Pneumothorax

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Outline

- Classification of Pneumothoraces
- Epidemiology & Pathophysiology
- Diagnosis
- Guidelines & Evidence
- Management options
- Summary

DEF.

Classification of Pneumothorax

Spontaneous;

- Primary spontaneous PMTX - occurs in people without clinically apparent lung disease (subpleural blebs & bullae)
- Secondary spontaneous PMTX- occurring as a complication of preexisting lung disease (esp COAD)

Classification of Pneumothorax

Other;

- Iatrogenic (procedural- lines & biopsies)
- Traumatic (Penetrating, blunt, barotrauma)
- Non-Pulmonary in origin (Boerhaave's, Catamenial, 2^{o} to pneumoperitoneum)

Pathophysiology

- Lung tissue breach, air enters pleural space (negative pressure), intra-pleural pressure equilibrates with intra-bronchial pressure.
- Unventilated segments create a shunt and potentially hypoxia.
- Tension PMTX is due to “Flap-valve” effect, mediastinal shift distorts great vessels, reduces VR and causes hypotension.

Symptoms and signs.

- Primary;
  - often occur at rest with ispilateral pain or acute SOB
  - symptoms may resolve within 24 hrs
  - small PTX (<15%) may have no signs, large PTX classic signs. Tachycardia is common.
  - ABG may show ⇑ A-a gradient and acute respiratory alkalosis

Symptoms and signs.

- Secondary;
  - Small PMTX often badly tolerated in severe CAL- potentially life-threatening.
  - SOB and hypoxia often disproportionate to size of PMTX. Most have ipsilateral Pain
  - Signs often subtle & masked by underlying disease
  - hypercarbia often occurs

Symptoms and signs.

- Signs include:
  - Asymmetrically decreased breath sounds
  - Hyperresonance
  - Altered vocal resonance
  - Often chest examination is unremarkable
  - Less commonly: Hamman’s crunch or Surgical emphysema
  - Tracheal deviation & shock= ?Tension pneumothorax

Complications.

Acute;

- Tension pneumothorax
- Sc emphysema
- Pneumomediastinum/ pericardium

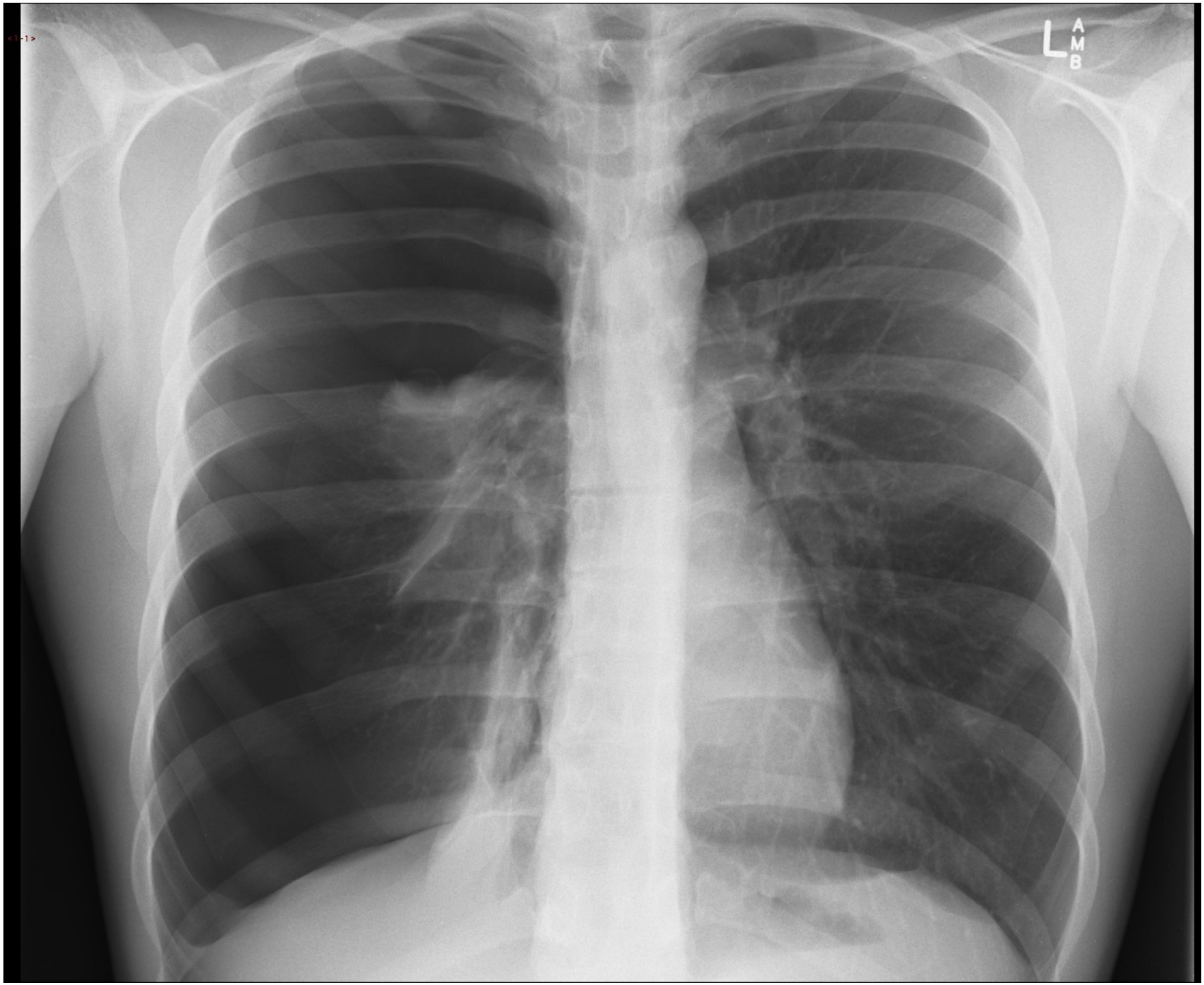
Delayed;

- Failure to rexpand
- Recurrence

Diagnosis

CXR

- PA erect CXR will demostrate 83%
- routine use of expiratory films doesn’t increase yield (?useful for small apical PTX).
- Hyperlucency, lack of peripheral markings, fine visceral pleural line paralleling chest wall, blunted CP angle
- lat. decubitus view may be helpful
- supine films, PMTX easily missed - deep sulcus (CP angle)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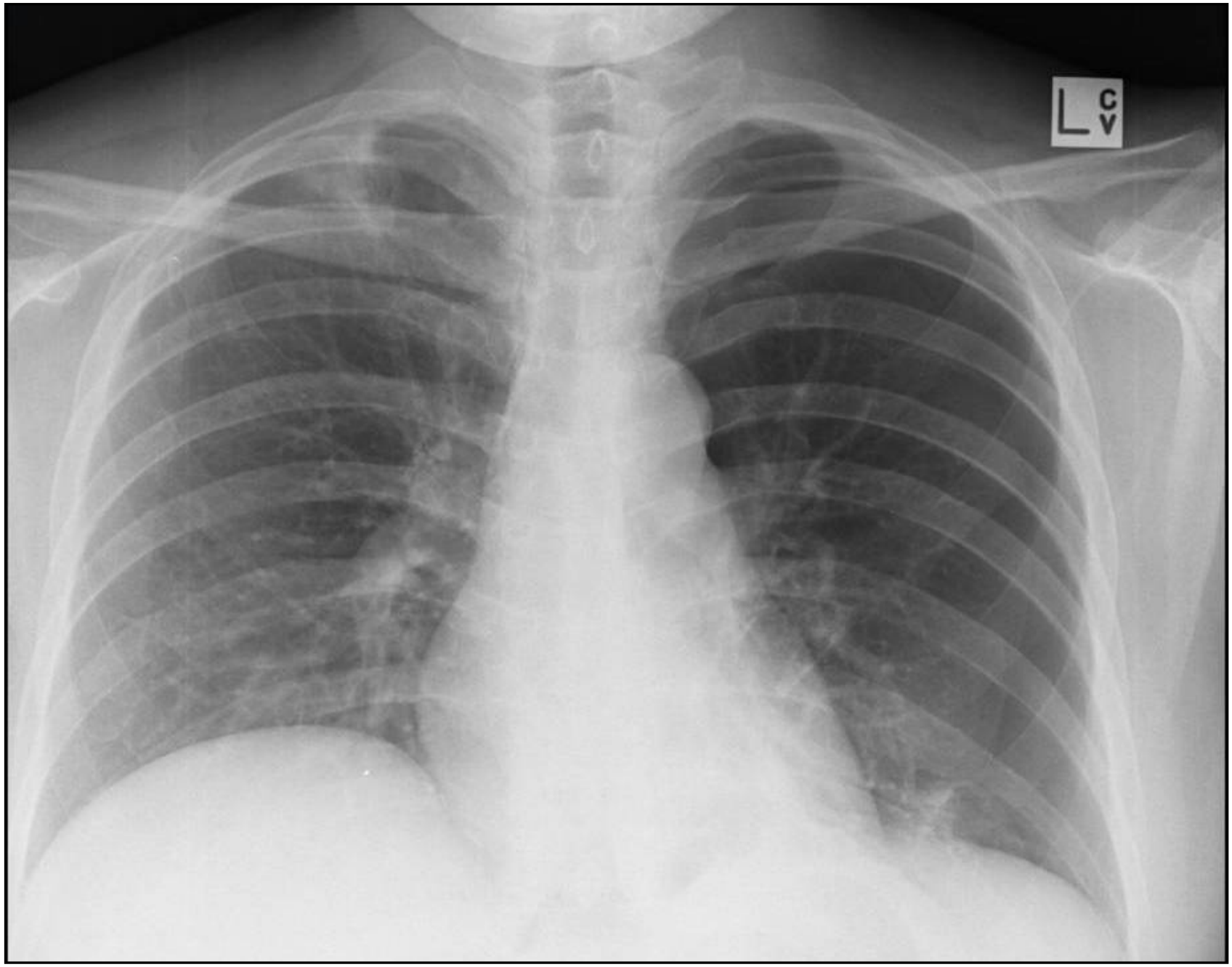
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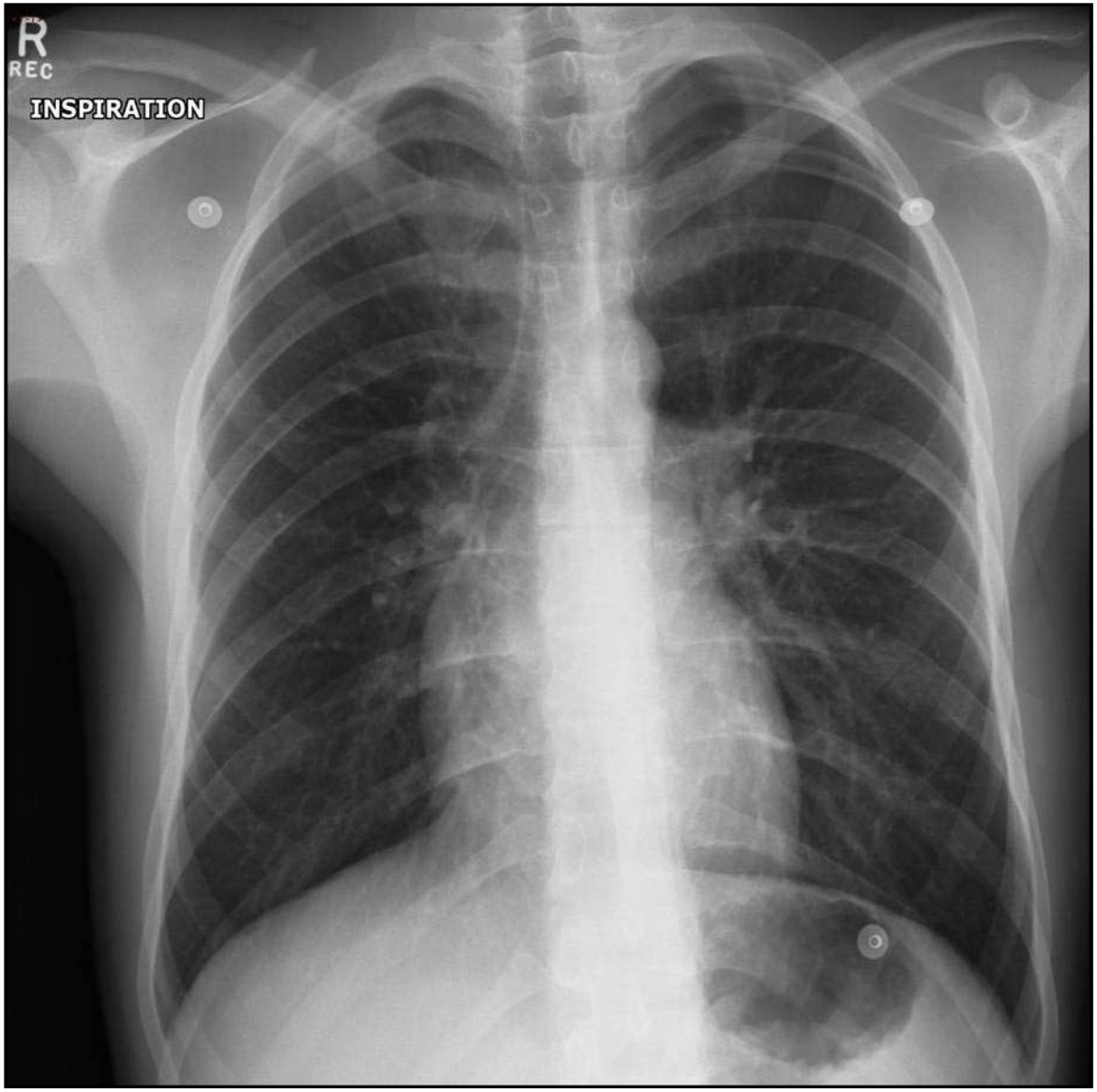
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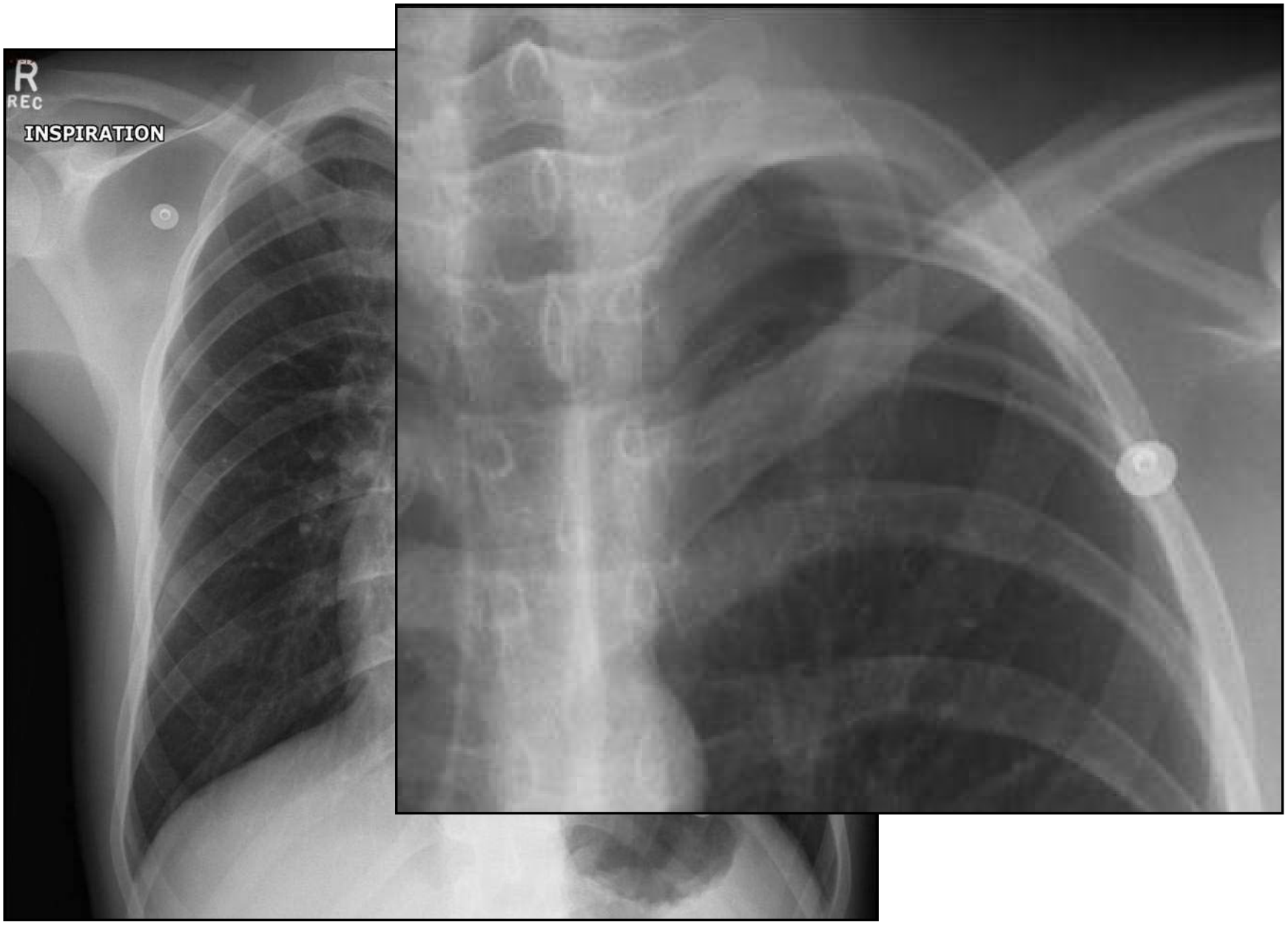
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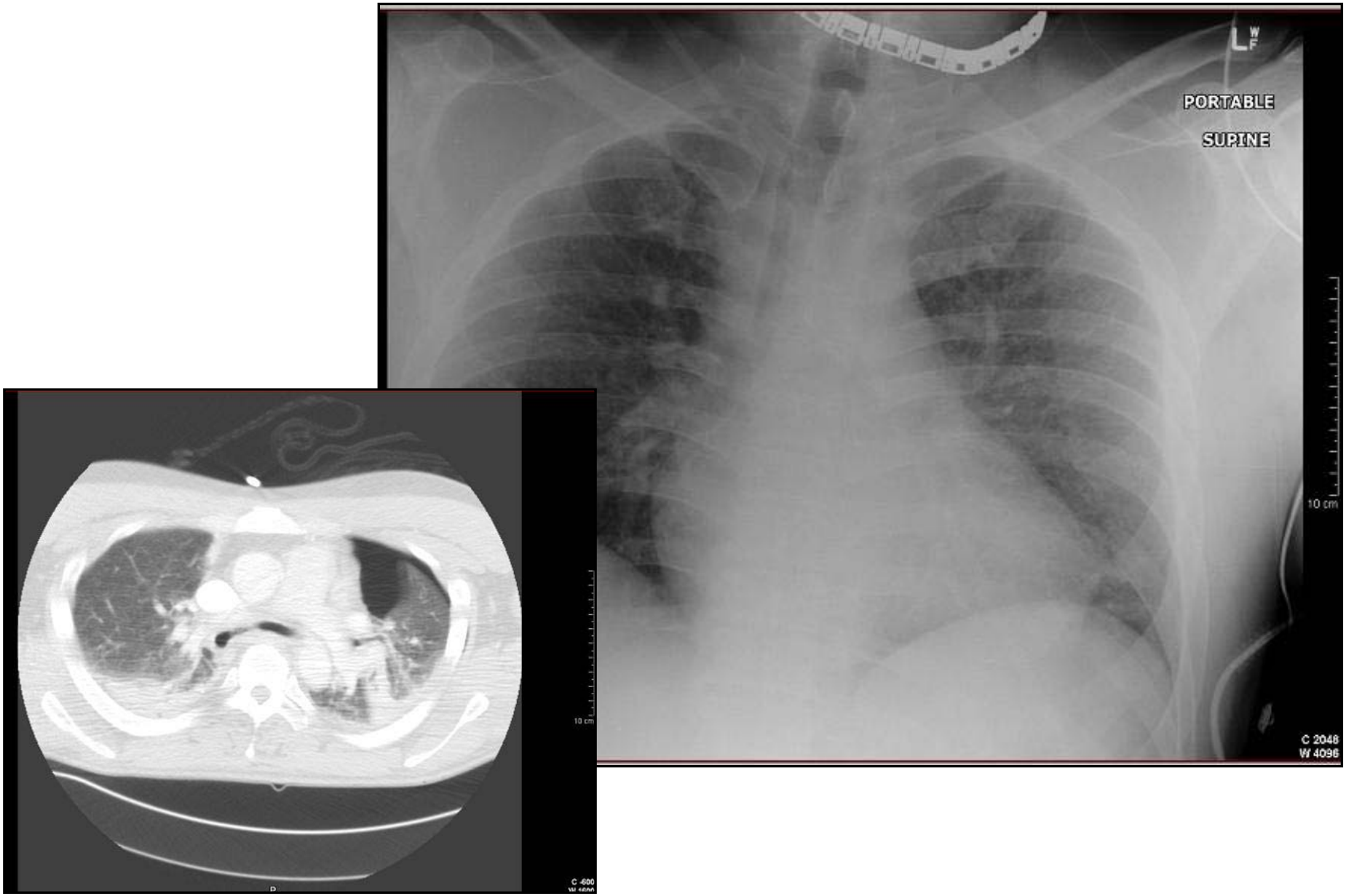
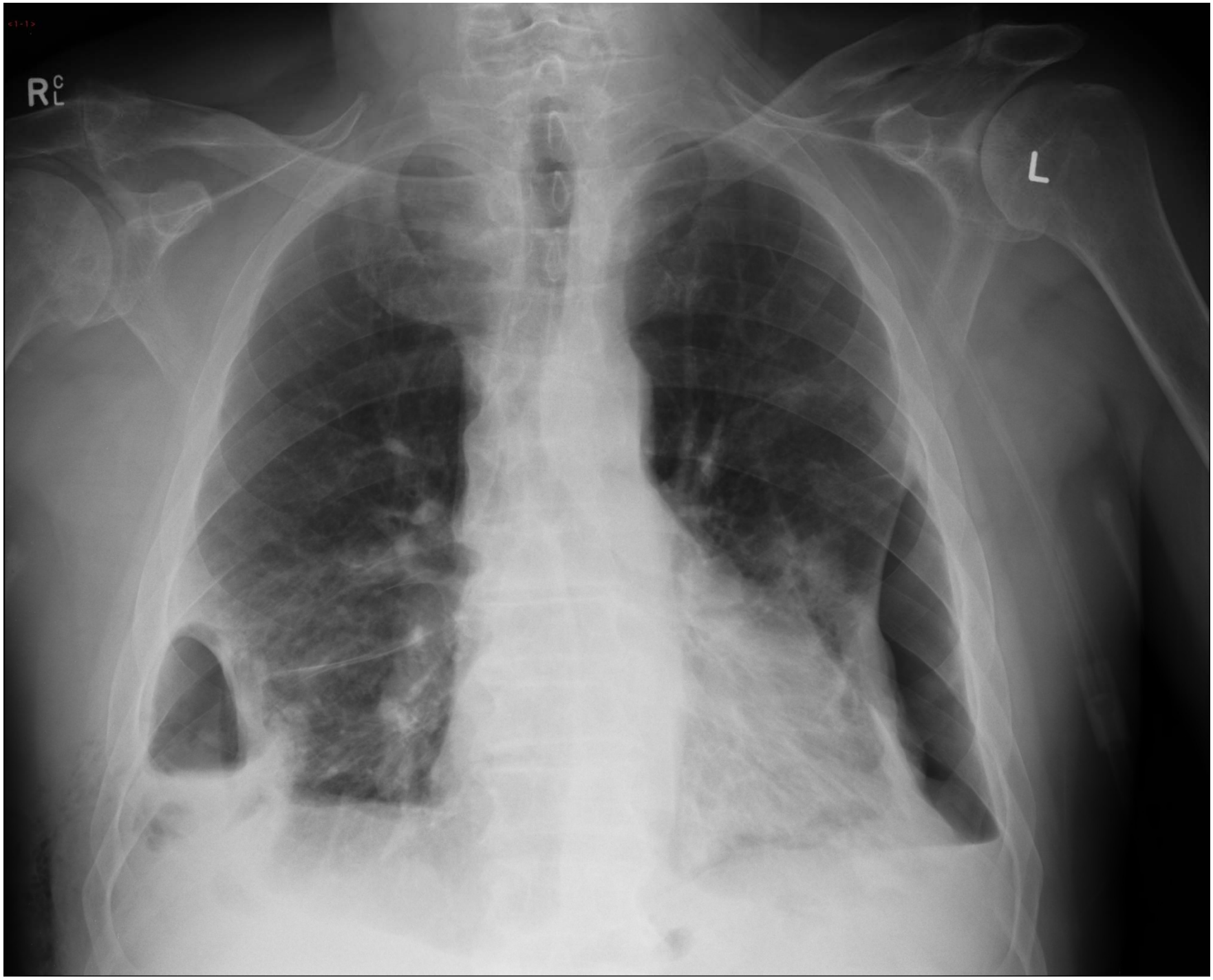
Diagnosis

- Estimating size of PTX is challenging and unecessary;
    - Small= <2cm between lung and chest wall
    - Large= >2cm between lung and chest wall

The Supine Film

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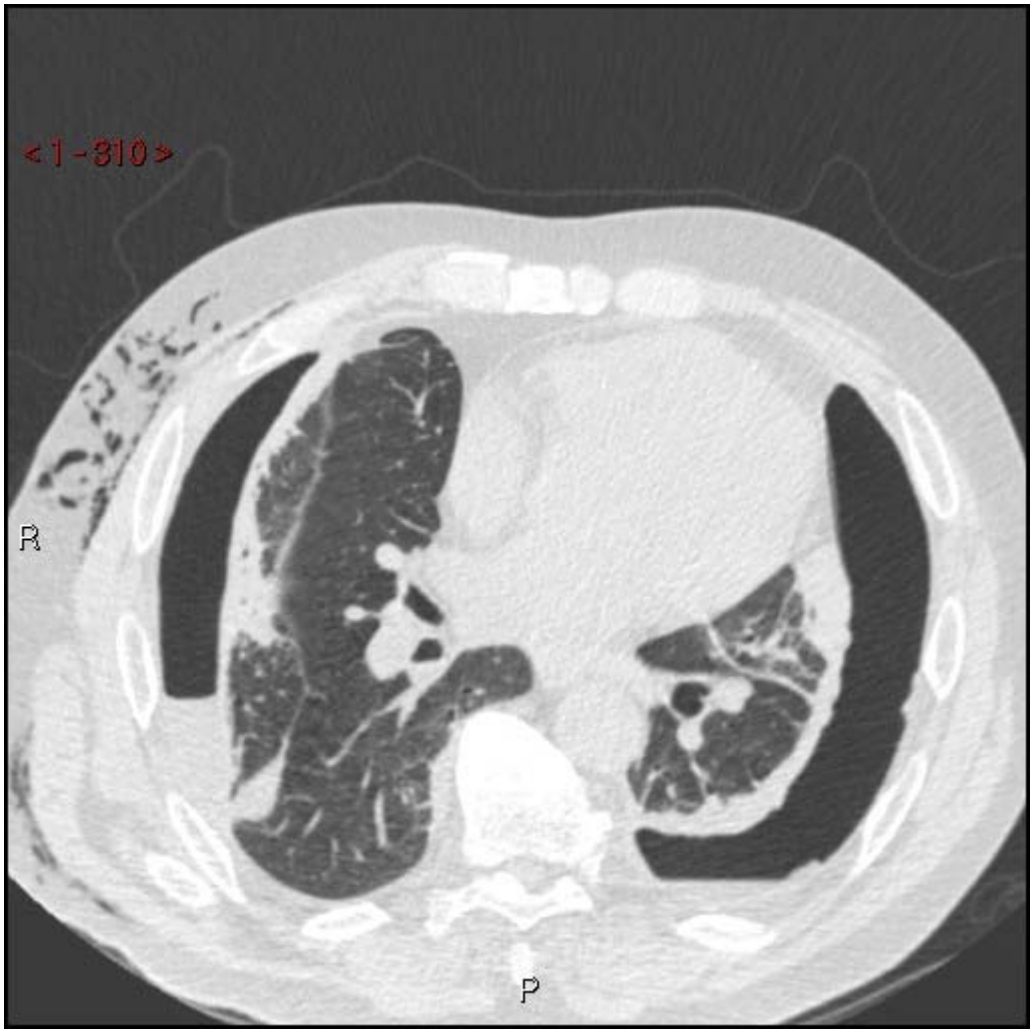


CT may be used to differentiate PMTX from bullae

Treatment Options

- Depends on pneumothorax size, symptom severity, co-morbidities, resources and patient preferences:

  Observation (& Oxygen)

  Aspiration

  Intercostal tube drainage

  Referral to specialists (physicians/surgeons)

Guidelines.

- BTS Thorax 2003;58(Supp II):ii39-ii52
- ACCP Chest 2001; 119:590-602

Figure 1 Recommended algorithm for the treatment of primary pneumothorax.

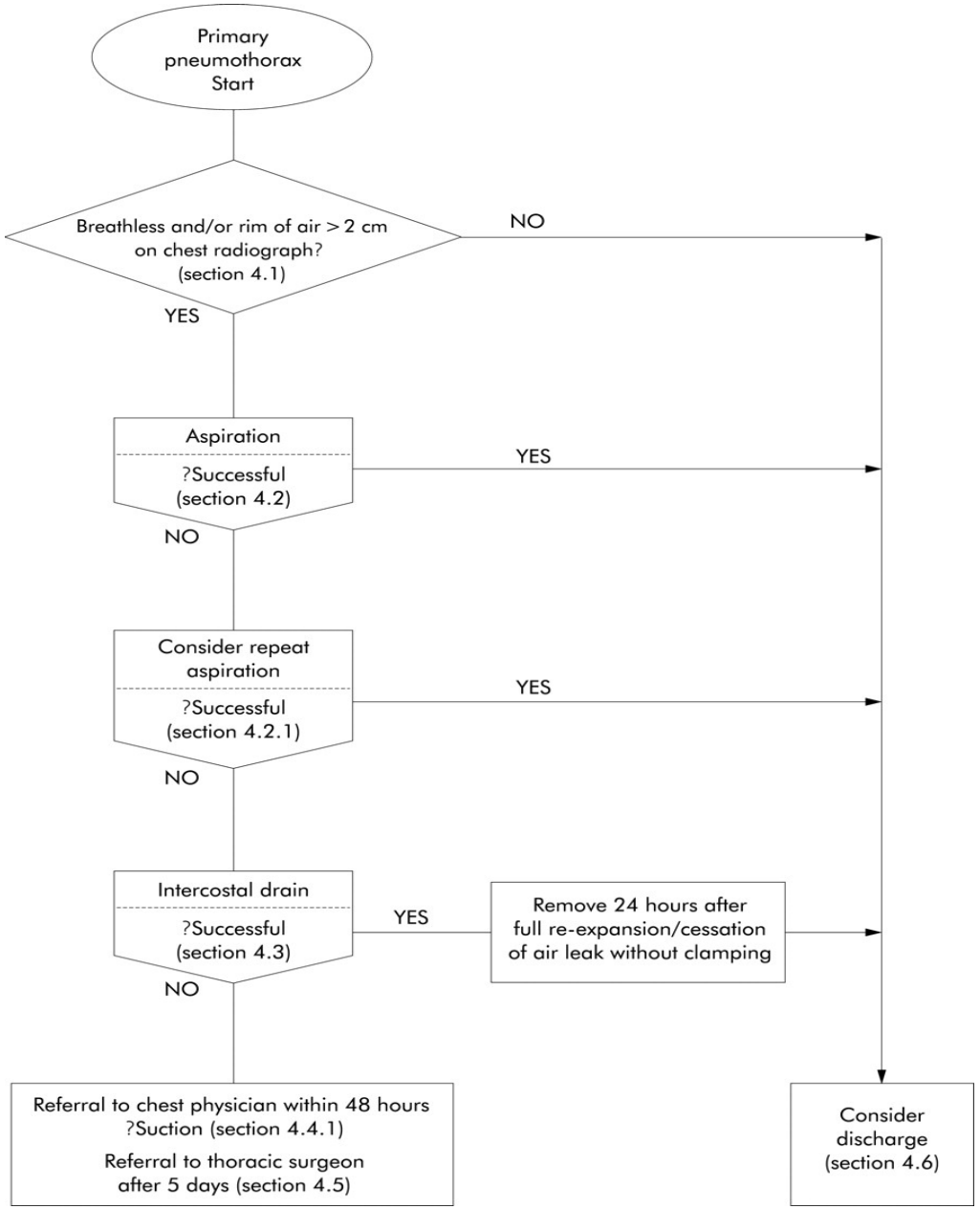
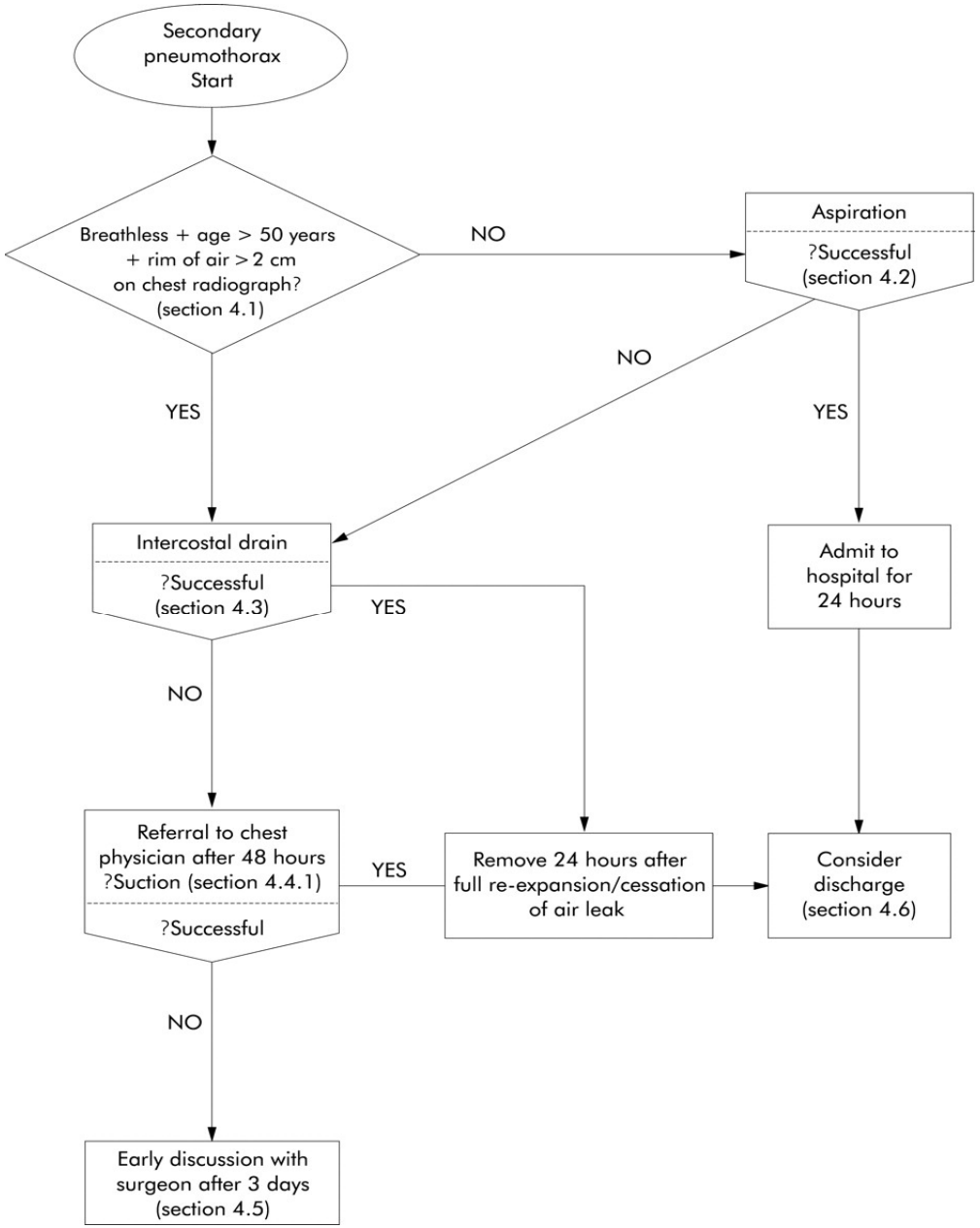


Figure 2 Recommended algorithm for the treatment of secondary pneumothorax.



Evidence?

- BMJ Evidence Review;
  - Small tubes are easier to insert but large PMTX may not respond.
  - Suction? Studies are too small and underpowered to show any benefit.
  - Optimal timing of pleurodesis is unclear.

Observation.

- Sensible pts living close with small (<2cm) PSP who have minimal symptoms may be discharged with early outpatient review (?re X-Ray in ED at 24 hrs and 7days).
- These patients should be advised that they should return in the event of worsening breathlessness or pain (no flying or diving).
- up to 40% require further drainage

Denitrogenation...

- Whilst in hospital (ED or ward) give high flow oxygen (10 L/min, not for COAD).
- Resorption is 2% per day on room air – supplemental oxygen increases this rate 4-fold (Northfield TC BMJ 1971 –n=22) in humans plus several animal models.

Simple Aspiration

- Big advantages…
- Easier, less painful, involves fewer complications and may allow discharge home (fewer hospital days)
- NB; there are small catheters that can be used for aspiration followed by UWSD if necessary.

Simple Aspiration

- First line treatment for all primary pneumothoraces requiring intervention (59-83% success rate).
- Only recommended as an initial treatment in small (<2cm) secondary pneumothoraces in minimally breathless patients under the age of 50 years (or as a temporary manoeuvre in the anti-coagulated).

Simple Aspiration

- Use a seldinger kit (custom pigtail or CVL) and a 60mL leur lock syringe with a 3-way tap (avoid cannulas).
- Aspirate until discomfort is felt, patient coughs, no more air aspirated , or 3L aspirated (leave catheter in situ)
- Re-Xray now and at 6 hours

Simple Aspiration

- What is success? Reduction to < 20% maintained at 6 (?) hrs.
- If successful, re-Xray at 6 hours then discharge to follow up (back in 24hrs for X-ray then 7 days)
- Admit successfully aspirated SSP

Simple Aspiration

- Immediate failure - no/minor improvement. (if >2.5L aspirated then failure likely)
- ? Role of repeated attempt (up to 20% success quoted)

Simple Aspiration

In whom is aspiration less likely to be sucessful?

- Large PMTX- some studies report correlation with size (82% success with moderate vs 43% with large- Aplin Emerg Med 1996)
- Secondary PMTX
- ? Earlier presentation
- Age >50yrs

Simple Aspiration

Pleurocath

CVL

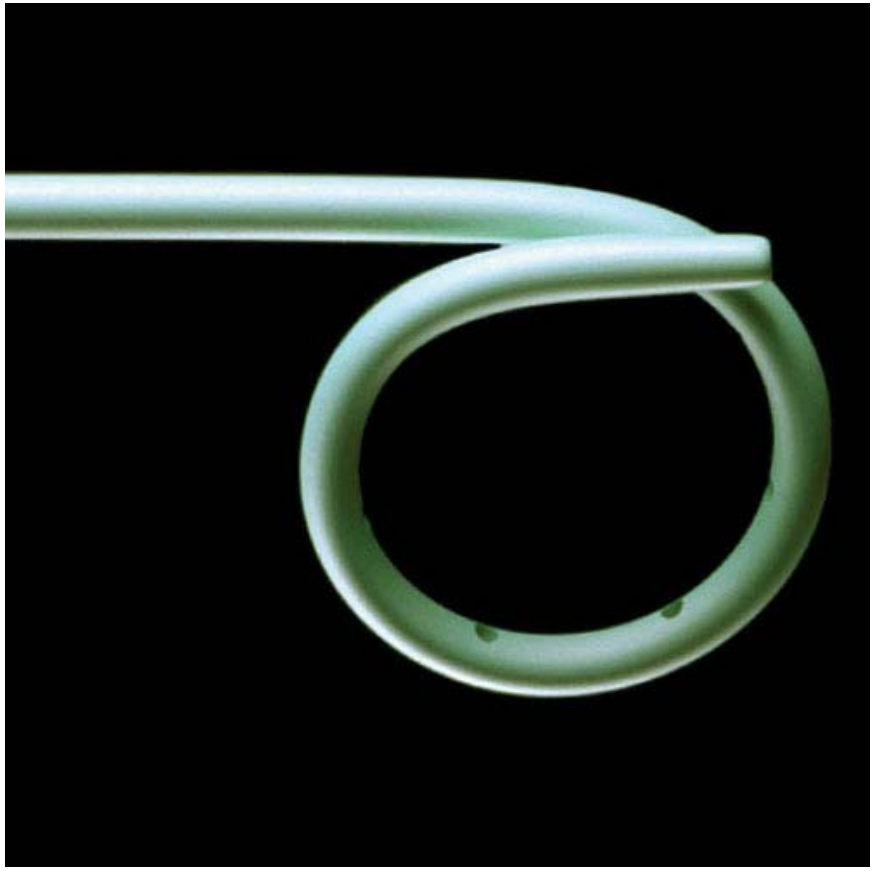
Cannula

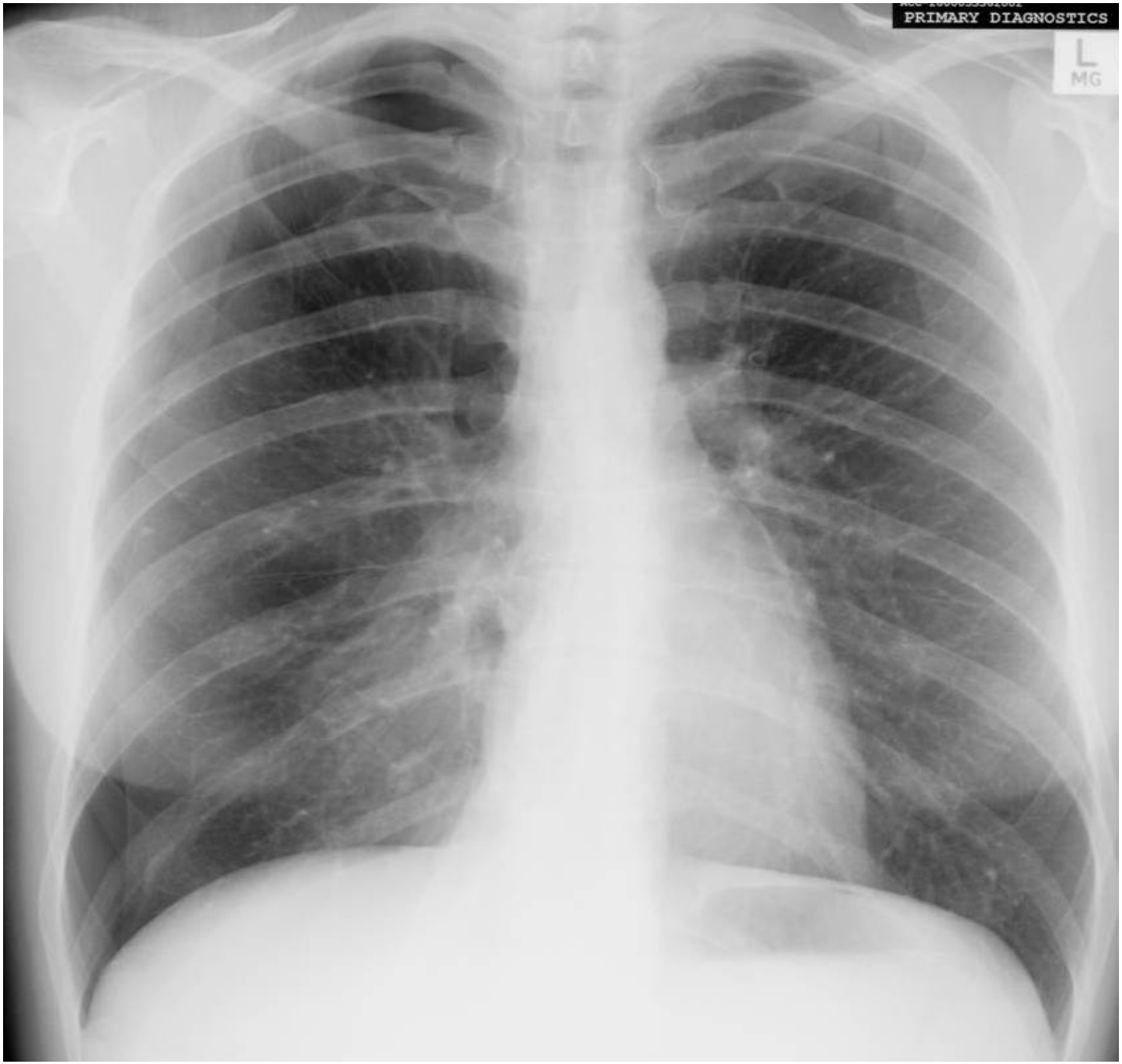
Simple Aspiration

14Fr

Seldinger

Pigtail catheter

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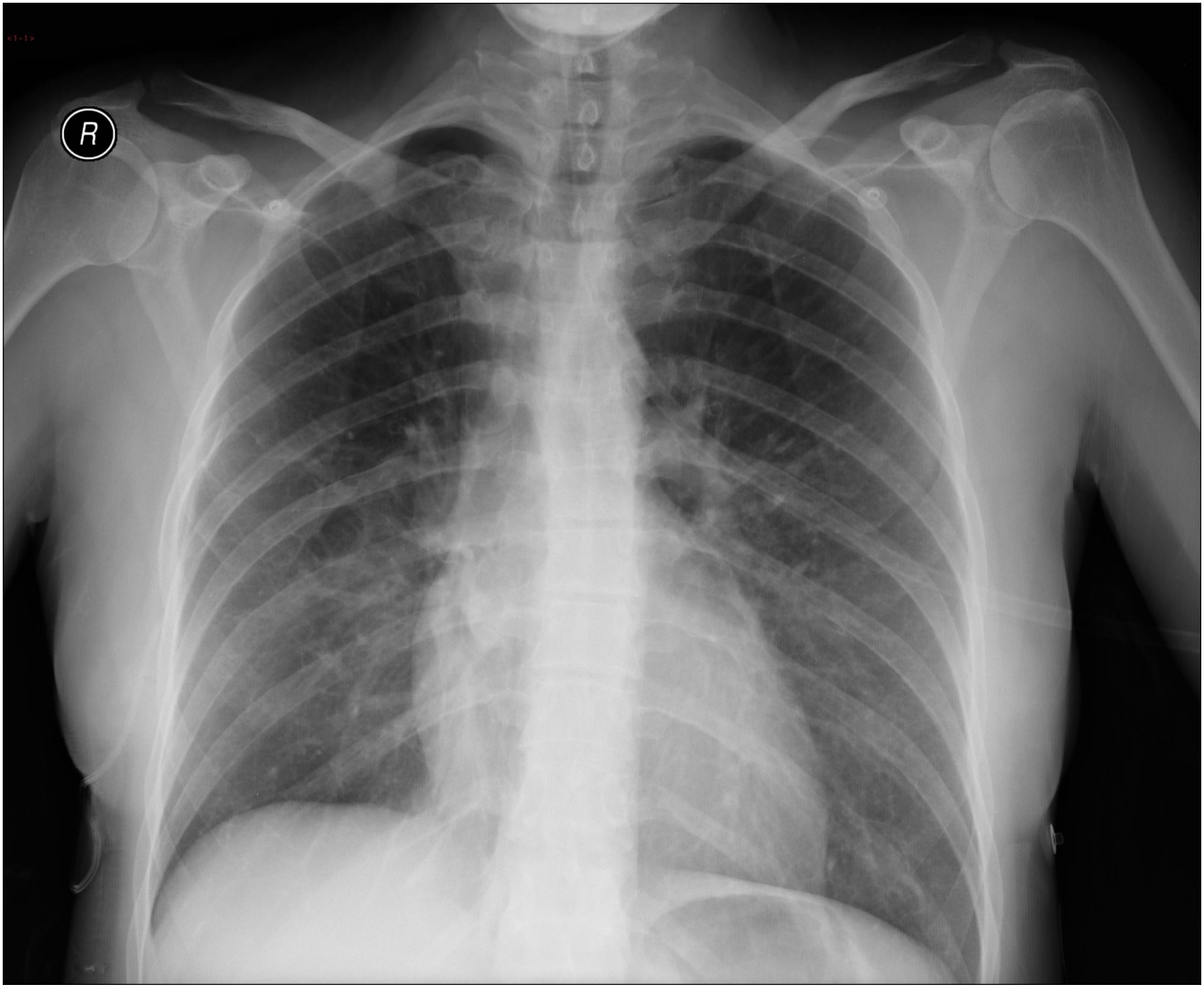
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Intercostal catheter drainage

When?

- If simple aspiration fails in PSP.
- Secondary pneumothorax (except small PMTX in <50yrs).
- Mechanical/NI ventilation planned.
- Significant fluid/blood collection
- Tension PMTX
- Bilateral PMTX
- Air transport planned
- Recurrence if chemical pleurodesis planned

Intercostal catheter drainage

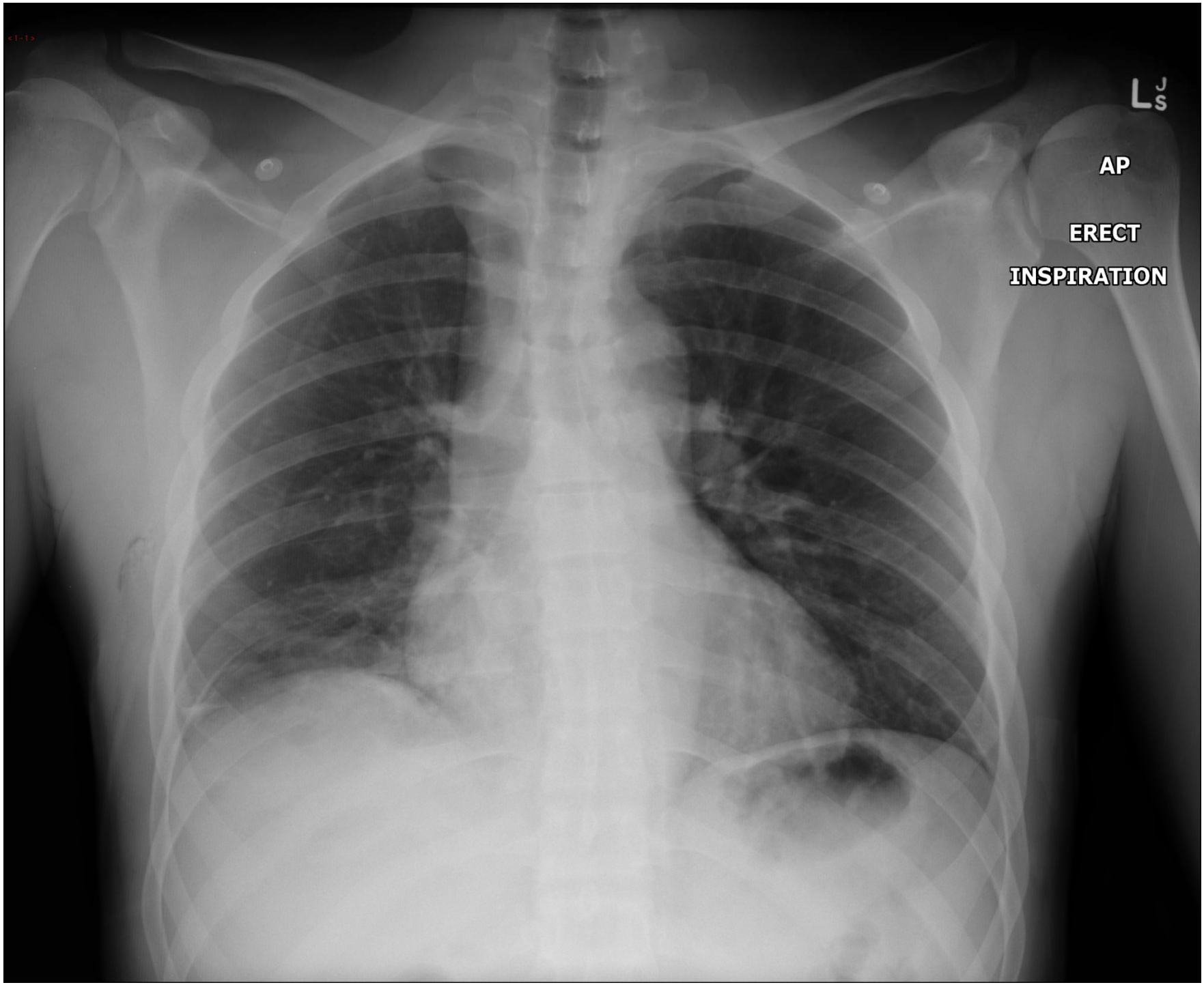
What Size?

- There is no evidence that large tubes (20-24F) are any better than small tubes (10-14F).
- The initial use of large tubes is not recommended, although it may become necessary if there is a persistent air leak.

Intercostal catheter drainage

Methods

- A brutal, torturous procedure in the wrong hands.
- Seldinger style tubes.
- Blunt dissection- finger into pleural space NO TROCAR!
- Use maximum volume of LA allowable and infiltrate en route through the chest wall.
- Use morphine and sedation if possible
- In most adults a depth of >12cm at skin is required.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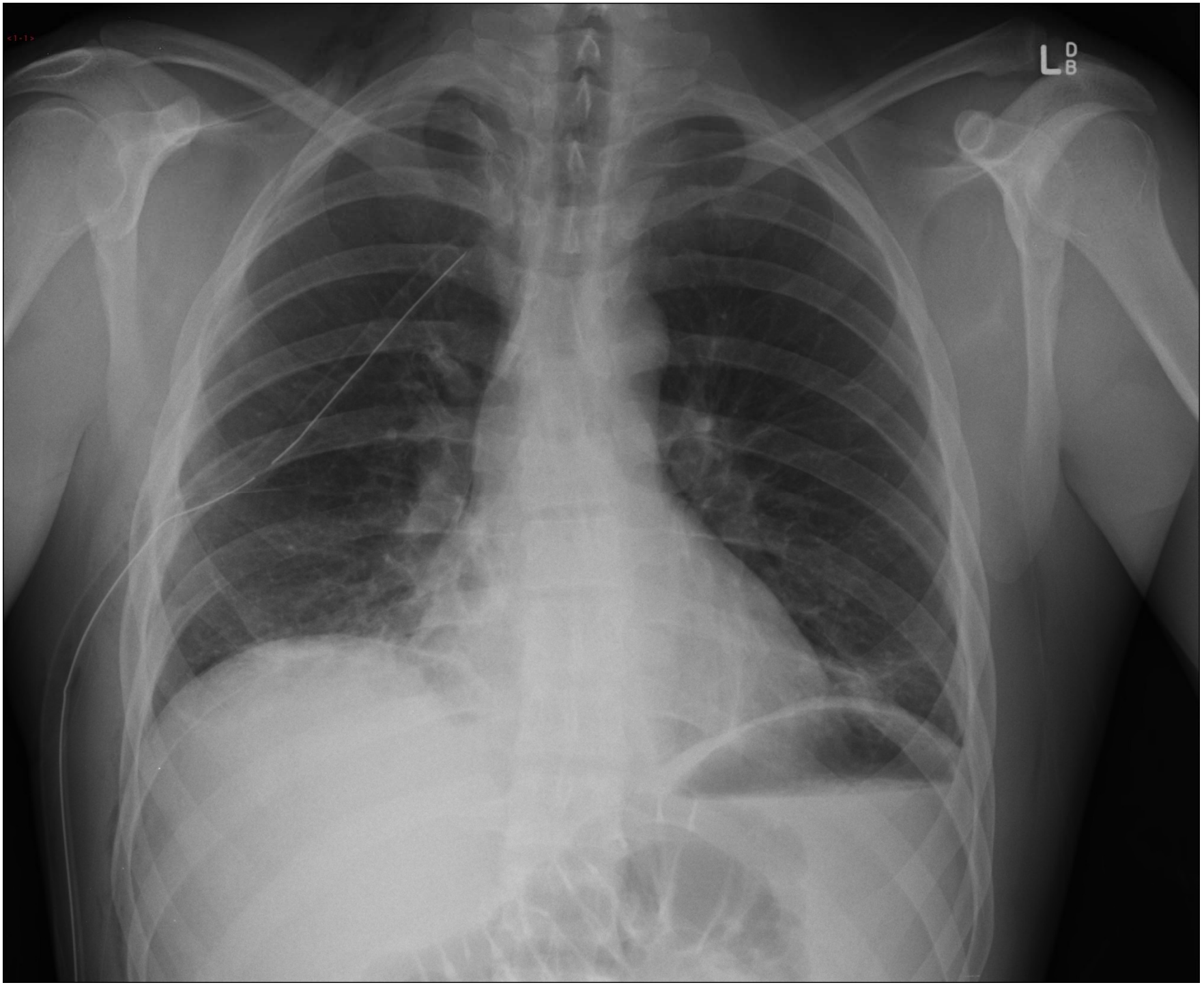
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Intercostal catheter drainage

ICC Care;

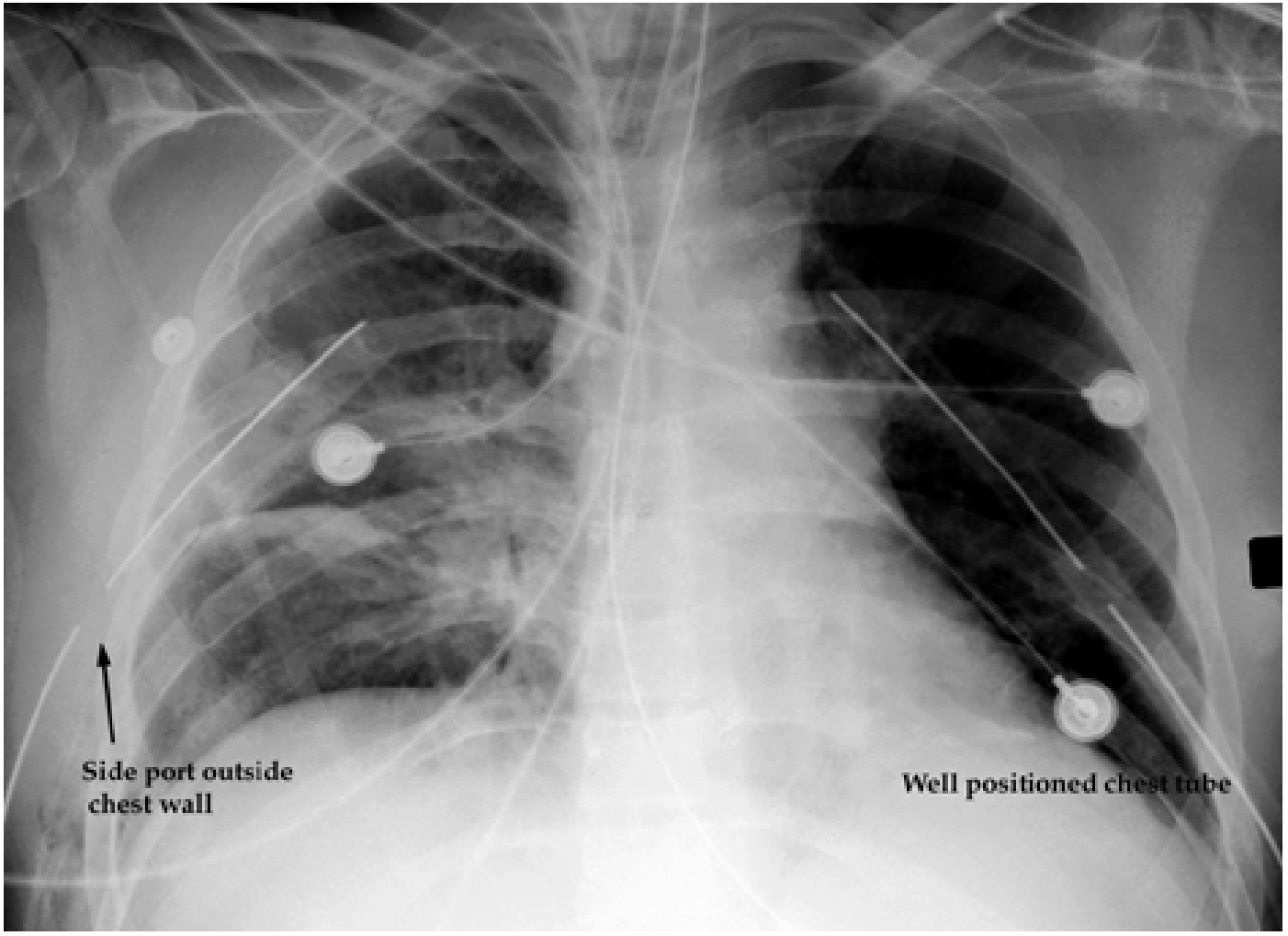
- Suture securely and tape joins well
- admission until lung completely expands + bubbling ceases for 24 hrs.
- Suction should not be routinely applied.
- 90% success for 1st SPTX, 52% for 1st recurrence, 15% for 2nd recurrence

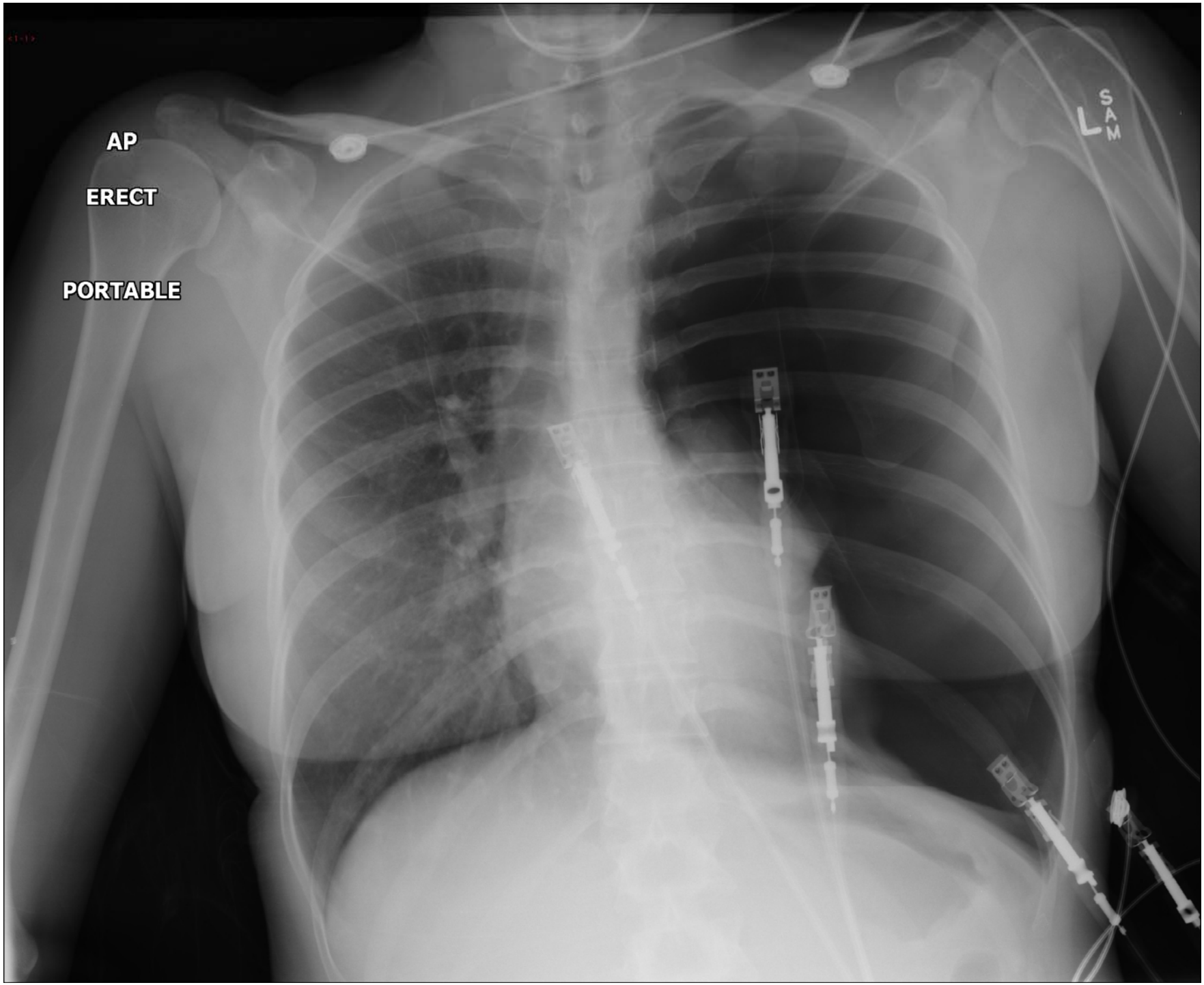
Complications.

ICC Complications;

- Subcutaneous placement
- Inserted too far (painful)
- sc emphysema
- Haemothorax
- Lacerated intrathoracic or intra-abdominal organs (heart, liver, colon, stomach…)
- Empyema
- Re-expansion pulmonary oedema
- Kinking, dislodgement, clotting of tube

Radiological Anatomy of an ICC

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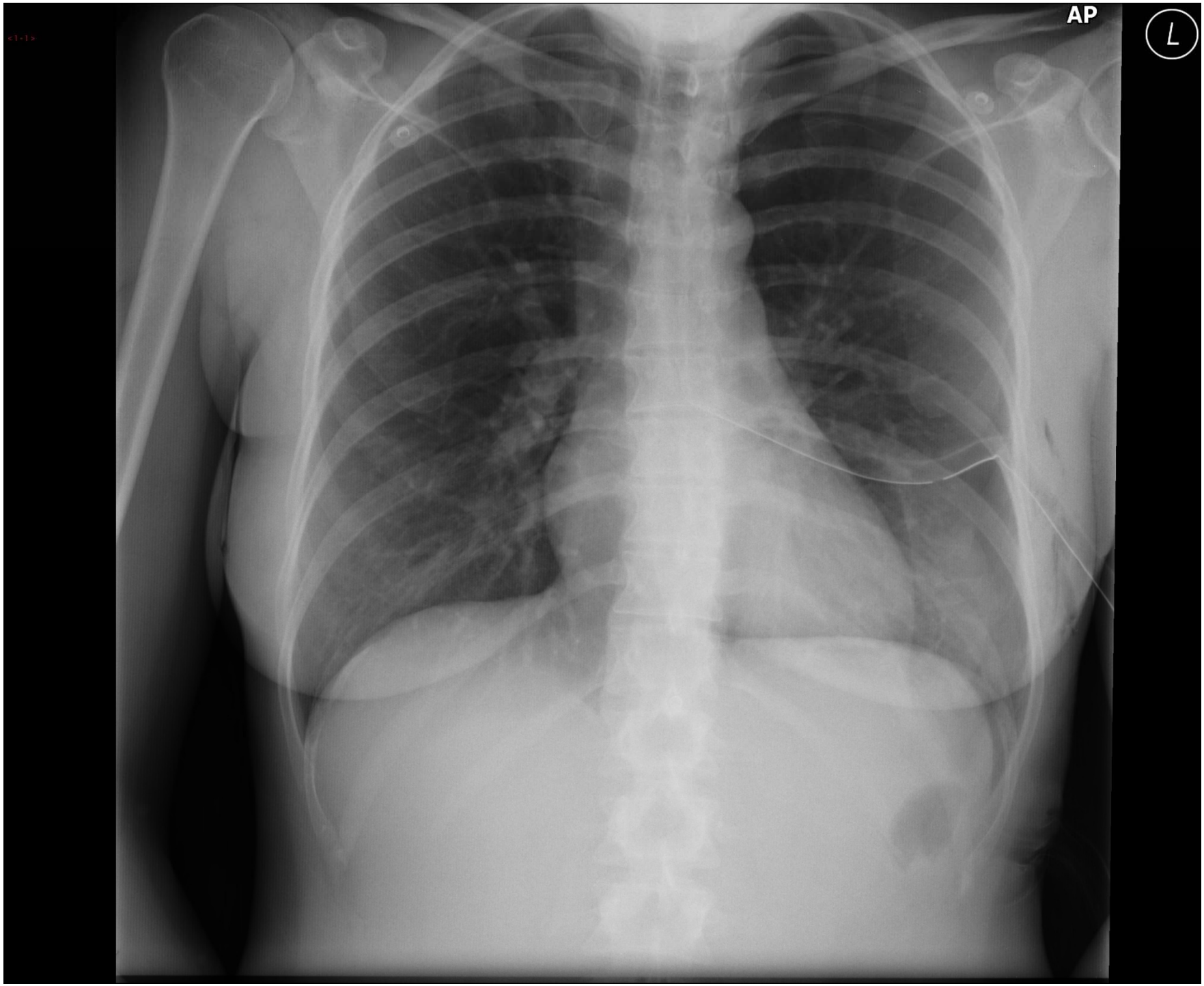
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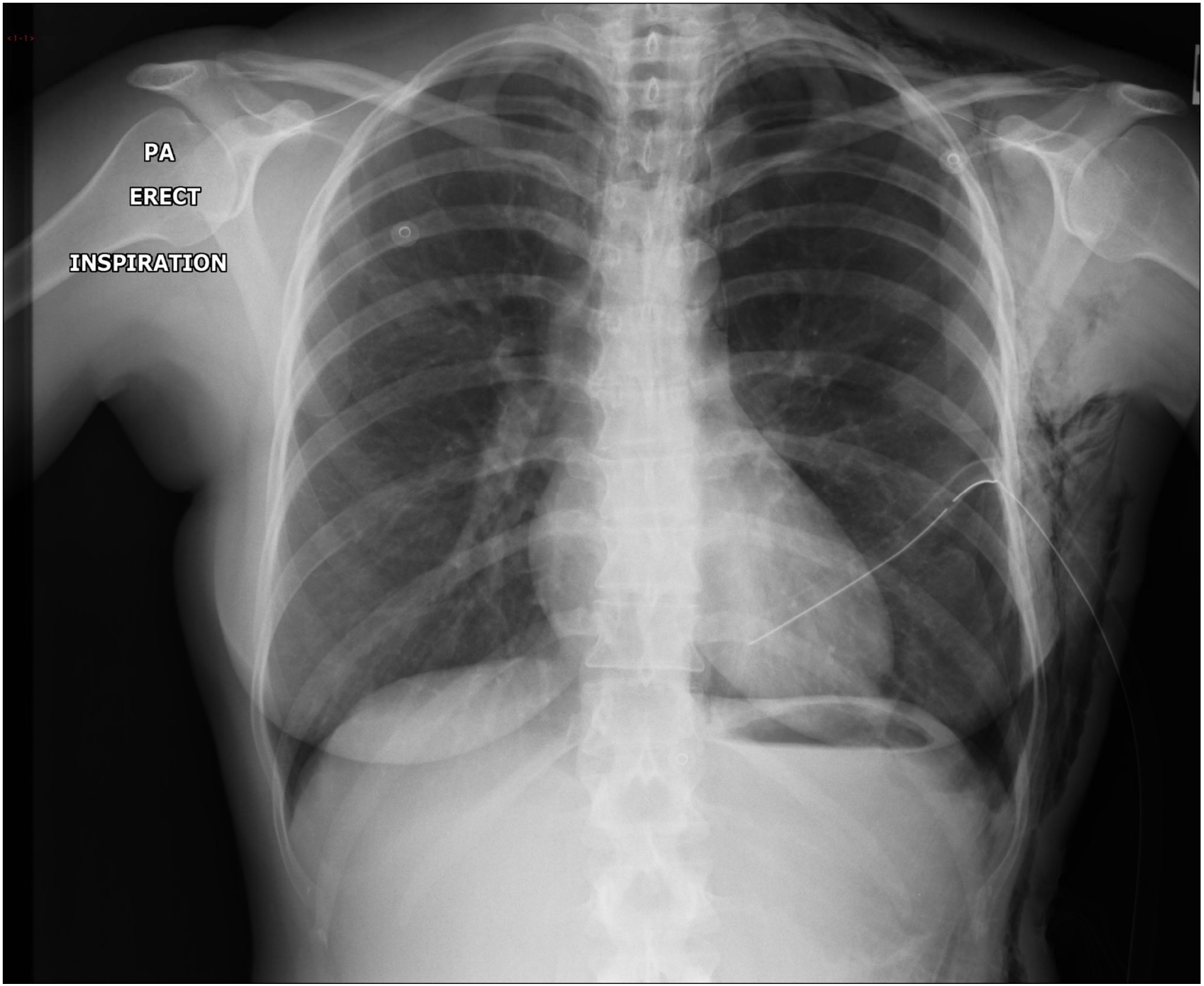
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Recurrences

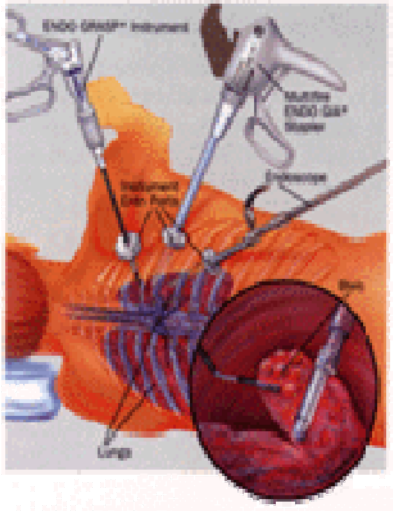
- Recur in 50% first episode and 60-70% subsequent episodes
- Primary
  - in compilation of 11 studies after treatment with observation, catheter drainage or ICC the average recurrence was 30% (range 16-52%), most within 2 yrs.
  - Presence of bullae not predictive
- Secondary
  - 39-47% recur

Treating Recurrence

- Chemical Pleurodesis
  - If unwilling/unable to undergo surgery
  - talc, silver nitrate, tetracycline, minocycline
  - recurrence rate 8 - 25%
  - Painful

Treating Recurrence

- Thoracoscopy
  - Refer to surgeons after recurrence or if there is failure to re-expand.
  - Allows resection of bullae, mechanical pleural abrasion and talc insufflation
  - Recurrence rate is 2-14%

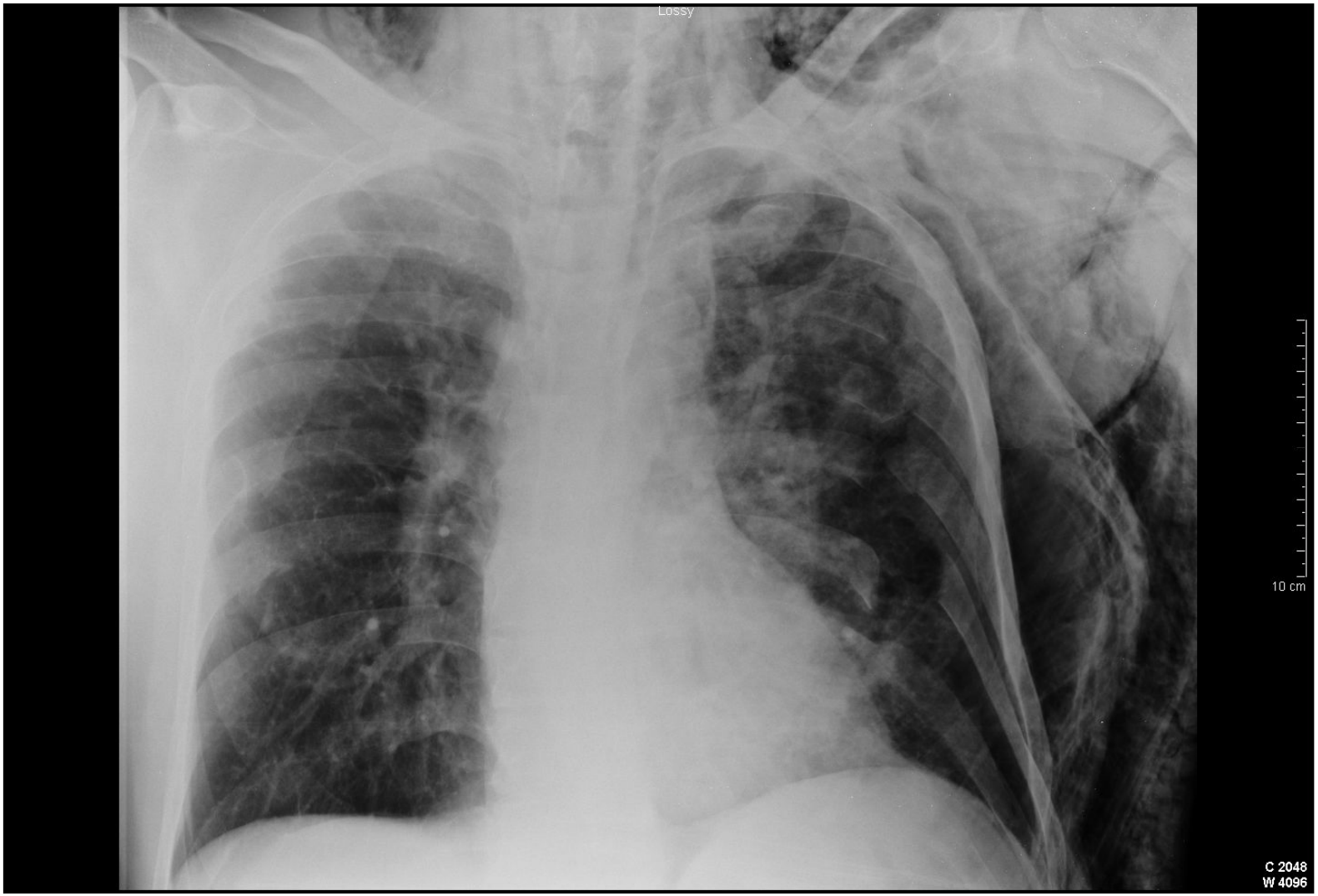


Iatrogenic pneumothorax

Management:

- The majority will resolve with observation.
- If required, treatment should be by simple aspiration.
- Patient with COAD who develop an iatrogenic pneumothorax are more likely to require tube drainage.

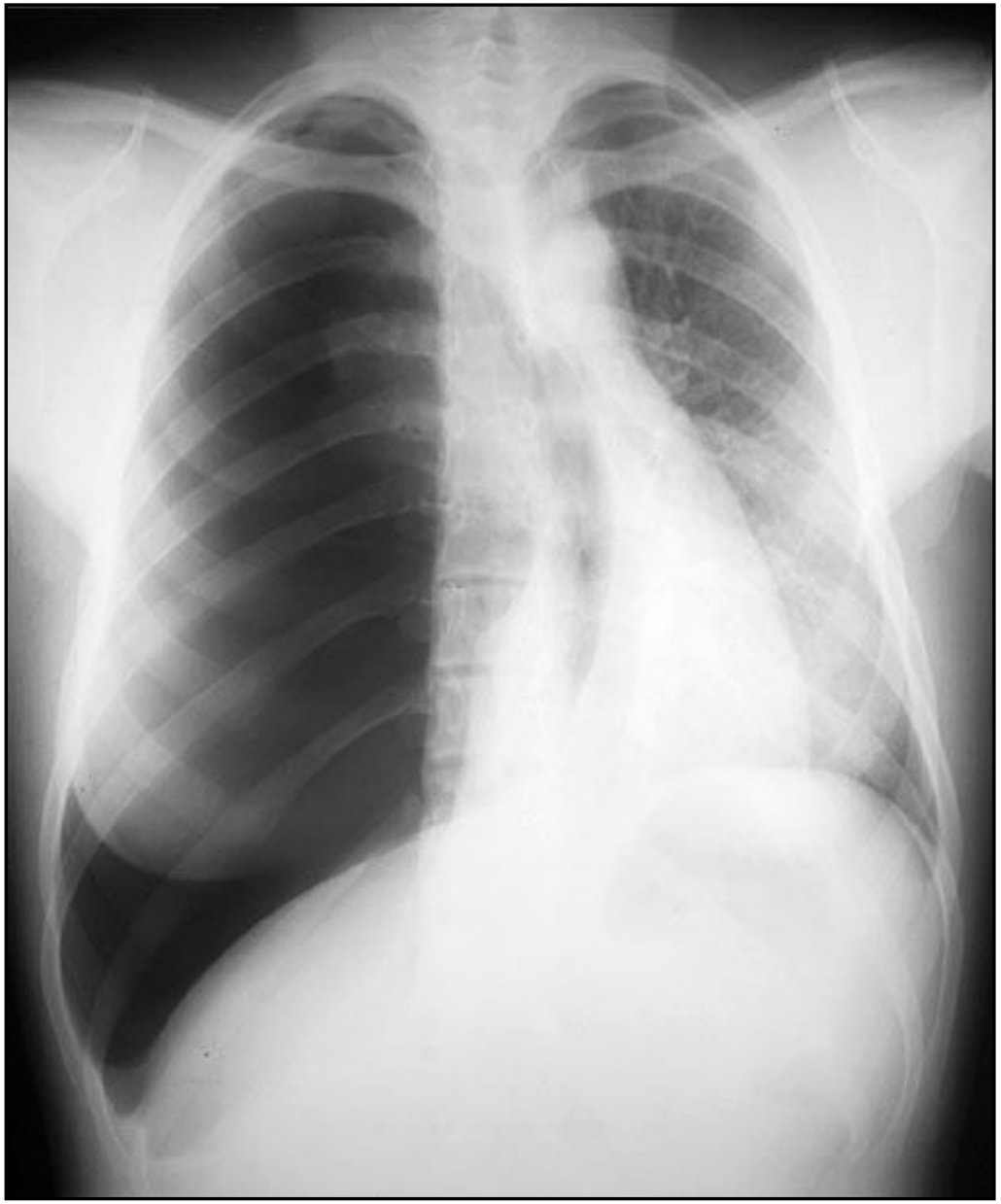
Traumatic pneumothorax



Traumatic pneumothorax

Management:

- Because of the associated risk of Haaemothorax and persistent leak a formal large bore (28-32Fr) ICC is recommended by most authorities.



Tension pneumothorax

Management:

- ATLS recommends a 50mm catheter be placed 2ics-mcl.
- Our 14G cannulae are 45mm long
- A CT study of dead adult male soldiers showed a mean chest wall thickness at the recommended site to be 53mm!
- Place a tube early as the cannula used for thoracentesis commonly kinks or dislodges.

TAKE HOME

- How would you like your PMTX managed?
- Not all PMTX need a procedure.
- Not all PMTX need admission.
- Any procedural breach of the pleural space has a complication rate- especially when undertaken emergently.
- NEVER USE THE TROCAR!!!

TAKE HOME

- Aspiration is simple and safe.
- Aspiration is less painful, probably has fewer complications and reduces hospital admission.
- Aspirated patients recur at the same rate as those who get an ICC.
- If drainage is required then aspiration should be attempted first in most patients using a drainage kit that can be attached to an UWSD.

TAKE HOME

- Before committing a patient to an ICC & admission the Emergency & Respiratory physicians would like to discuss the options (we are generally conservative and not as driven by procedural greed as trainees).