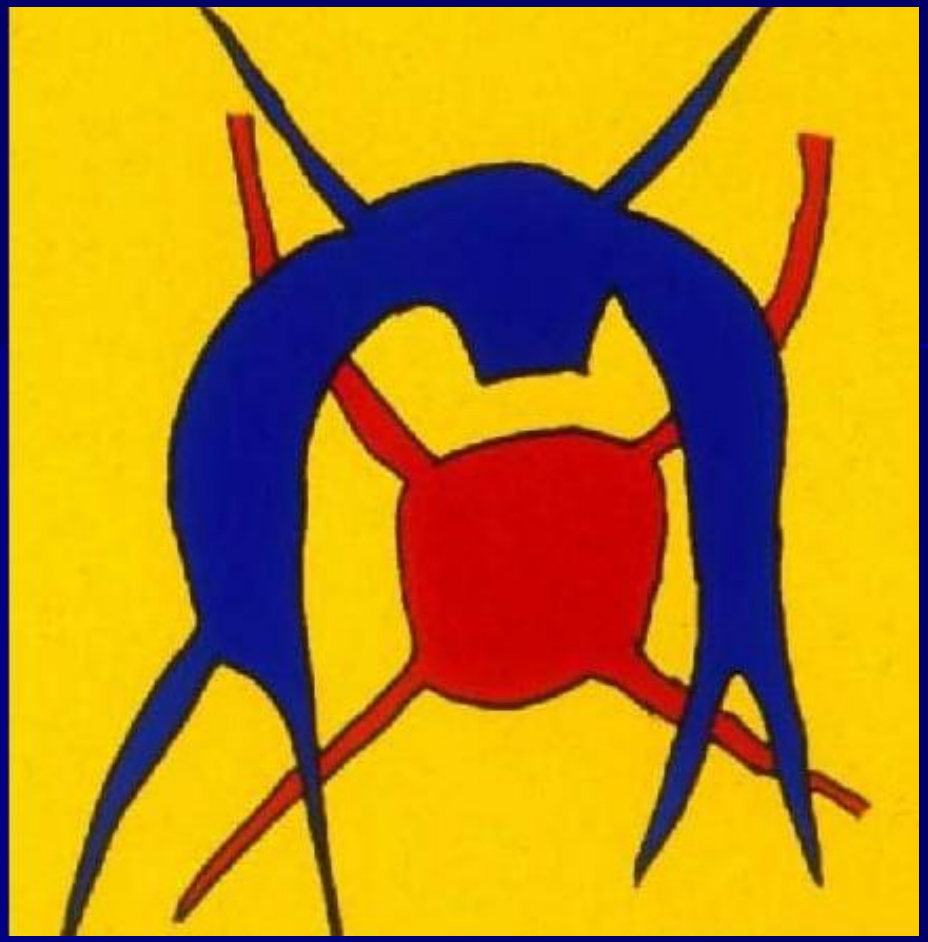
Normal Flow



Decreased Flow

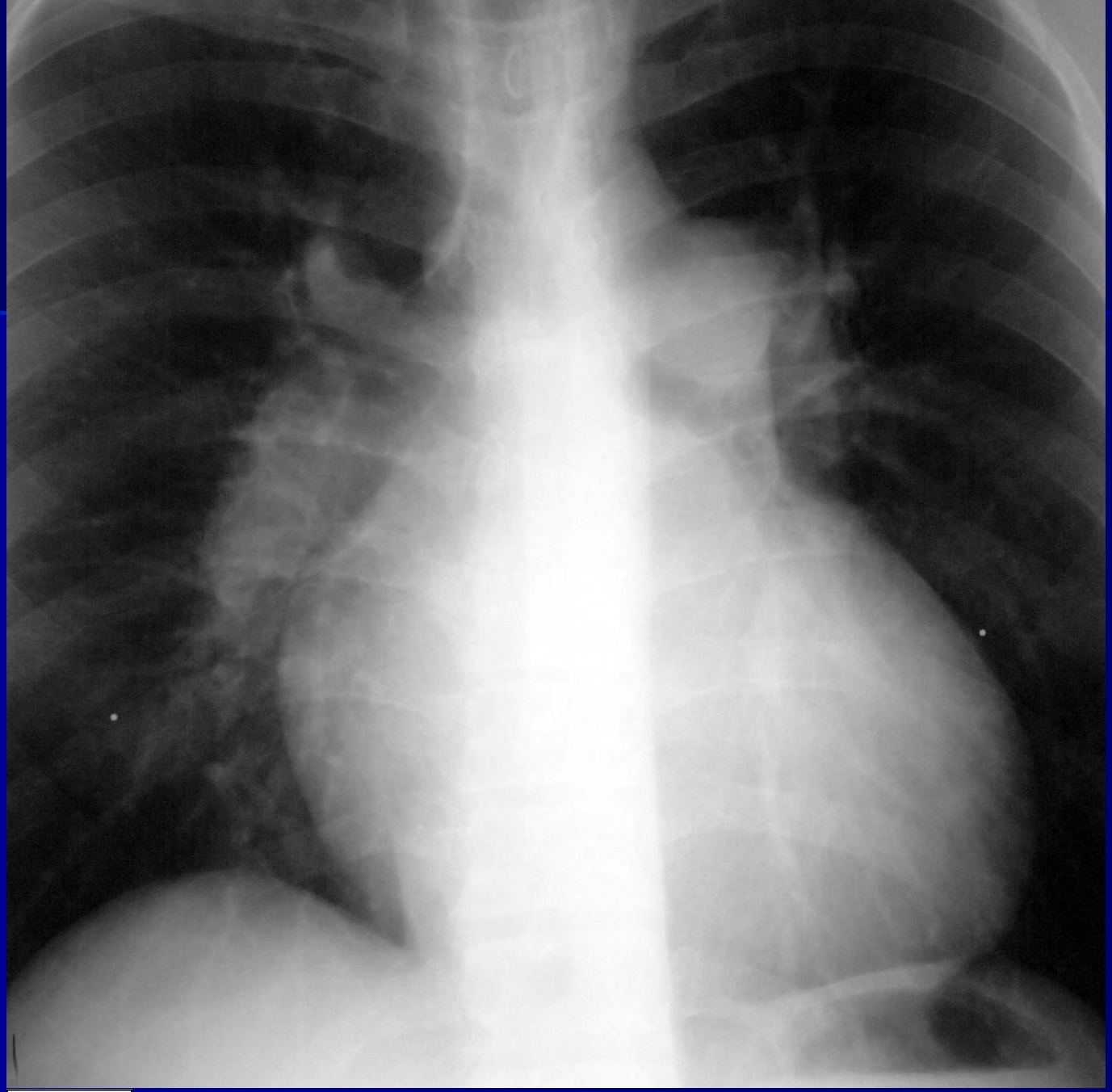






Normal Flow

Pulmonary Hypertension



Thanks for your attention