

Pericardial tamponade



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Critical Care Ultrasound Course

Summary

Overview: diagnosing tamponade

Scanning an effusion: US appearance, mimics

Measuring the effusion?

US signs of tamponade

Should I stick in a needle?

Pericardiocentesis

Overview: get your thinking right!

Effusion \neq Tamponade

Tamponade is a **clinical** diagnosis

Beck's triad

?????
?????



How to diagnose tamponade

- Shock, resistant to fluid
- Breathless, with clear chest
- **Clinical suspicion** of tamponade eg recent MI
- Ultrasound features?

US features of tamponade

1. Is the patient shocked?
2. Is there stuff in the pericardium?
3. Is the IVC distended?
4. How big is the effusion?
5. RV diastolic collapse?

Is there stuff in the pericardium?

Scanning a pericardial effusion

- Either probe is fine (curved or sector)
- Either preset is fine (cardiac or abdominal)
- Try all available cardiac windows
- Subcostal is usually best (liver is a nice window)

Pericardial fluid

Usually anechoic (dark)

Usually surrounds heart

Usually seen better in systole





Not always dark

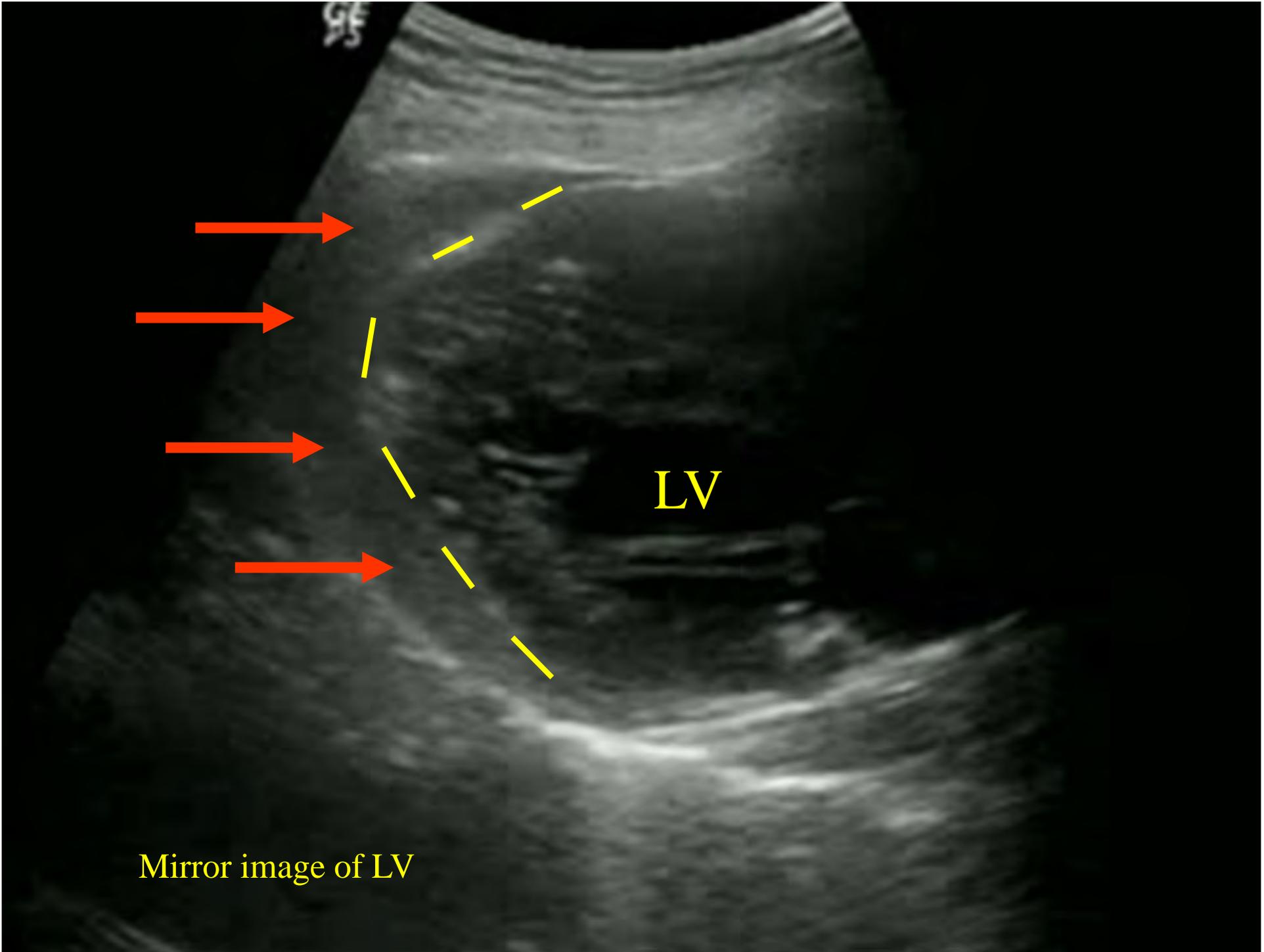
Iso- or hyperechoic (clotted blood)

Heterogenous (clots, tumour, pus)

Not all fluid is black on US

Don't be fooled



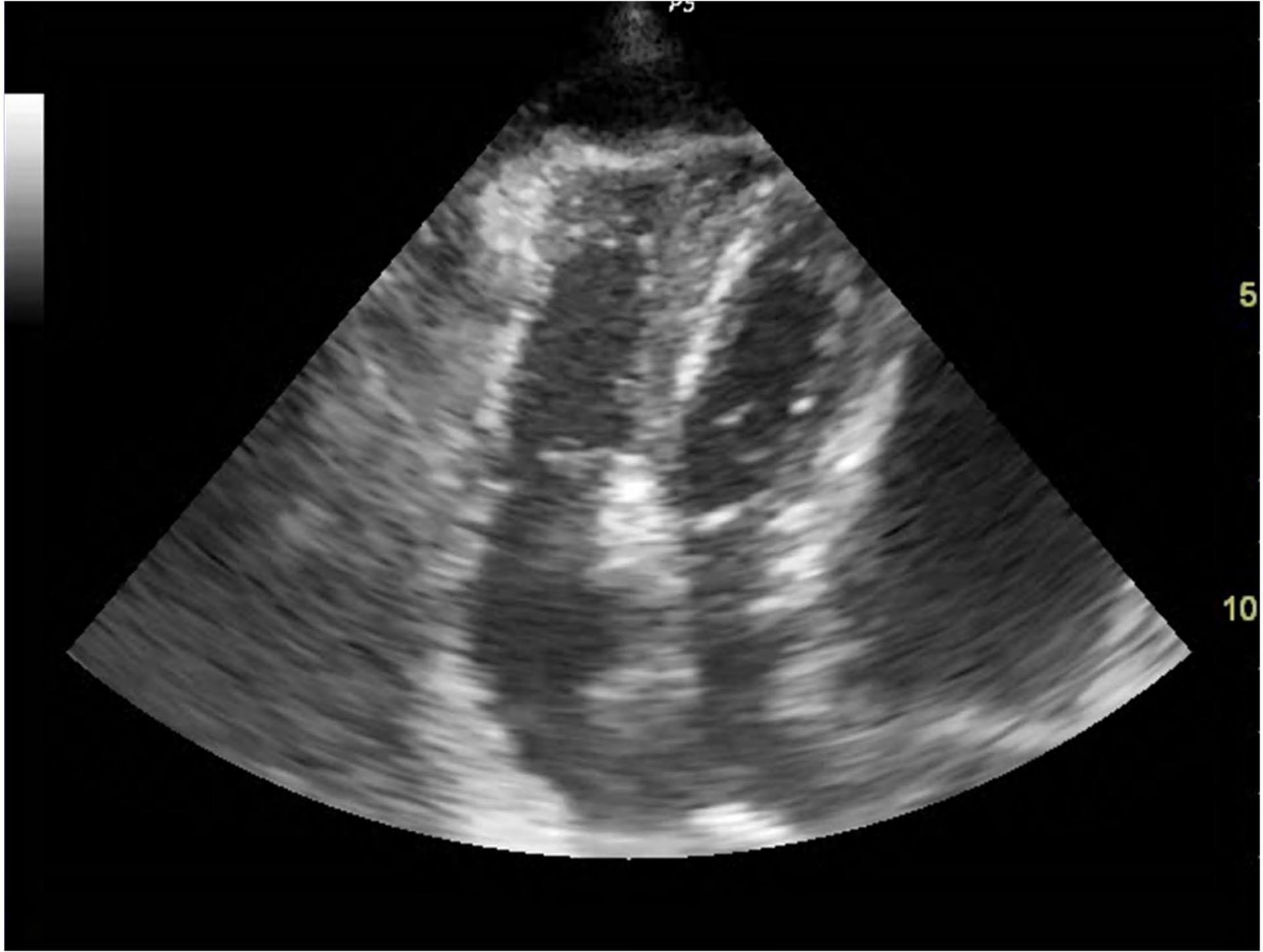


Doesn't always surround the heart

Localised effusions can occur
Esp. after post cardiac surgery



P5



Not always pericardial fluid!

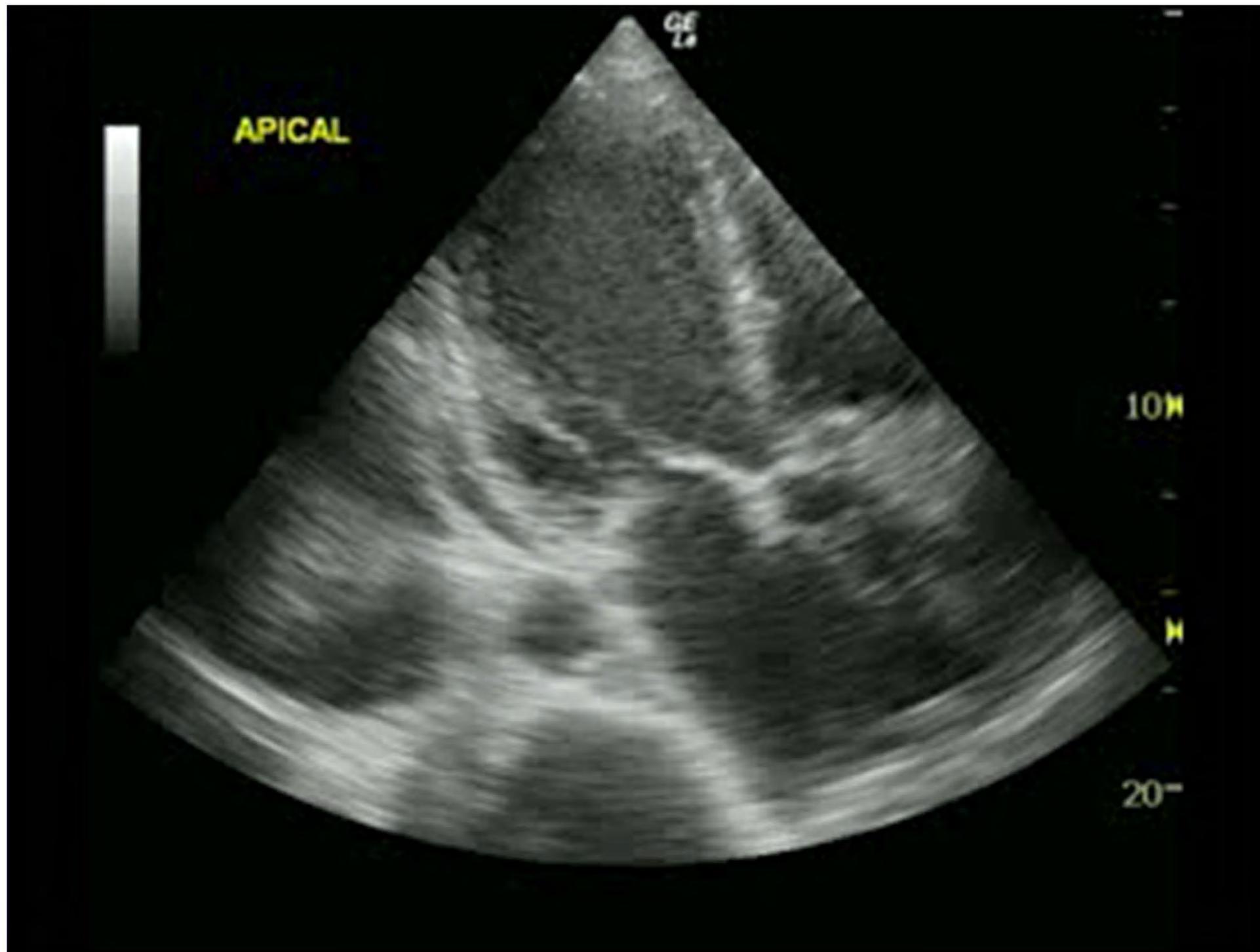
False positives for pericardial effusion:

Pericardial fat pad

- Usually anterior to heart
- Not quite anechoic

Pleural effusion

- Not limited by pericardial space
- Seen in left thorax as well



False positives & negatives

False negatives

- Clotted blood
- Tumour
- Localised effusions
(post cardiac surgery)

False positives

- Pericardial fat pad
- Pleural effusion

**Not sure if it's pericardial fluid
or a fat pad?**

It's 2am & everyone is looking at you.

Not sure if it's pericardial fluid or a fat pad?

It's 2am & everyone is looking at you.

If you don't like the question, change the question.

Is it pericardial fluid or fat pad?

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Is it pericardial fluid or fat pad? **X**

Not sure if it's pericardial fluid or a fat pad?

It's 2am & everyone is looking at you.

If you don't like the question, change the question.

Is it pericardial fluid or fat pad? **X**

Is it a tamponade or can it wait? **✓**

US features of tamponade

1. **Shocked patient**
2. Stuff in the pericardium
3. Distended IVC
4. Size of the effusion (not so much)
5. RV diastolic collapse (hard to see)

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US features of tamponade

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Is the IVC distended?

Is this a tamponade?



5"

M

10"

M

15"

IVC

GE

Is this a tamponade?



5

5

5

10



How big is the effusion?

How big is the effusion?

Not so important!

A small effusion can tamponade if it accumulates rapidly.

A large effusion might accumulate slowly.

Rarely, a small **localised** effusion can cause tamponade (eg post-valve surgery).

But everyone loves to ask. So...

A rough guide:

- Just in systole = a tiny effusion
- Also in diastole = a bit larger
- Heart rocking = a massive effusion

But it still ain't tamponade... unless patient is shocked!

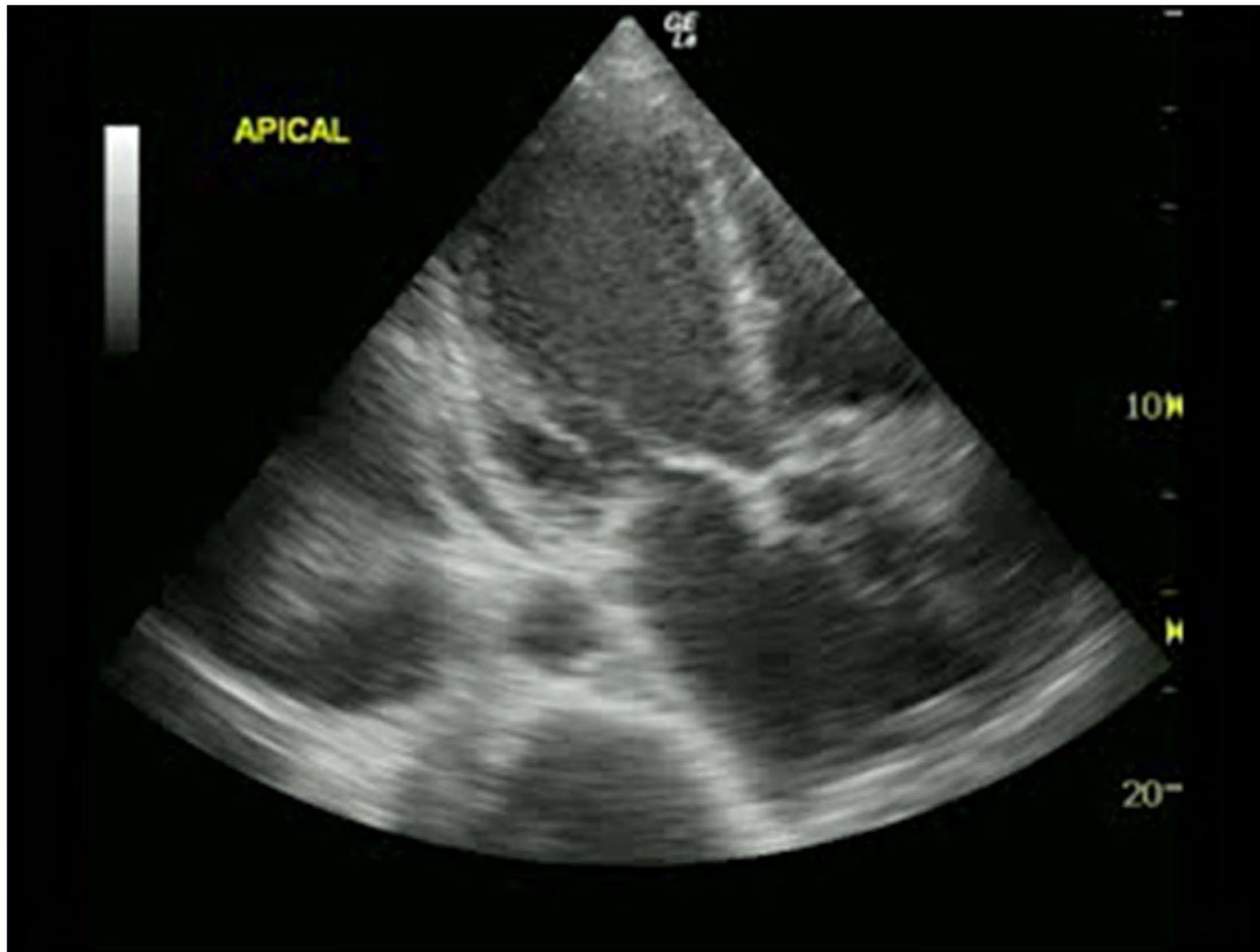
Test: pericardial effusion size

T

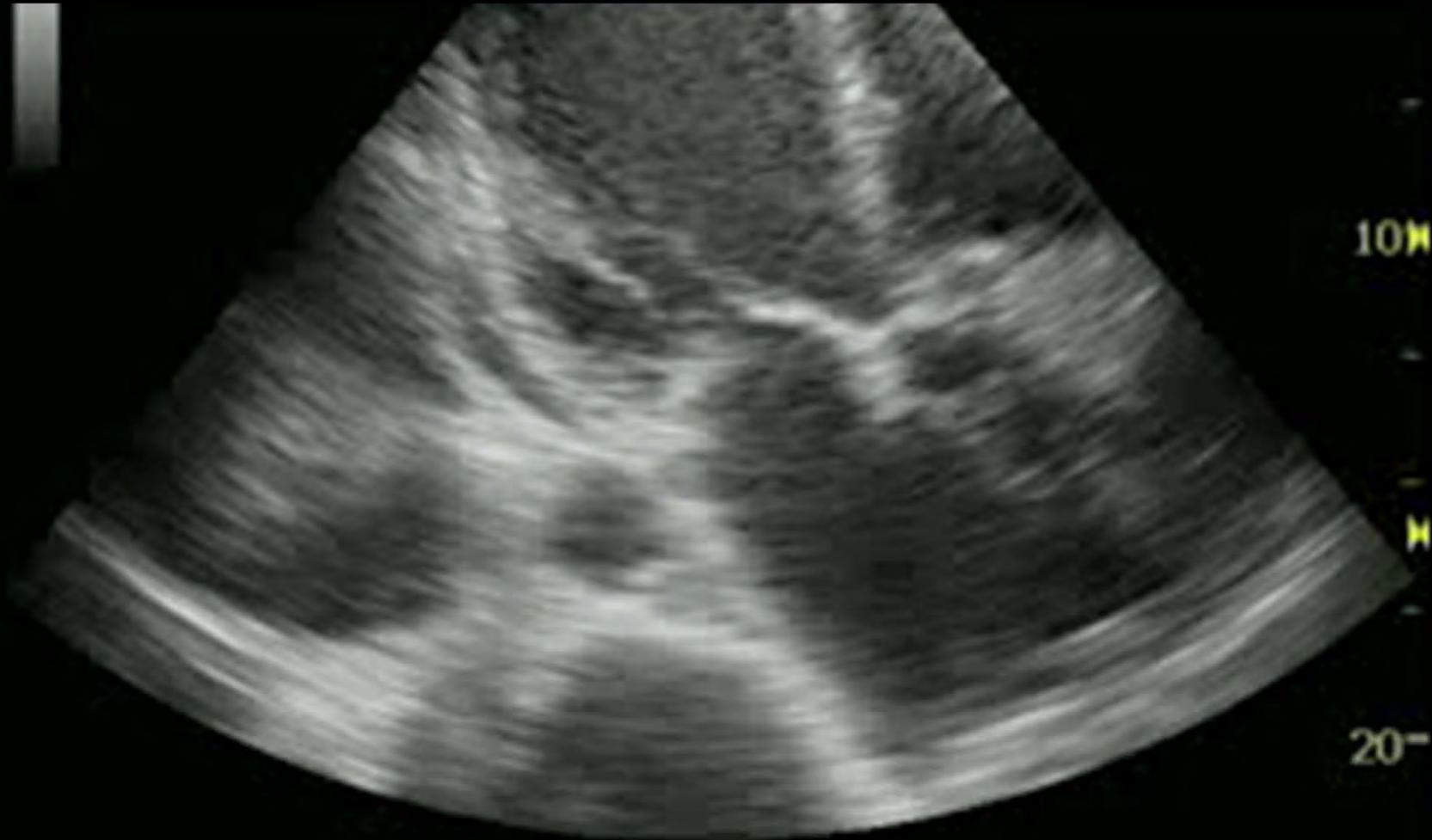


Massive effusion: RV 'squeezed' (NB how can you tell this one is chronic?)





Small effusion: doesn't surround heart





Moderate effusion: clotted blood from dissection



GE
Le



0

5

10

15

Moderate pericardial effusion AND pleural effusion

PLEURAL
FLUID



PERICARDIAL
FLUID

LUNG

HEART

0
5
10
15



Massive pericardial effusion (swinging heart)



Finally...
Is there RV diastolic collapse?

Does the RV collapse in diastole?

- RV is always anterior to LV
- RA/RV is a low pressure system
- In diastole, pressure falls further
- The pericardium is a tough fibrous sac
- Pericardial fluid that accumulates too fast for the pericardium to stretch, then ...
- Pericardial pressure > RA filling pressure
- Then pericardial pressure > RV filling pressure
- On US: 'diastolic collapse'

RV diastolic collapse

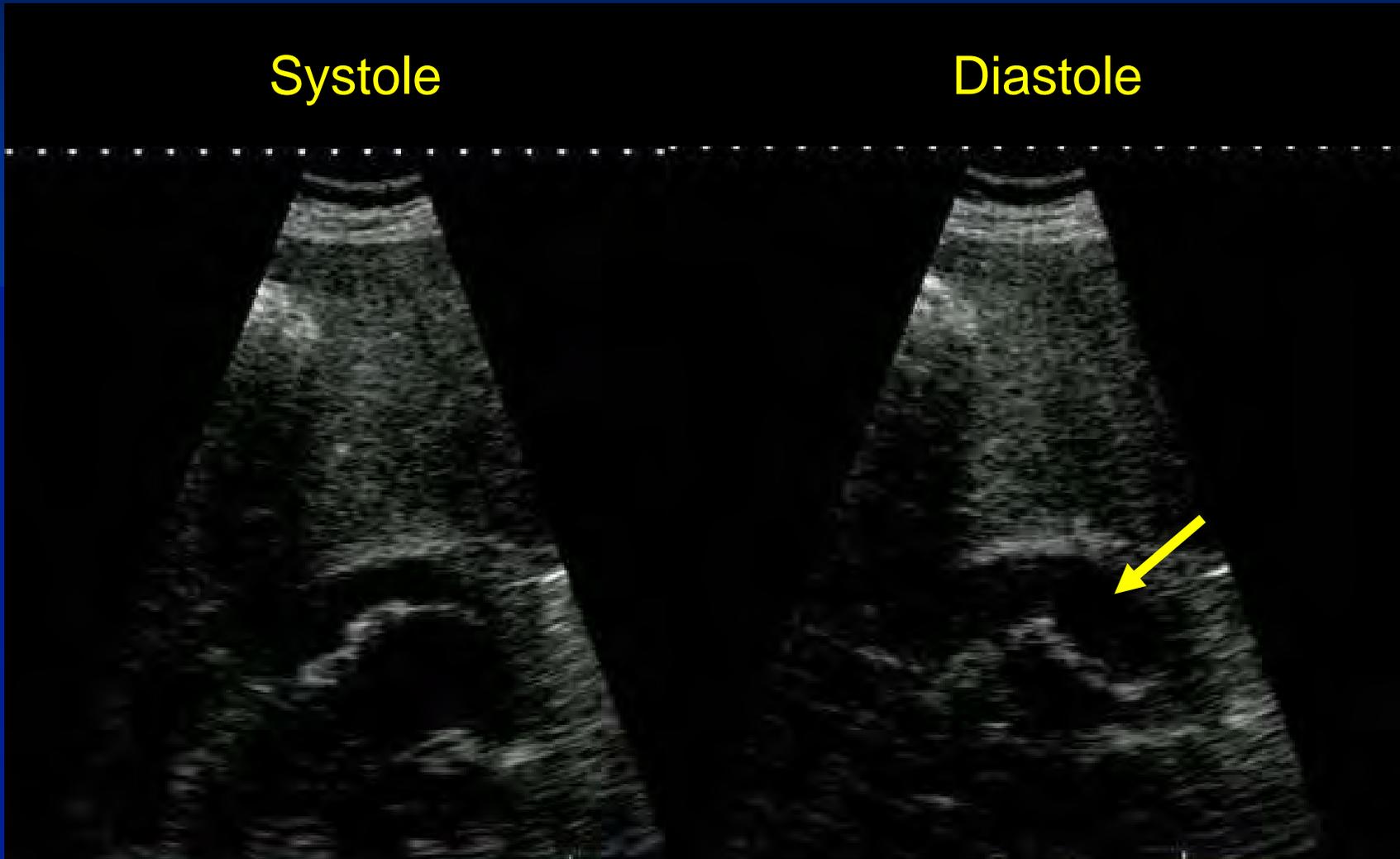
- Tricky!
- We don't use ECG leads
- We don't usually play back the images slowly
- The easiest way to describe: 'the RV is behaving strangely in diastole'
- 'Someone's jumping on the trampoline'
- 'Duh... somethin' ain't right!'



RV diastolic collapse

Systole

Diastole



RV diastolic collapse?

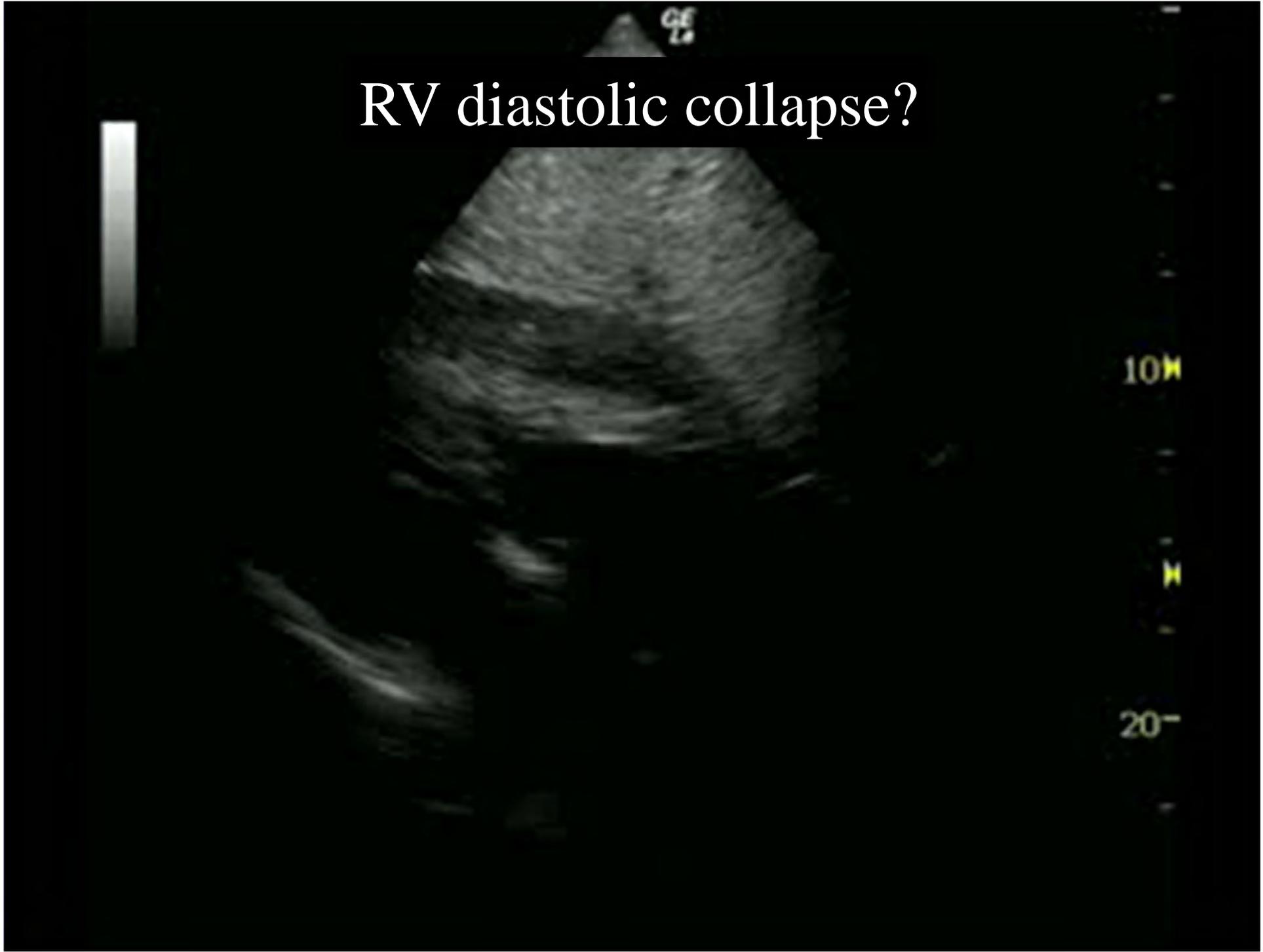


GE
L4

10M

M

20"



RV diastolic collapse?



5-
10-
15-

GE
L₉

RV diastolic collapse?



5-
10-
15-

RV diastolic collapse

This is almost tamponade!

But unless patient is shocked, tamponade is not present.

Top tips

If in doubt: turn off the machine & be a doctor

Remember the 90% rule: you will be wrong 10% of the time.
If this is a problem, don't practise critical care medicine.

Summary

Is the effusion causing a tamponade?

- ① **Is the patient shocked?** = the big question
- ② Is the IVC distended? = also important
- ③ How big is the effusion? = not as important
- ④ (Is there RV diastolic collapse? = tricky)

Should I stick in a needle?

This is a **clinical** decision

- ① YES- if shock + pericardial effusion + distended IVC
- ② NO- if not shocked
- ③ NO- if needle won't help (eg type A dissection)
- ④ PROBABLY NOT- if IVC is skinny and collapsing

If in doubt: turn off the machine & be a doctor

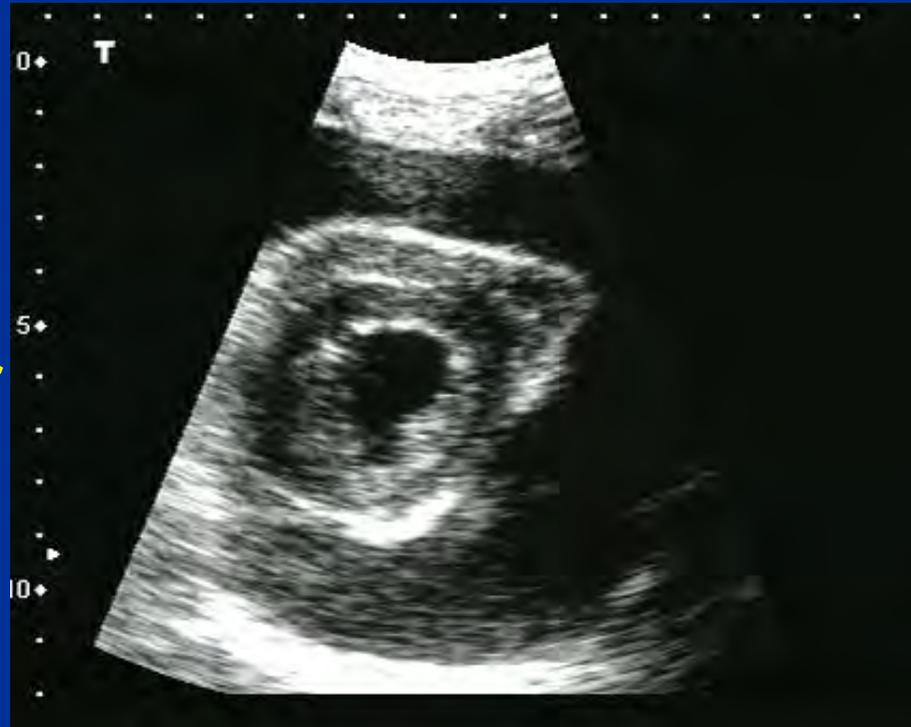
Draining pericardial effusions

Summary

- Indication
- Technique
- Top tips

Indications

- Tamponade
 - Effusion
 - Compromised patient
- Experienced operator
... ideally



Preparation

- Consent, equipment
- Get the patient / machine / needle / probe in the right position
- Sterile technique
- Team

US machine

- In line of sight [demo]
- Assistant

Probe

Cardiac probe: get the big picture

- 2 planes
- Scan thru resp cycle
- Check depth

No need to switch to linear probe

- Wastes time
- Worse at landmarks
- But can be comforting because likelier to show the needle & catheter!

Tips if using the cardiac probe

- Pick the site with most pericardial fluid
- May not see the needle on screen (steep angle, near field)
- Use needle/syringe with agitated saline: **insert** a small amount: turbulence & microbubbles on screen
 - If pericardial space 'lights up', you're in!
 - If RV lights up, pull out!

Pick the site with most pericardial fluid

'Pericardiocentesis – bubble confirmation'

<http://www.youtube.com/watch?v=wGeS81cQNS0>

Best site for drainage?

Traditional: subcostal

*What's wrong with
this picture?*



Best site for drainage?

Best site depends on:

- Patient position
- Best window
- Greatest depth of pericardial fluid

A needle introduced subcostally will penetrate the
liver!

SUMMARY

- If not shocked, there is no tamponade
- It's easier to image the IVC than the RV
- Pericardiocentesis: often you won't see the needle on screen
 - Advance needle slowly
 - Confirm placement confirmation by reinjecting fluid or agitated saline

Thanks to

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