



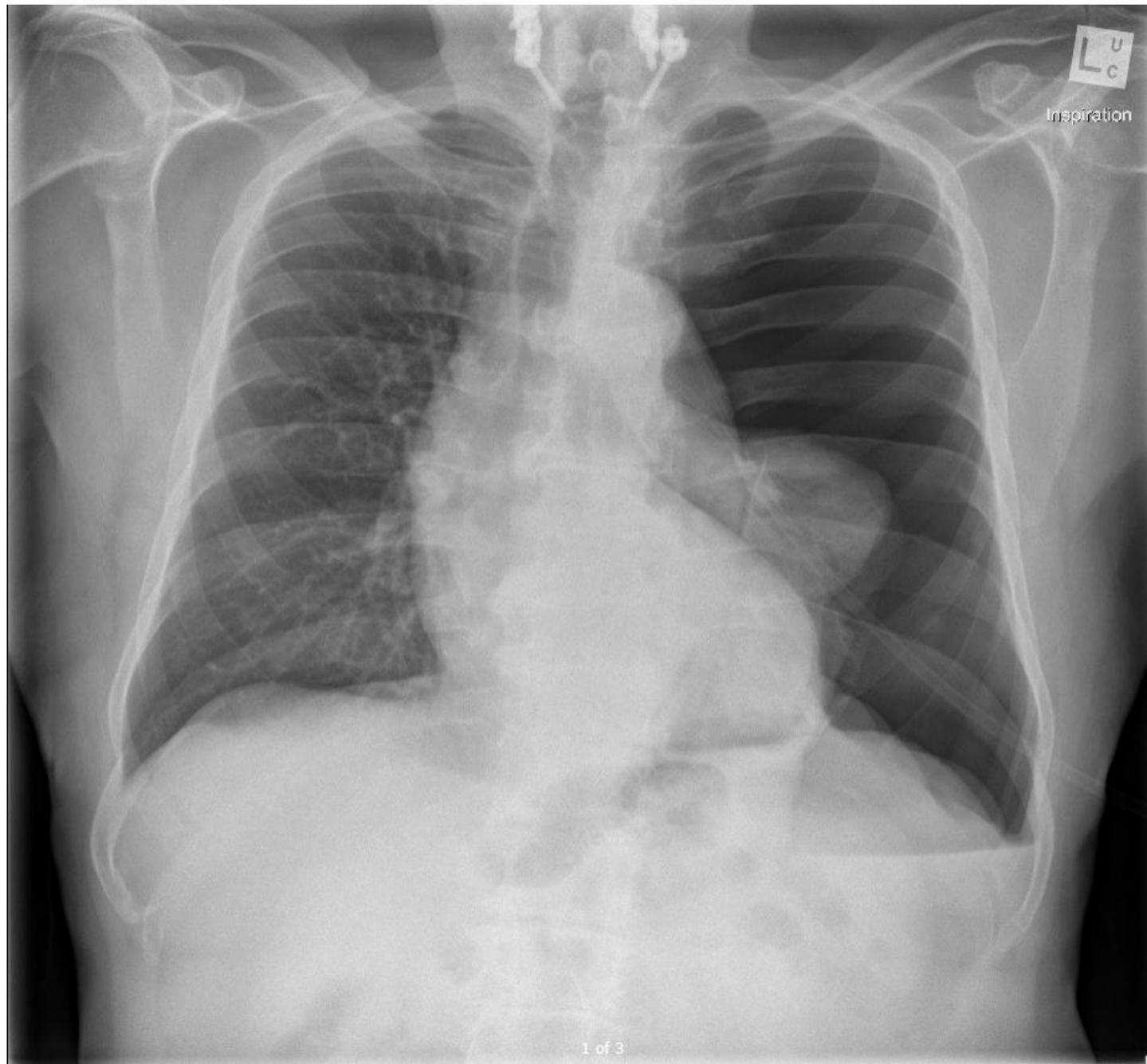
# Management of Pneumothorax

Lungs, Lines and Larynx

Lecture 1

# Learning Outcomes

1. You will be able to list the different **classifications** of pneumothorax
2. You will be able to explain different **management options** of pneumothorax
3. You will be able to evaluate different **methods** of **chest drain insertion**
4. You will be able to evaluate different **methods** for **decompressive thoracostomy**



**Findings:**

There is a left-sided tension pneumothorax with complete collapse of the left lung and slight tracheal deviation to the right.

Whose x-ray is it.....

# Case 1

- 25 year old male
  - Stab wound to left chest
  - 1.5cm sucking chest wound
  - Pale and clammy
  - Resp rate 35
  - Thready radial pulse 130bpm
  - Sats unrecordable
  - Blood pressure 80 systolic

# Case 2

- 18 year old male
  - Sudden onset pleuritic pain now settled
  - Not distressed
  - Resp rate 14 breath per minute
  - Sats 97% room air
  - radial pulse 65bpm
  - Blood pressure 120 systolic

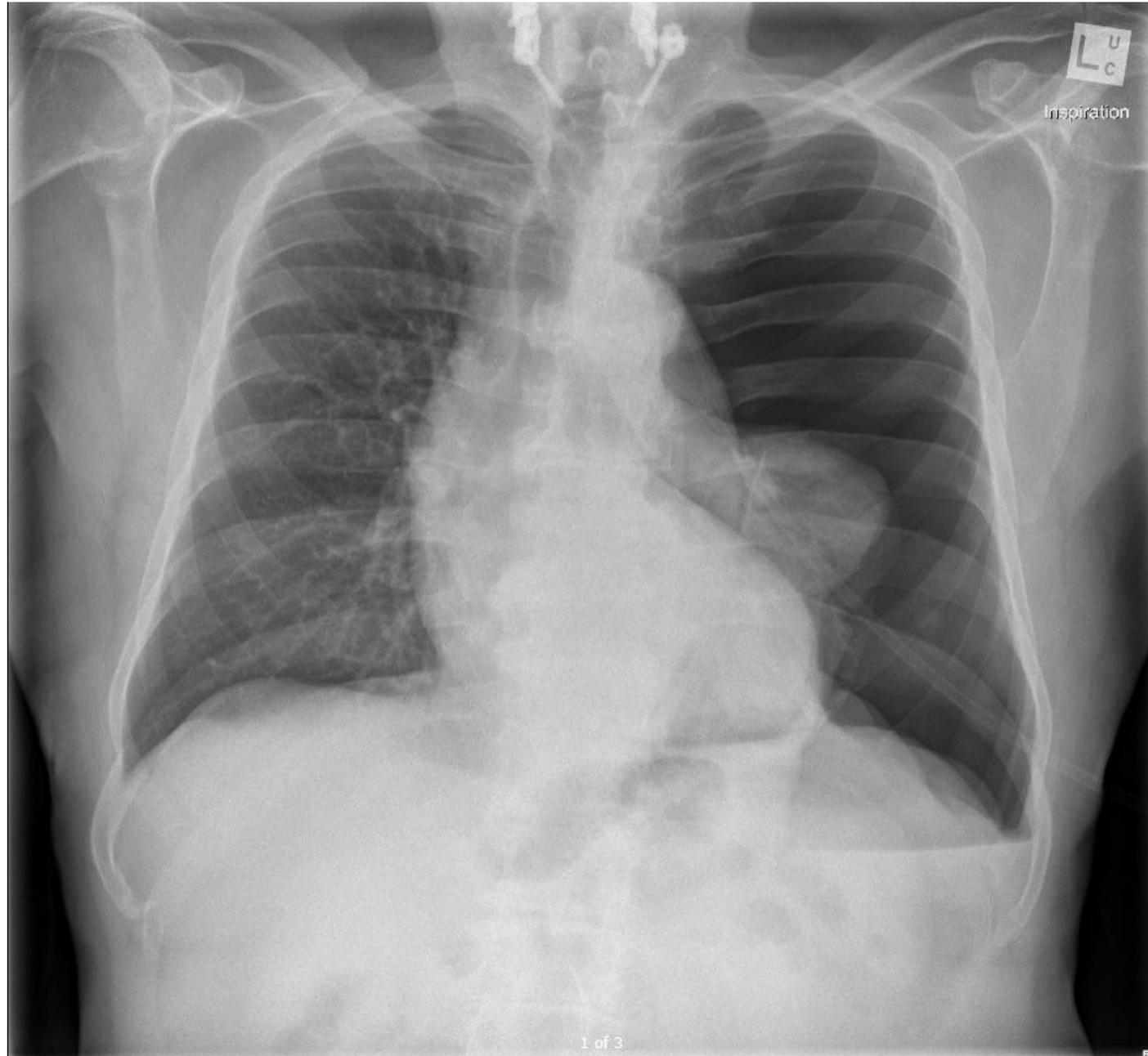
# Case 3

- 65 year old
  - Increasing shortness of breath on background of COPD
  - Increased work of breathing
  - Resp rate 20
  - Sats 89% room air
  - Hr 100
  - Blood pressure 140 systolic

This chest x-ray could from any of these cases

Size of pneumothorax is not the sole determinant of management

Tension Pneumothorax is a clinical diagnosis

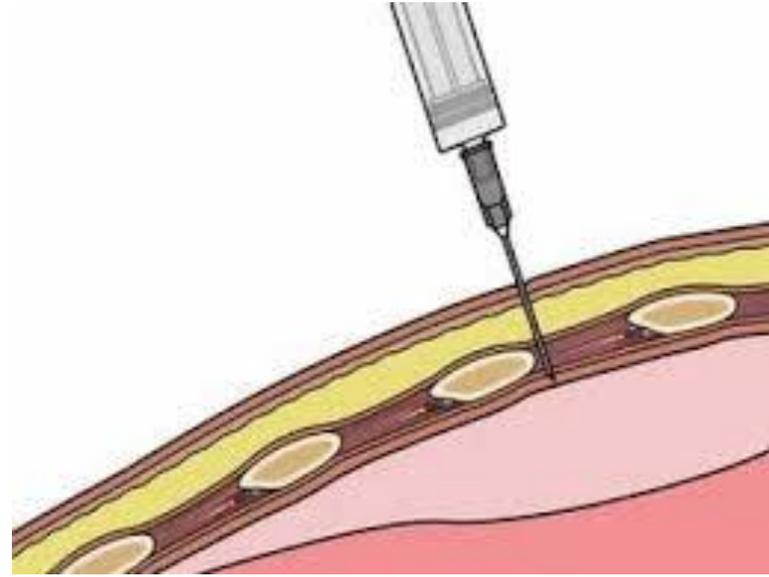


Each of these cases will be managed differently.....

Conservative



# Needle Aspiration



# Finger Thoracostomy



# Guide Wire Technique (fine bore chest drain)



# Traditional Chest Drain

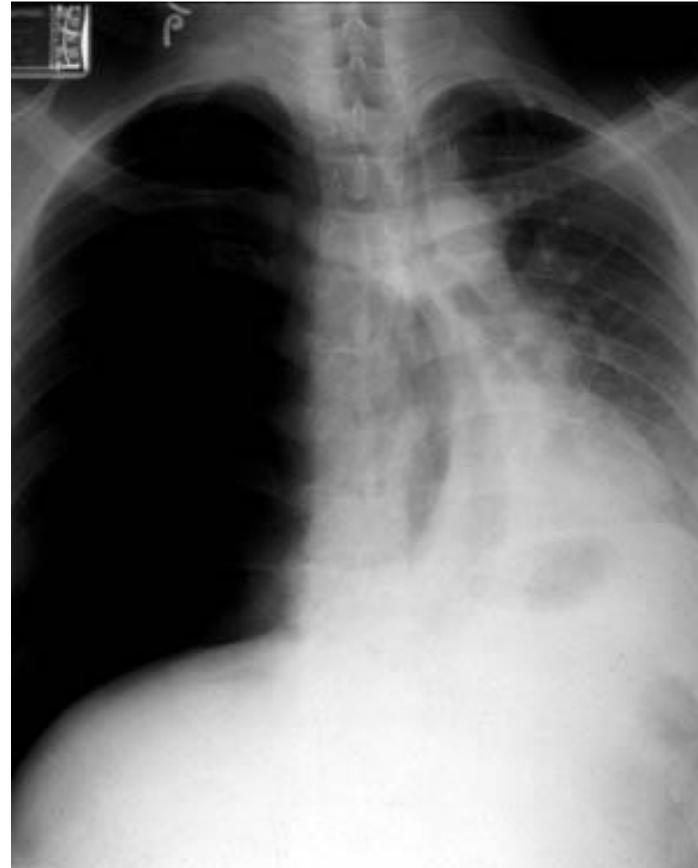


# Classification of PTX

- Traumatic PTX
- Primary Spontaneous PTX (PSP)
  - Occurs in otherwise healthy individuals
  - Young men
  - No precipitating event
- Secondary Spontaneous PTX (SSP)
  - Underlying lung disease, eg. COPD, connective tissue disorder
  - No precipitating event

# Resuscitation

- Apply high flow O<sub>2</sub>
  - 1. maintain/improve oxygen saturations
  - 2. increase the rate of PTX resolution
- Rule out tension
  - Significant SOB
  - Hypotension
  - Tachycardia
  - Confusion



Use of Ultrasound.....

# The Pleural Line

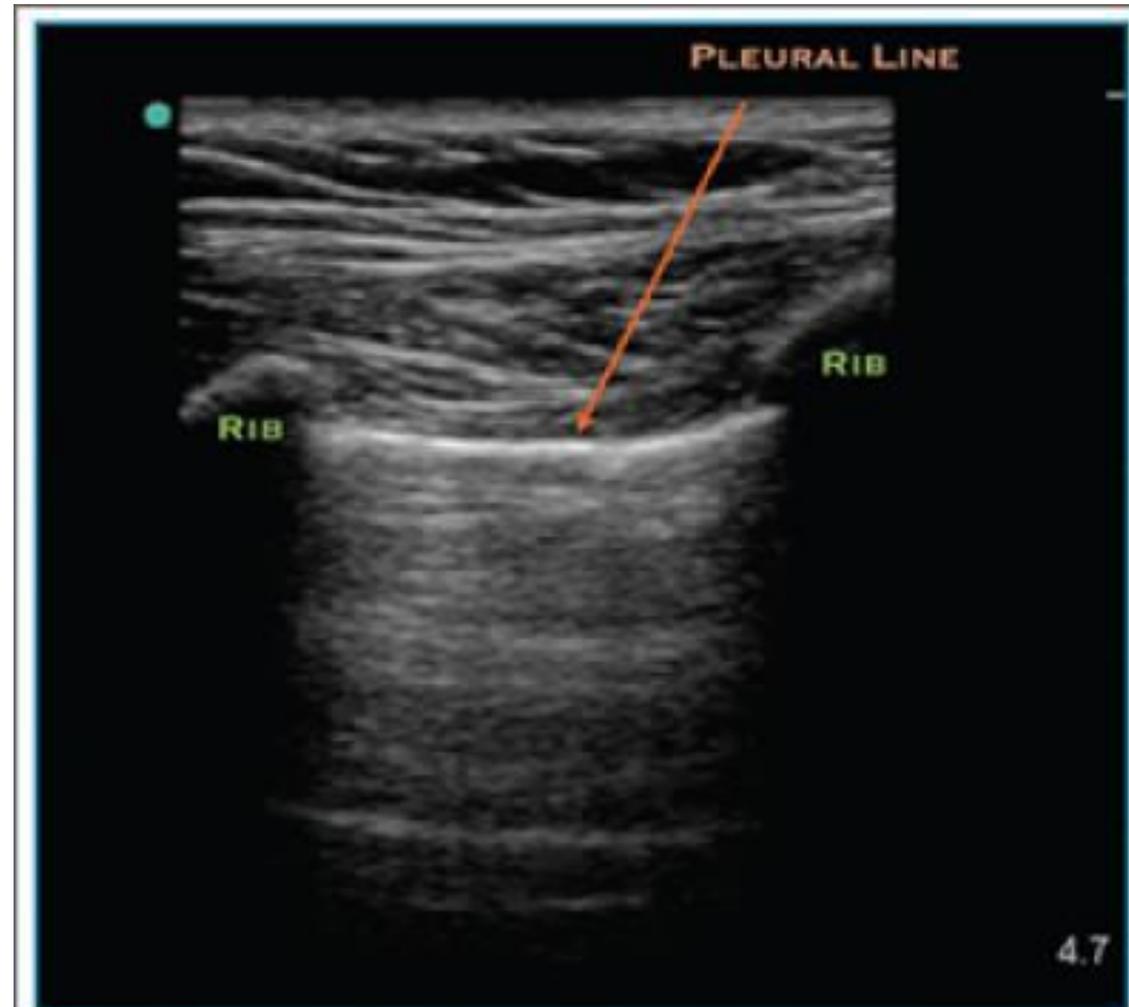
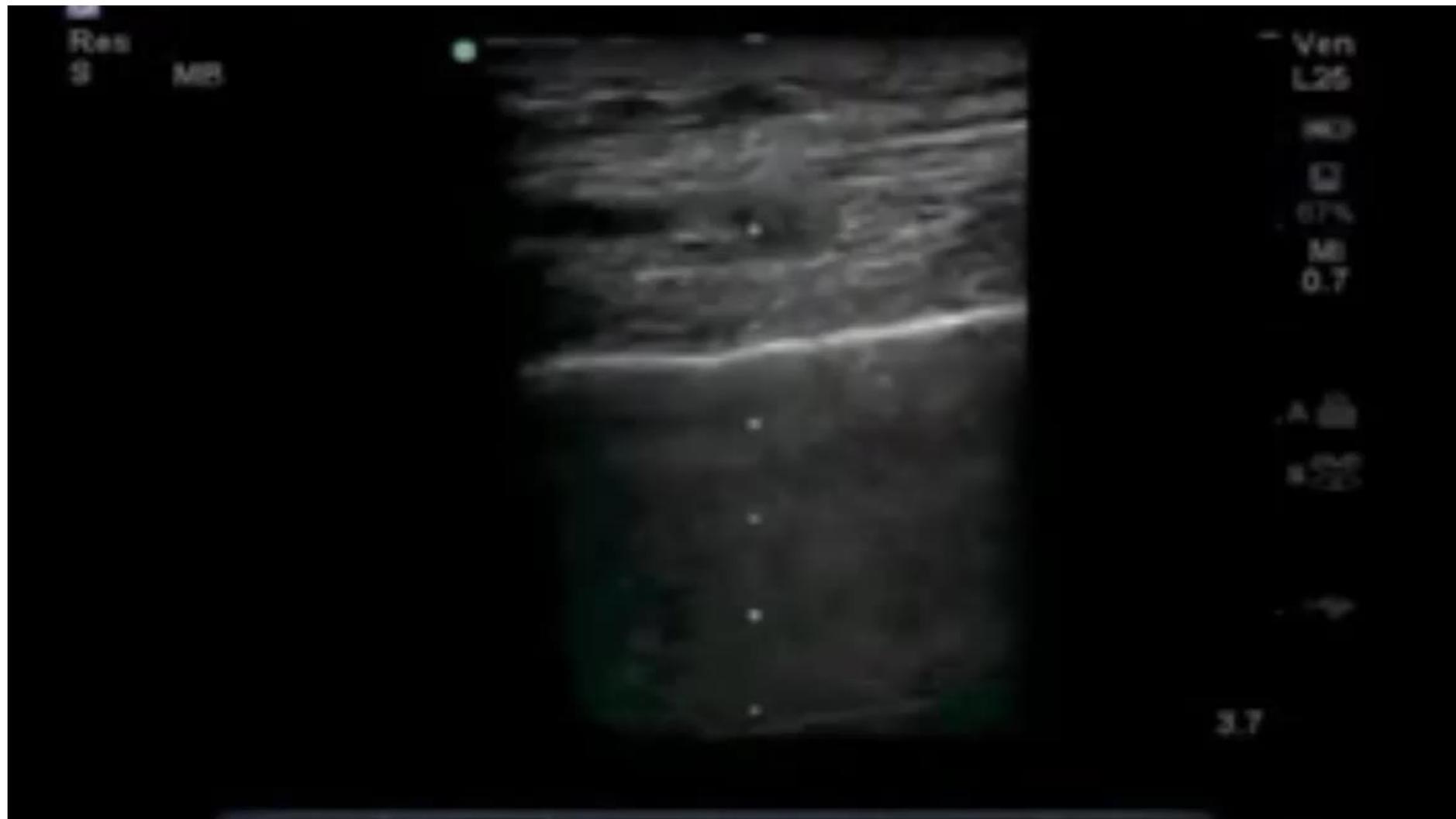
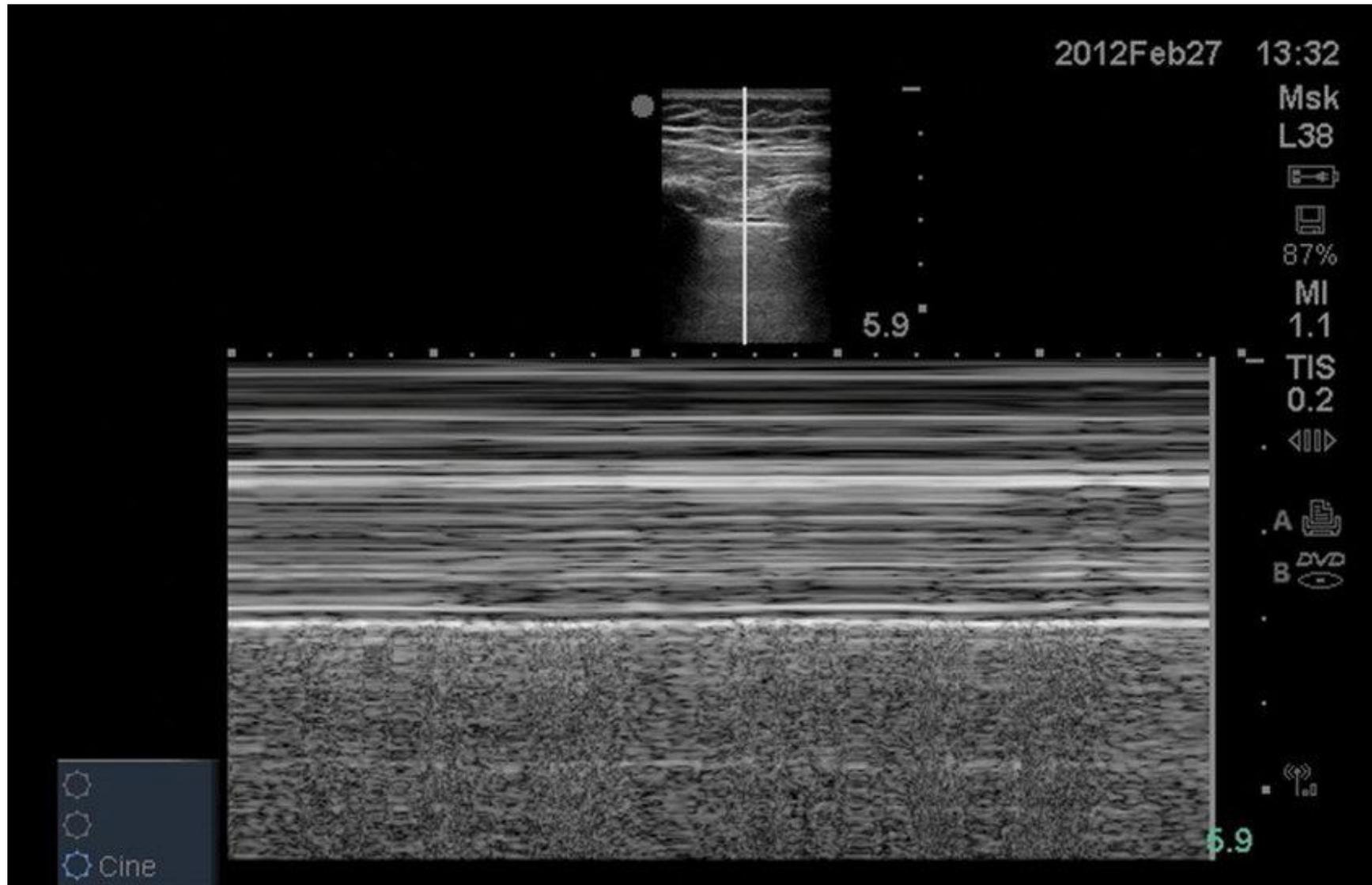


Figure 1. Ultrasound showing the pleura as a bright hyperechoic line

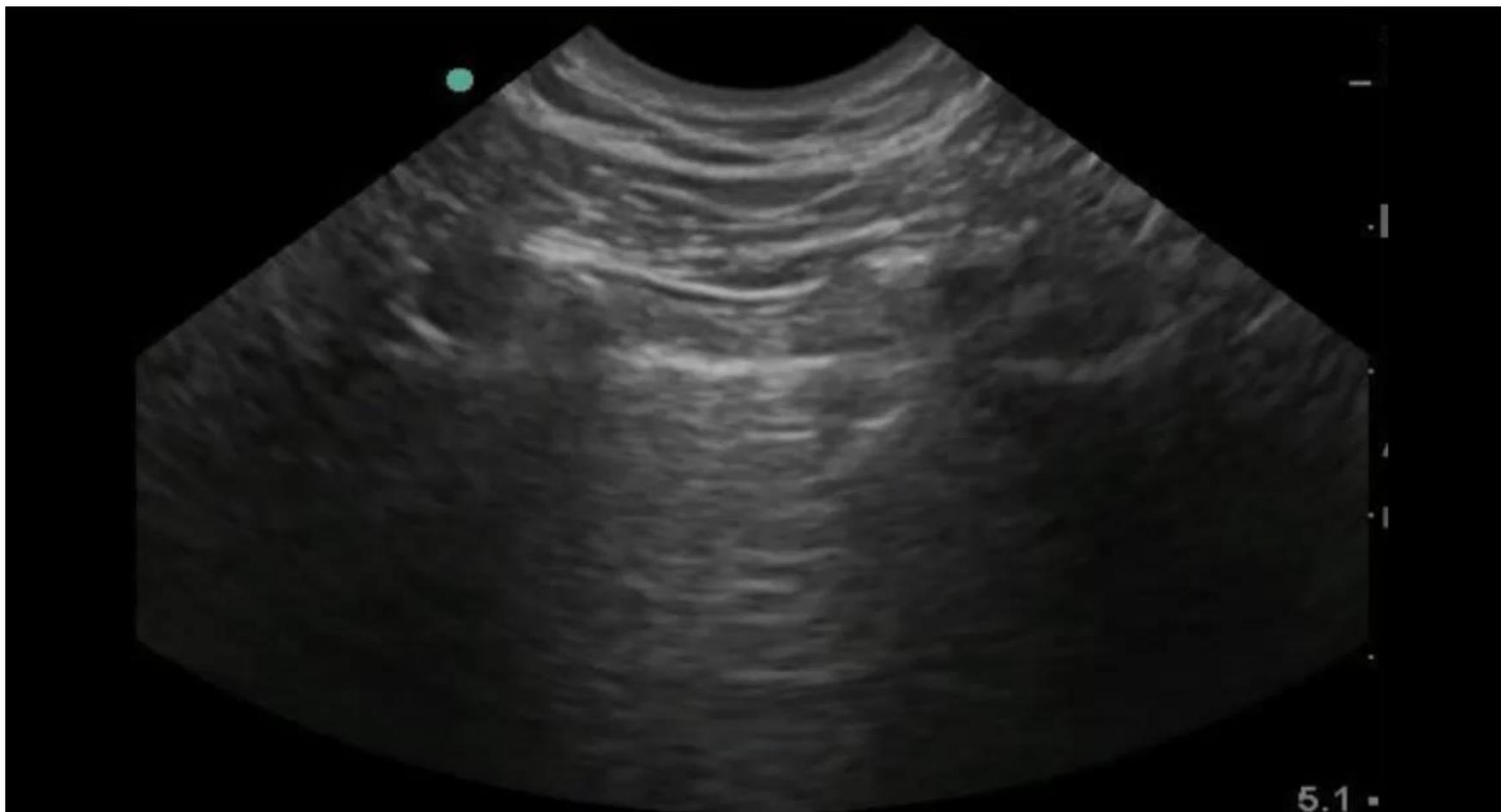
# Sliding Lung Sign



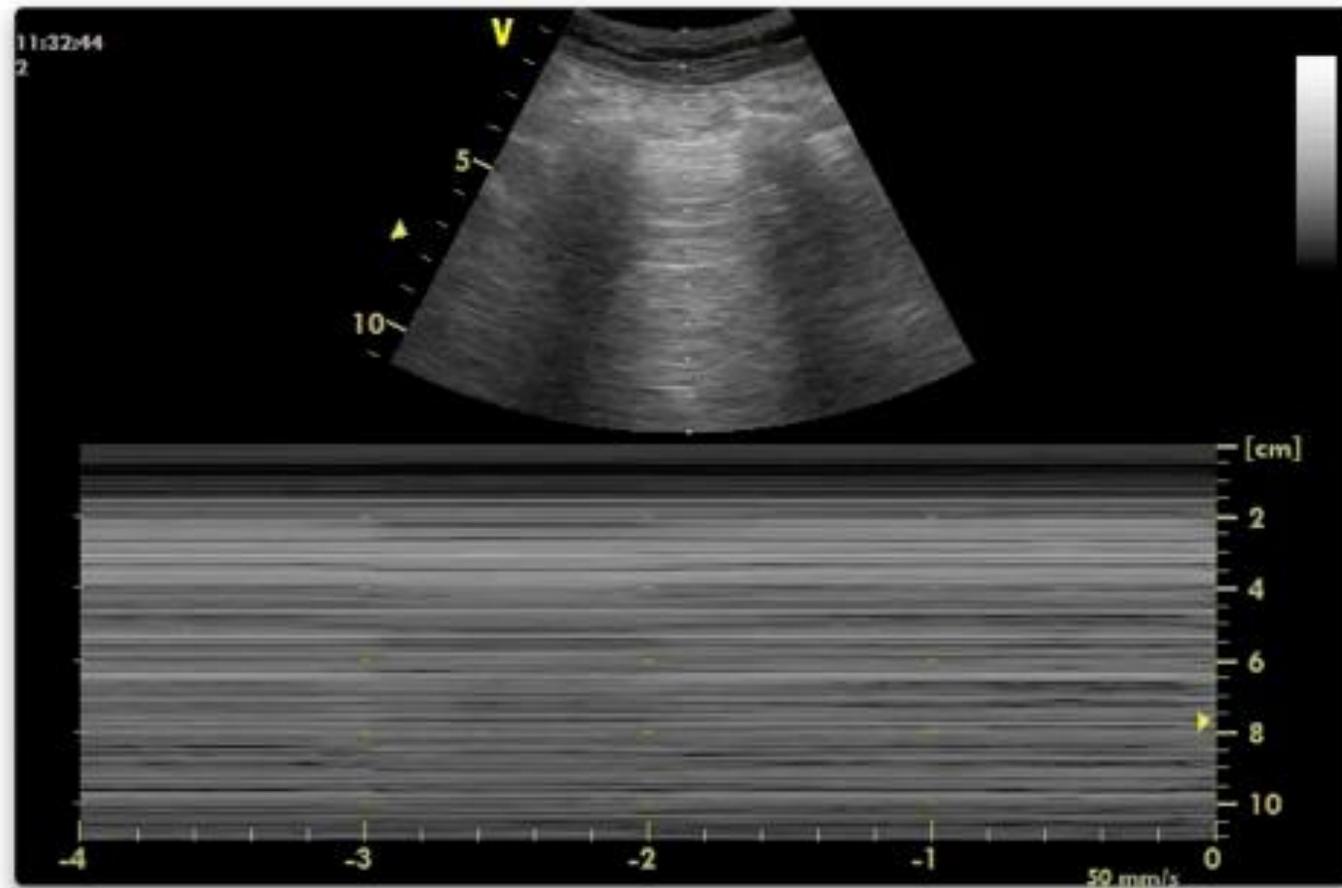
# M- Mode “Seashore sign”



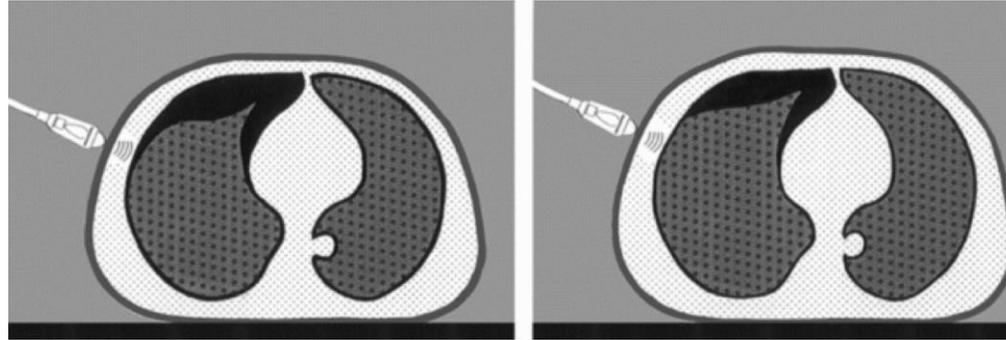
# Absent Sliding Lung Sign



# M-Mode “Barcode sign”



# The Lung Point



The point of abolition of the sliding lung sign in pneumothorax.

A specific sign that allows pneumothorax to be confirmed.

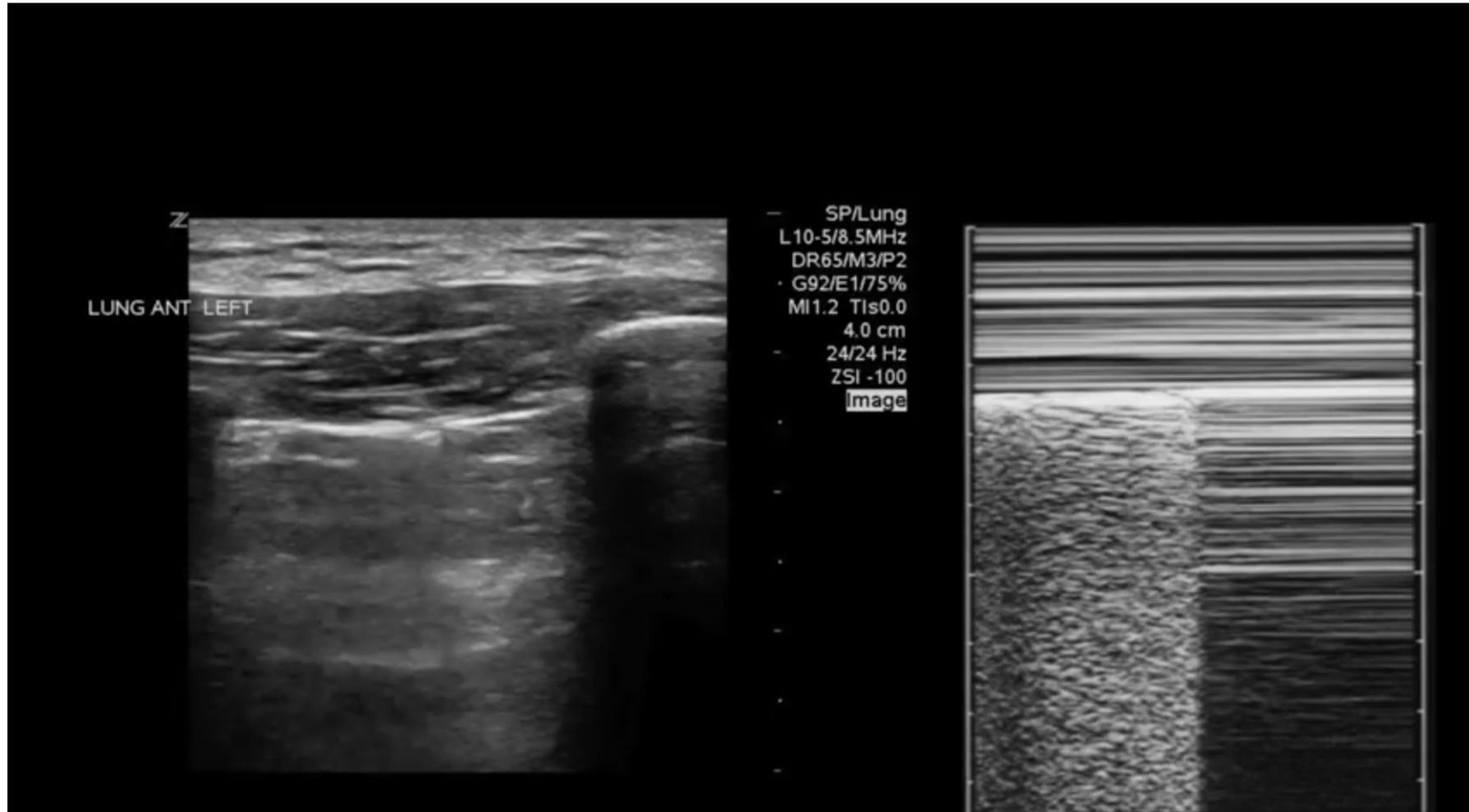
'Tracking the Lung Point' through serial ultrasound exams.

Classify as mild, moderate or severe.

# The Lung Point

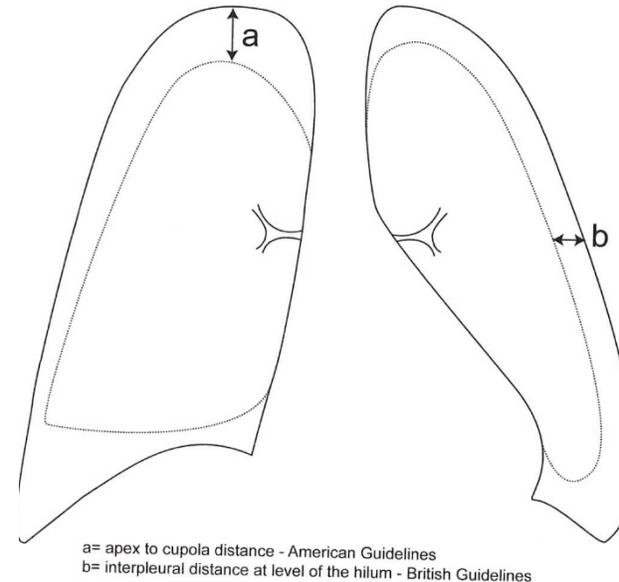


# Lung Point - M Mode



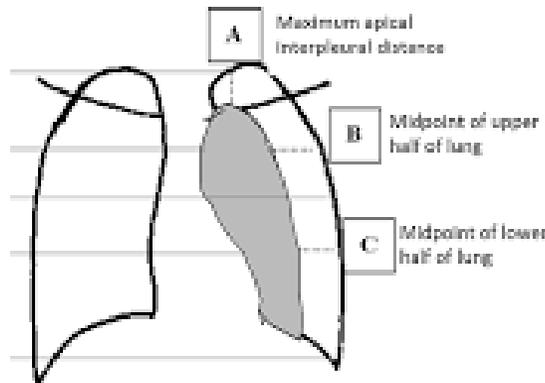
# Measuring a PTX on CXR

- Size does not correlate well with symptoms
- **Clinical** picture more important when deciding management strategy
- CT scanning most accurate method not practical for all patients
- Erect PA CXR
  - USA guidelines (a) measures distance lung apex to cupola – may overestimate localised apical PTX
  - BTS guidelines (b)
  - 2cm rim at the level of the hilum indicates 50% PTX
  - <2cm = small
  - >2cm = large



# More complicated ways of measurement

1. Measure the pneumothorax rim in centimeters in A,B,C
2. SID (sum interpleural distance) = A+B+C
3. Read pneumothorax size from table PA or table AP

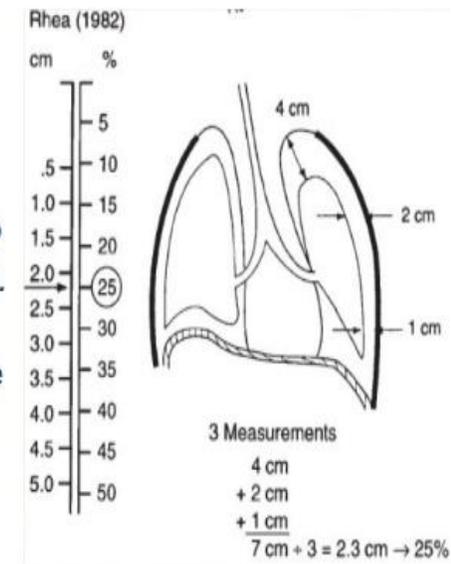


PA projection (Rheo) Formula: Pe% = 4.98 + (5.0x SIDx3)	AP projection (Chou) Formula: Pe% = 5 + (10x SIDx3)
SID 3 cm equals 11 %	SID 3 cm equals 10 %
SID 4 cm " 17 %	SID 4 cm " 20 %
SID 5 cm " 23 %	SID 5 cm " 25 %
SID 6 cm " 29 %	SID 6 cm " 30 %
SID 7 cm " 35 %	SID 7 cm " 35 %
SID 8 cm " 41 %	SID 8 cm " 40 %
SID 9 cm " 47 %	SID 9 cm " 45 %
SID 10 cm " 53 %	SID 10 cm " 50 %
SID 11 cm " 59 %	SID 11 cm " 55 %
SID 12 cm " 65 %	SID 12 cm " 60 %
SID 13 cm " 71 %	SID 13 cm " 65 %
SID 14 cm " 77 %	SID 14 cm " 70 %
SID 15 cm " 83 %	SID 15 cm " 75 %
SID 16 cm " 89 %	SID 16 cm " 80 %
SID 17 cm " 95 %	SID 17 cm " 85 %
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SID 43 cm " 251 %	SID 43 cm " 215 %
SID 44 cm " 257 %	SID 44 cm " 220 %
SID 45 cm " 263 %	SID 45 cm " 225 %
SID 46 cm " 269 %	SID 46 cm " 230 %
SID 47 cm " 275 %	SID 47 cm " 235 %
SID 48 cm " 281 %	SID 48 cm " 240 %
SID 49 cm " 287 %	SID 49 cm " 245 %
SID 50 cm " 293 %	SID 50 cm " 250 %

## RHEA METHOD:

it uses a *nomogram*, that relates *da average intrapleural distance to the pneumothorax size*.

On this nomogram there is *10% pneumothorax for every cm of intrapleural distance*.



# Conservative

- Small PSPs where patients are not breathless can be managed safely as outpatients
- 80% small PSPs have no persistent air leak and observation in these patients results in less recurrence than those treated with chest drains
- Patient needs to be able to seek medical attention if there is any deterioration, should be followed up in respiratory outpatients, and should be given written advice eg. symptom management, concerning symptoms
- Appropriate oral analgesia for pain
- Observation is inappropriate for a patient who is breathless

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## Conservative versus Interventional Treatment for Spontaneous Pneumothorax

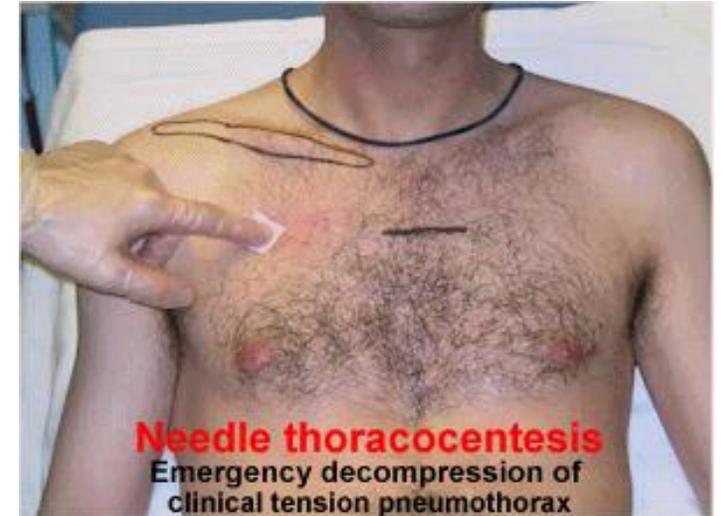
S.G.A. Brown, E.L. Ball, K. Perrin, S.E. Asha, I. Braithwaite, D. Egerton-Warburton, P.G. Jones, G. Keijzers, F.B. Kinnear, B.C.H. Kwan, K.V. Lam, Y.C.G. Lee, M. Nowitz, C.A. Read, G. Simpson, J.A. Smith, Q.A. Summers, M. Weatherall, and R. Beasley, for the PSP Investigators<sup>a</sup>

### CONCLUSIONS

Although the primary outcome was not statistically robust to conservative assumptions about missing data, the trial provides modest evidence that conservative management of primary spontaneous pneumothorax was noninferior to interventional management, with a lower risk of serious adverse events. (Funded by the Emergency Medicine Foundation and others; PSP Australian New Zealand Clinical Trials Registry number, ACTRN12611000184976.)

# Needle Aspiration

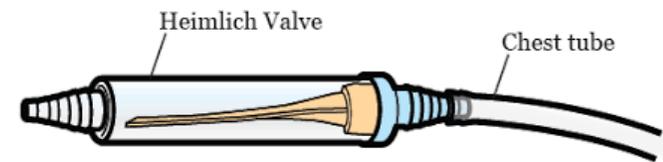
- In PSP NA has been shown to have equivalent success to ICC insertion (although this is disputed – BTS vs ACCP)
- Less painful than ICC
- Decrease rate of hospital admission
- Failure rate in around 1/3 of patients will require a second procedure. Repeat NA is not recommended
- May be unsafe to use sharp needle aspiration on PTX <1cm
- The choice of initial intervention should take into account operator experience and patient choice

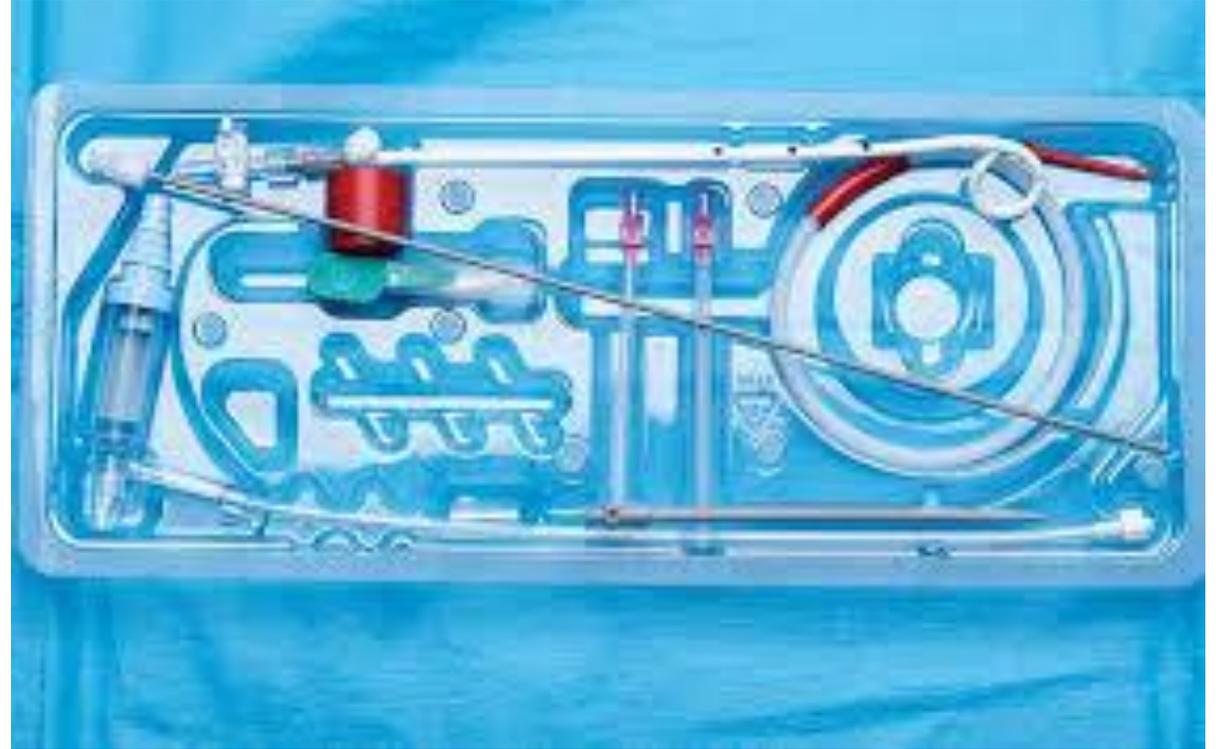
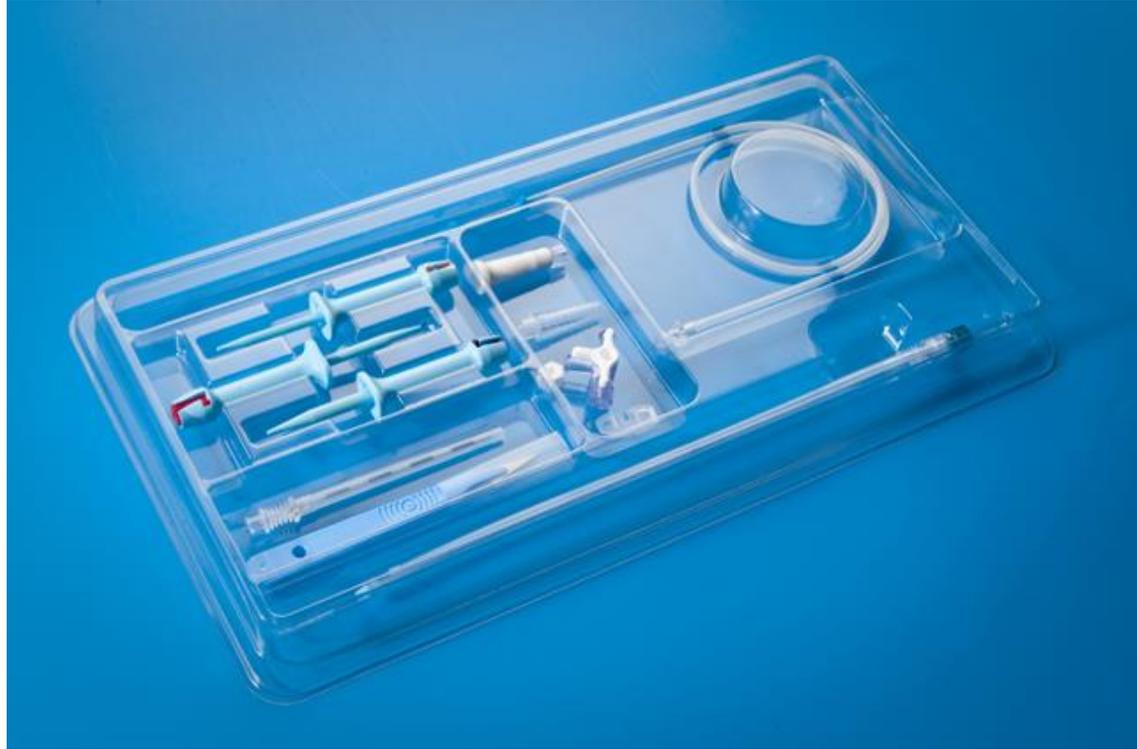


# Intercostal Catheter

## Seldinger / Fine Bore Catheter

- Small bore, wire-guided ICC (10-14 French)
- Ease of insertion (easier than needle aspiration?)
- Attachment of a Heimlich valve allows patient mobilisation and potentially outpatient care:
- More painful than NA but less painful than tradition large bore ICC
- Factors that predispose to small tube failure include presence of pleural fluid and/or presence of a large air leak
- Chemical pleurodesis is still possible through small chest drains
- Although Seldinger intercostal catheters come in a range of sizes the latest realization is the 3 way tap (9 French) is the rate limiting step in air evacuation





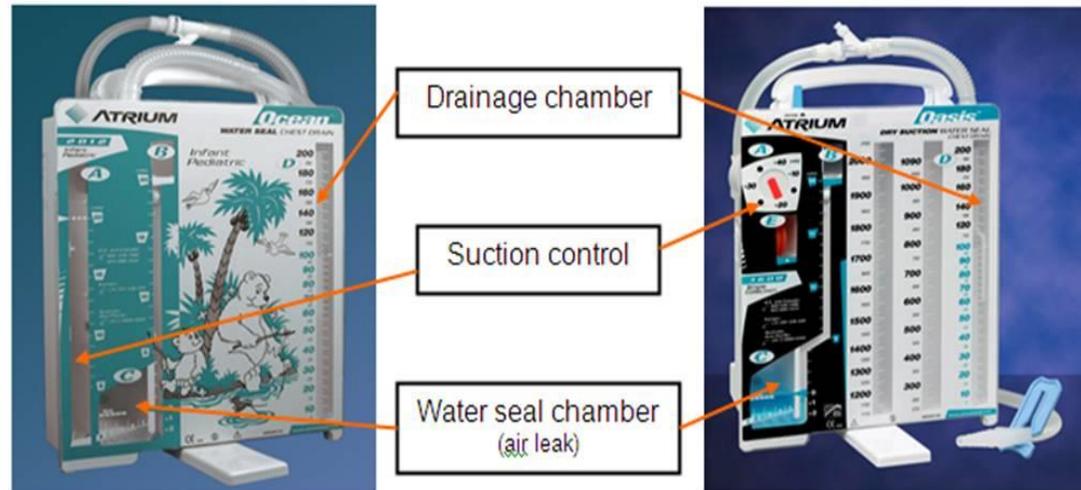
# Traditional ICC

- Large bore ICC (>24 French) are not recommended for initial treatment of PTX (although it may become necessary to replace a small ICC with a large one if there is a persistent air leak)
- First line for trauma patients?
- Very painful often requiring IV sedation and analgesia
- Complications:
  - Penetration of a major organ (lung, liver, spleen, stomach, heart, great vessels). Usually a result of inappropriate trocar use
  - Incorrect tube placement (increasing rate of pick up from CT scanning)
  - Pleural infection and empyema (1% of ICC placement – up to 6% in trauma)



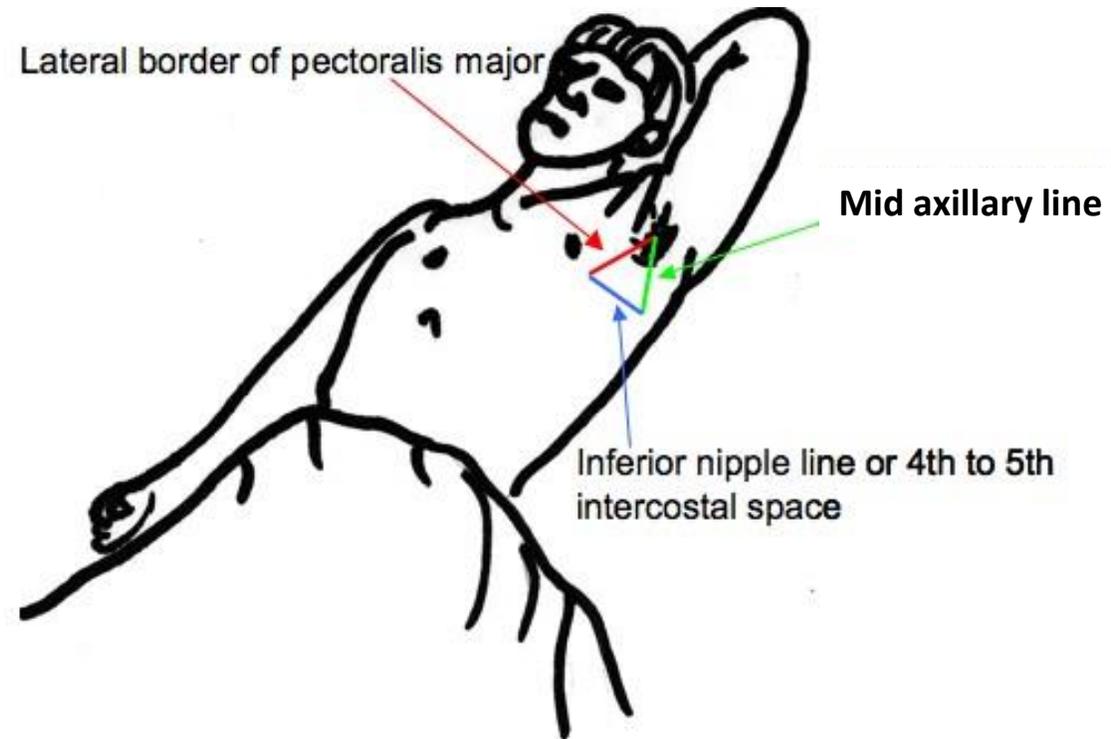


Chest drain system



# Triangle of Safety

- Pectoralis Major
- Anterior to the Mid-Axillary Line
- Above the 5<sup>th</sup> intercostal space



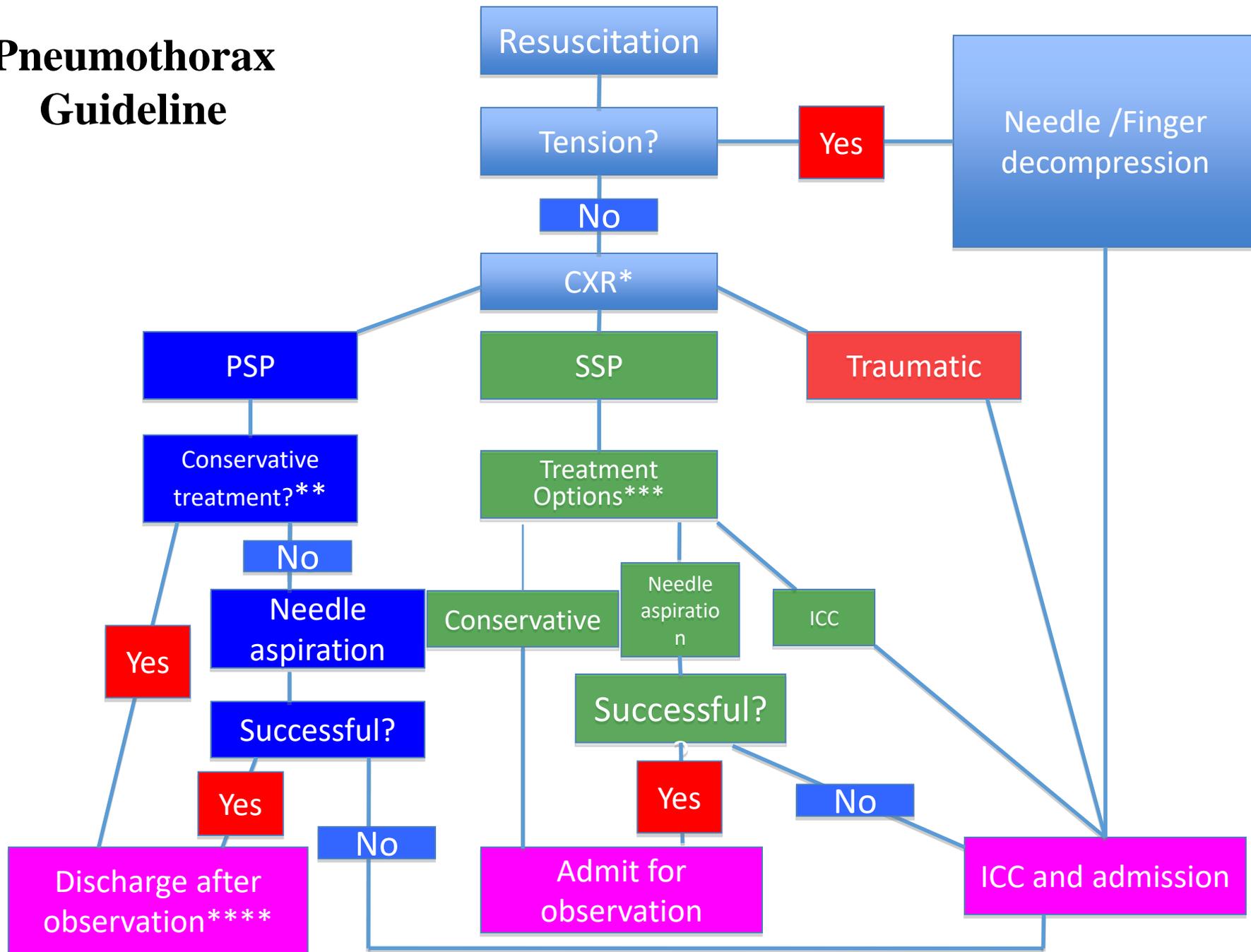
# Suction?

- No evidence for routine use
- Indicated if persistent air leak after 48 hrs (therefore no role for suction in the ED)
- The addition of suction too early after chest drain insertion may precipitate re-expansion pulmonary oedema (esp in PSP that may have been present for several days)

# Disposition

- PSP - Observation in ED after conservative management or NA, and home with written advice
  - Follow up in respiratory OP in 7-10 days
  - Re-expansion rate of 2.2% a day with wild variations
- SSP - Admission for observation after conservative management or NA
- Admission after ICC

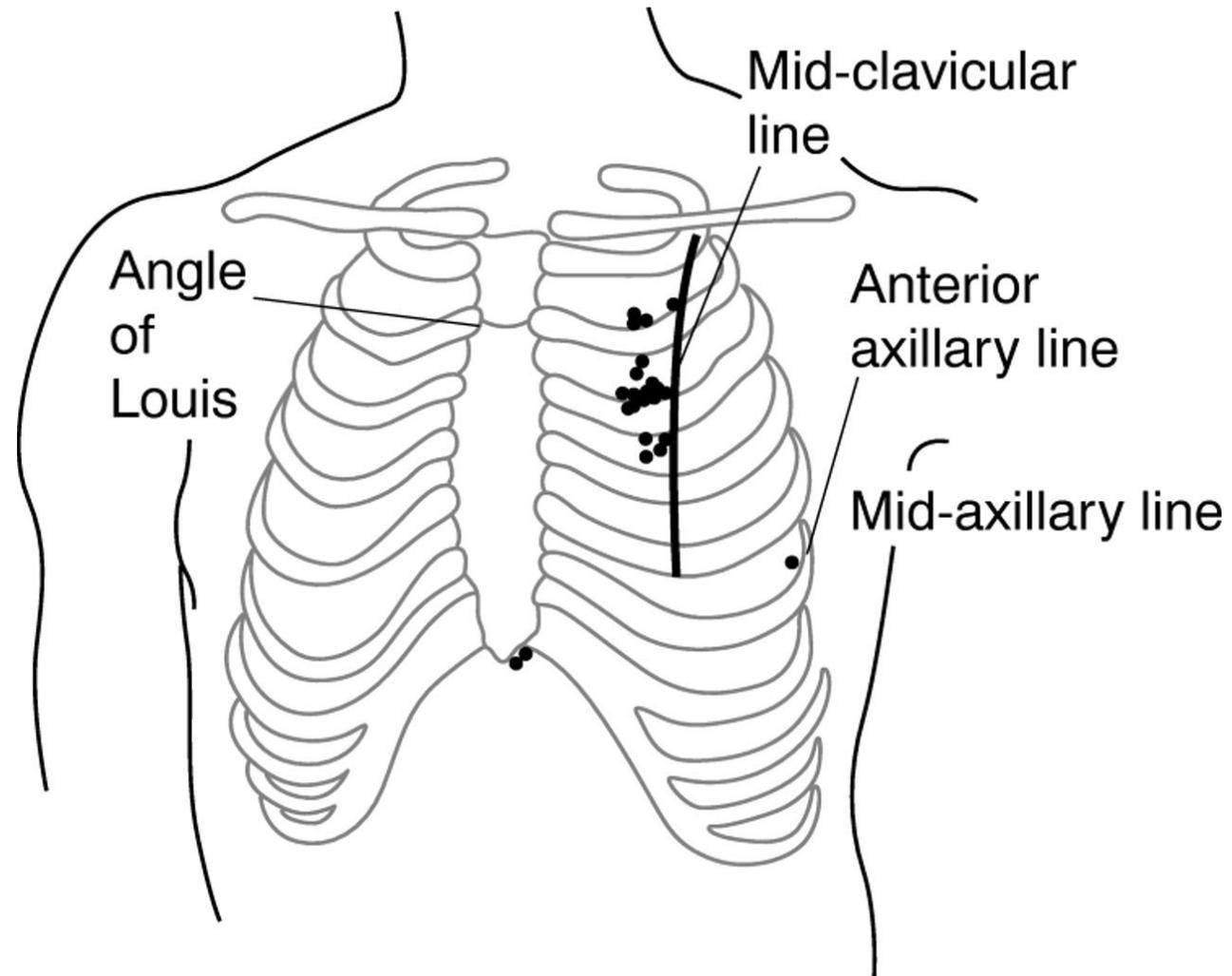
# Pneumothorax Guideline



# Needle Vs Finger Decompression

- Conventional Teaching:
  - Anterior approach
  - 2<sup>nd</sup> intercostal space, midclavicular line
  - Most attempts go medial to this!
  - Several vital structures medial to mid clavicular line that you should not hit !

25 ED Physicians asked to point out the site to do a “thoracocentesis”



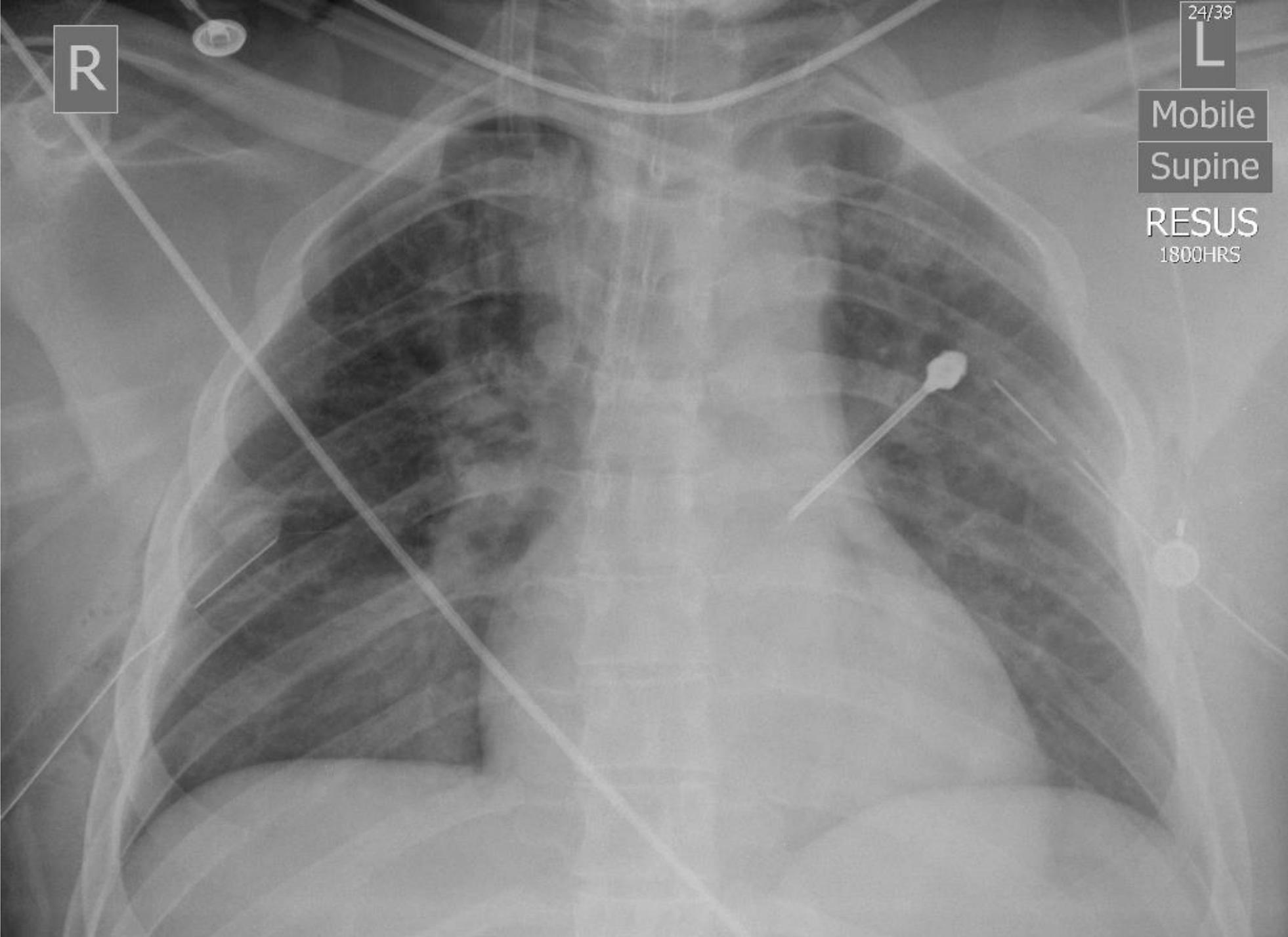
R

24/39

L

Mobile  
Supine

RESUS  
1800HRS



R

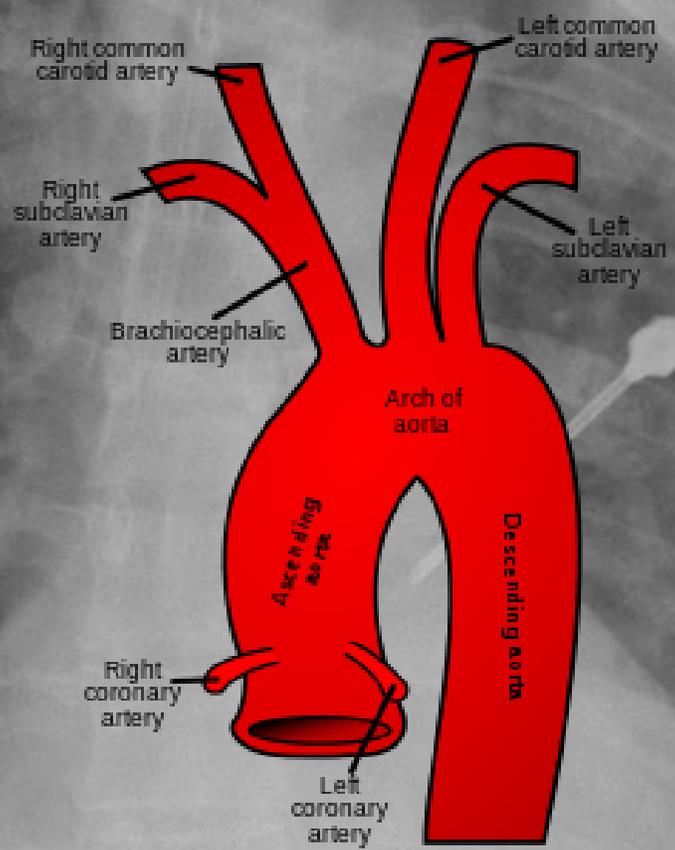
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Mobile

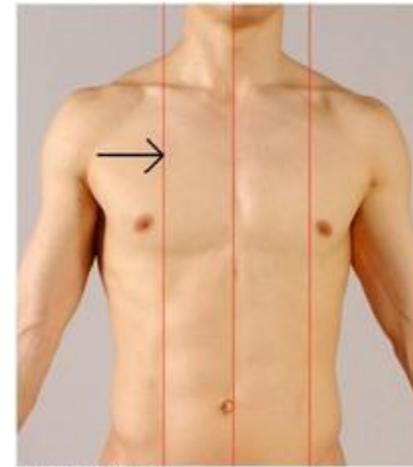
Supine

RESUS

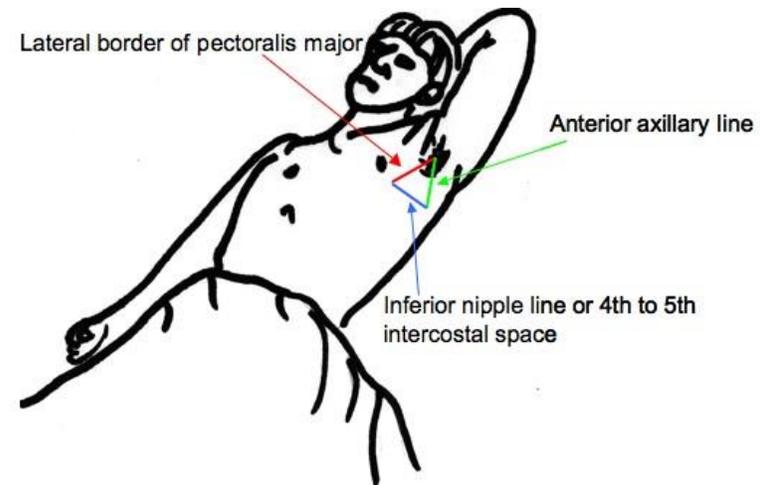
1800HRS



- Mid clavicular line is almost on the nipple line
- Going lateral to the nipple is probably safest
- Or.....



- ....do the needle decompression in the same site you would do a chest drain



- Normal IV cannula is not long enough is 65% of cases
- The cannula that comes in the central line kit may be more appropriate
- Even if you get cannula in the correct place it may kink, occlude, compress or dislodge

- Finger Thoracostomy

- Essentially the first step of a large bore ICC insertion
- Provides definitive decompression of the pleural space
- Can be followed up by insertion of an ICC or the wound can simply be sutured closed

- Much more appropriate procedure in trauma patients
- Bilateral finger thoracostomies can be converted into a clamshell thoracotomy



Back to our cases.....

# Case 1

- 25 year old male
  - Stab wound to left chest
  - 1.5cm sucking chest wound
  - Pale and clammy
  - Resp rate 35
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Questions?????