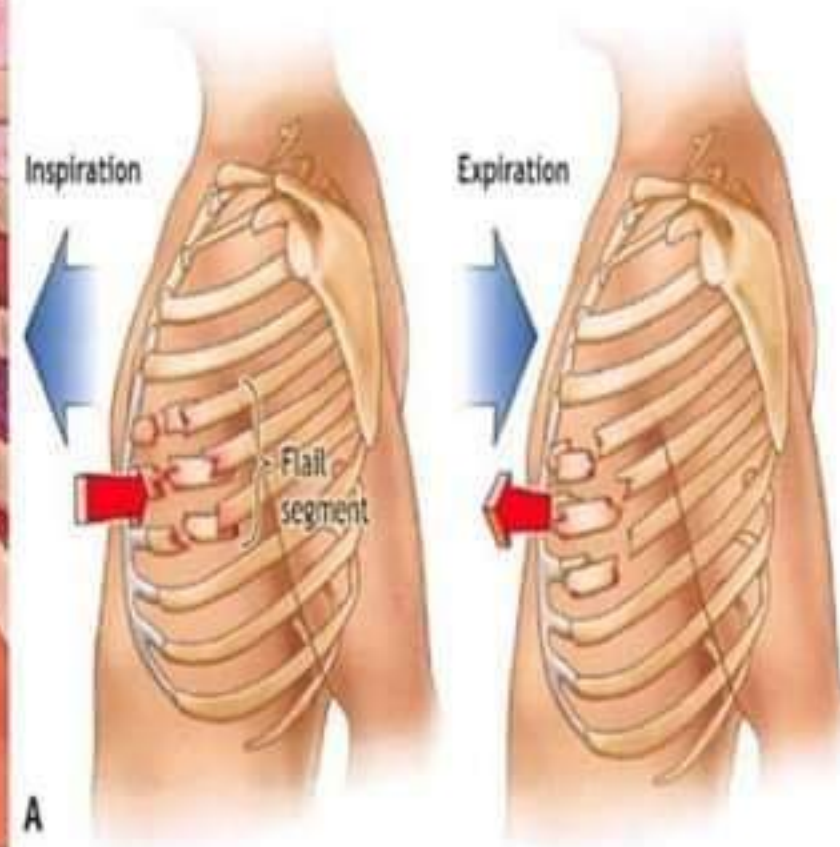
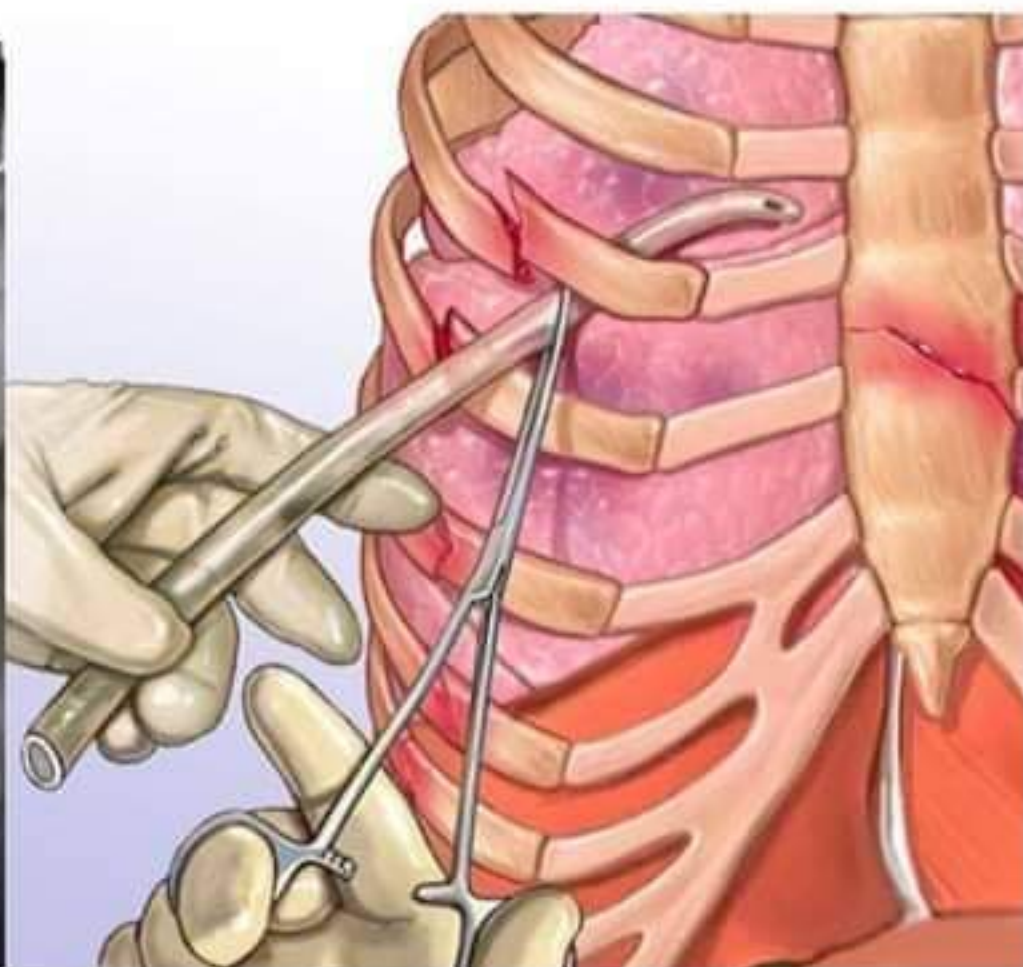


THORACIC TRAUMA

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INTRODUCTION

Thoracic trauma → 25% all injury related deaths

Contributory factor in further 50% (hypoxia, hypovolaemia)

To lung and pleura low (<1%)

Cardiac involvement → increases by 20%!

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Approx. 85% can be treated successfully without need for surgical intervention

However; important to realise that patients often have OTHER injuries (particularly to the head), which contributes to the high overall mortality

THORACIC TRAUMA

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- **Blunt / Penetrating / Both**
- **Majority may require simple procedures (eg. Thoracostomy tube)**
- **Minority require urgent surgical exploration due to bleeding**
- **Most life-threatening injuries can be identified in the primary survey**
- **Repeated / serial examination and use of adjuncts important, as initial normal examination does not exclude**

PRIMARY SURVEY

Physical examination

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- Look (RR & depth)
- Wall asymmetry, paradoxical movement
- Bruising, seat belt / steering wheel, penetrating wounds
- Feel tracheal deviation, adequate & equal chest wall movement
- Chest wall tenderness, rib 'crunching' indicating #

- Surgical emphysema
- Listen breath sounds
- Both sides!
- Percuss for dullness / resonance

ATOM FC

1. Airway obstruction / disruption
2. Tension pneumothorax
3. Open chest wound / open pneumothorax
4. Massive haemothorax
5. Flail chest
6. Cardiac tamponade

TREAT LIFE THREATENING INJURIES AS THEY ARE IDENTIFIED

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WHEN?

Think
DR.

A

B

C



- Updated clinical information from lead instructor to team members
- - - → Ongoing instruction and interaction between all team members
- → Movement of lead instructor around scenario to impart additional information

(DEFG..)

SECONDARY SURVEY

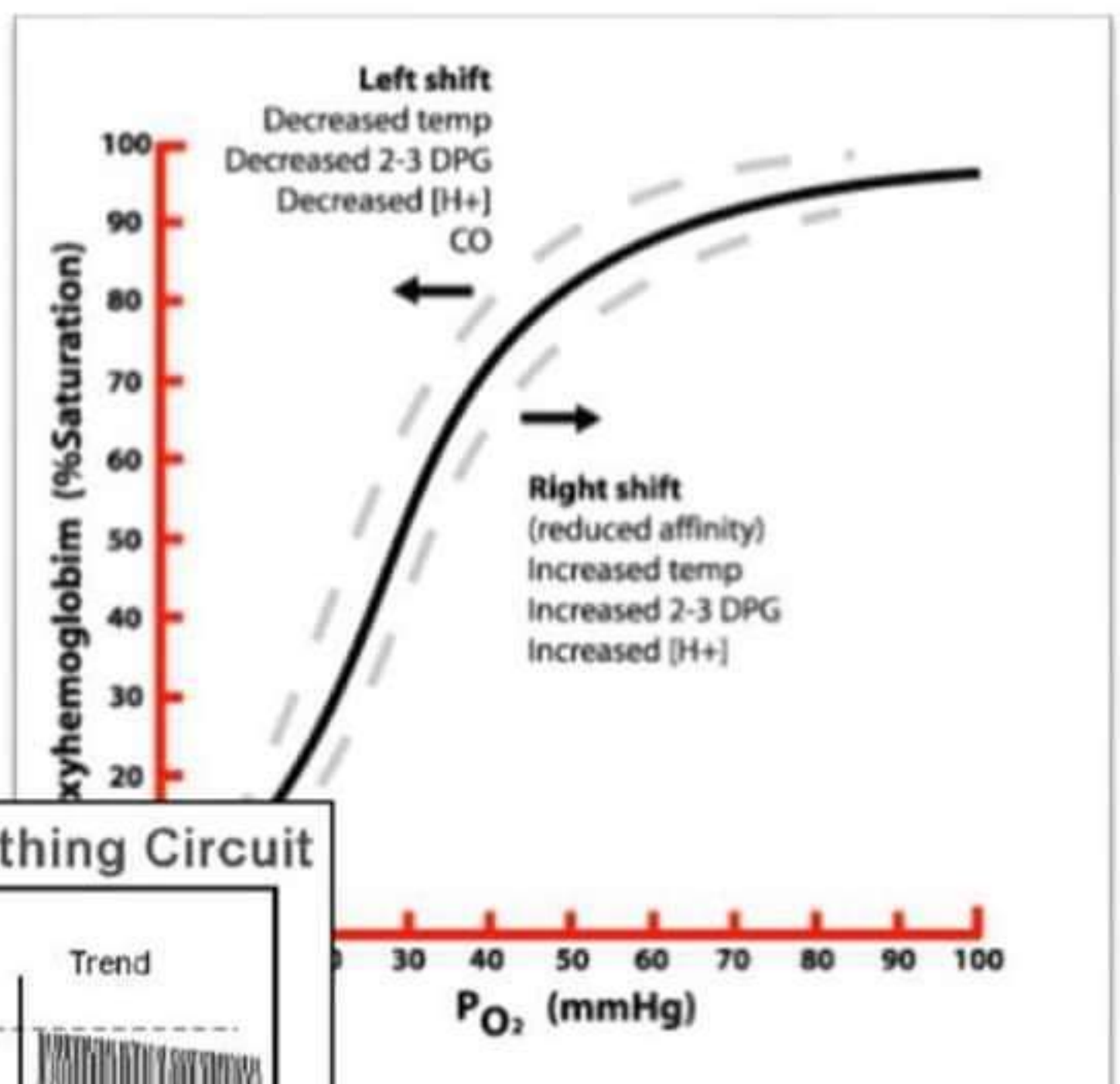
1. Rib # and flail chest
2. Pulmonary contusion
3. Simple pneumothorax
4. Simple haemothorax
5. Blunt aortic injury
6. Blunt myocardial injury

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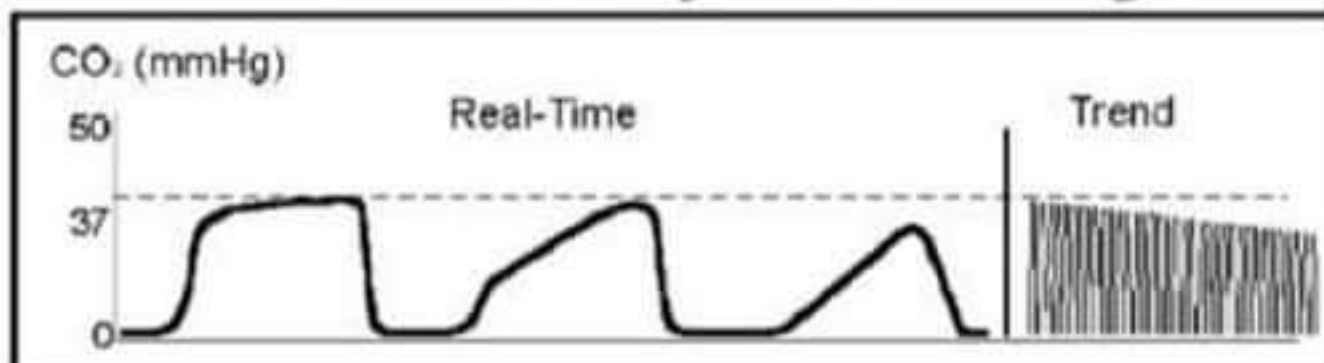
ADJUNCTS

Monitoring

- BP / Pulse
- Oxygen saturation
- End-tidal CO₂ (if intubated)



Obstruction in Airway or Breathing Circuit



Possible Causes:

- Partially kinked or occluded artificial airway
- Presence of foreign body in the airway
- Obstruction in expiratory limb of breathing circuit
- Bronchospasm

ADJUNCTS

Diagnostic

- CXR
- FAST USS
- ABG

Interventions

- Chest drain
- ED Thoracotomy
- Transfer to critical care area for ventilation / observation

Further investigation may include

- CT scan
- Angiography
- Bronchoscopy
- Oesophagoscopy / oesophagram

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CLASSIC EXAMINATION FINDINGS

	Trachea	Expansion	Breath Sounds	Percussion
Tension Pneumothorax	Away	Decreased. Chest may be fixed in hyper-expansion	Diminished or absent	Hyper-resonant
Simple Pneumothorax	Midline	Decreased	May be diminished	May be hyper-resonant. Usually normal
Haemothorax	Midline	Decreased	Diminished if large. Normal if small	Dull, especially posteriorly
Pulmonary Contusion	Midline	Normal	Normal. May have crackles	Normal
Lung collapse	Towards	Decreased	May be reduced	Normal

R

AIRWAY OBSTRUCTION / DISRUPTION

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Loss of upper airway muscle tone, usually due to a reduced conscious level

The presence of blood, vomit or foreign bodies

Trauma to the face or neck

Chest trauma compromises respiratory function

Need for ventilation (traumatic brain injury)

Airway at risk of swelling (burns, c-spine fractures, subcutaneous emphysema)

Laryngeal spasm

Bronchospasm



A



C



B



D

SOUNDS

Breath sounds

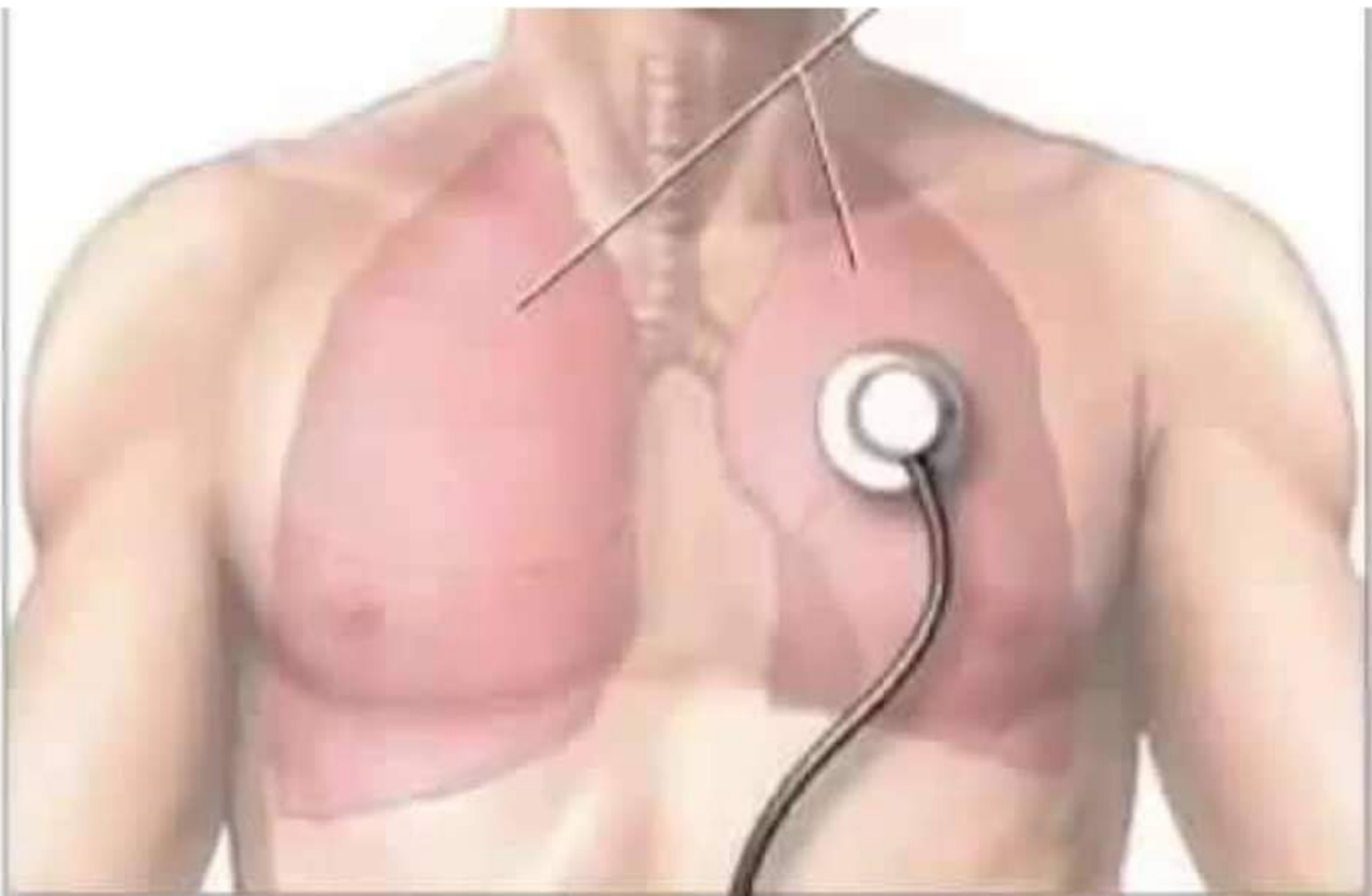
Snoring

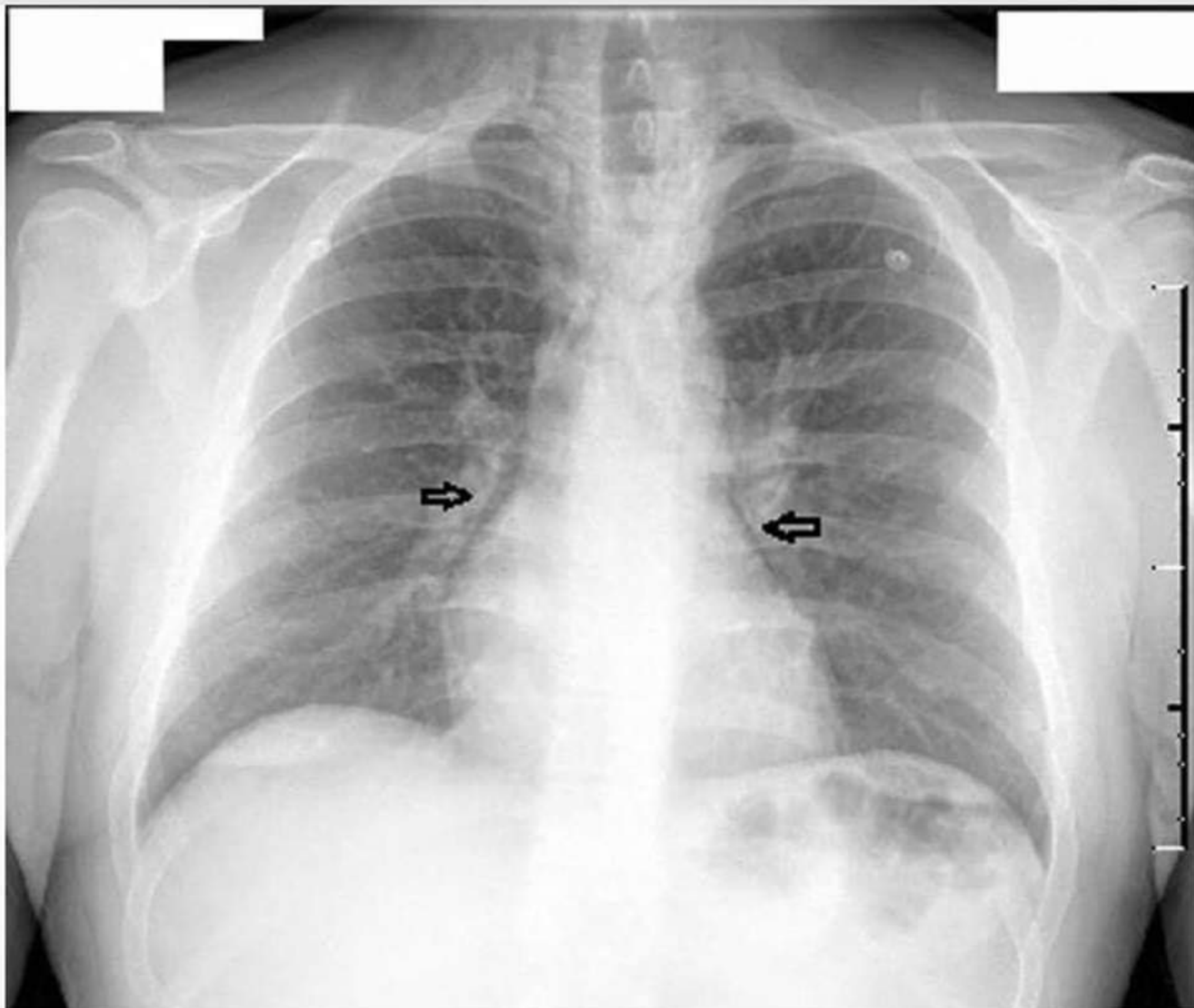
Inspiratory stridor / crowing

Expiratory wheeze

Gurgling

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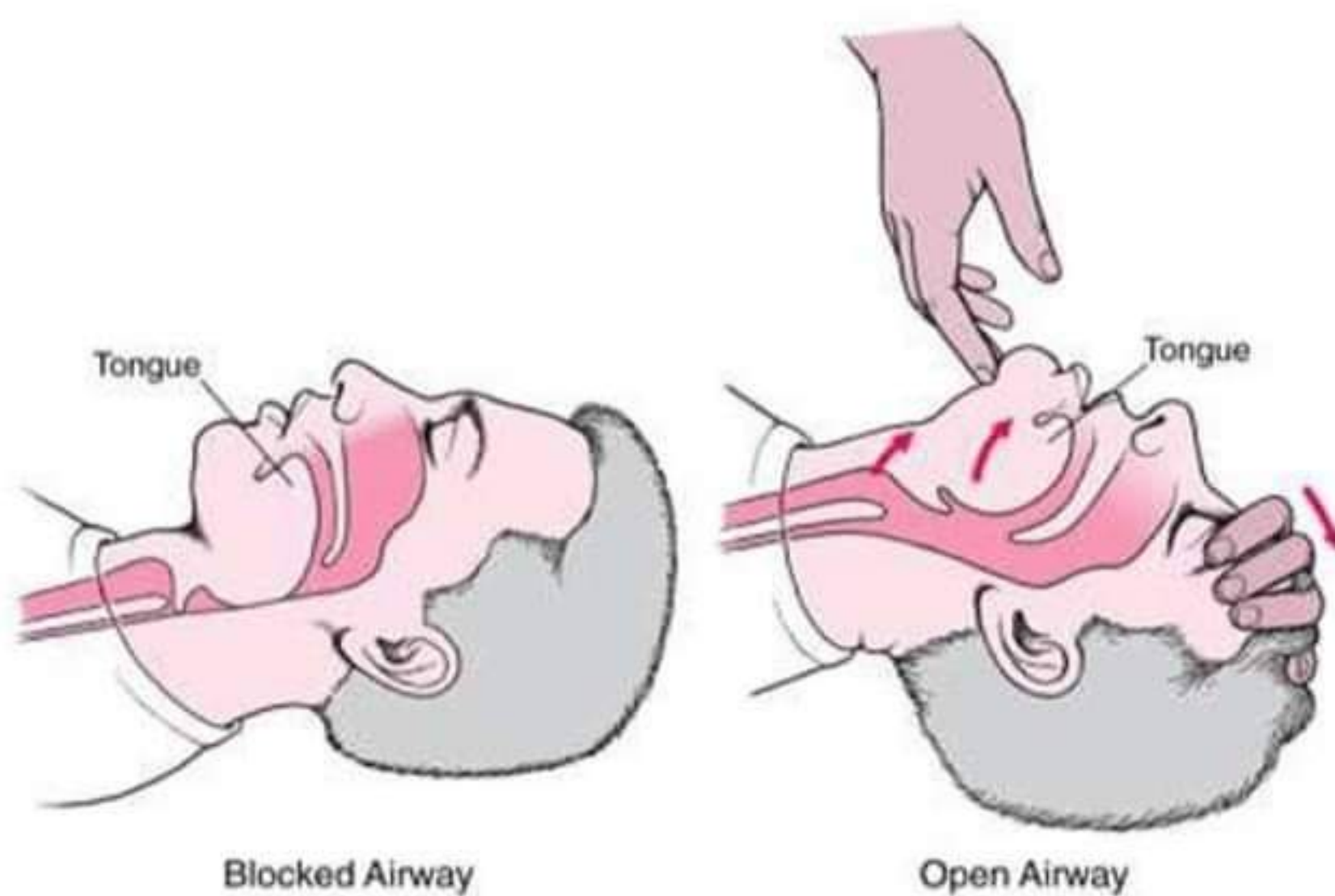




BASIC TECHNIQUES

- Chin lift
- Jaw thrust

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ADJUNCTS

- Oropharyngeal airway (Guedel)
- Nasopharyngeal airway
- Supraglottic airway devices
 - Laryngeal mask airway (LMA)
 - I-gel
 - Laryngeal tube (LT)
- Orotracheal intubation
- Surgical airway
 - Needle or surgical cricothyroidotomy
- Mechanical ventilation



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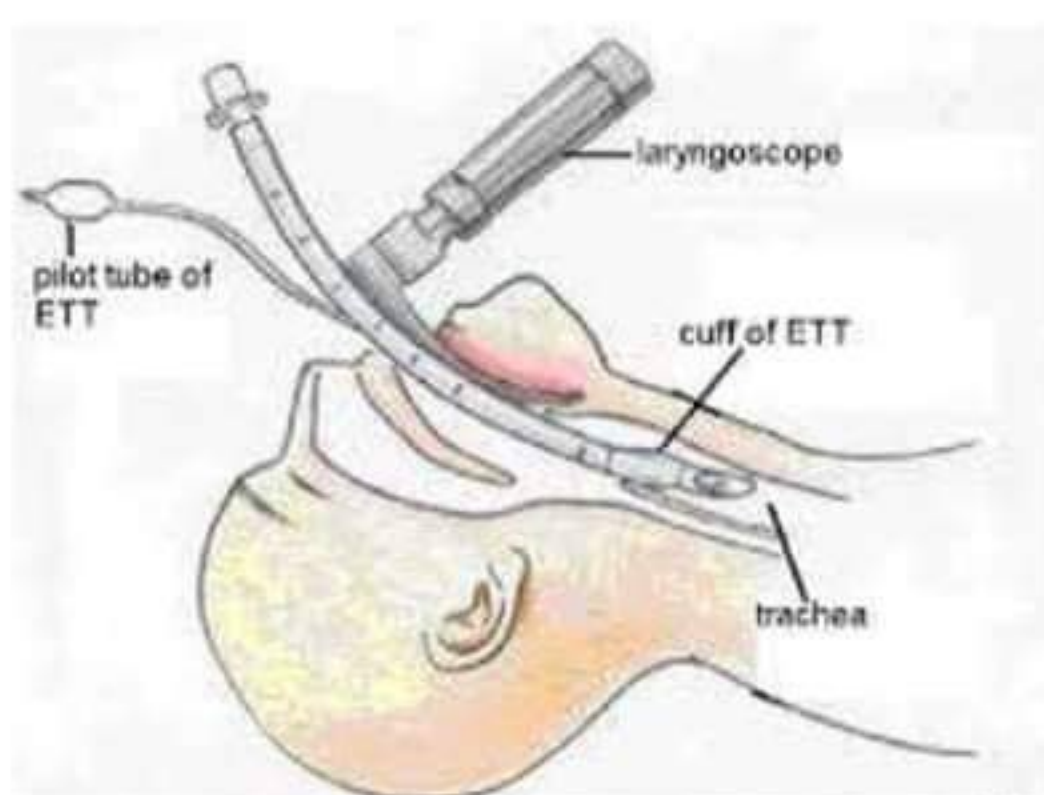
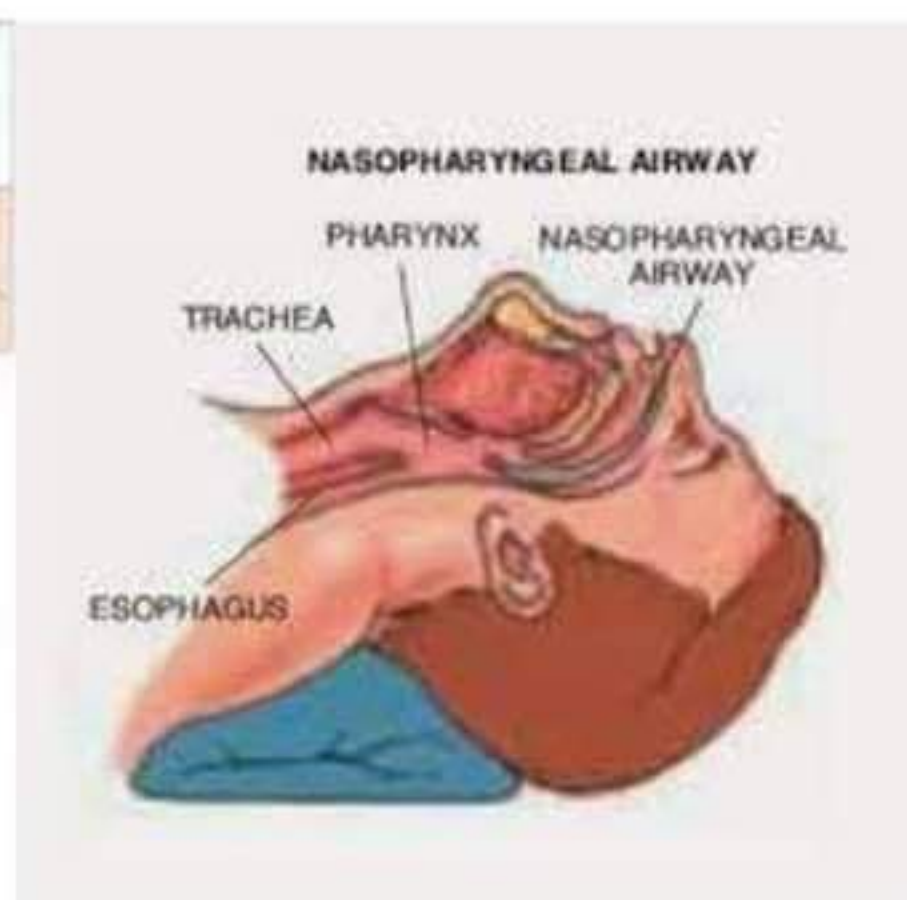
The length of the Guedel airway can be estimated by the distance from the patient's earlobe to the earlobe, or the angle of the jaw.



The Guedel airway is best inserted when the patient is in the supine position. Prior to insertion the airway should be lubricated with a water soluble lubricant.



Insert with the curve facing the opposing direction and follow the airway whilst turning the Guedel airway through 180°.



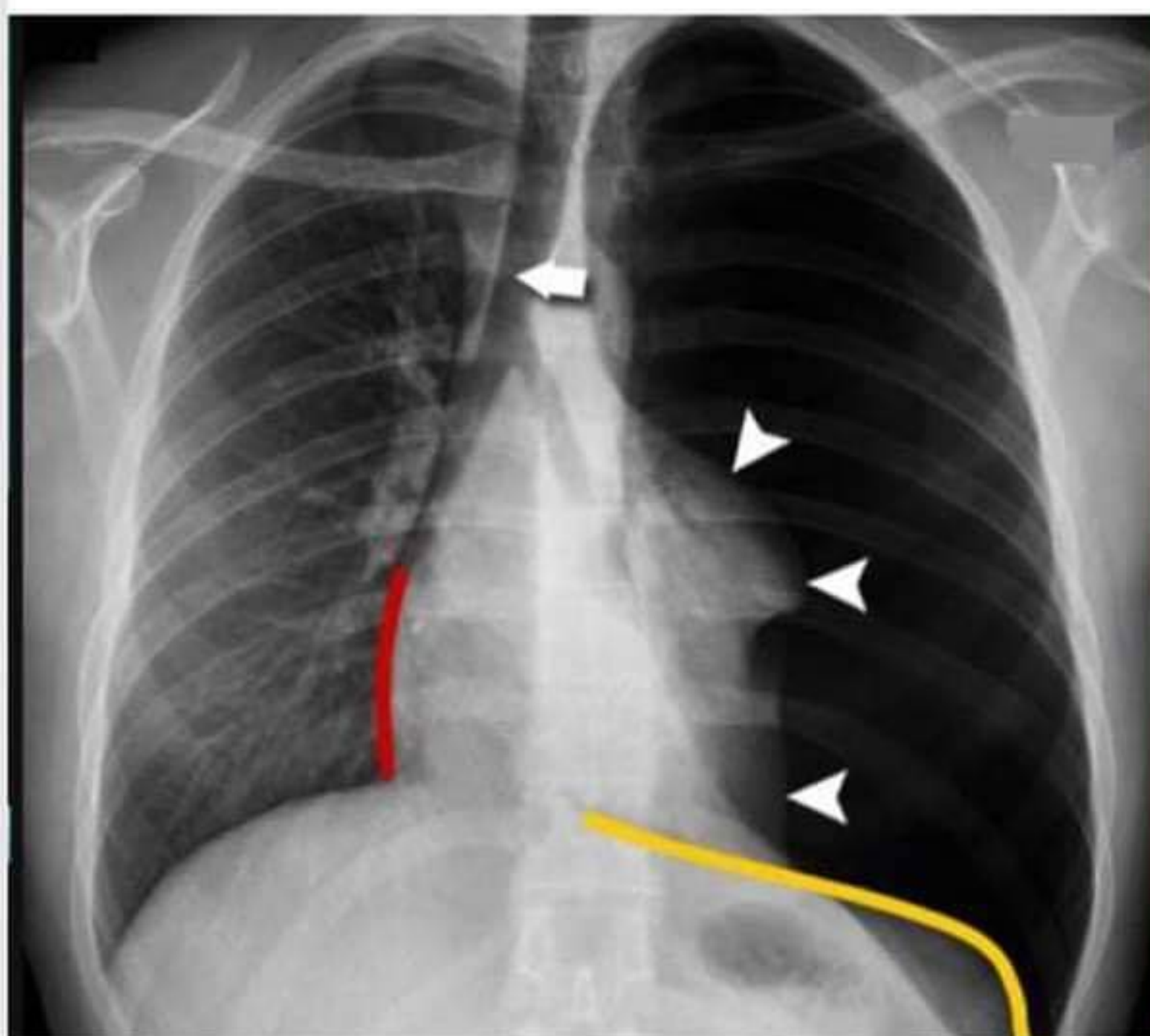
TENSION PNEUMOTHORAX

- 'One way' valve
- Gas on inspiration
- Pressure increases rapidly
 - Atelectasis
 - Diaphragm flattened
 - Hemi-thorax distended
 - Mediastinal shift



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Hypoxaemia → reduced cardiac output → hypotension
Increased sympathetics → adrenaline discharge →
tachycardia and vasoconstriction



This is the one not to miss. If you cannot diagnose a tension pneumothorax at medical finals you won't find an examiner who will defend you.

The left hemithorax is black due to air in the pleural cavity.

Signs of tension

The left lung is completely compressed (arrowheads).

The trachea is pushed to the right (arrow)

The heart is shifted to the contralateral side - note right heart border is pushed to the right (red line)

The left hemidiaphragm is depressed (orange line)

Remember

If you diagnose a tension pneumothorax clinically - do not request an X-ray - TREAT THE PATIENT!



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MANAGEMENT

Immediate chest decompression

Lateral thoracostomy

Insertion of chest drain

Bilateral may be necessary if you get bilateral tension?!

(or if in doubt, a situation which can arise in the suddenly decompensating, intubated and ventilated patient)

Needle decompression (thoracocentesis) should be considered a last resort (14g cannula, 2nd intercostal space, midclavicular line)

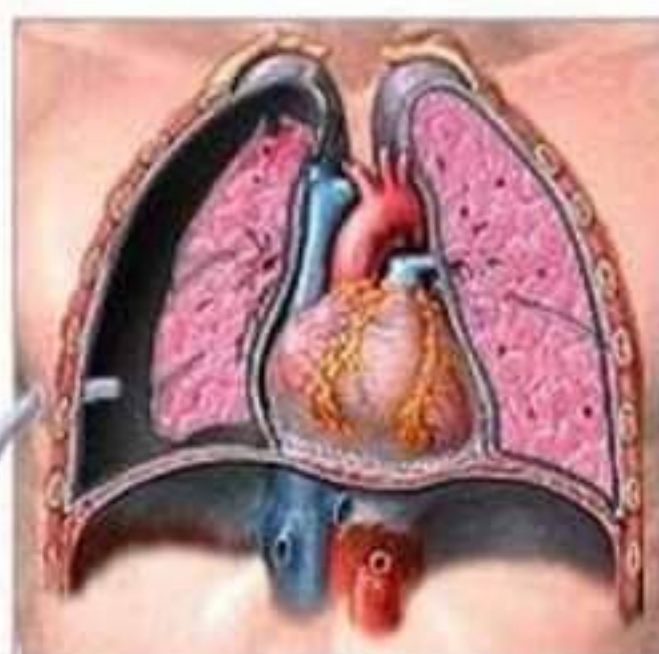
Open procedure; blunt dissection

5th intercostal space

1cm anterior to mid-axillary line

Complications: Haematoma, intercostal neurovascular injury, thoracic and abdominal visceral injury, infection

Tube malposition (ie. Not in pleural cavity) or slippage

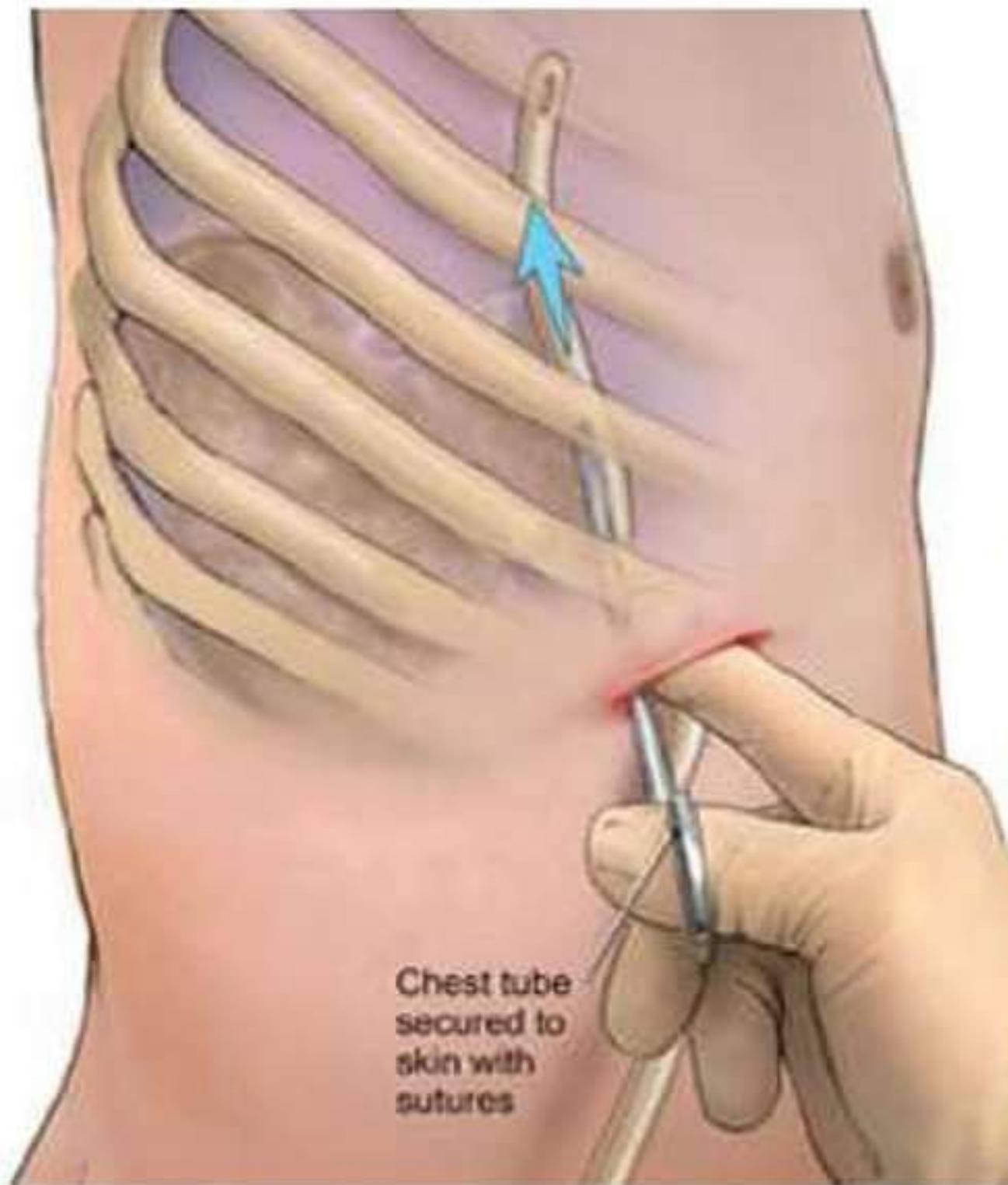


Pneumothorax



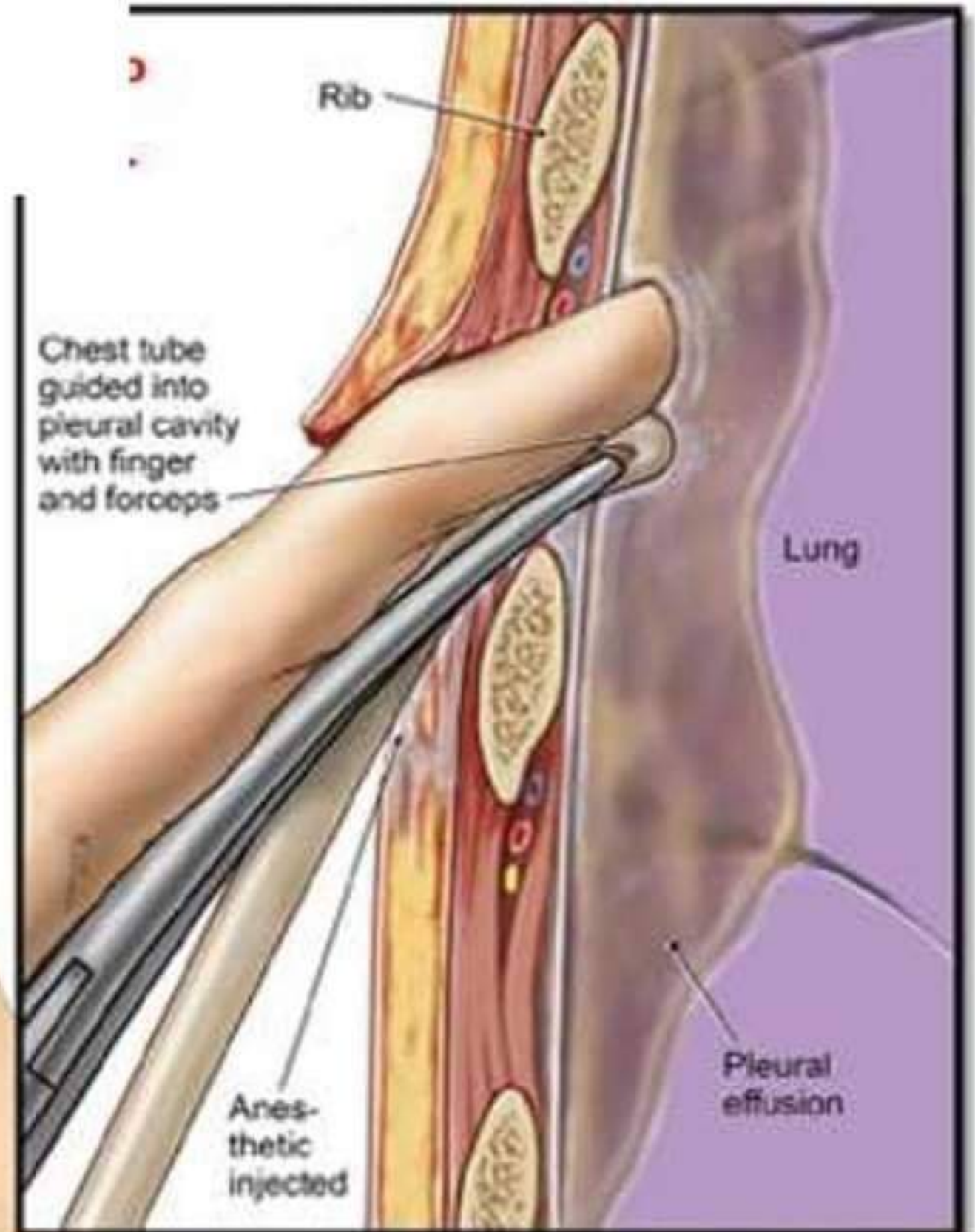
Re-expanded lung

MANAGEMENT



Thoracostomy (Chest Tube Insertion)

Cross Section of Chest Wall



OPEN CHEST WOUND / OPEN PNEUMOTHORAX

‘Sucking chest wound’ – may develop tension

Overlying dressing? (1 way adhesive seal to permit gas / blood to escape, and preventing air to re-enter) – this is to buy time, not definitive!

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Rarely occurs in ventilated patients, as pressure within lungs is positive, which keeps them inflated

100% oxygen; occlusive dressing;
place intercostal drain



MASSIVE HAEMOTHORAX (...HOW MASSIVE?)

Small – will not be detectable by physical examination

More likely

- CXR / CT / FAST

How much blood does it take to occlude the costo-phrenic angle on a CXR? (ie. A fluid level)



Multiple stabbing: front



Don't forget the back!

...400-500 MLS

Hypovolaemic shock

Hypoxia

Dull percussion

Decreased breath sounds

'Unilateral whiteout' (supine)

IV warmed fluid resuscitation, major haemorrhage protocol, autotransfusion



Clampr?



THORACIC CAGE INJURIES

Trauma; rib #'s (ribs 1, 2, 11, 12 protected, often escape #)

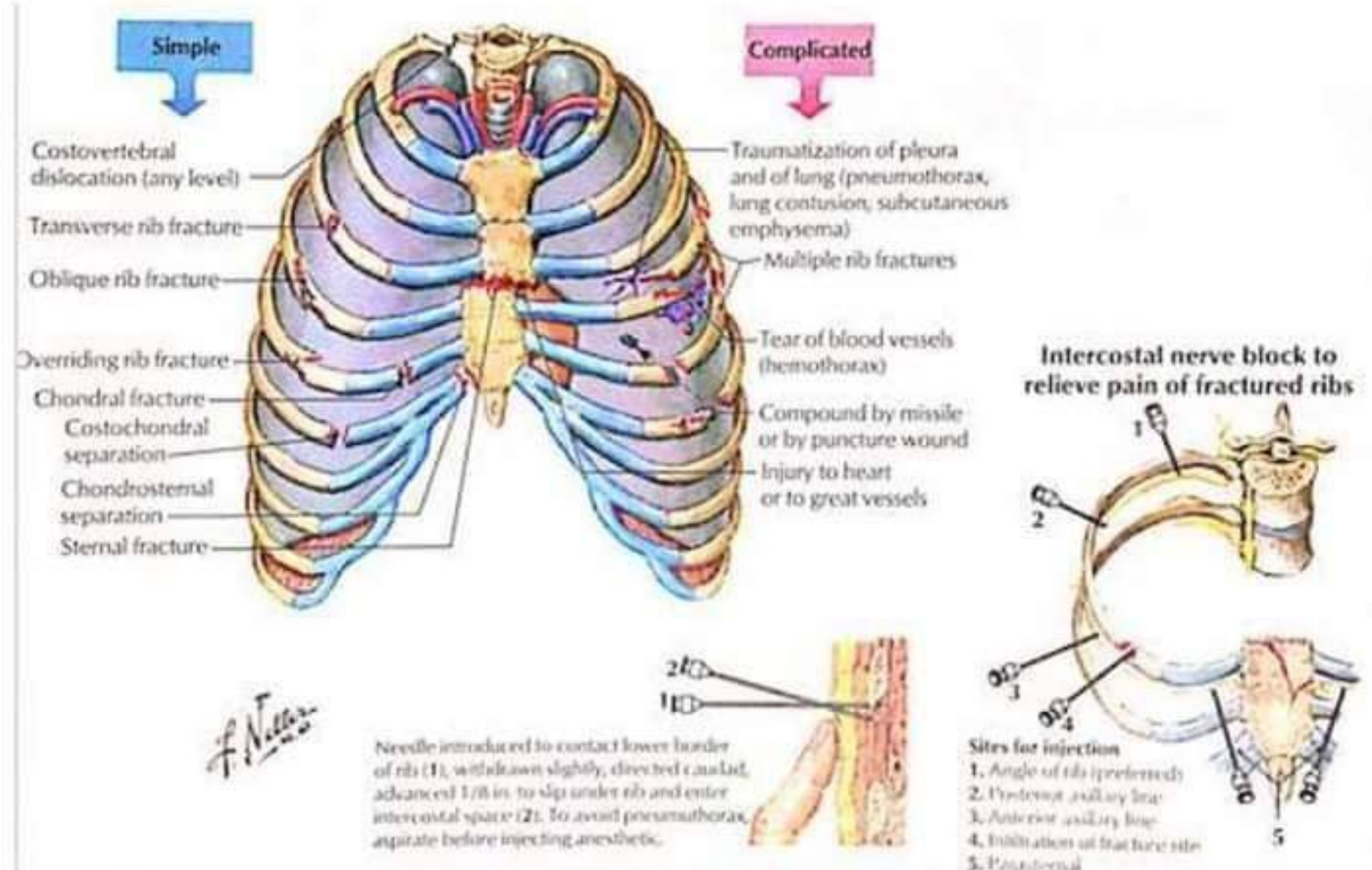
Crush injuries, penetrating chest wounds (gunshot / stab)

Clavicular, scapular # indicates high energy transfer

Pain caused by rib #'s can be intense (expansion and contraction of rib cage during respiration),

sometimes requiring palliation by anaesthetising the intercostal nerve (nerve block)

Paradoxical movement (Flail chest)



FLAIL CHEST

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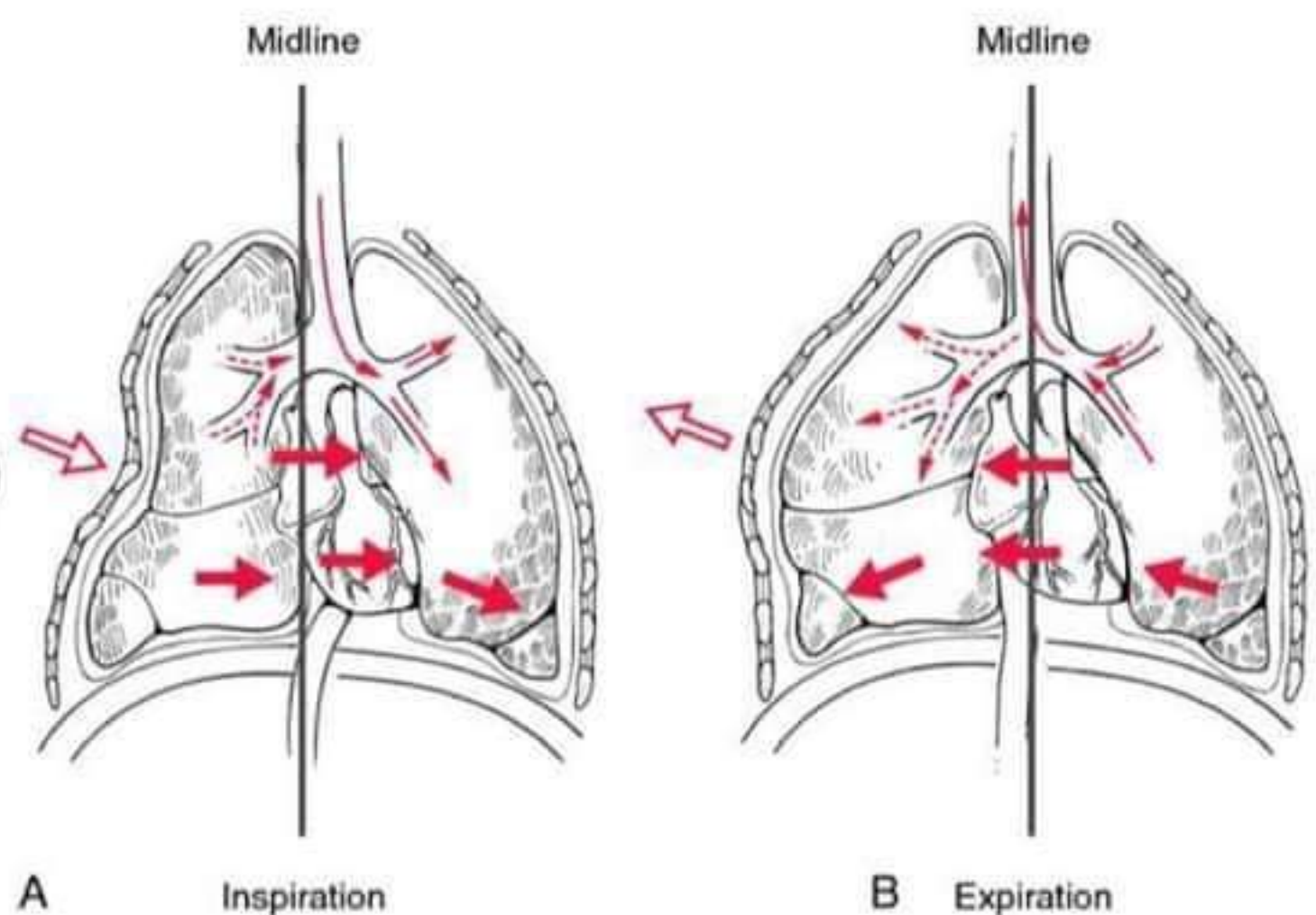
2 or < adjacent ribs # @ 2 or < places

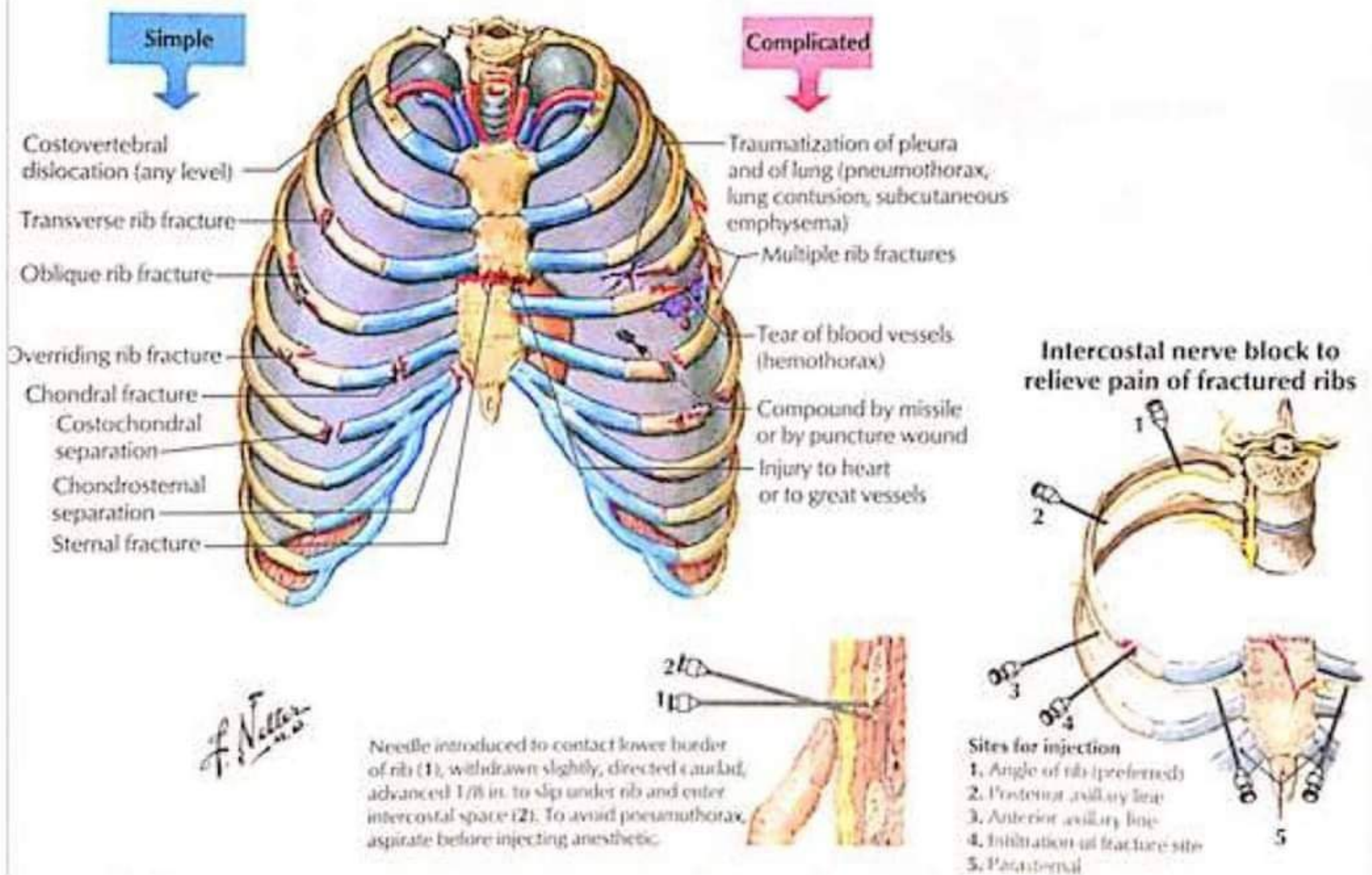
Tender, crepitus, shallow rapid breathing

High-flow, warmed & humidified Oxygen

Cautious fluid resuscitation (overload / pulmonary oedema)

Analgaesia (IV opioids) allowing maximal movement





INDICATIONS

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For tracheal intubation and ventilation in cases of flail chest:

Oxygen

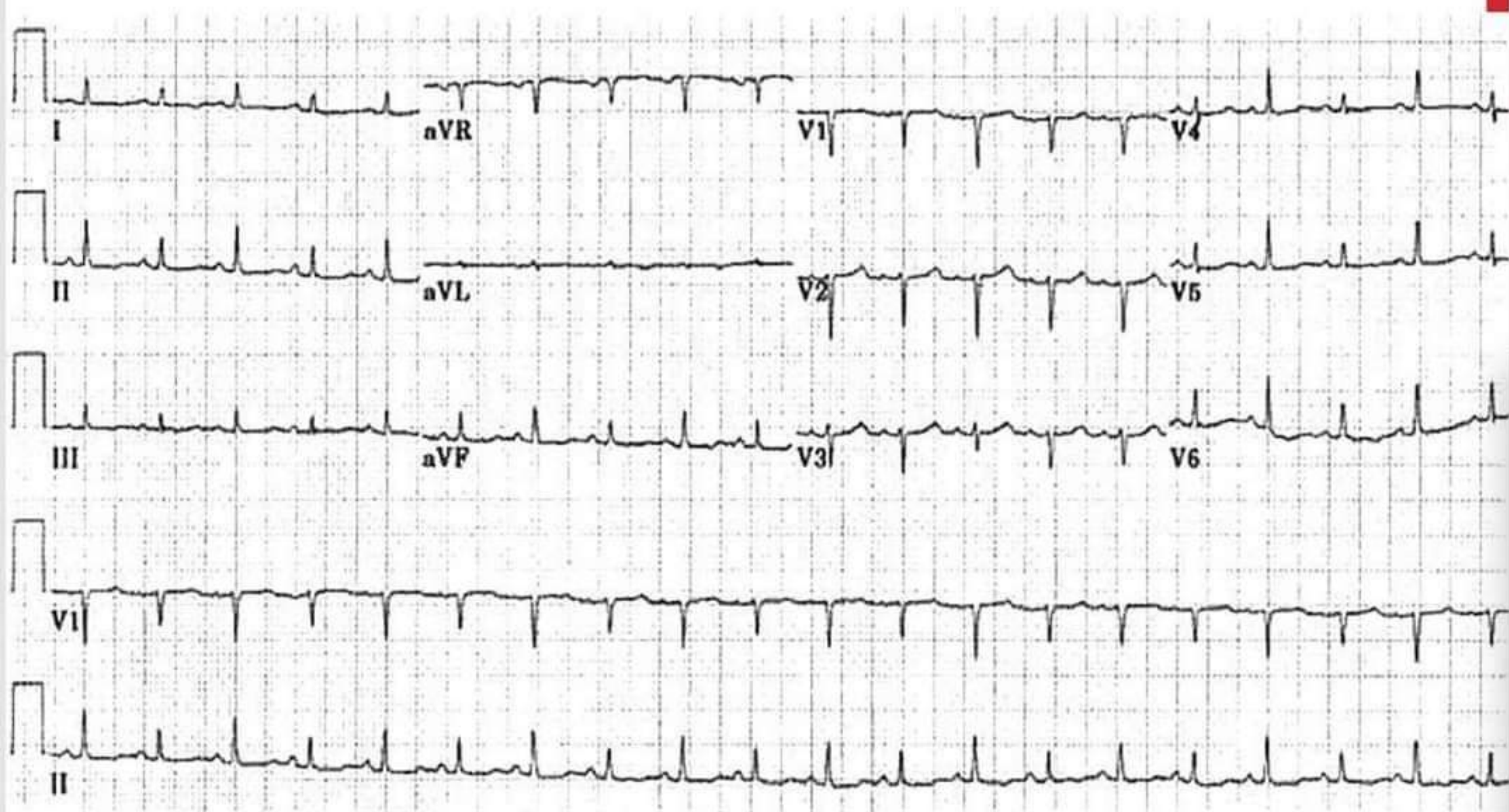
- Falling PaO_2 or $\text{PaO}_2 < 7 \text{ kPa}$ (55 mmHg) breathing air
- $\text{PaO}_2 < 10 \text{ kPa}$ (75 mmHg) on high flow oxygen

Carbon dioxide

- Increasing PaCO_2 or $> 6 \text{ kPa}$ (45 mmHg)

Respiratory rate

- Exhaustion ($\text{RR} < 8 \text{ r/min}$)
- Tachypnoea ($\text{RR} > 30 \text{ r/min}$)
- Associated injuries compromising ventilation



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CARDIAC TAMPONADE

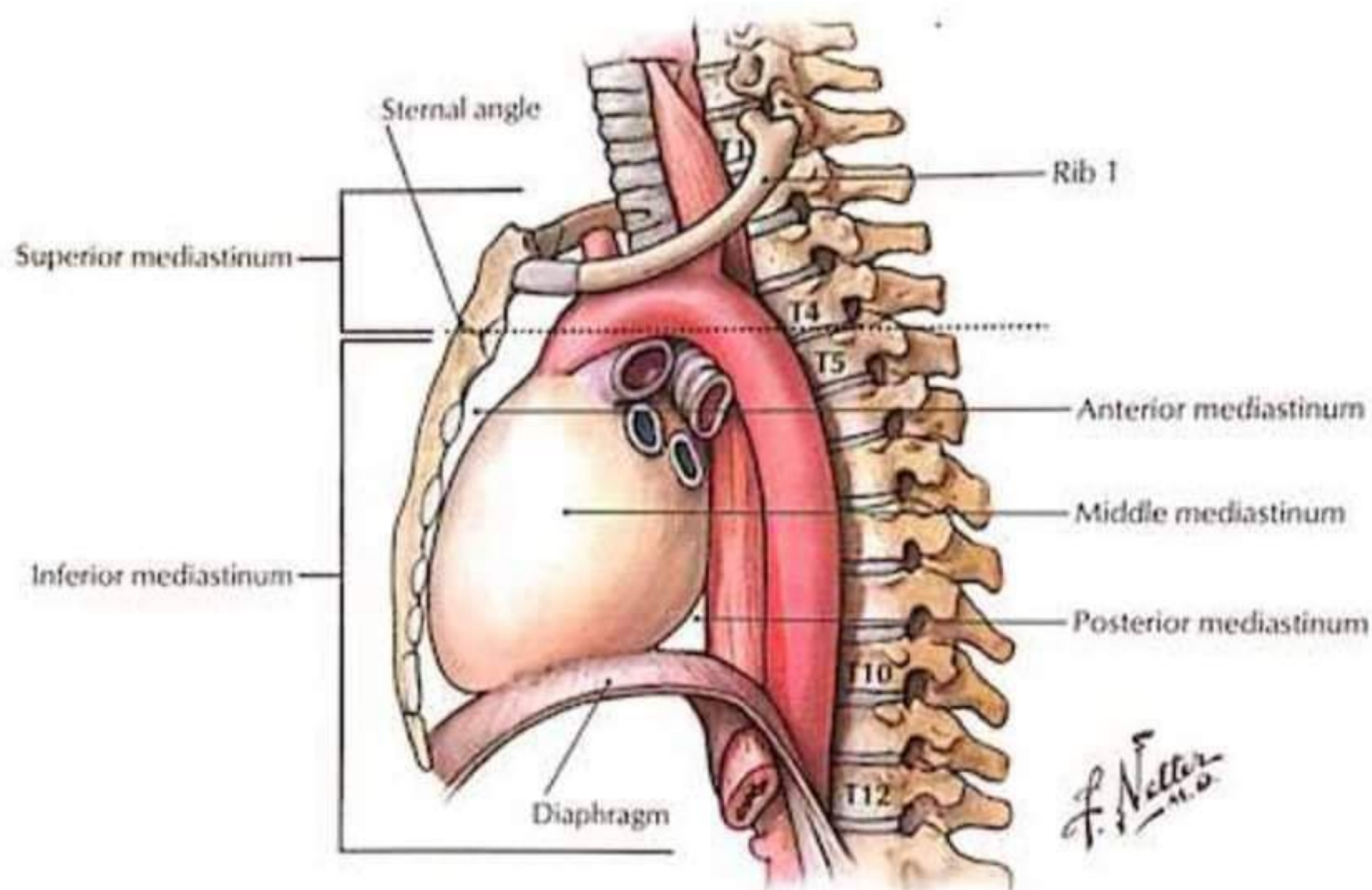
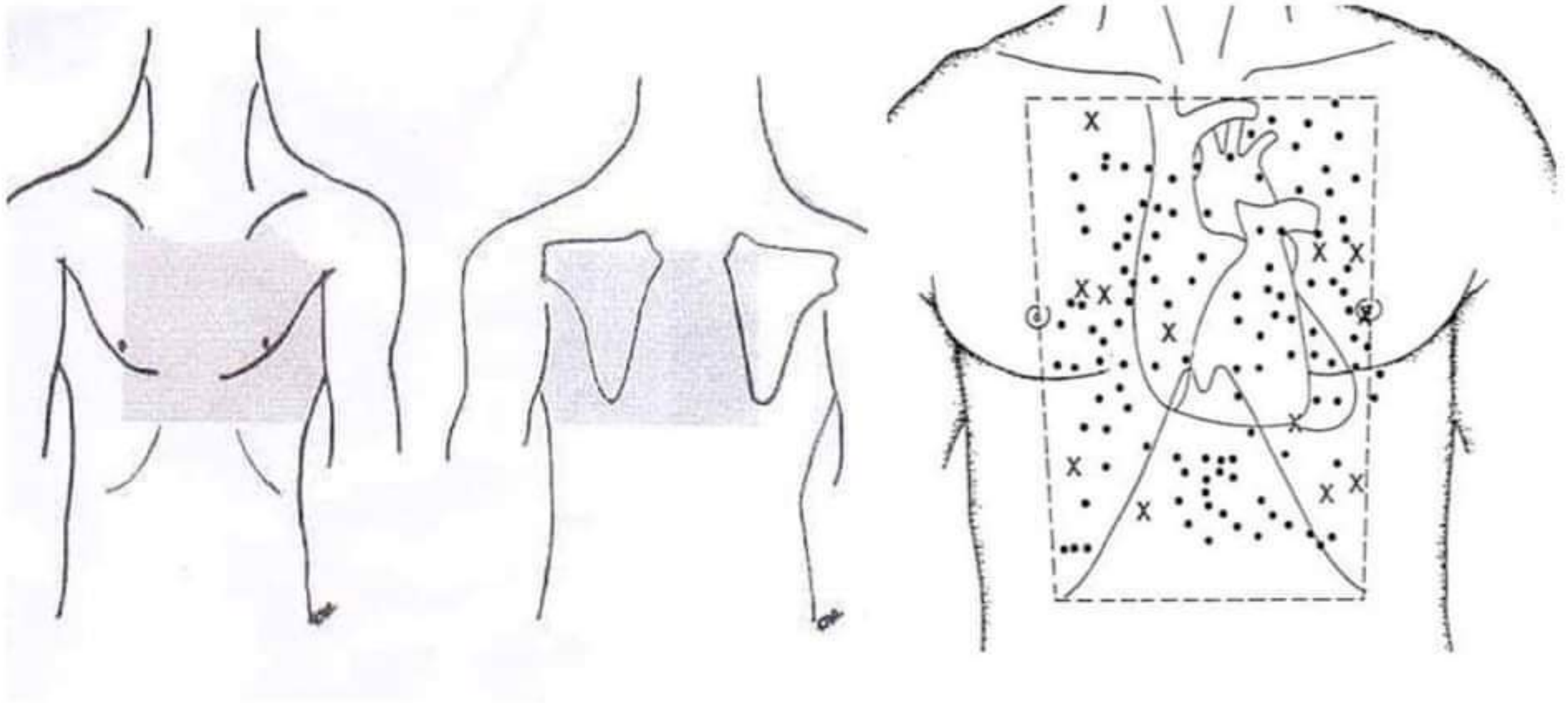


FIGURE 3-1 Subdivisions of the Mediastinum

DANGER BOX



MECHANISM

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Penetrating injury → **bleeding** in pericardium → laceration seals with clot

Only small mls **restricts** ventricular filling → reduces preload / stroke volume

HR increases initially to **compensate** as does perfusion pressure (increases peripheral vascular resistance)

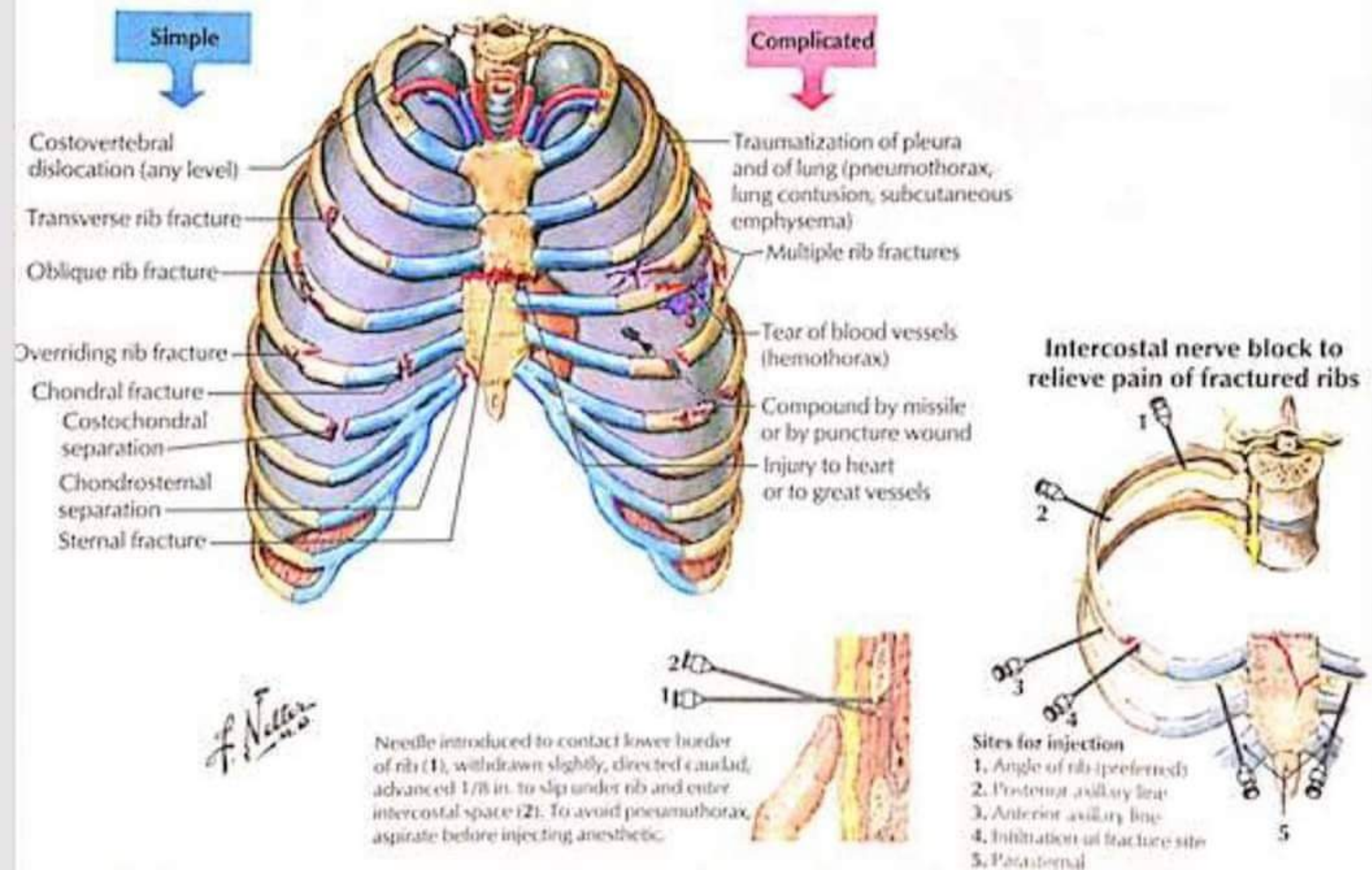
Leads to profound **hypotension** → reduced coronary perfusion → myocardial injury → death

BECK'S TRIAD

1. Hypotension
 2. Raised JVP (distended veins)
 3. Decreased heart sounds
- *Pulsus paradoxus* (>10 mmHg fall in pressure during inspiration)
 - *Kussmaul's sign* (raised JVP on inspiration)

Only seen in 1/3rd of patients → Sonography / echo best diagnostic

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INITIAL MANAGEMENT

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Augment venous return → Raise patient's leg (if possible)

Rapid IV fluid infusion

Surgical evacuation of clot / repair of cardiac laceration (via median sternotomy)

If urgent, thoracotomy in ED can be effective

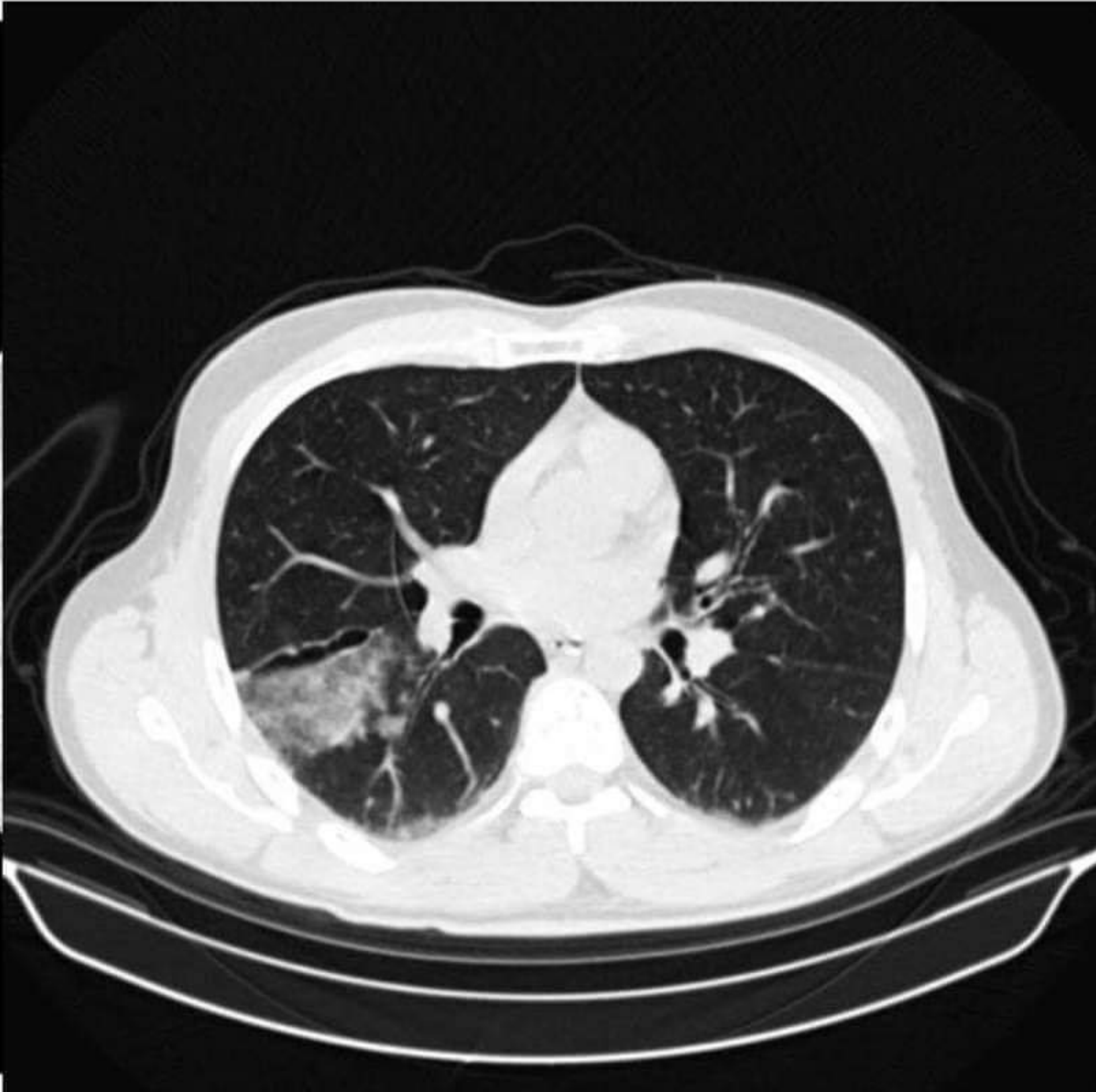
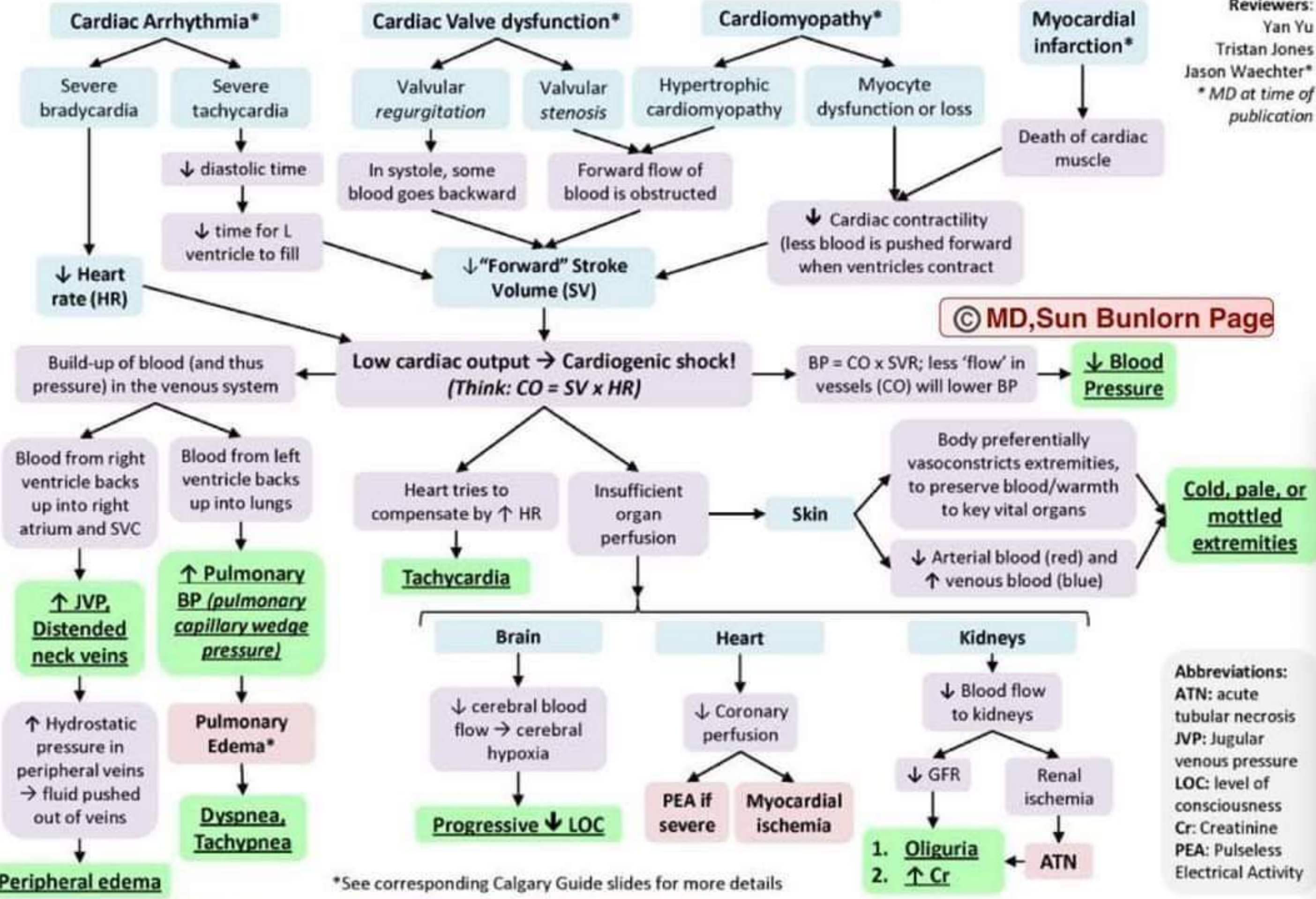
Pericardiocentesis should be considered only if expertise not available and patient is dying

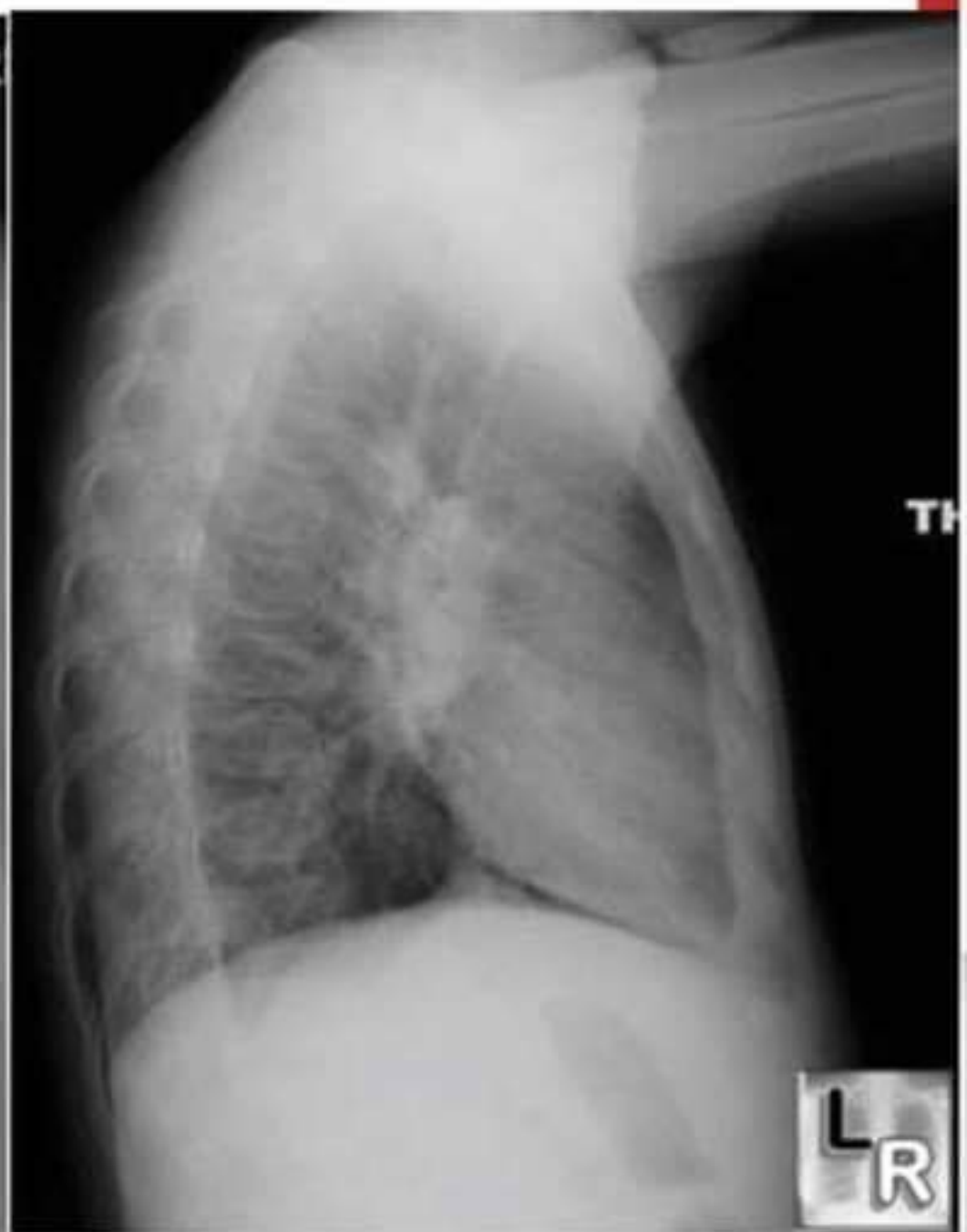
PERICARDIOCENTESIS

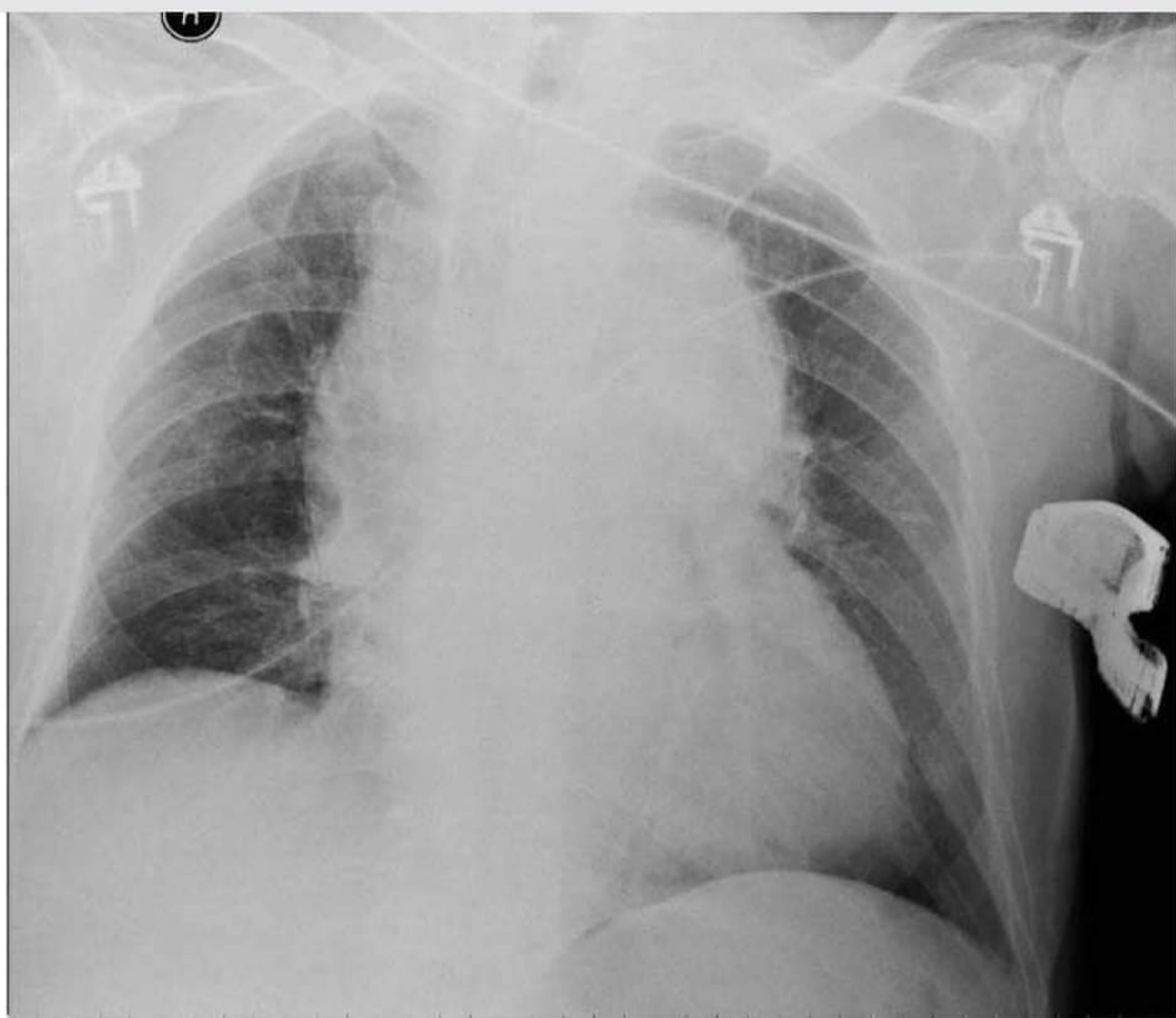
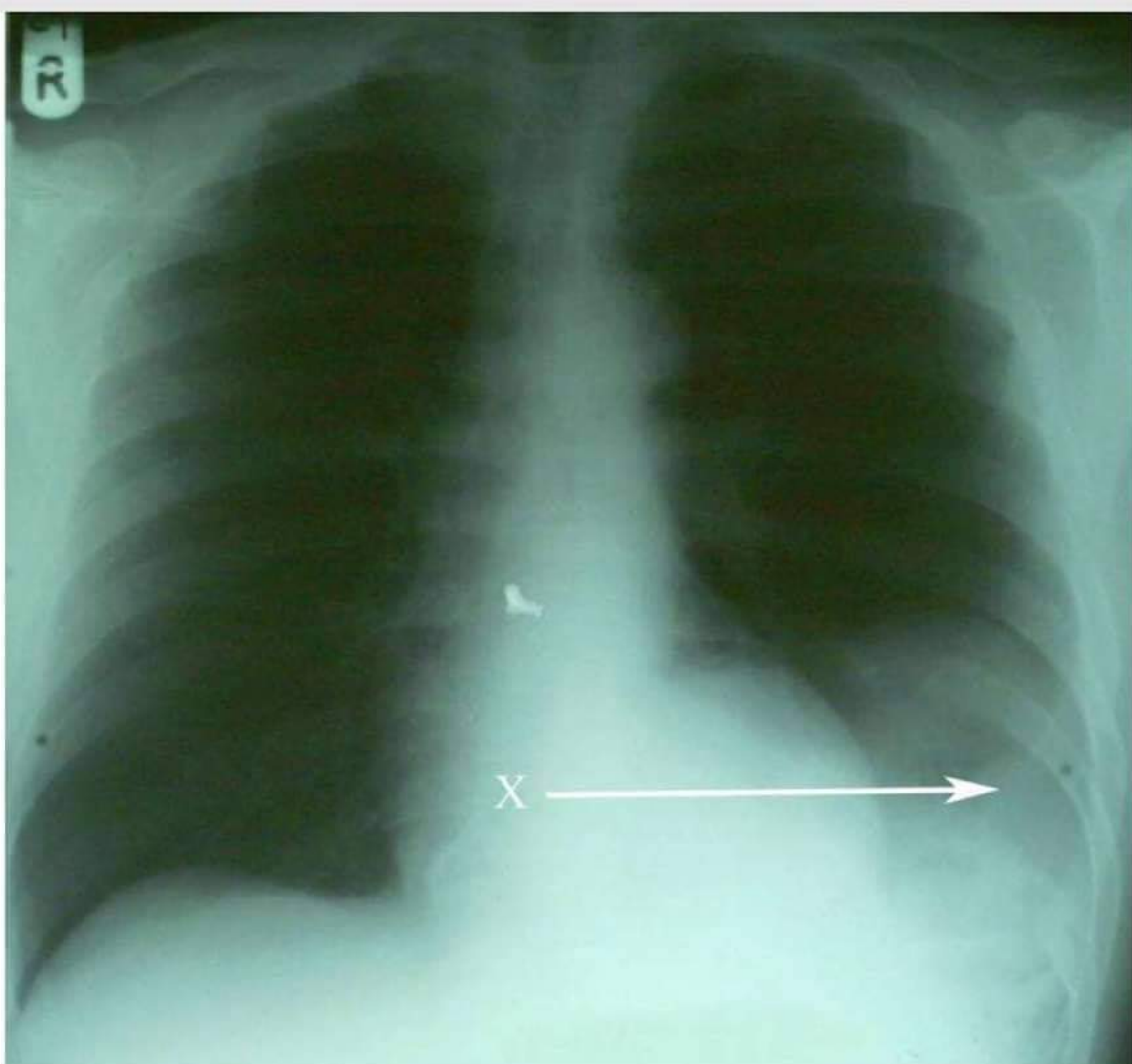


Cardiogenic Shock: Pathogenesis, complications and clinical findings

Author:
Dean Percy
Reviewers:
Yan Yu
Tristan Jones
Jason Waechter*
* MD at time of publication







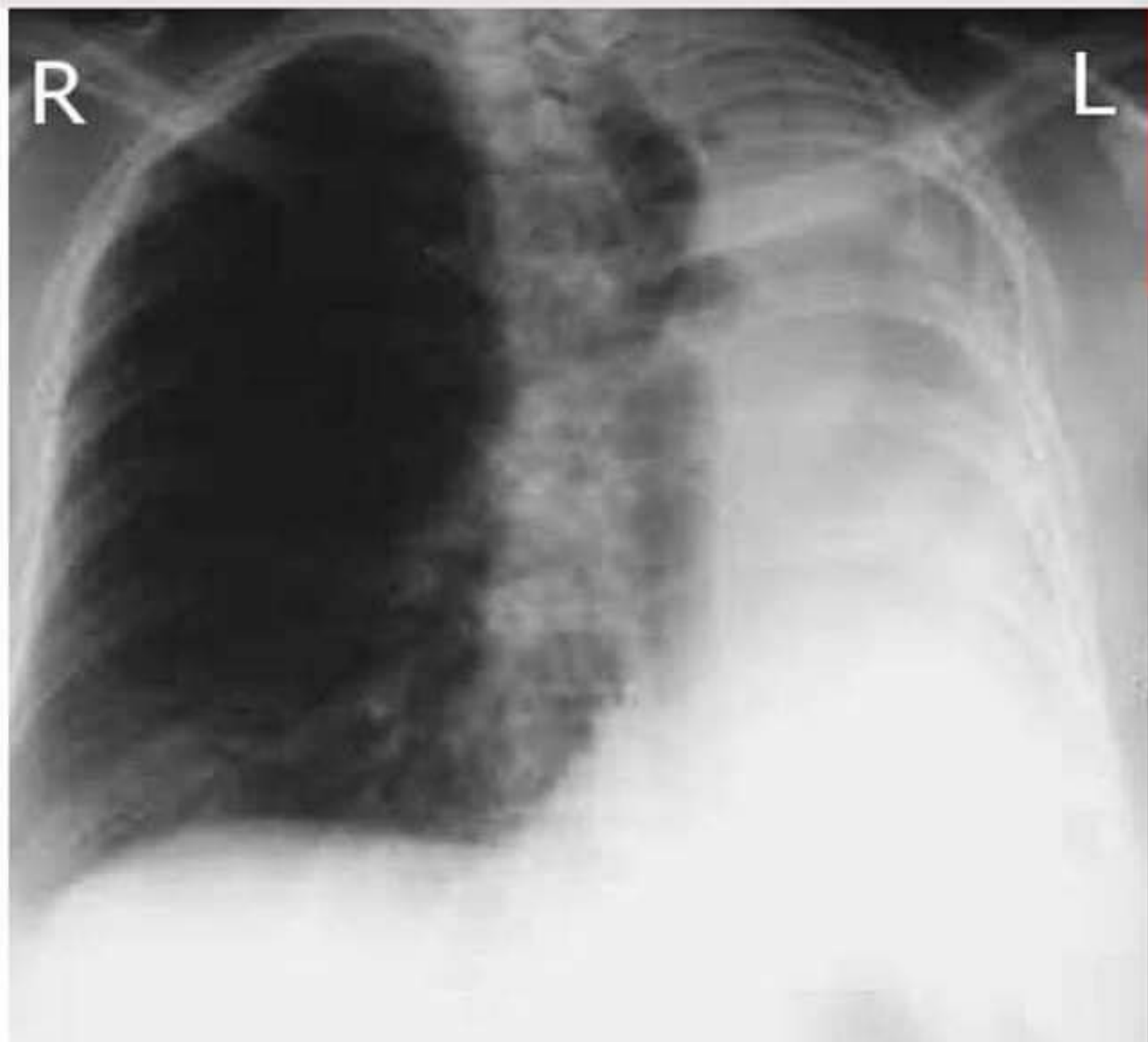
PITFALLS

- Simple pneumothorax → tension pneumothorax
- Retained haemothorax
- Diaphragmatic injury
- Severity of rib fractures / pulmonary contusion
- Elderly people

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- Think: airway, gas exchange, perfusion, circulation...

You are the radiologist on call and are asked to interpret this chest x-ray of a 56 year old male who presented to the trauma bay after being struck by a motor vehicle while riding his bike home from work.



What's the diagnosis?

- A) Massive left hemothorax (blood in the chest)*
- B) Right pneumothorax (collapsed lung/air in the chest)*
- C) Right pneumothorax & left hemothorax*
- D) Left pneumonectomy (lung removed)*
- E) Ruptured left diaphragm*

D) LEFT PNEUMONECTOMY

'looks like he's missing a lung'

Explanation

- Total opacification should prompt DDx
 - Atelectasis
 - Pleural effusion
 - Pneumonia
 - Haemothorax
 - Pneumectomy (removal of lung tissue)

WHAT ELSE

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Pulmonary contusion / laceration

Blunt cardiac injury

Pneumomediastinum

Ruptured diaphragm

Traumatic disruption of aorta

Ruptured oesophagus