Focused abdominal sonography in trauma patient (FAST)

A workshop

Submitted in Alkindy teaching hospital

On Monday 14.3.2022

For the surgery postgraduate Iraqi & Arab board candidates

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6th class surgery rota student of Alkindy college of medicine

BY

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Learning objectives

- ✓To identify the role of US examination in abdominal emergency .
- ✓To identify the indications, contraindications and limitations of the FAST study .
- ✓To identify the relevant local anatomy
- ✓To identify the technique of the exam.
- ✓To identify normal and abnormal scans.
- ✓To identify pitfalls of the study.
- ✓To Perform practical training .

ULTRASONOGRAPHY IN ABDOMINAL EMERGENCIES

- The FAST (Focused Assessment with Sonography in Trauma) examination looks for the presence of fluid—presumed to be blood in the appropriate clinical setting—visualizing 10 structures or spaces in four areas:

- Pericardial
- Perihepatic
- Perisplenic
- Pelvic

- The E-FAST (Extended-FAST) additionally surveys the anterior and lateral pleural spaces (thoracic view) to evaluate for a pneumothorax or pleural effusion, assumed to be a hemothorax in trauma patients.

- Point-of-care ultrasound (POCUS) for hypotensive non-injured patients to identify free fluid with other causes (eg, ruptured ectopic pregnancy, ruptured abdominal aortic aneurysm).

ULTRASONOGRAPHY IN ABDOMINAL EMERGENCIES

- Indications:

- ✓ Evaluation of injury, hypotension, and/or shock of unknown etiology in a trauma patient to determine need for interventions
- ✓ Evaluation of unexplained hypotension or shock in the non-trauma patient
- ✓ To identify rupture of an ectopic pregnancy

ULTRASONOGRAPHY IN ABDOMINAL EMERGENCIES

- contraindications:

✓Absolute → Clear need for time-sensitive definitive care (which would be delayed by doing ultrasonography)

✓Relative → None

- Complications → unlikely

ULTRASONOGRAPHY IN ABDOMINAL EMERGENCIES

➢ Additional consideration :

✓ The E-FAST examination should be completed in < 5 minutes.

✓ The pericardial sac is evaluated first, especially after penetrating trauma, because pericardial fluid after trauma can be immediately life-threatening and supersede treatment of other injuries.

✓ The E-FAST examination maximizes sensitivity by imaging dependent positions in the peritoneal cavity where fluid preferentially accumulates. This fluid appears as anechoic (black) areas filling the potential spaces. The examination also focuses on interfaces between solid organs in order to maximize fluid visibility.

ULTRASONOGRAPHY IN ABDOMINAL EMERGENCIES

- Relevant anatomy :

✓The right paracolic gutter is deeper and less obstructed than the left. Fluid preferentially flows to the right. Thus, this area should be the first in the peritoneum to be evaluated (normally after the pericardium has been imaged).

✓ A potential space is formed by the reflection of the peritoneum from the rectum to the bladder in males or from the rectum to the uterus in females. Fluid preferentially flows into this area from the right or left paracolic gutters. The pelvis is one of the most dependent and easily visualized portions of the peritoneal cavity; thus, fluid collections are visible here earlier than in other areas.

➢ Equipments:

✓Bedside ultrasound machine.

- Low-frequency (2 to 5 MHz) probe ,either curvilinear or phased-array.
- High-frequency (5 to 10 MHz) linear probe, for examining the pleura.

✓Ultrasound gel (nonsterile) or, often, water-based surgical lubricant.

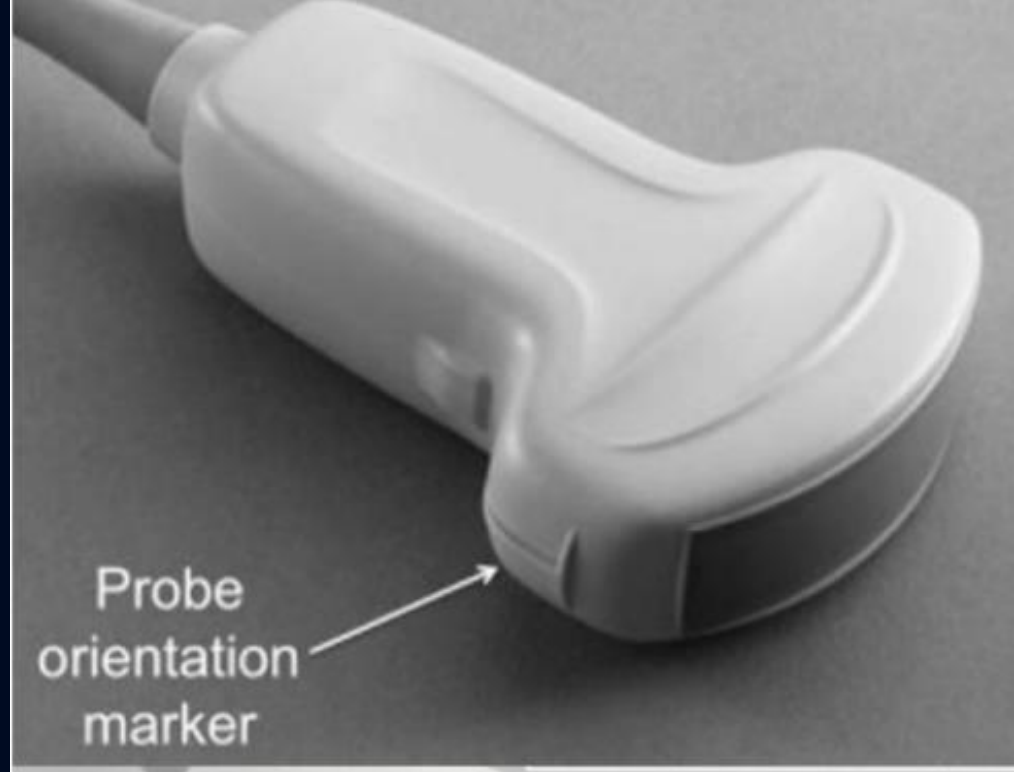
✓Gloves.

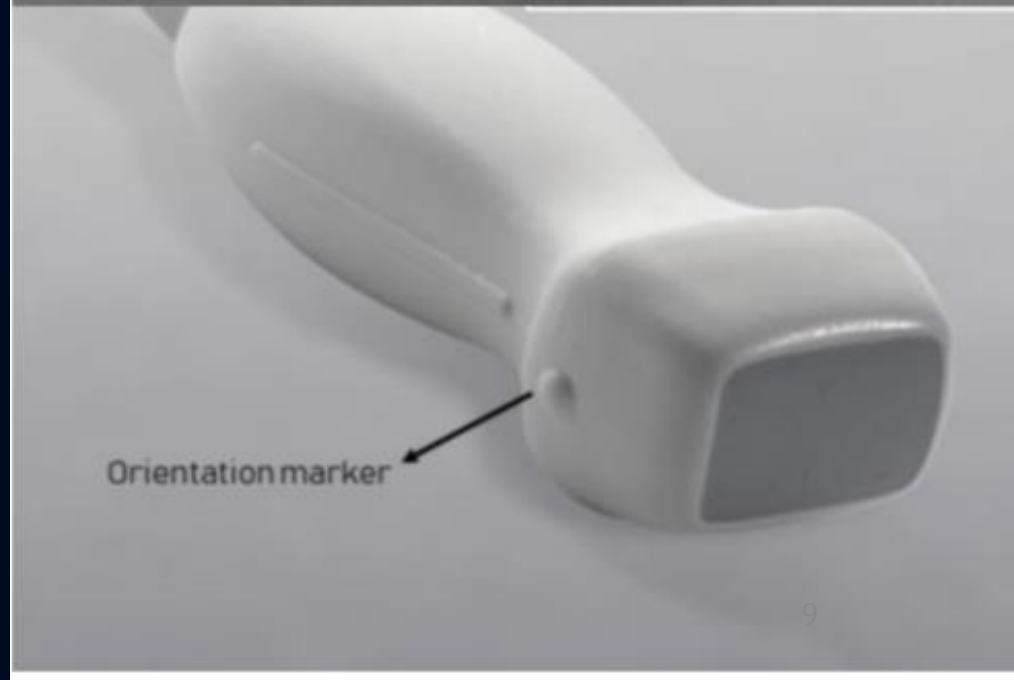
➢ Step-by-step description of the procedure :

Standard probe orientation

probe orientation marker should be to the right side of patient on the transverse(axial) view.

probe orientation marker should be to the head of patient on the longitudinal (sagittal) view.

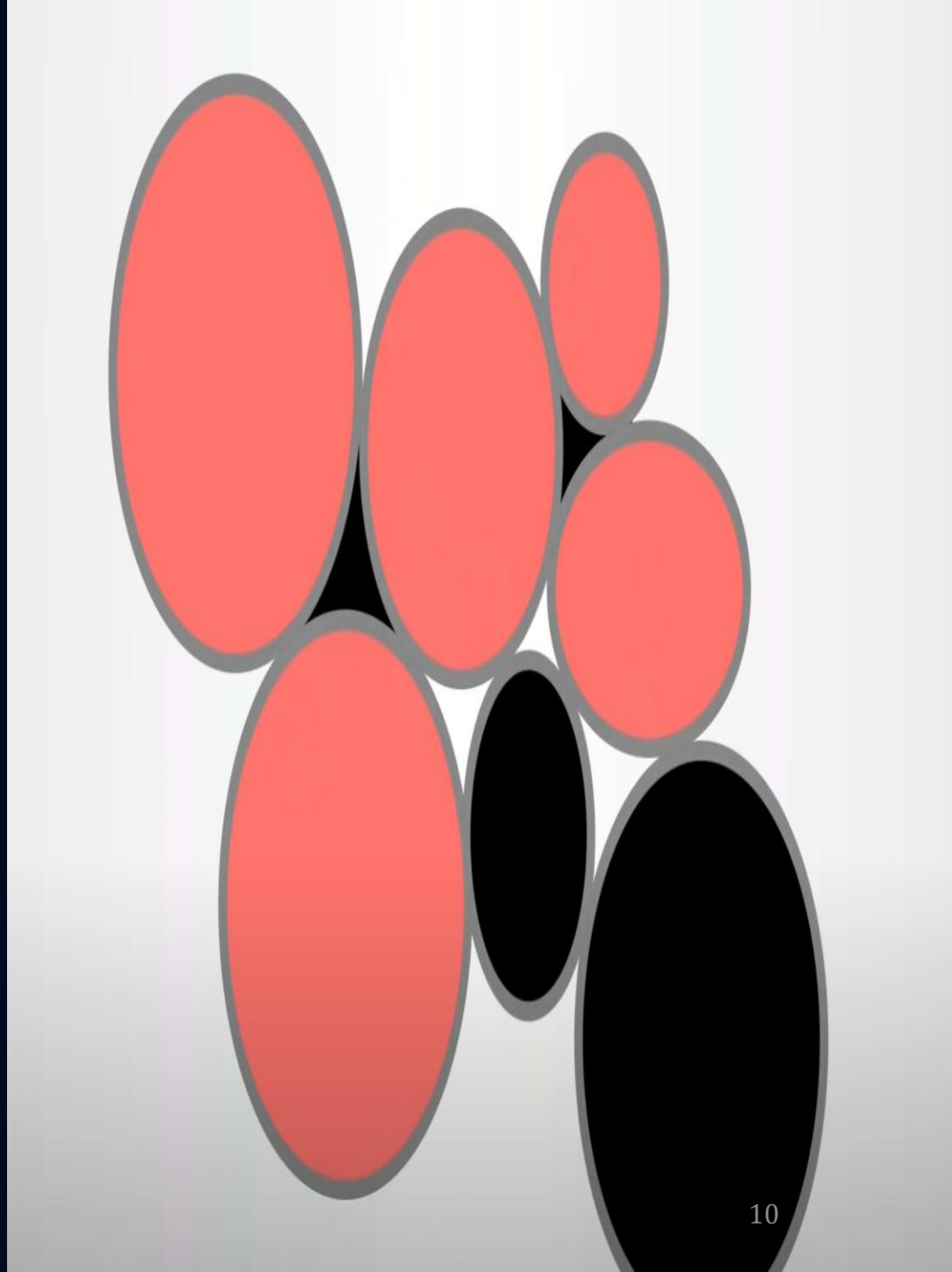




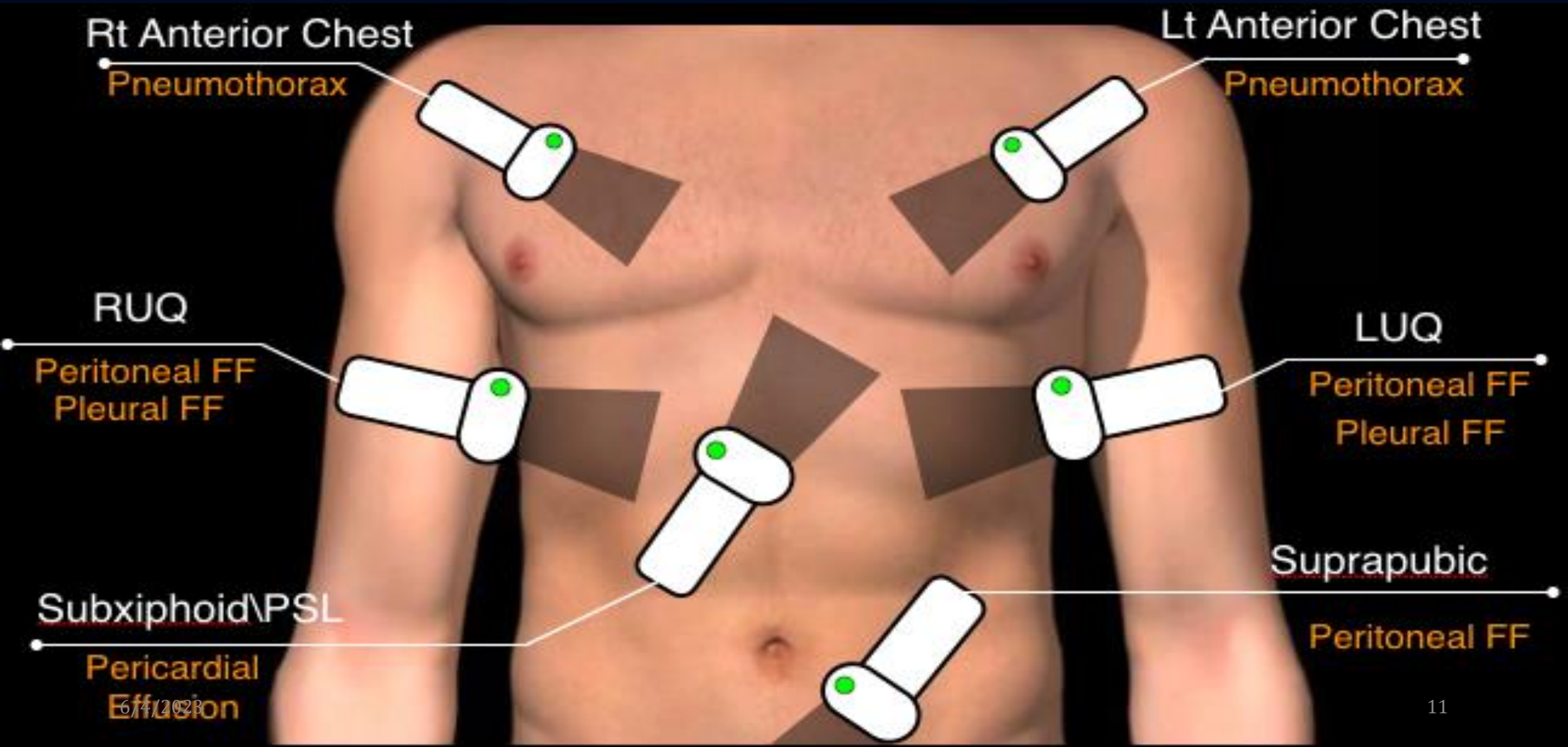
➢ What are we looking for ?

✓To detect free fluid(anechoic _black_) in appearance with sharp edges …..

❑Normal intra visceral fluid usually rounded with curved edges…



➢ Where to scan?



Pericardiac view (cardiac) :

- **Transducer:**

✓ Low frequency(curvilinear, phased array)

✓ Subxiphoid, transverse.

✓ Directed towards patient left shoulder.

✓ May need to increase depth.

✓ Liver as acoustic window.

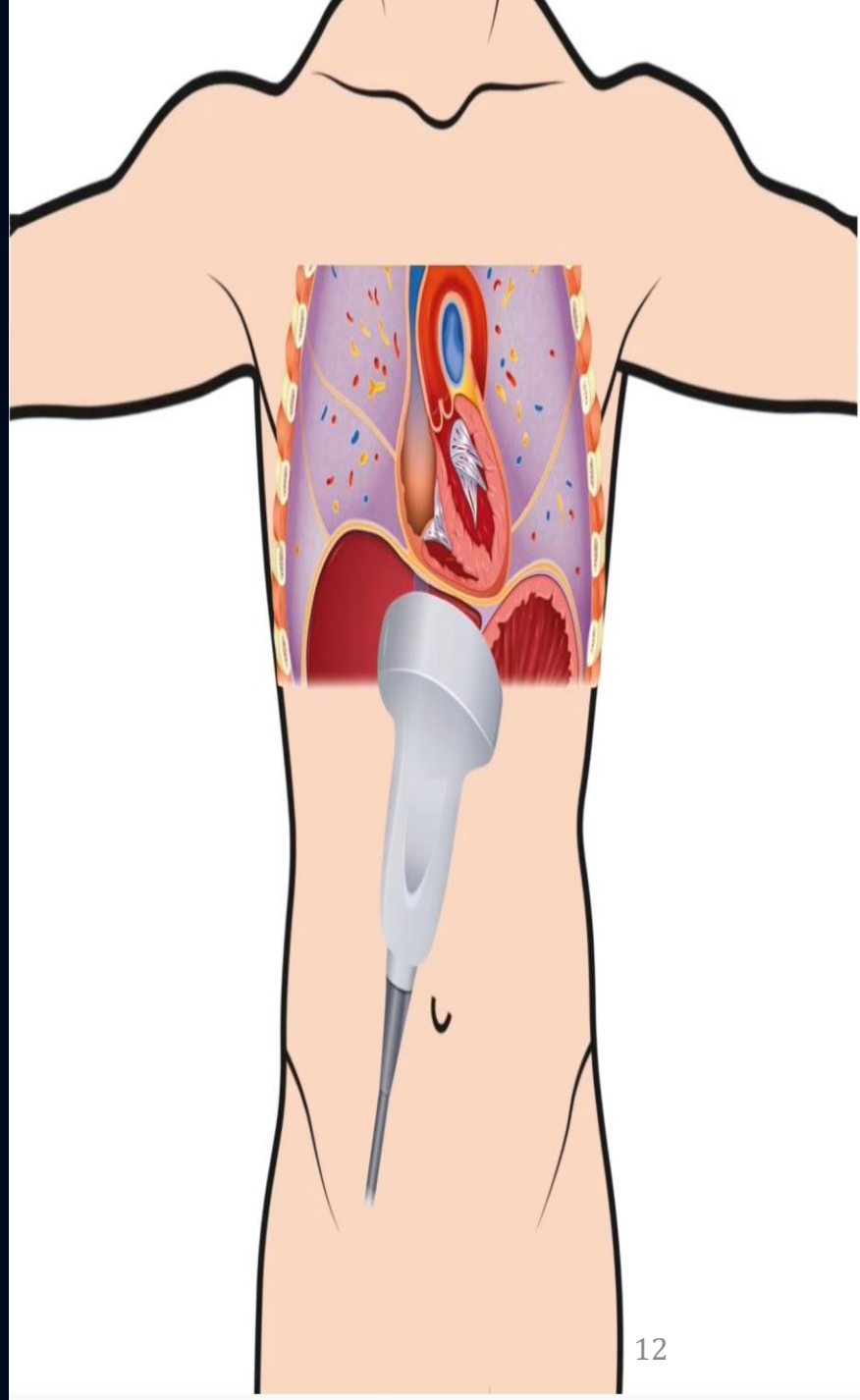
- On the ultrasound monitor, from top to bottom, observe the liver, right ventricle, and left ventricle. The right ventricle is adjacent to the liver because it is more anterior than the left ventricle. The two ventricles are up and to the right side of the monitor and the atria are down and to the left.

- **Review for :**Pericardial effusion witch appears as a black (anechoic) space between the white lines of the pericardium.

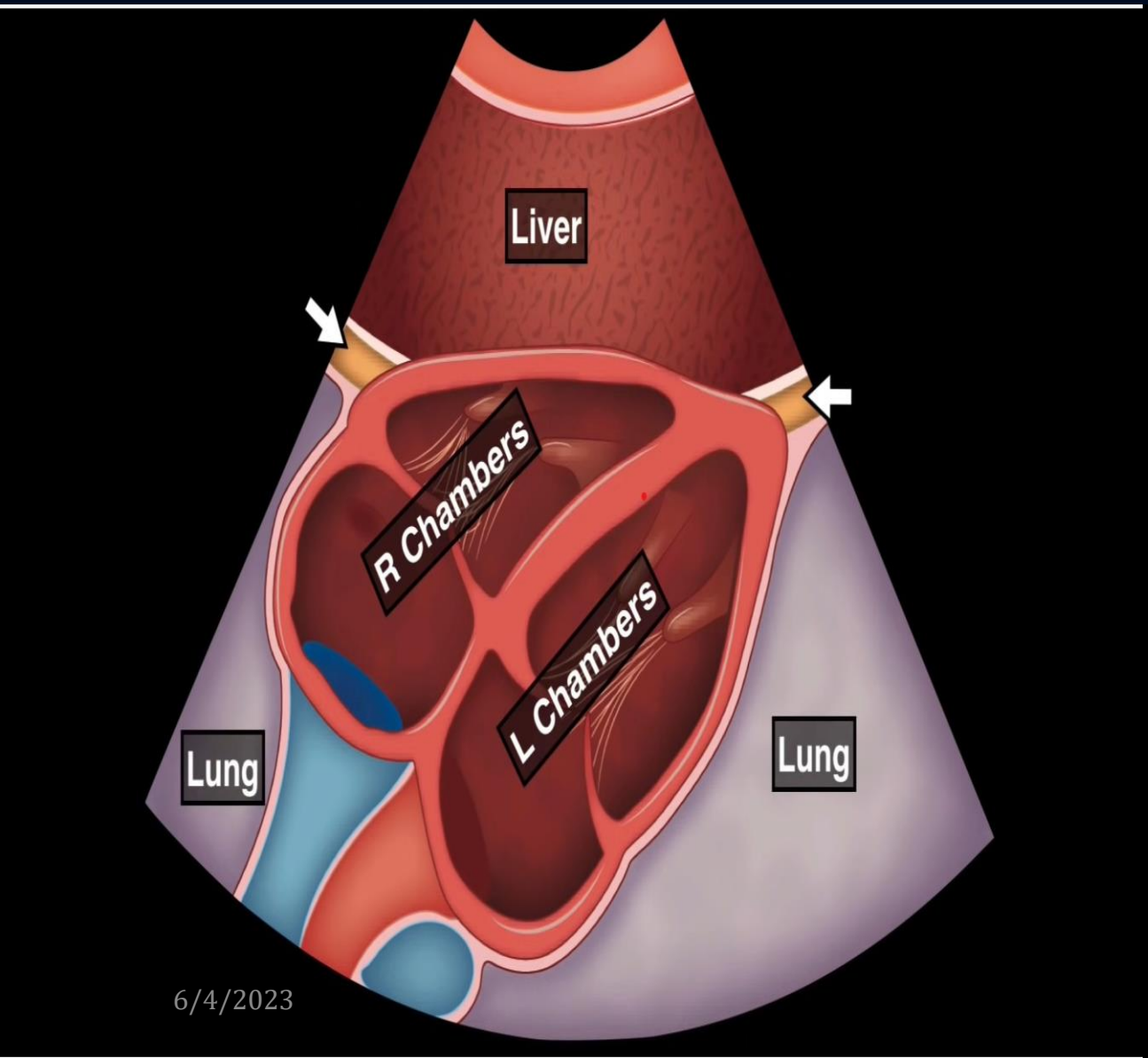
- **Pitfalls**

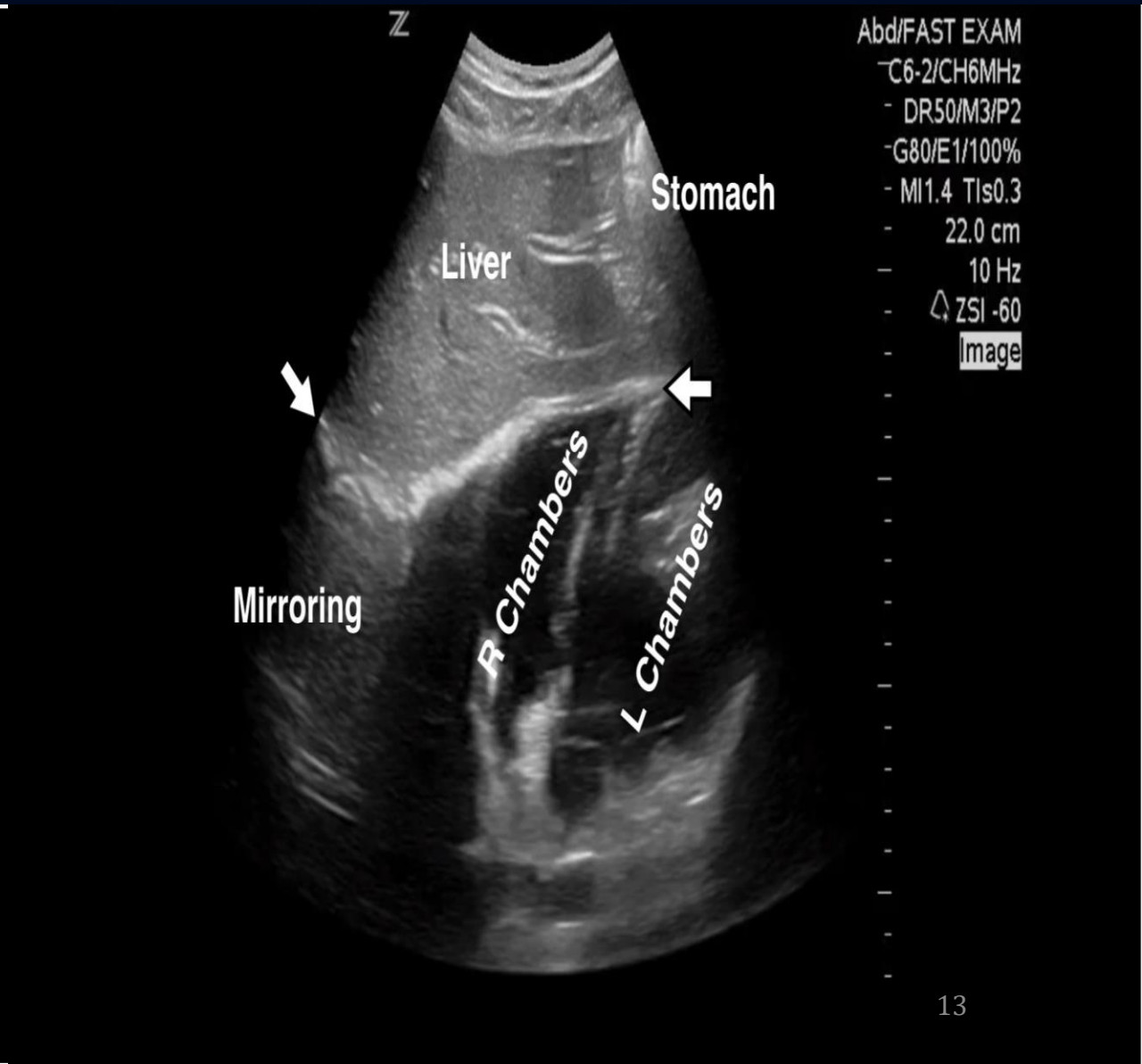
✓ Pleural effusion.

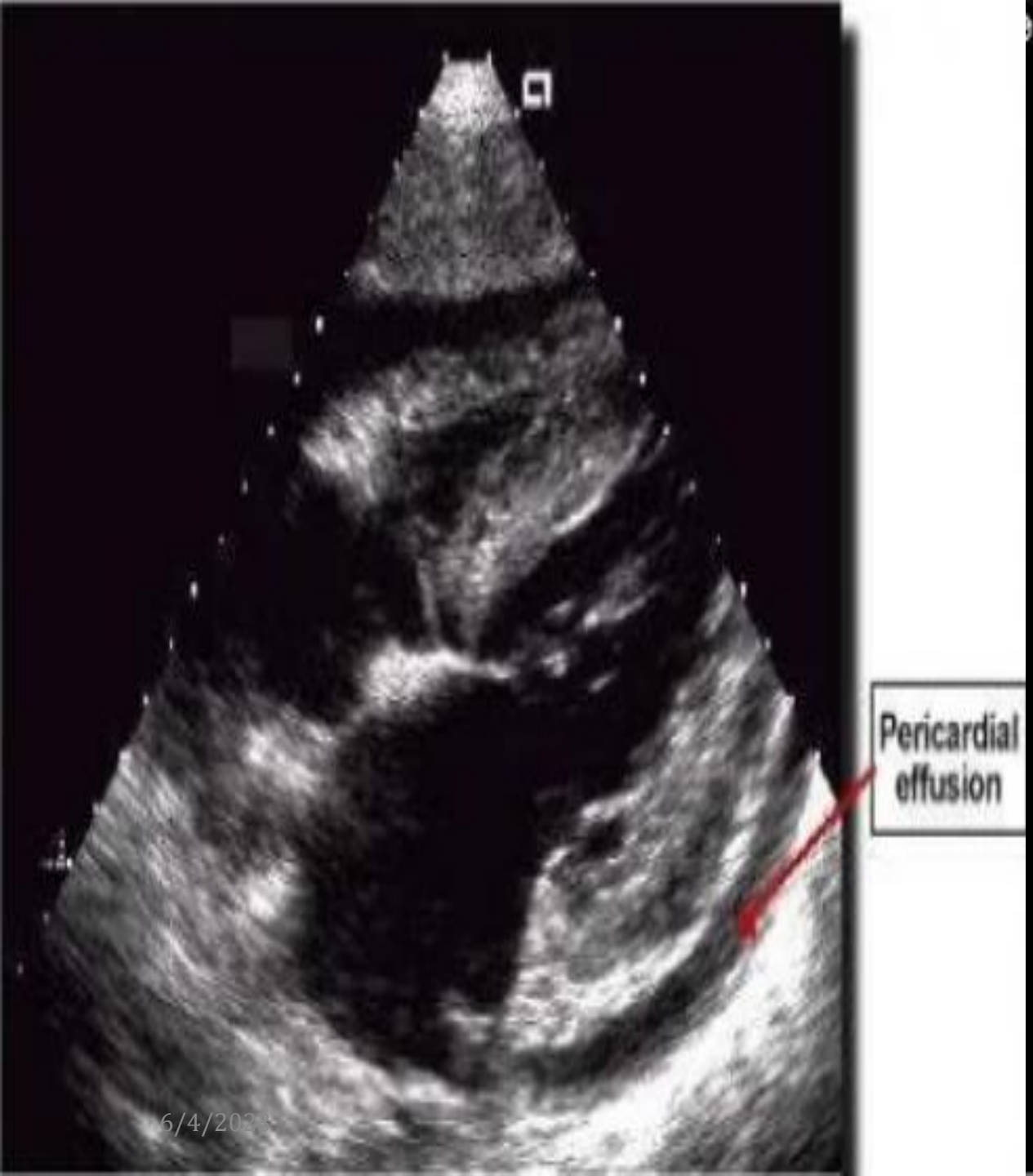
✓ epicardial fat pad.

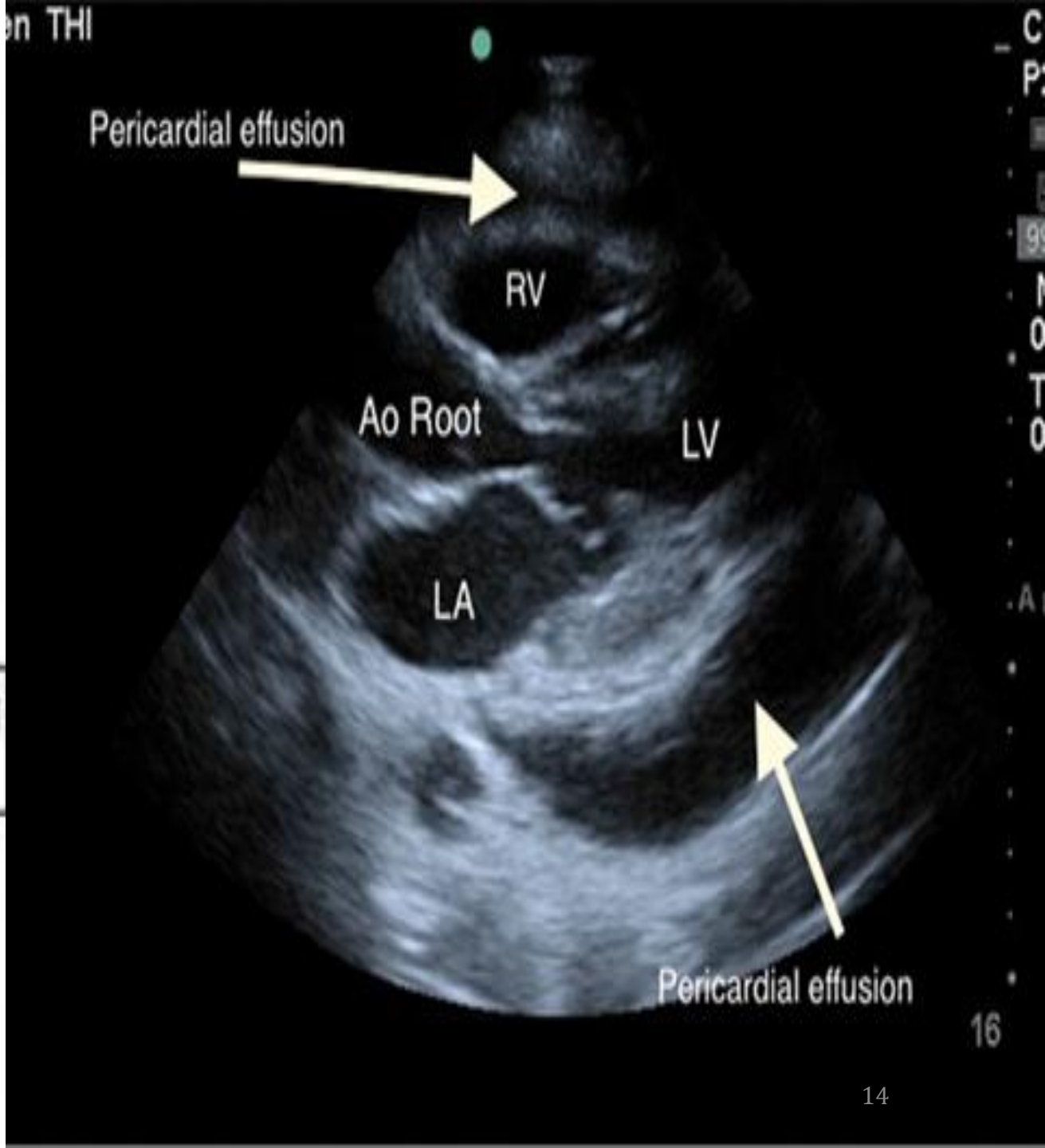


Normal subxiphoid scan:






Pericardial
effusion


Pericardial effusion
RV
Ao Root
LV
LA
Pericardial effusion
16

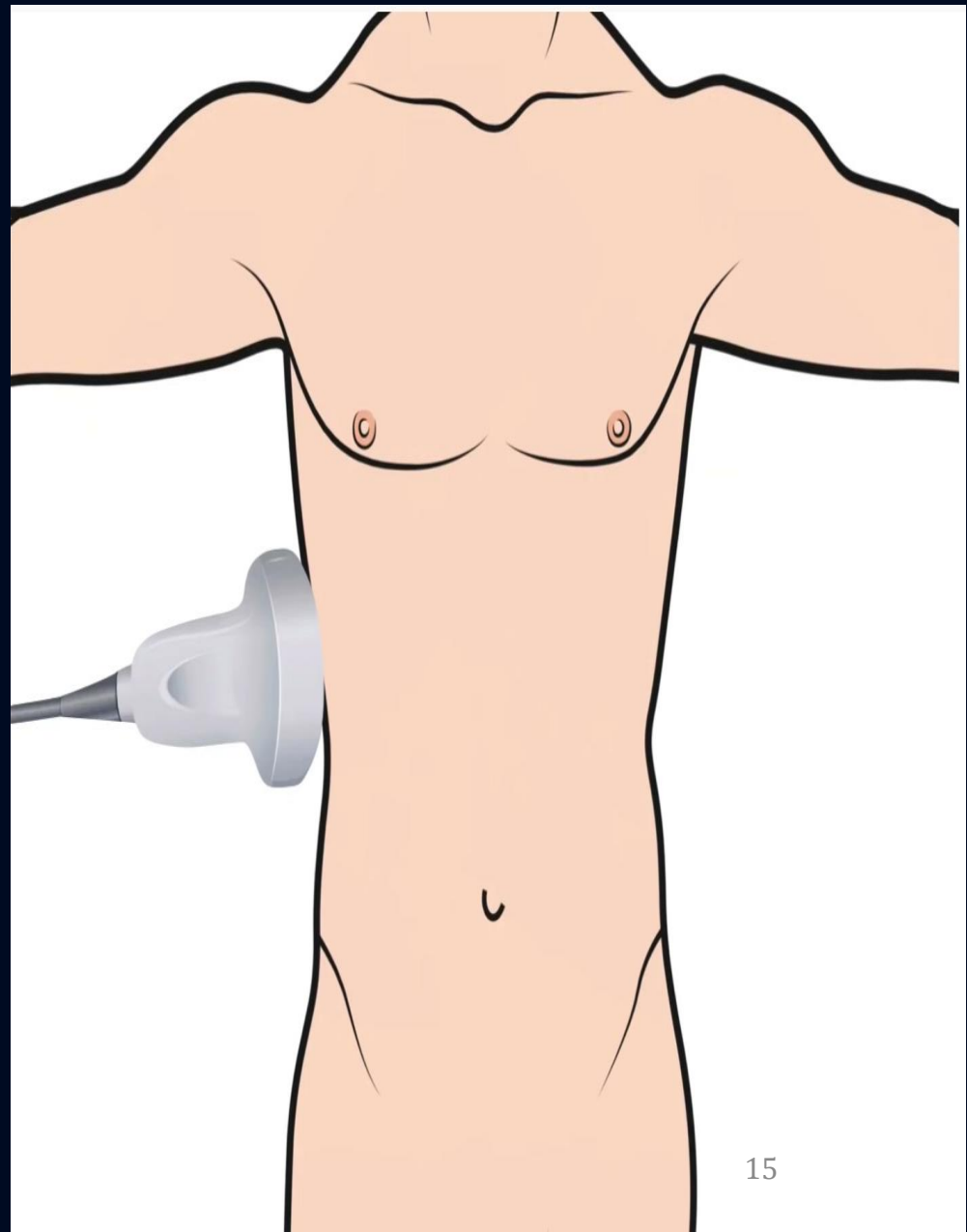
Perihepatic view (right upper quadrant) :

- **Transducer:**
  - ✓ Low frequency(curvilinear)
  - ✓ Coronal(longitudinal),marker toward patient head.
  - ✓ Mid_axillary line,Lower ribs.
  - ✓ Slide, rotate and fan.

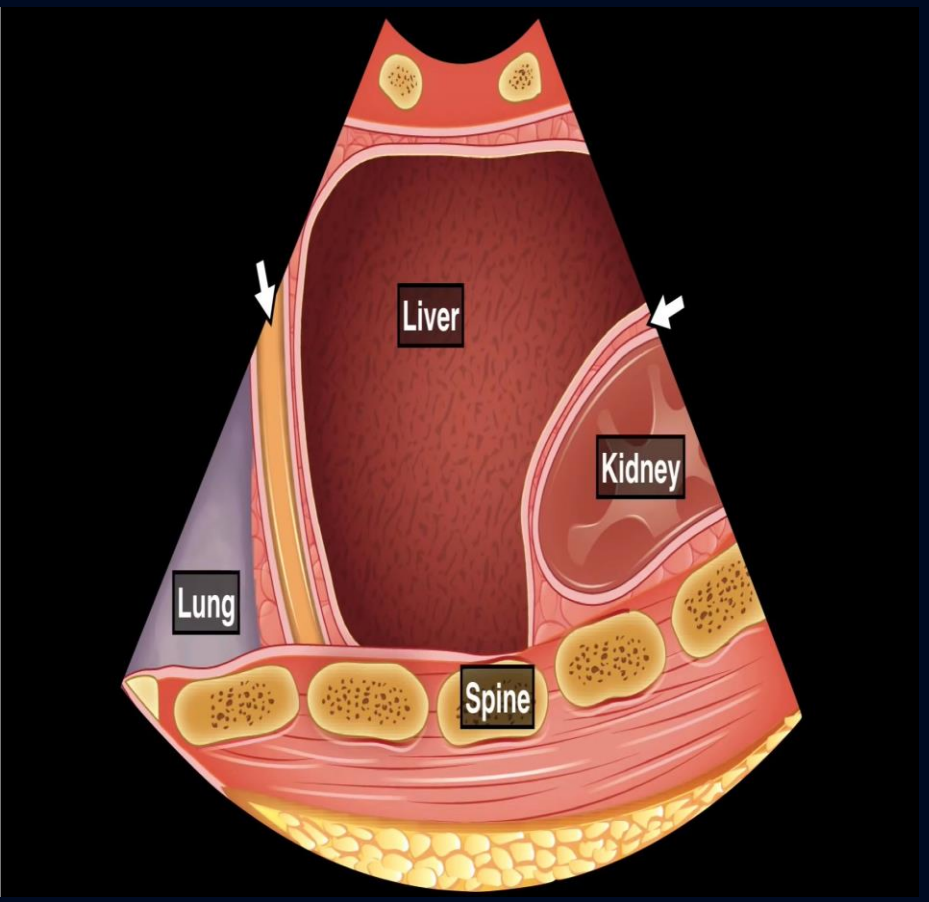
- **4 areas to evaluate for "free fluid":**
  - ✓ hepato_renal recess (Morison's pouch)
  - ✓ Pleural cavity.
  - ✓ Sub-diaphragmatic space
  - ✓ Inferior pole of the right kidney/right paracolic gutter

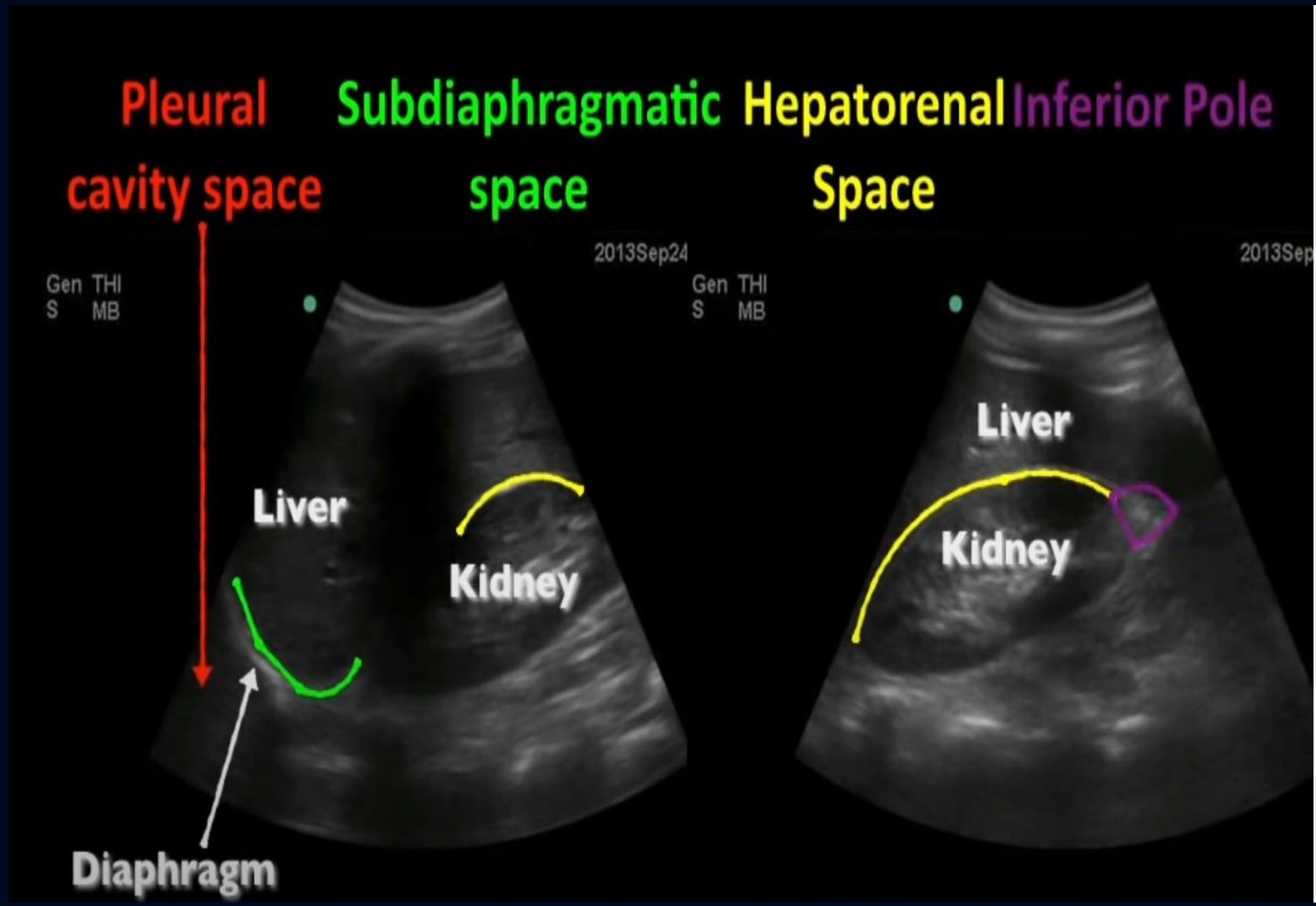
- **Pleural effusion (haemothorax) also indicated by :**
  - ✓ the "spine sign", abnormal continuation of the spinous line
  - ✓ Absence of mirror artifact.

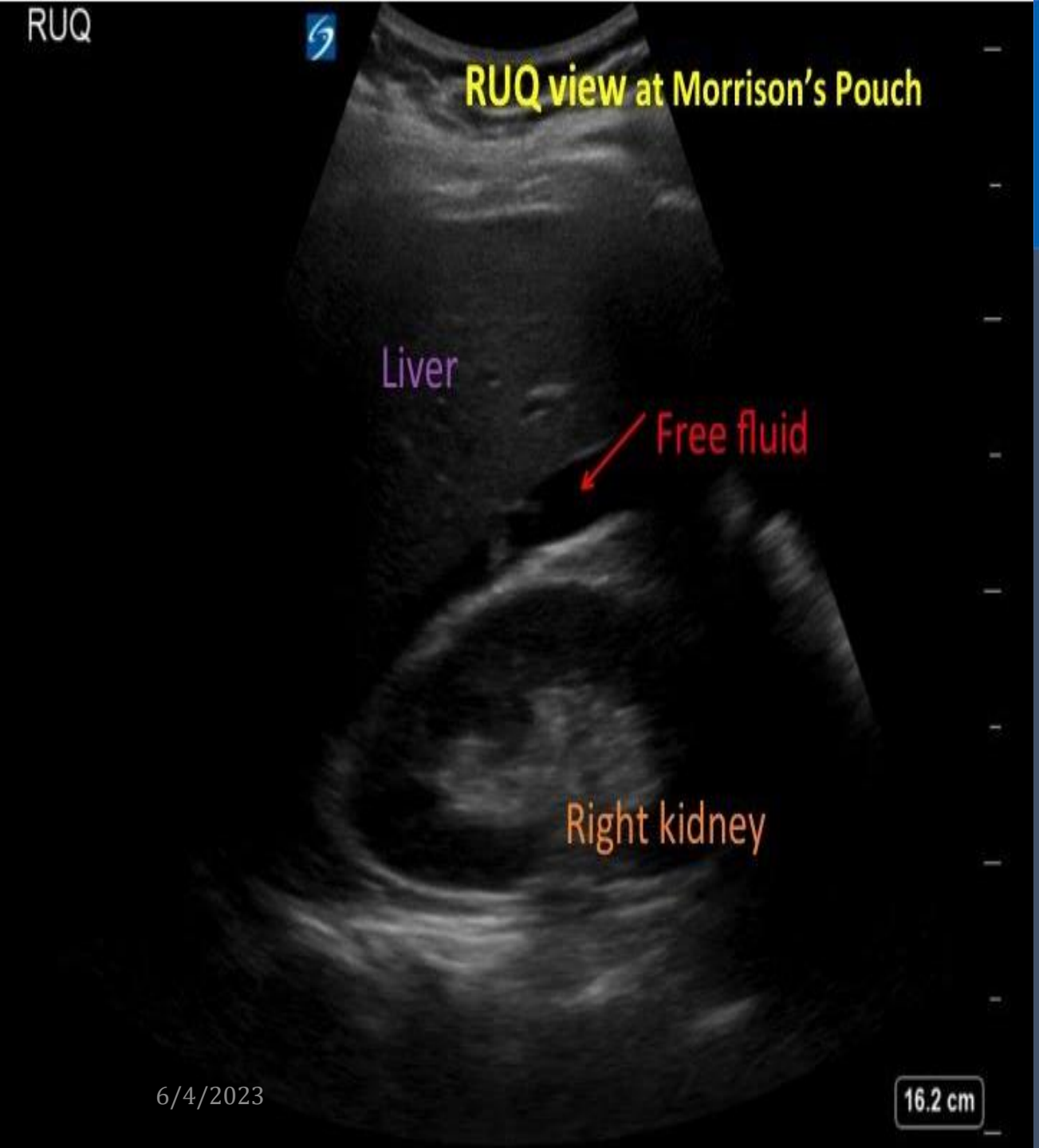
- **Pitfalls**:
  - ✓ Perinephric fat is a mimic for hematoma
  - ✓ Duodenal fluid, the gallbladder, and the IVC are all mimics for free fluid.



Normal RUQ scan





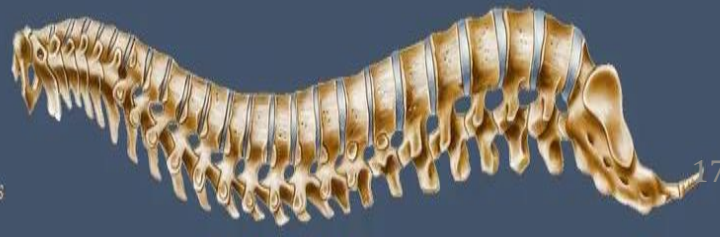


Spine sign or Thoracic spine sign

NephroPOCUS

No Pleural effusion

Pleural effusion



* Shadowing from vertebral bodies

Perisplenic view (left upper quadrant) :

➢ **Transducer:**

✓ Low frequency(curvilinear)

✓ Coronal(longitudinal)

✓ Marker toward patient head.

✓ More cephalad than RUQ (6^{th}_9) intercostal spaces)

✓ More posterior than RUQ(posterior axillary line).

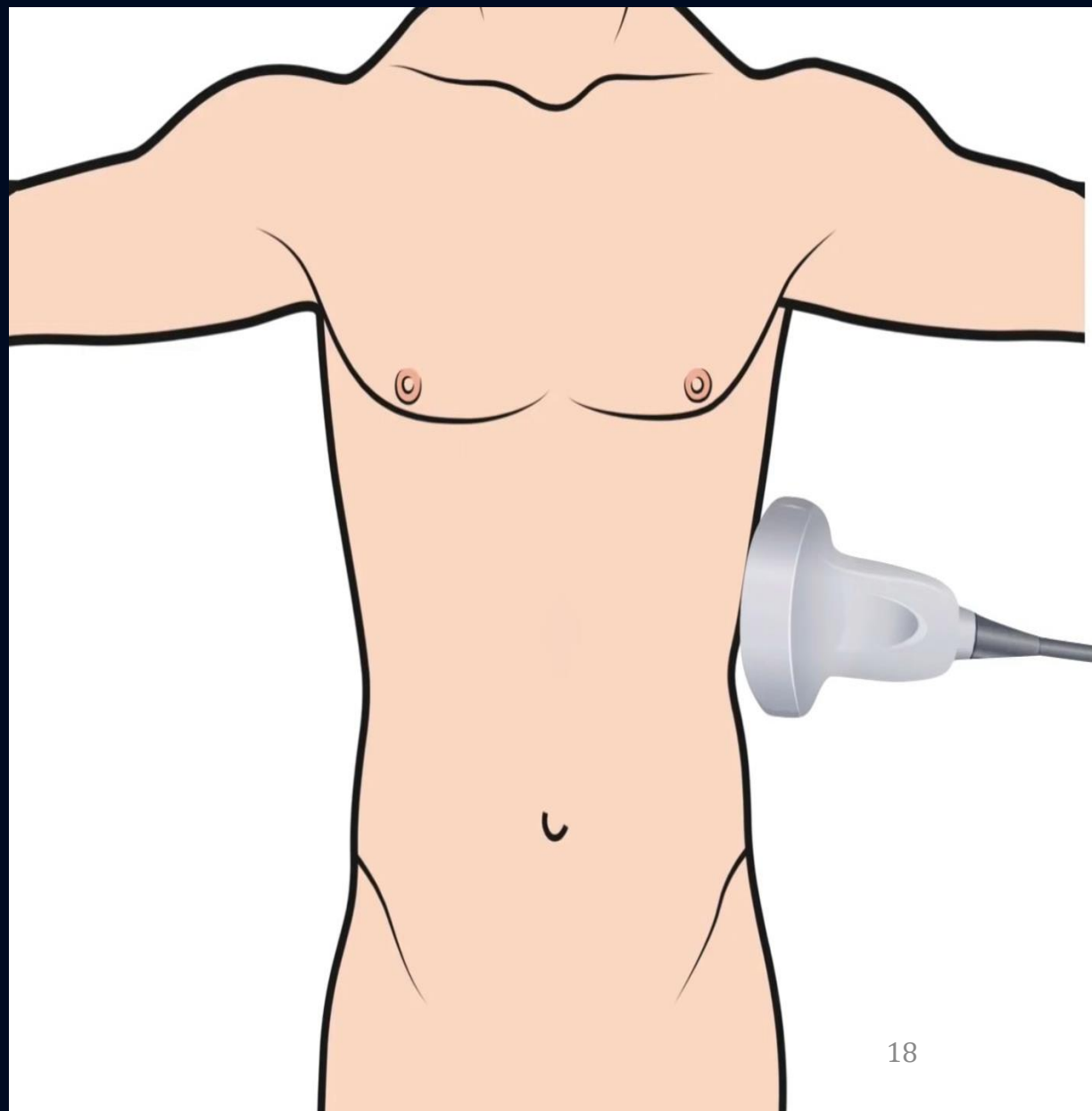
➢ **4 areas to evaluate for "free fluid":**

- Pleural cavity.
- Sub-diaphragmatic space(perisplenic)
- Between spleen and left kidney.
- Inferior pole of the left kidney/left paracolic gutter

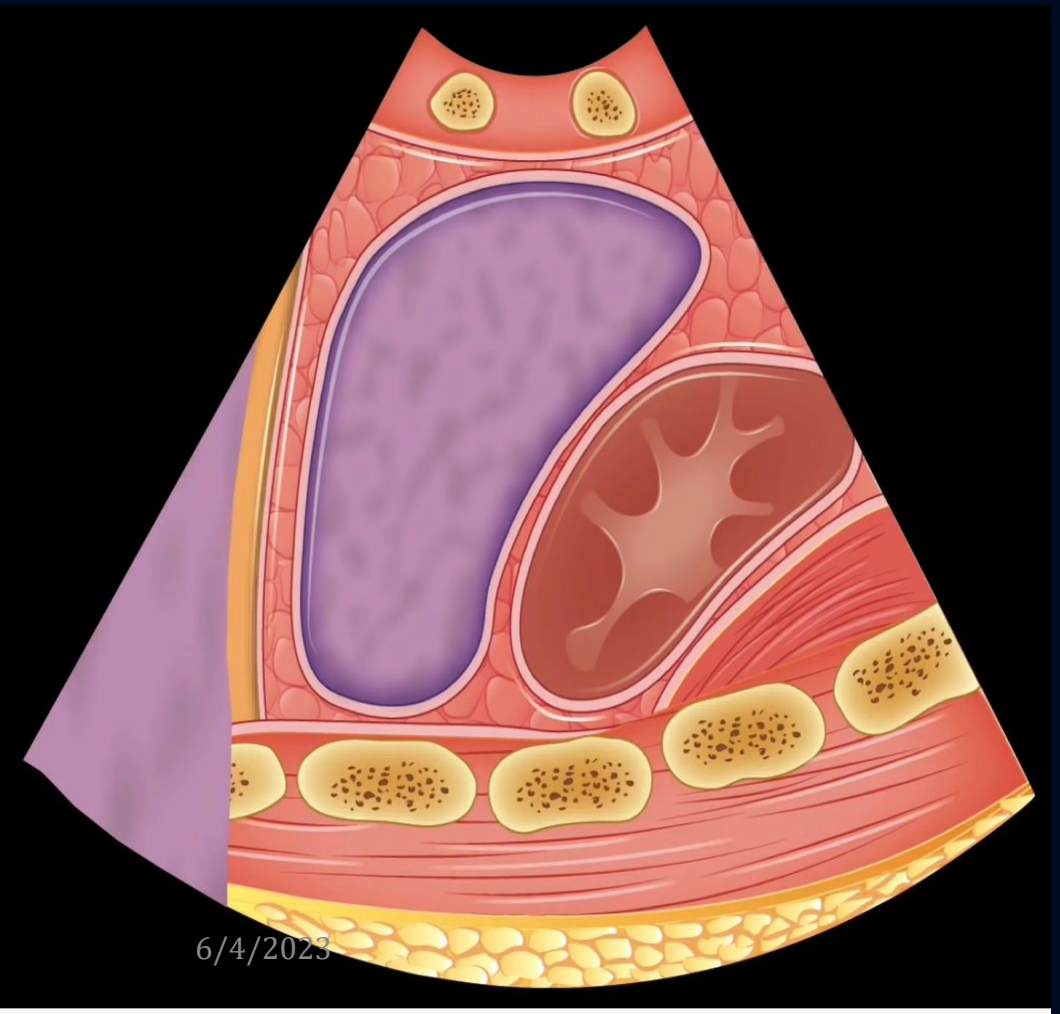
➢ **Pitfalls:**

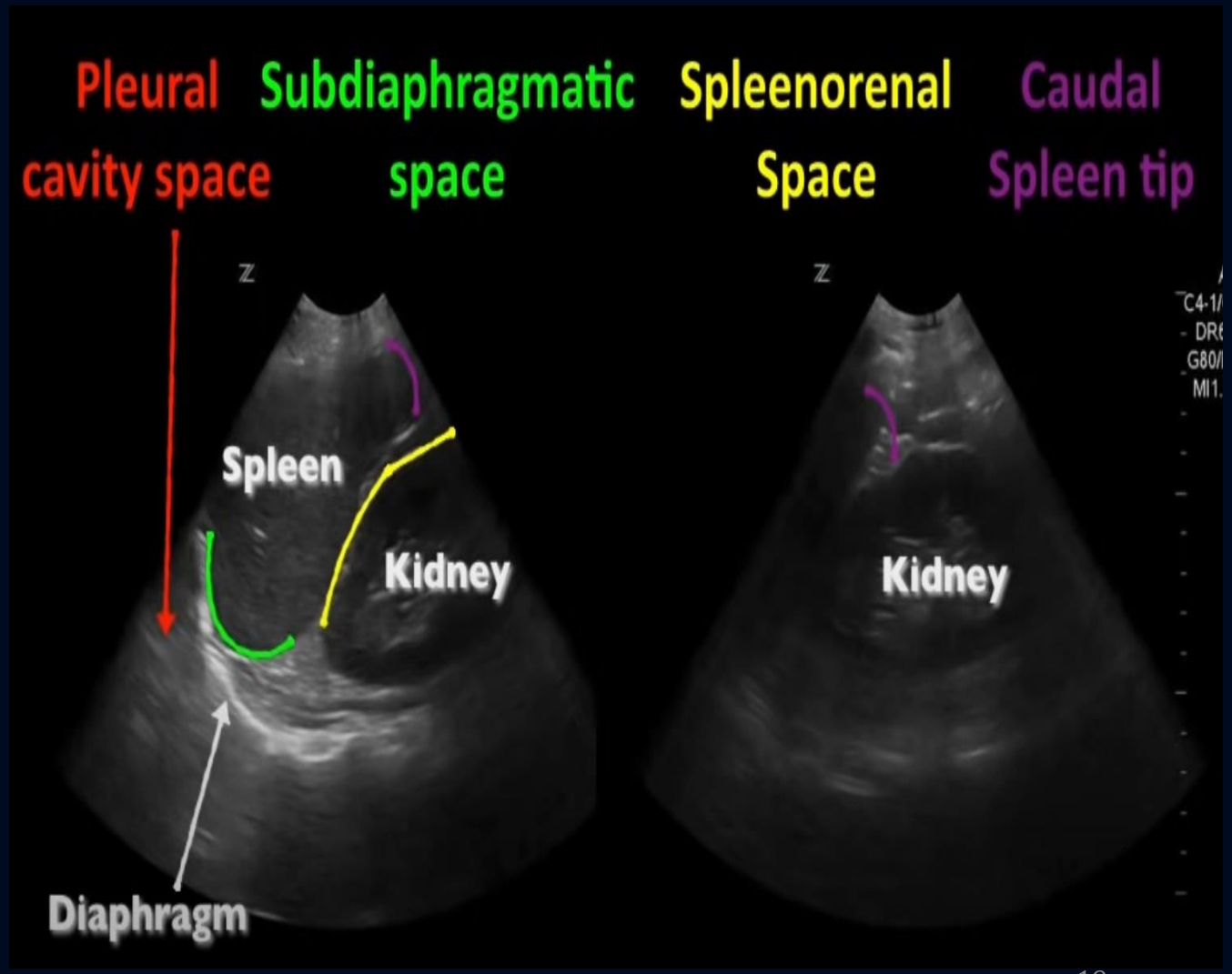
✓ Fluid-filled stomach can mimic fluid, as can loops of bowel

✓ perinephric fat.

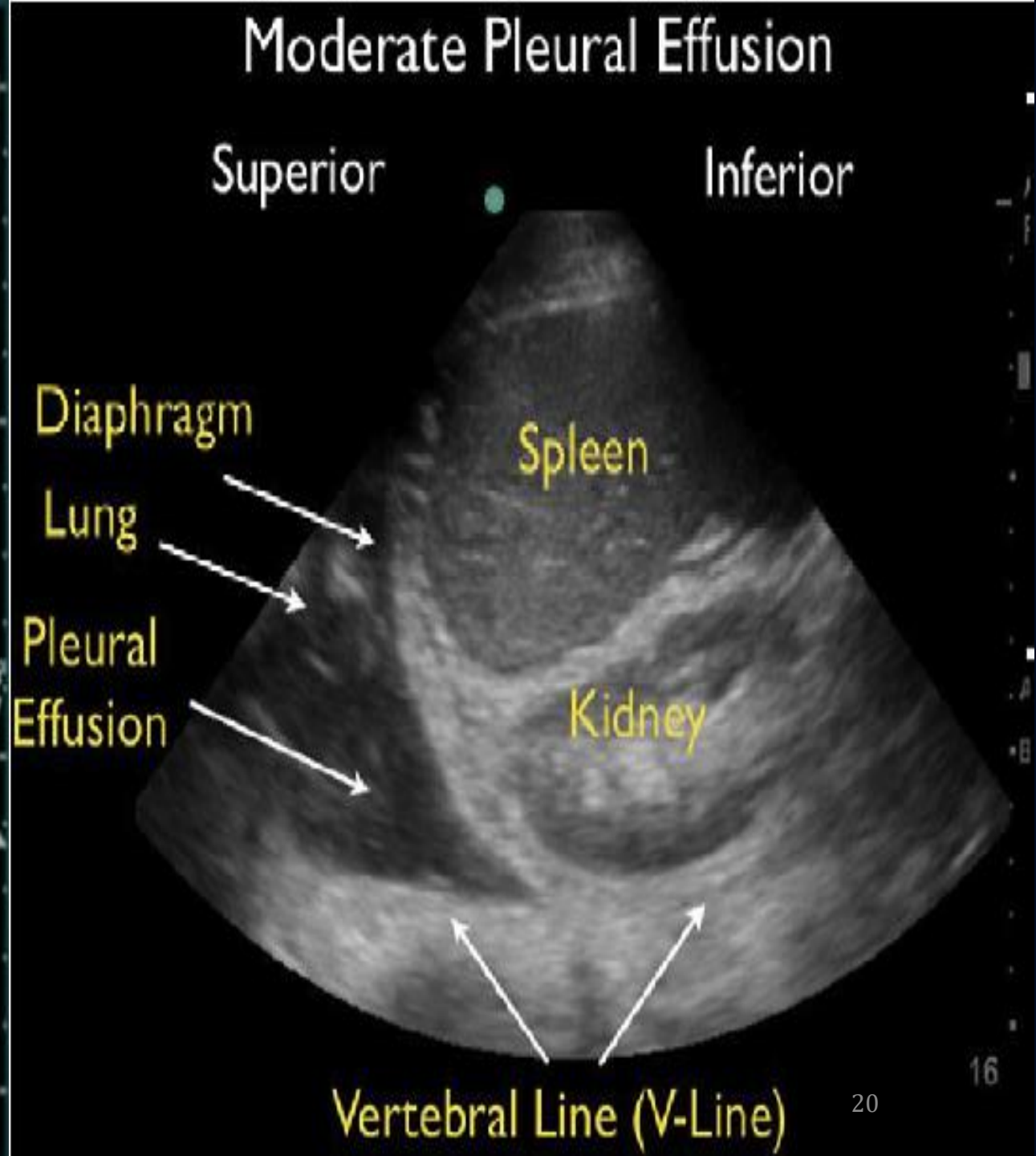


Normal LUQ scan:






Abdomen
C5-2
32Hz
15cm
2D
F3
Gn 60
232dB/C5
G/3/2
Spleen
Kidney
Diaphragm


Moderate Pleural Effusion
Superior
Inferior
Diaphragm
Lung
Pleural Effusion
Spleen
Kidney
Vertebral Line (V-Line)

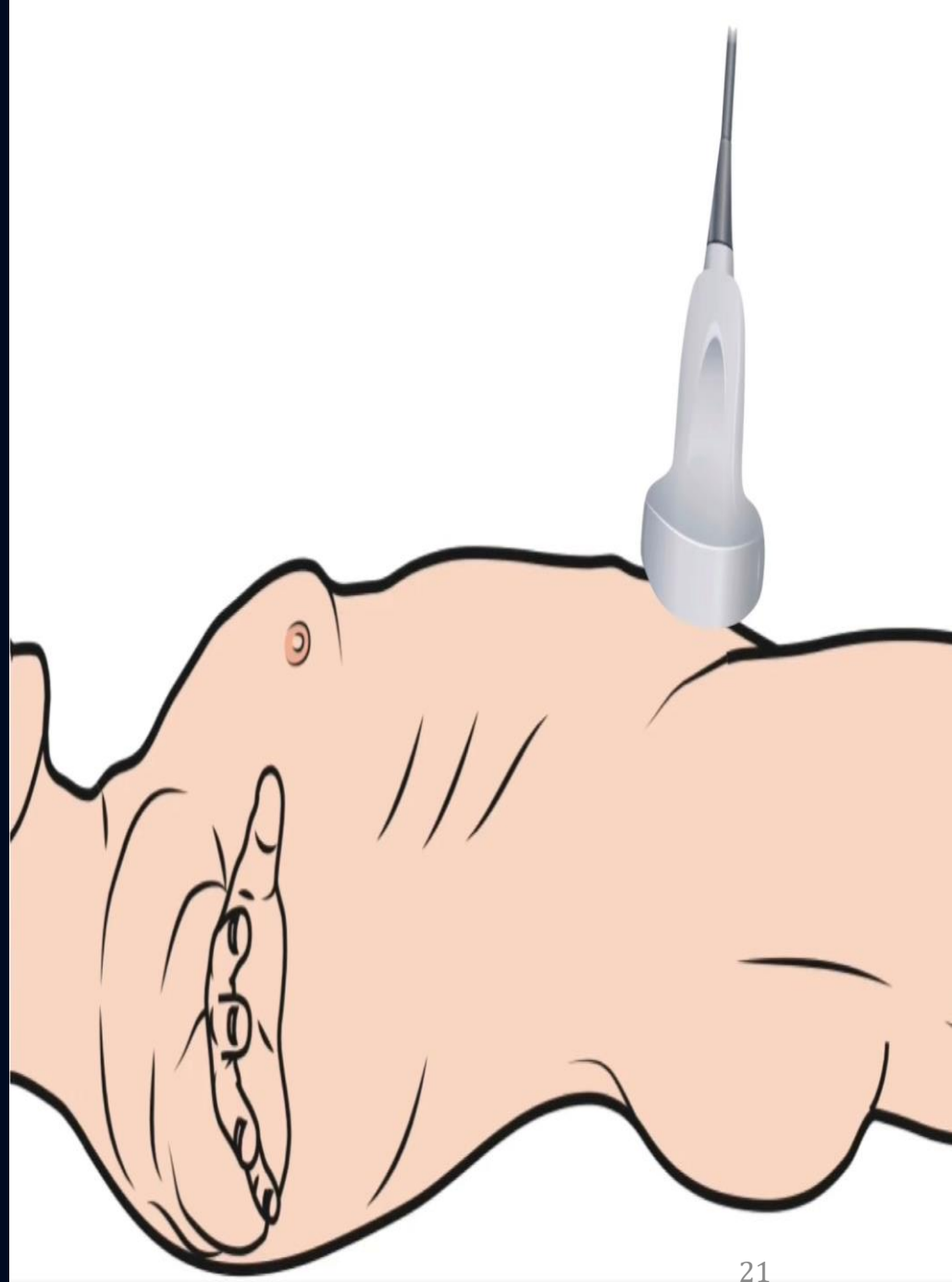
Suprapubic view (longitudinal):

- **Transducer:**

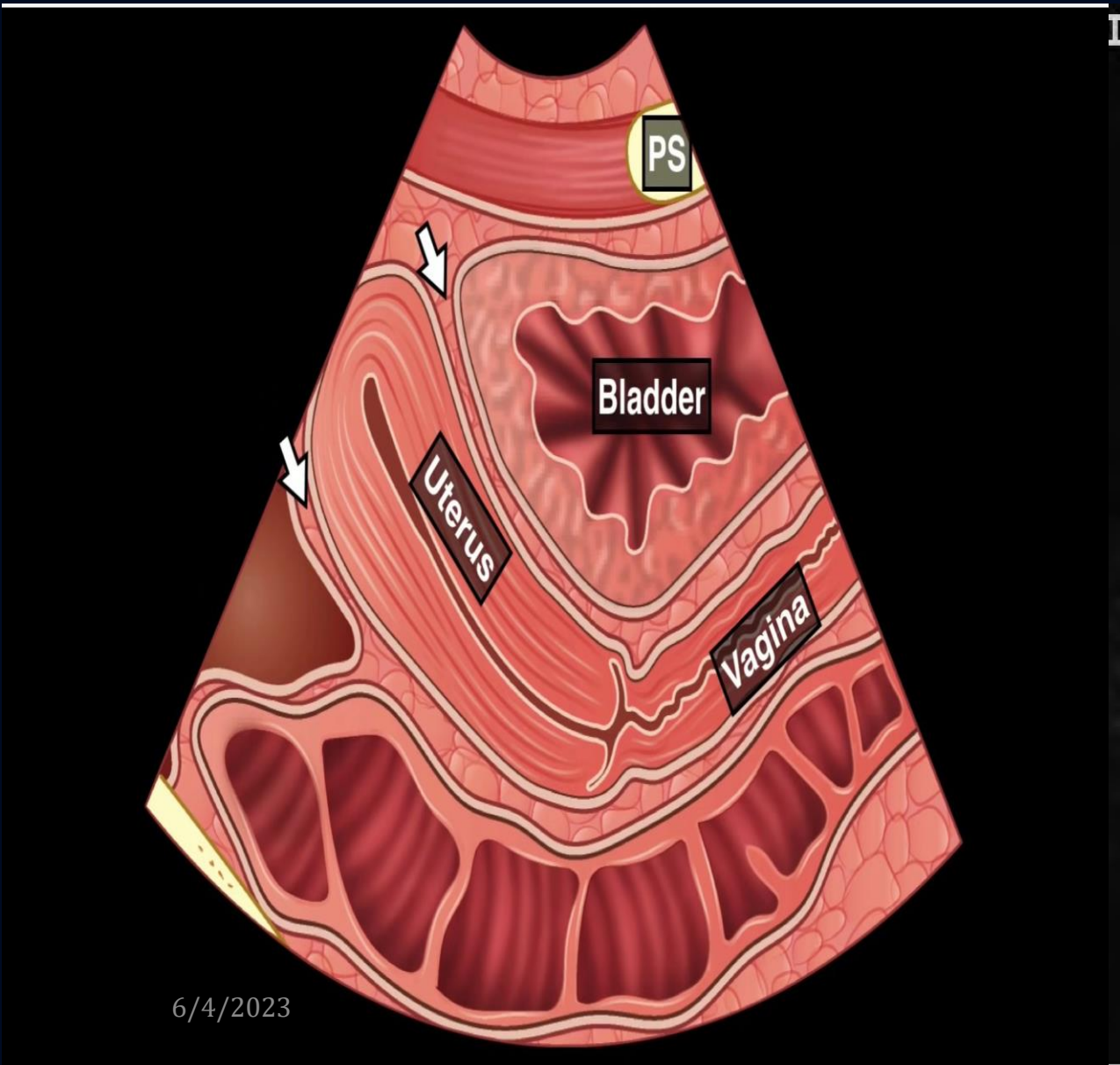
✓Low frequency(curvilinear)
✓Midline.
✓Marker toward patient head.
✓Caudal end of probe just superior to symphysis pubis.
✓Fan left to right.

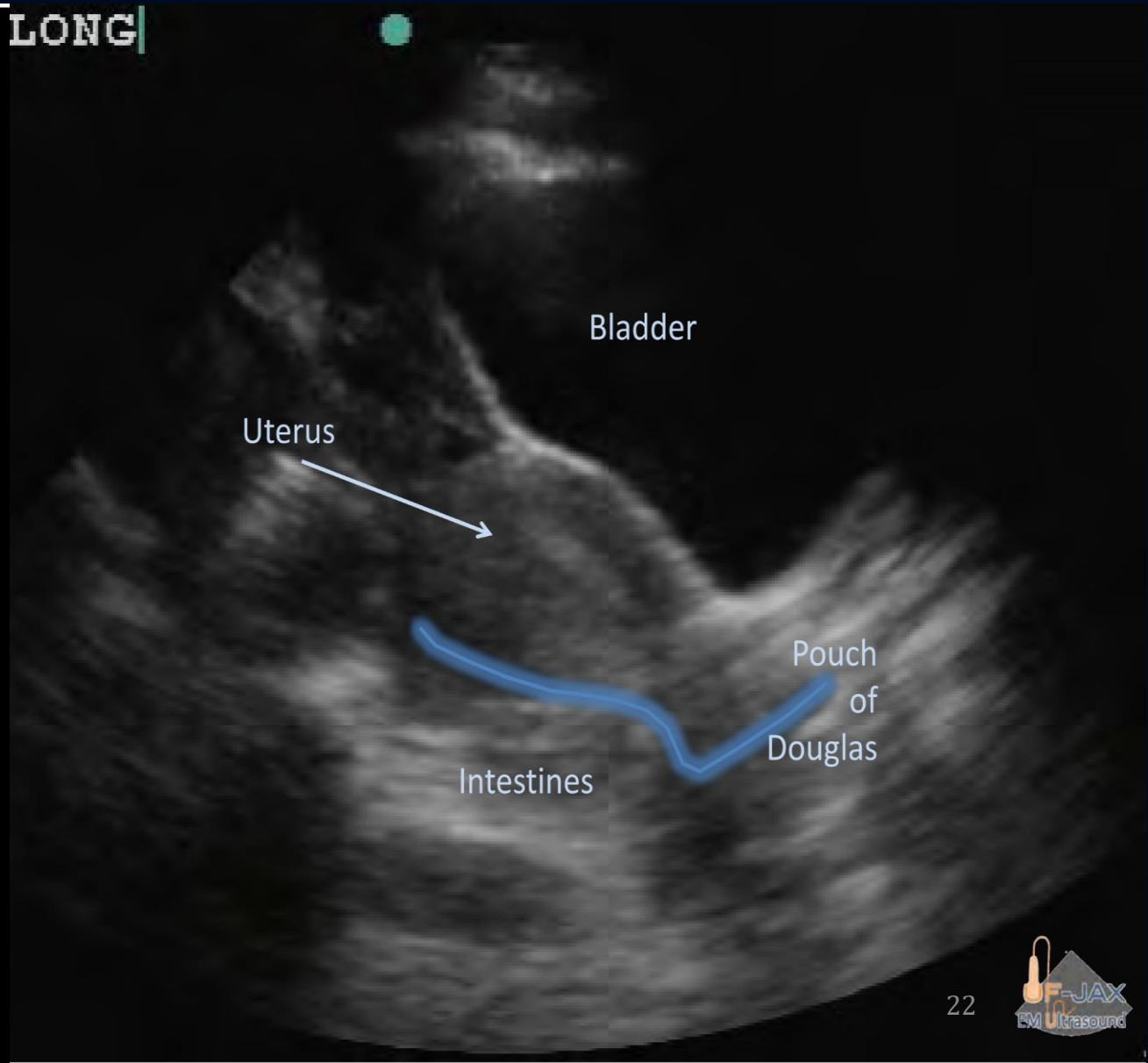
- **Review area:**

* men: rectovesical space.
*women:1.vesicouterine space.
2.retrouterine pouch(pouch of douglas)

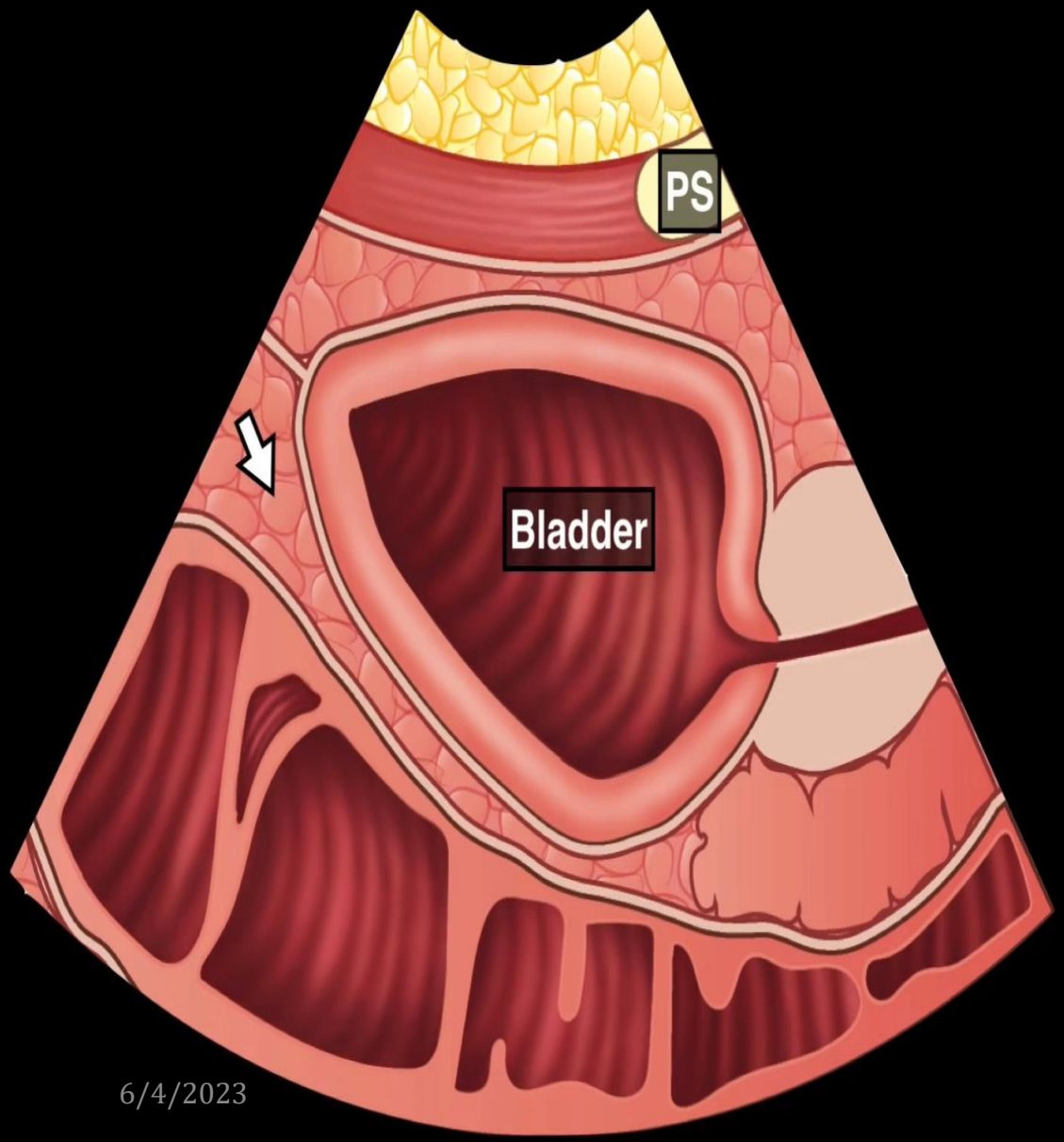


Normal suprapubic view (longitudinal)_female_





Normal suprapubic view (longitudinal) male



Suprapubic view (transverse):

➢ **Transducer:**

✓ Low frequency(curvilinear)
✓ Midline.
✓ Transverse.
✓ Marker toward patient right side.
✓ Fan superior to inferior.

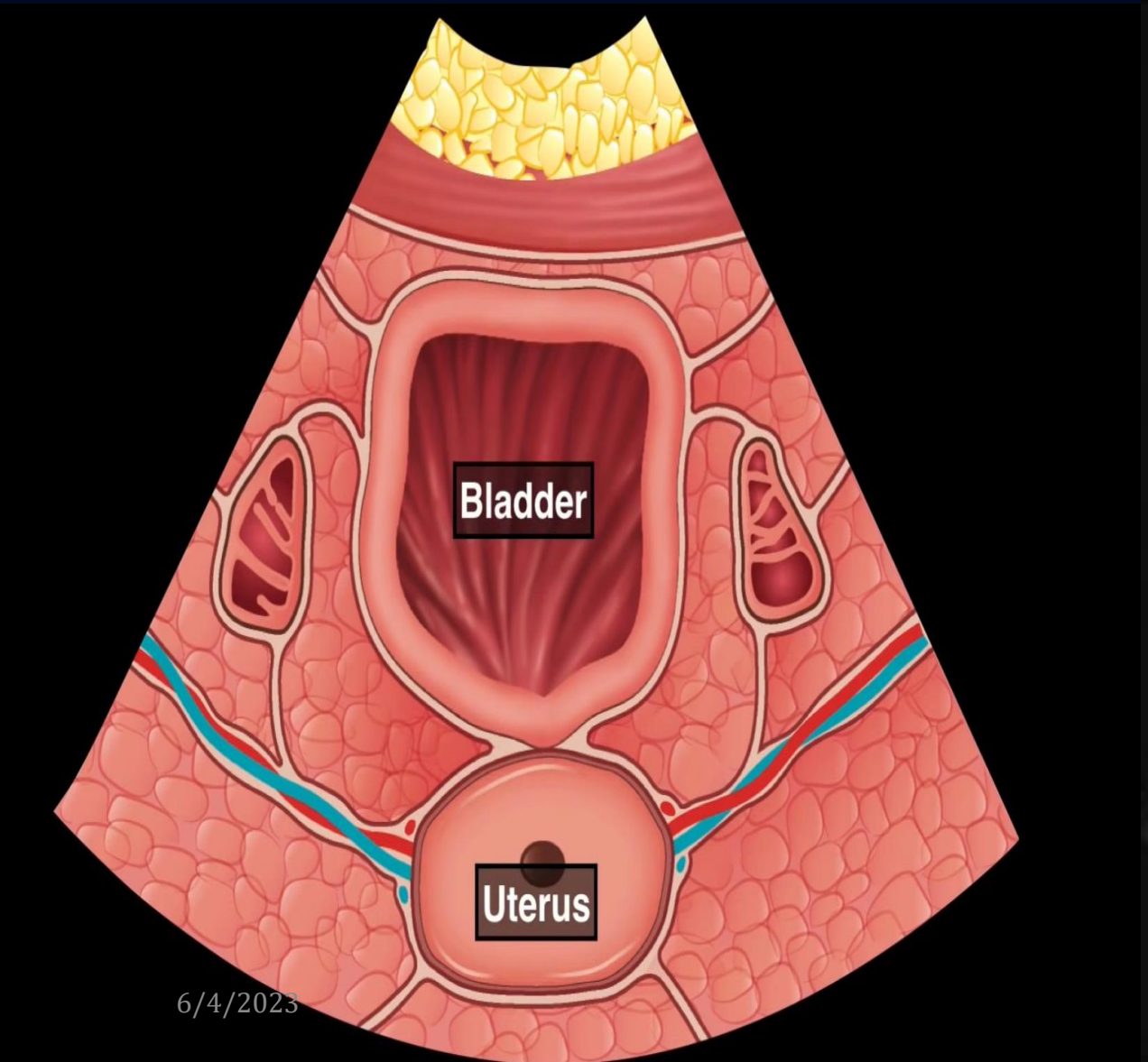
➢ **Review area:**

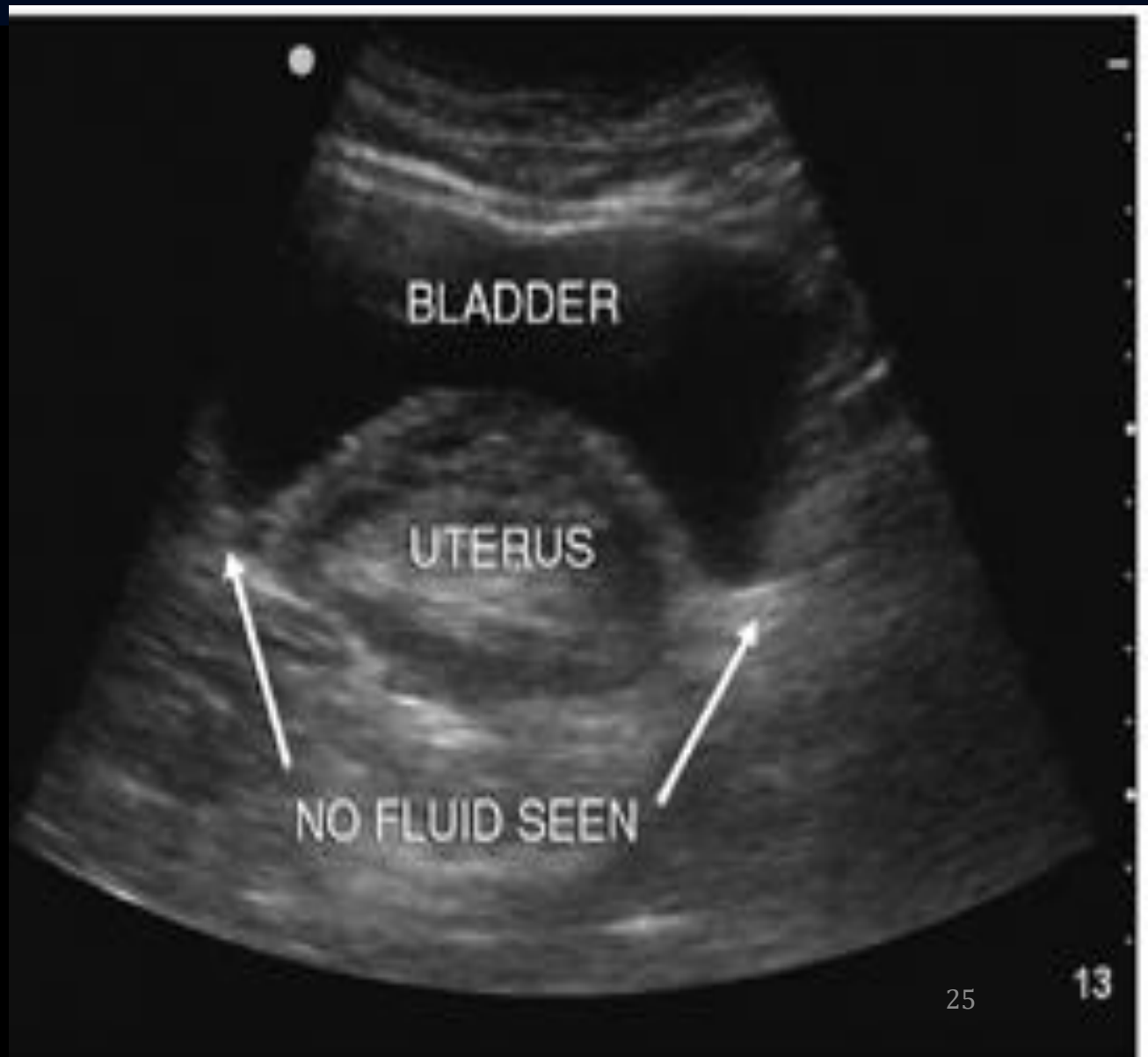
✓ Posterior wall of the bladder.

➢ **Pitfalls:**

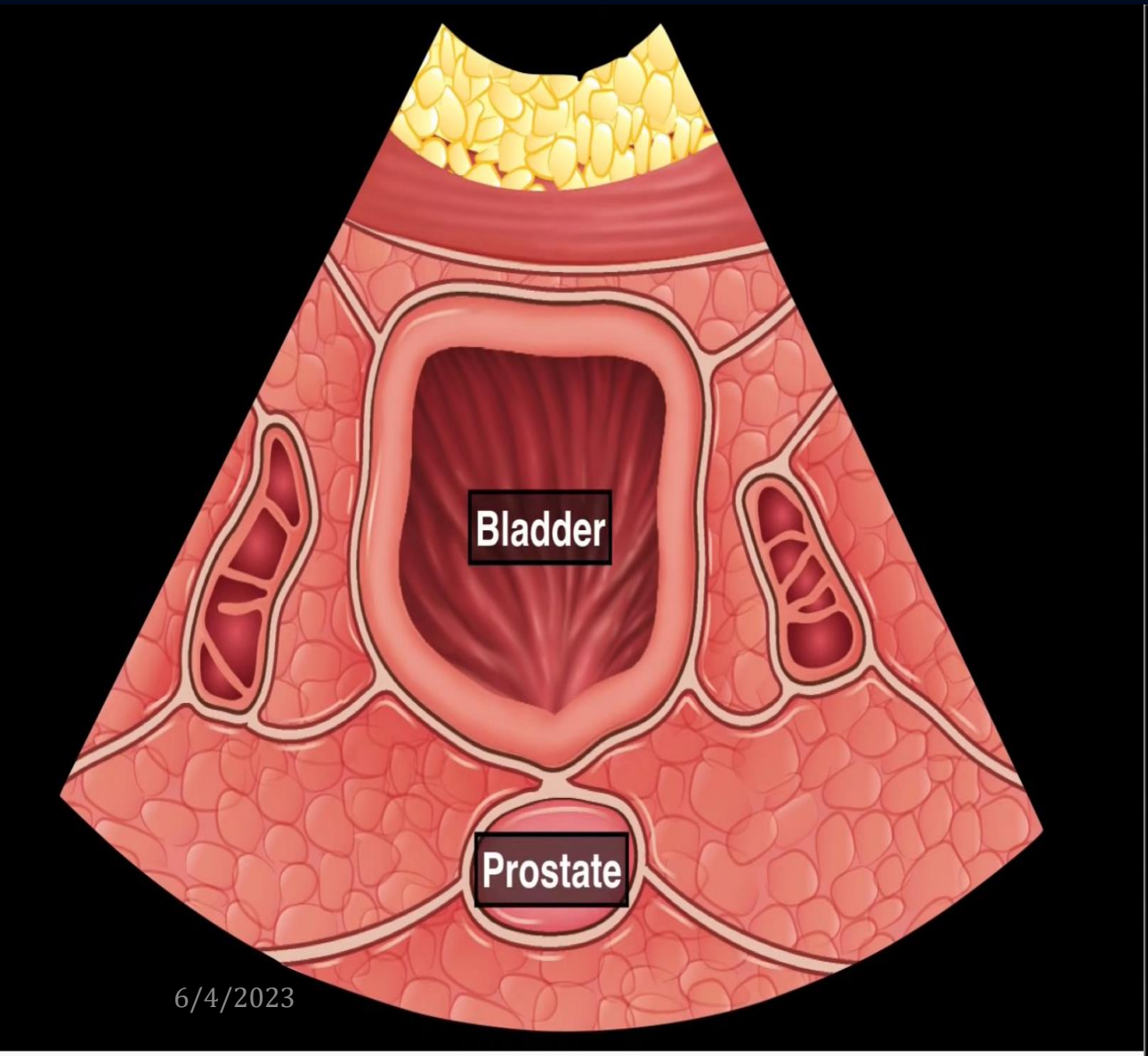
✓ Fluid within a collapsed bladder .
✓ ovarian cyst may
✓ Seminal vesicles may also be incorrectly identified as free fluid
✓ Premenopausal females may normally have a small amount of free fluid in the pouch of Douglas.
✓ Bowel fluid.

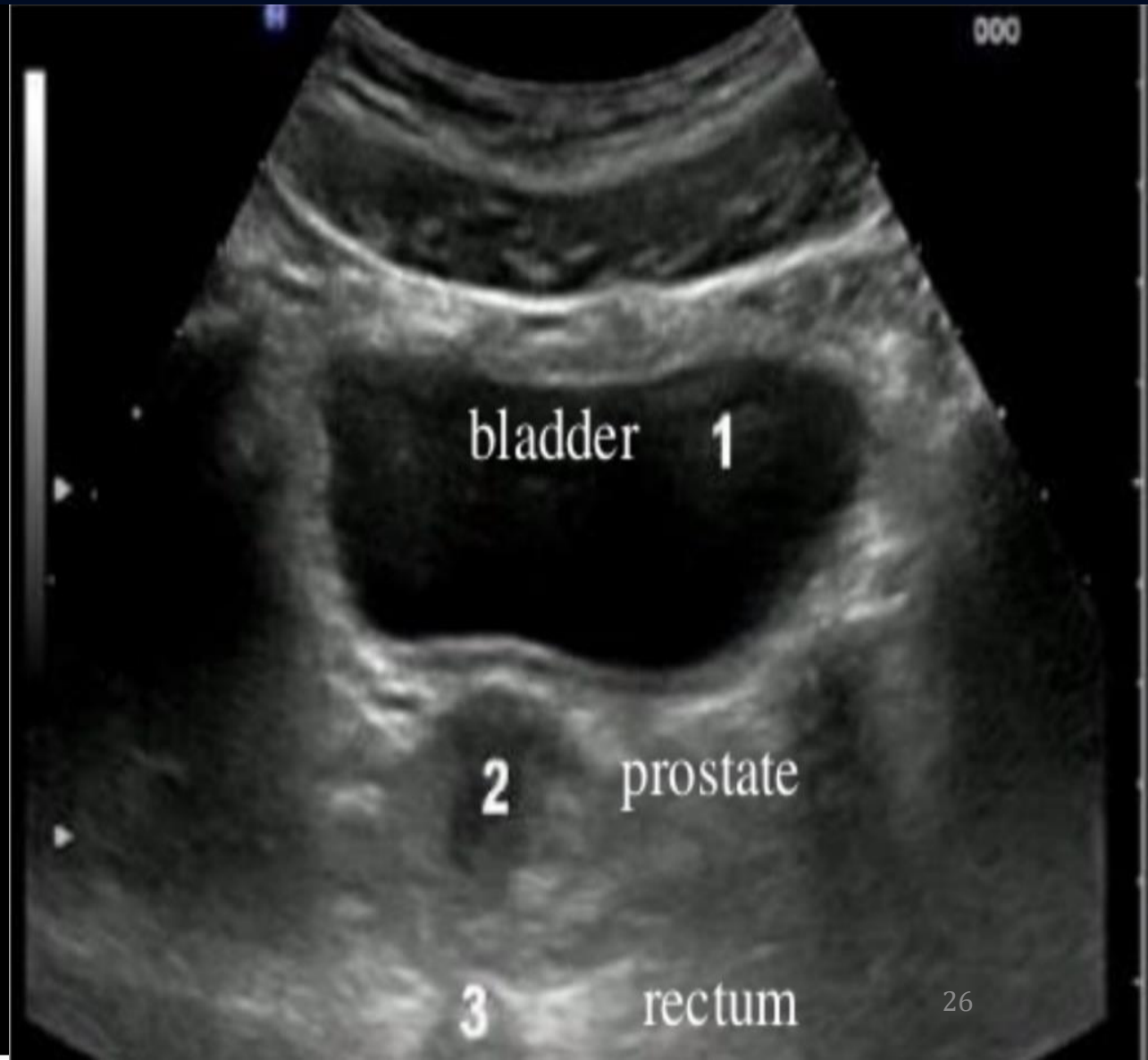
Normal suprapubic view (transverse) female

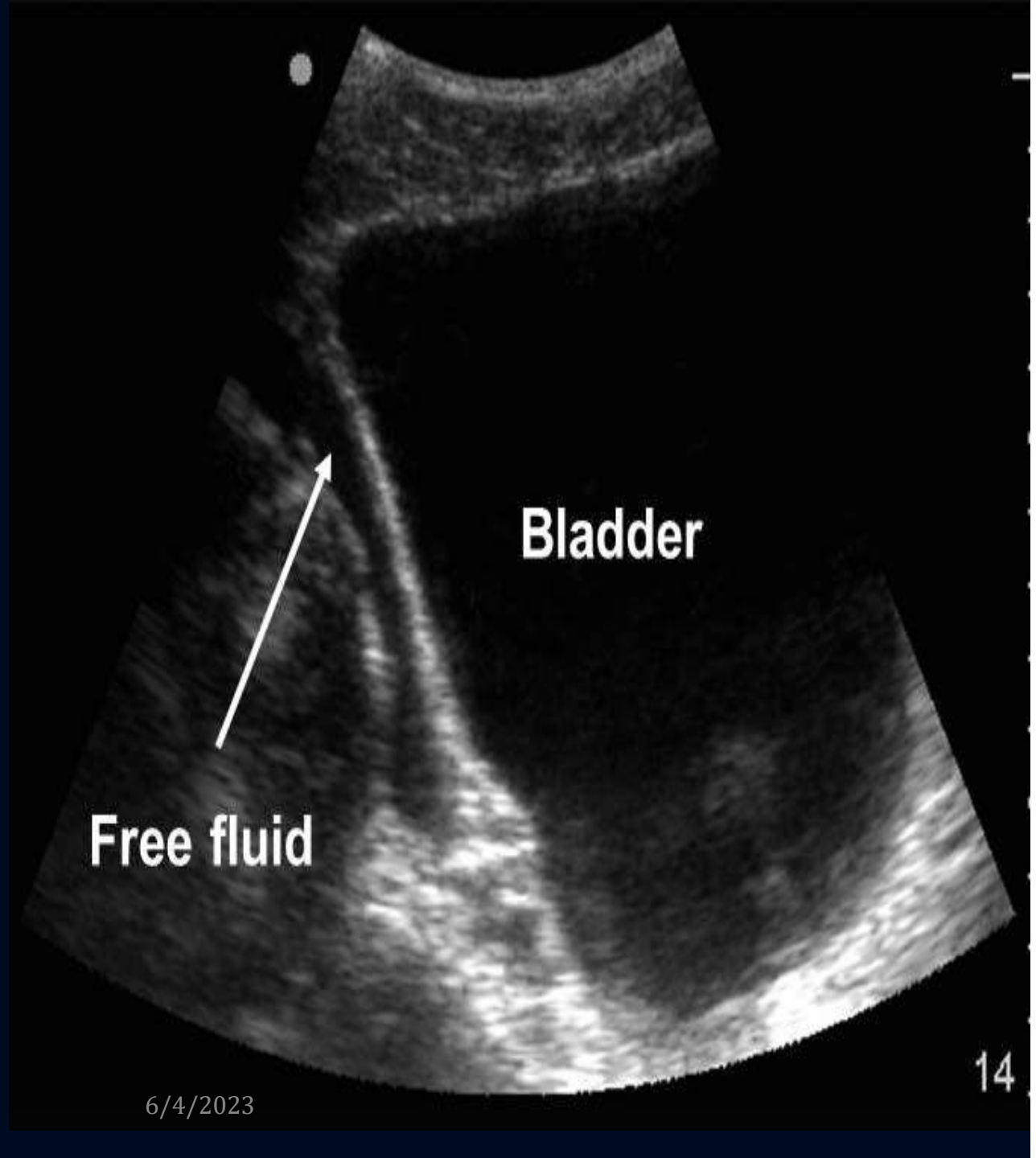


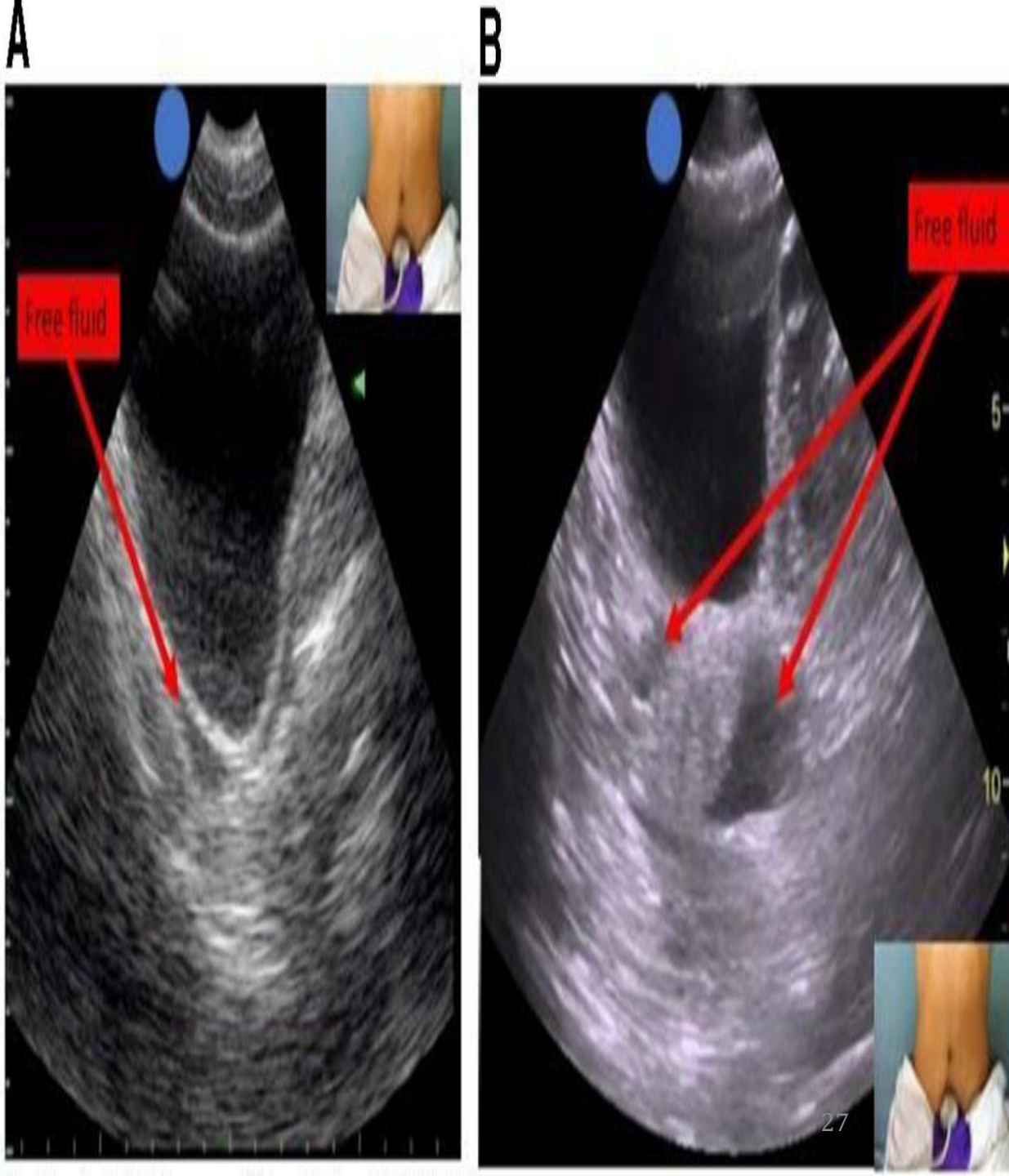


Normal suprapubic view (transverse) male






Bladder
Free fluid
14


A
B
Free fluid
Free fluid

Thoracic view(right and left):

- **Transducer:**

✓ high frequency probe(linear)
✓ Anterior chest wall ,midcalvicular line.
✓ longitudinal.
✓ Marker toward patient head.
✓ Fan to the lateral axillary line and infeiorly .

- **Review for:**

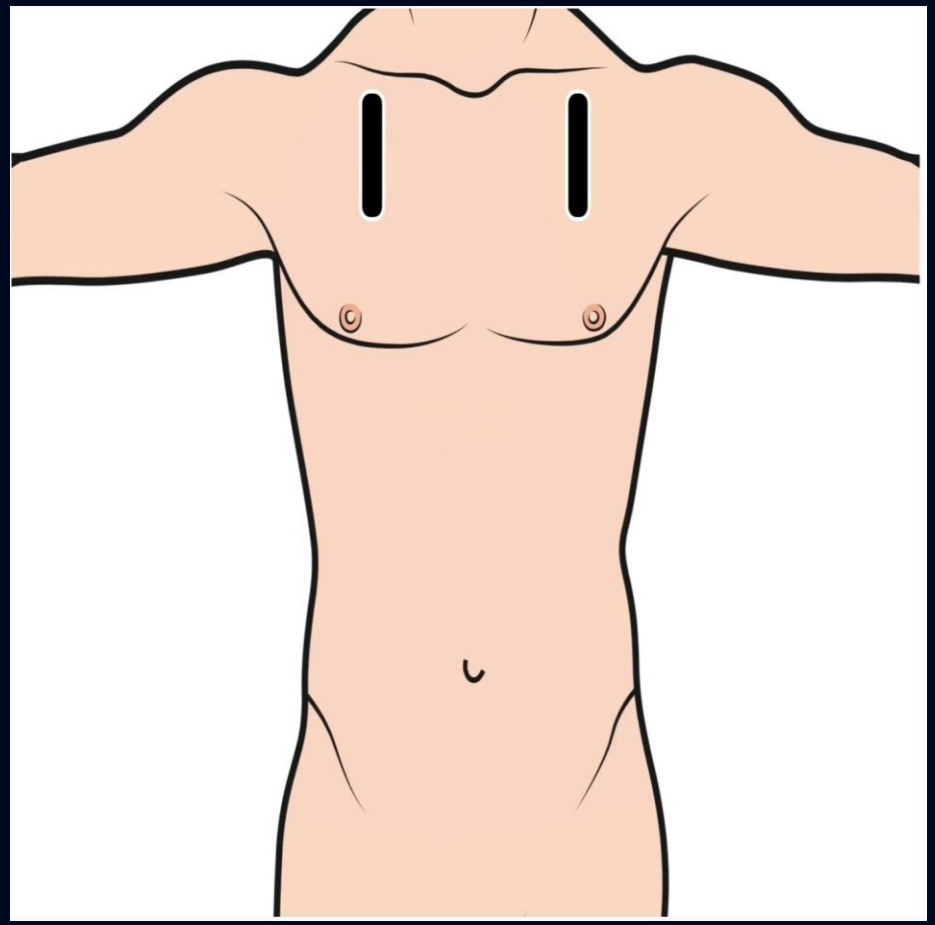
✓ pneumothorax.

- **Three normal findings which absence indicate pneumothorax;**

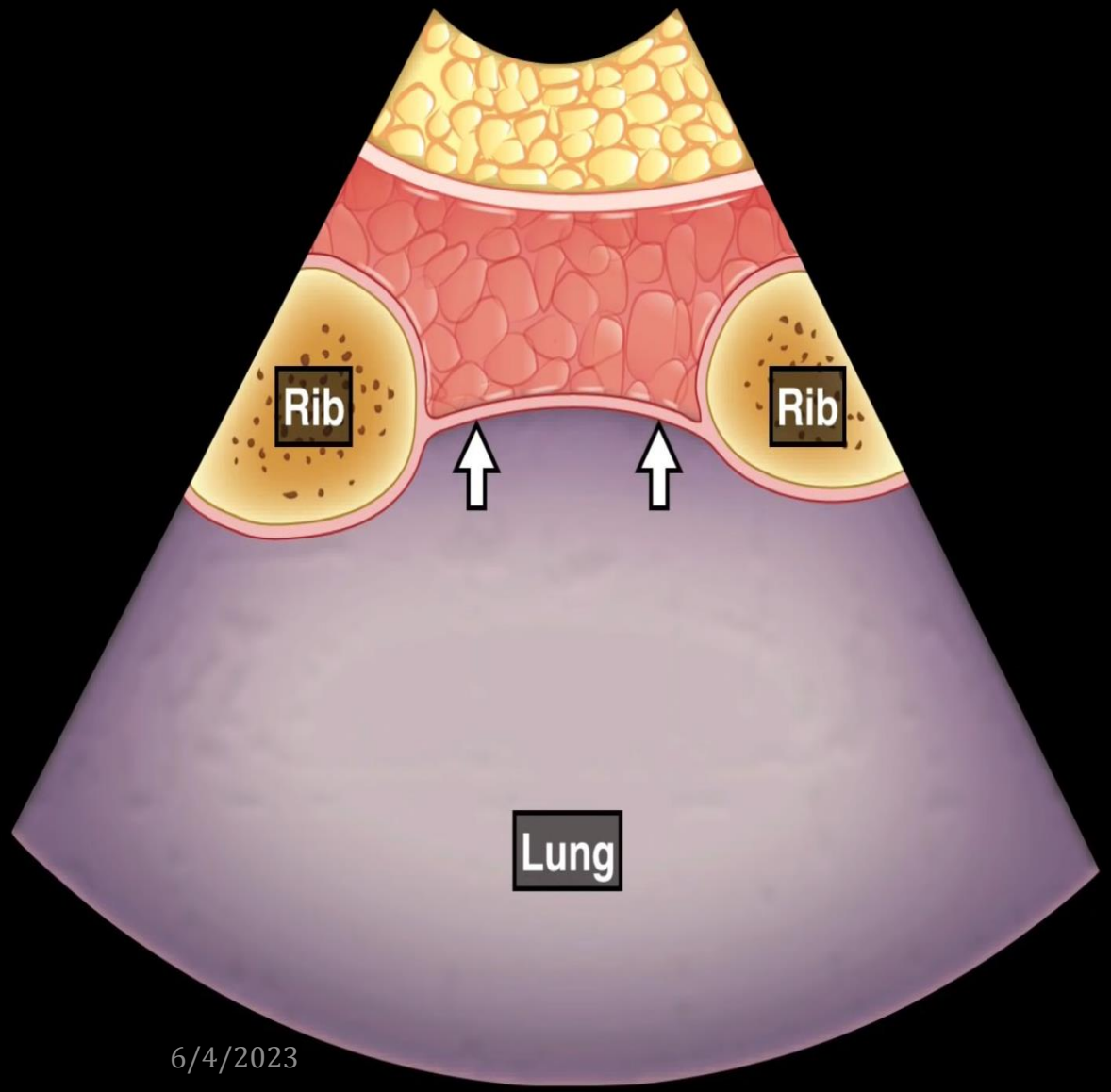
✓ Pleural sliding.(shimmering below pleura , ants on a log)
✓ comet tails.
✓ A lines.

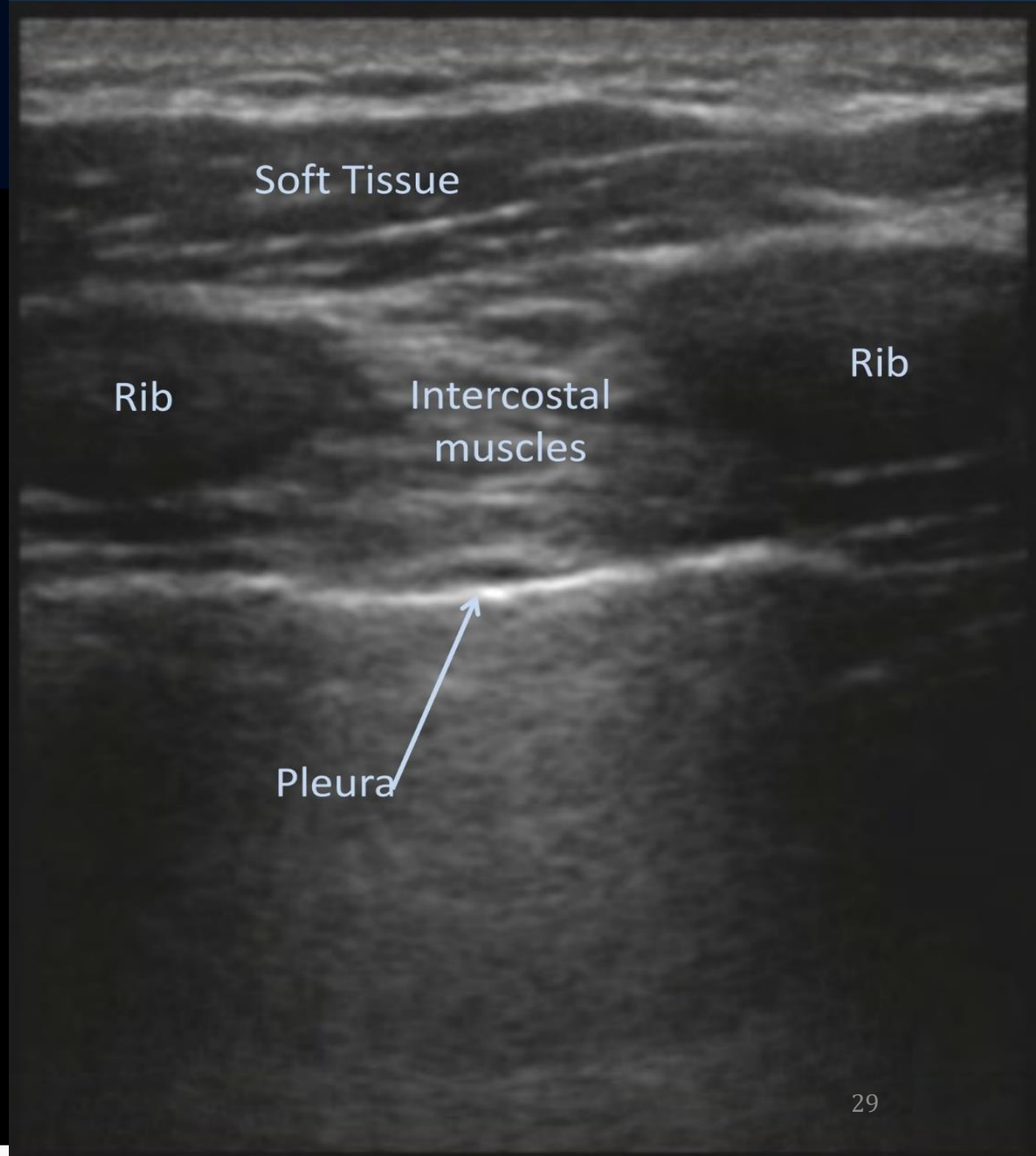
- **M-Mode**

✓ Place cursor on the pleura
✓ Normal lung: “sandy beach”
✓ Pneumothorax: “bar code sign”

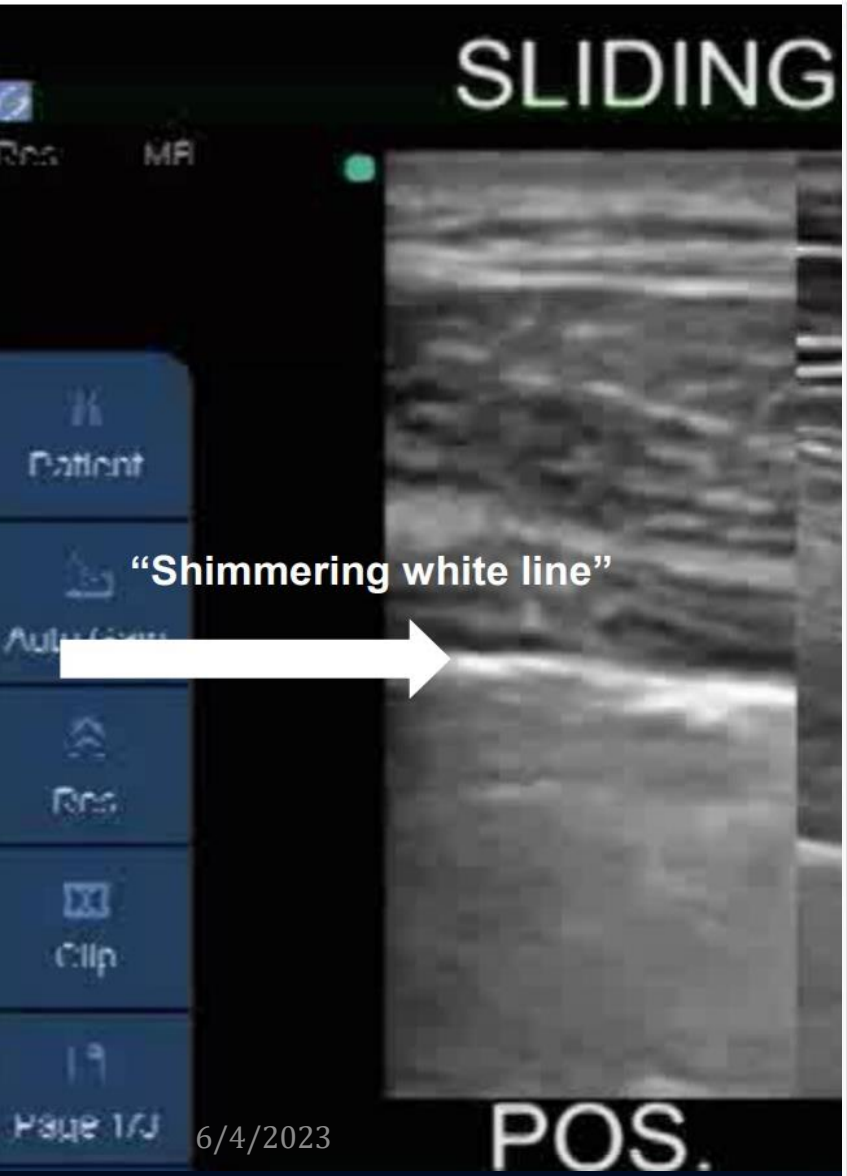


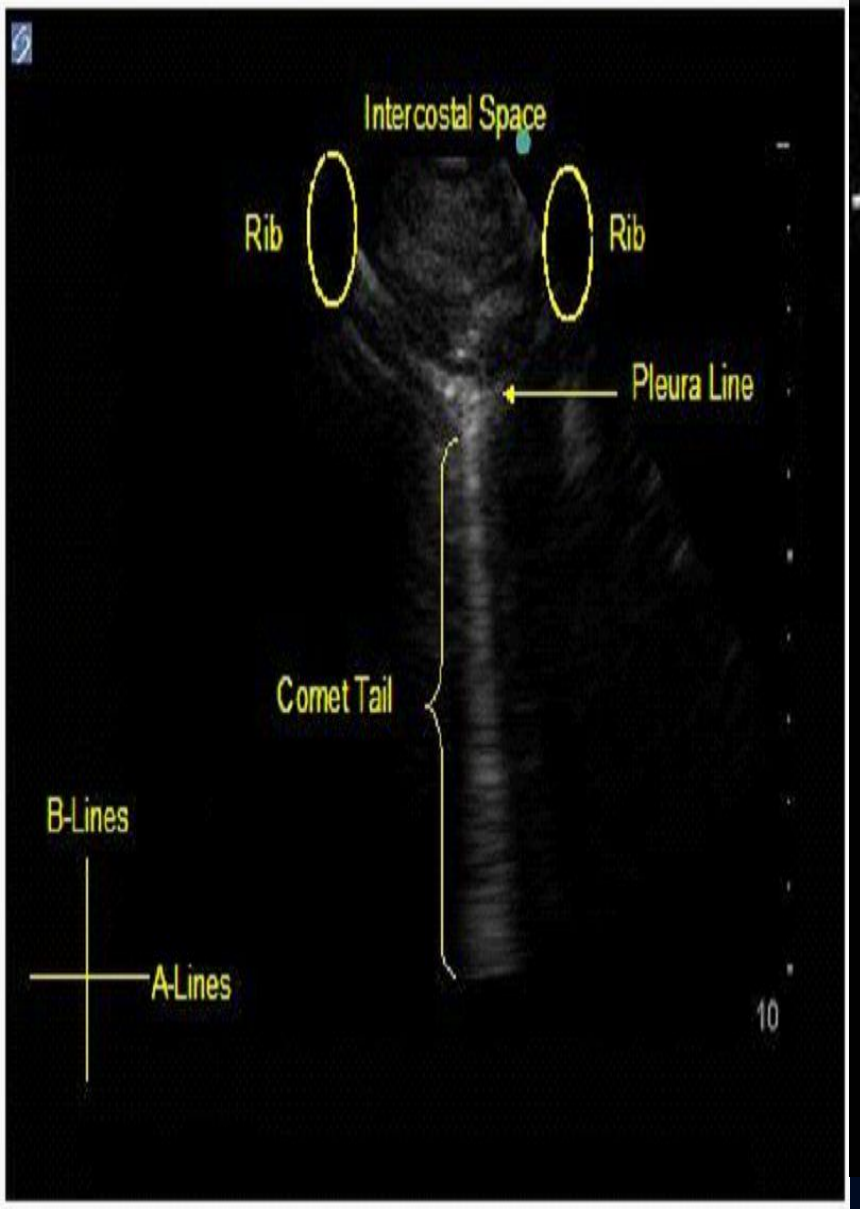
Normal transthoracic view

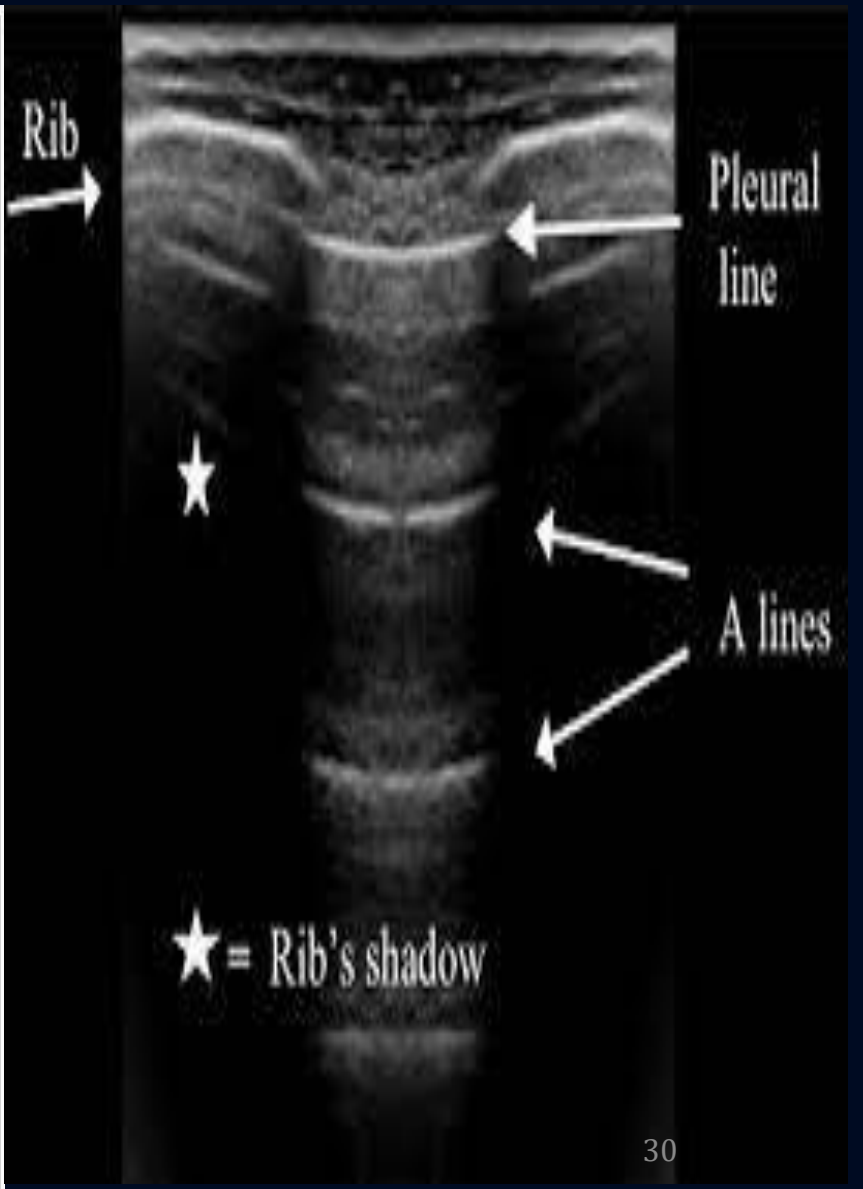


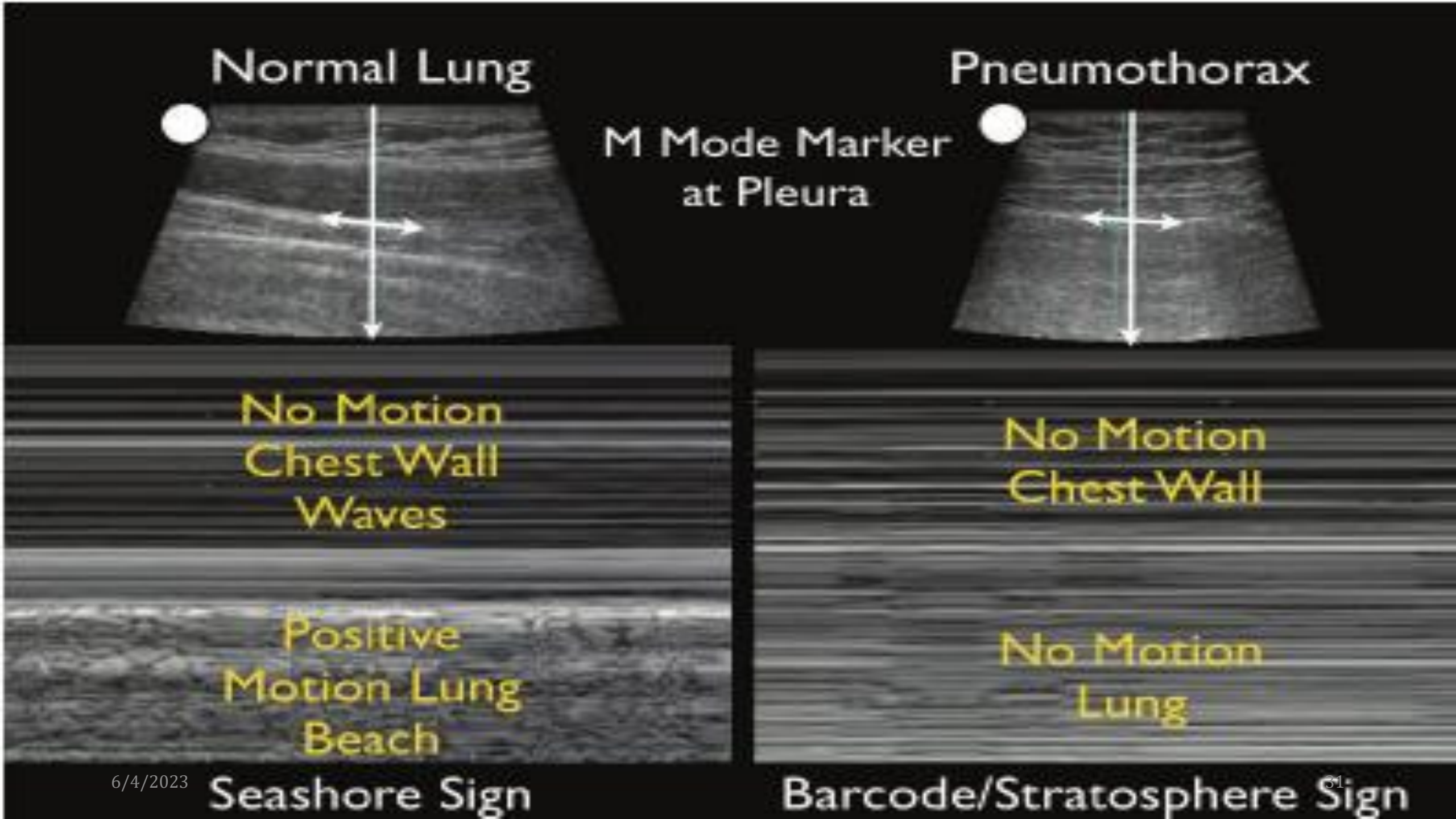


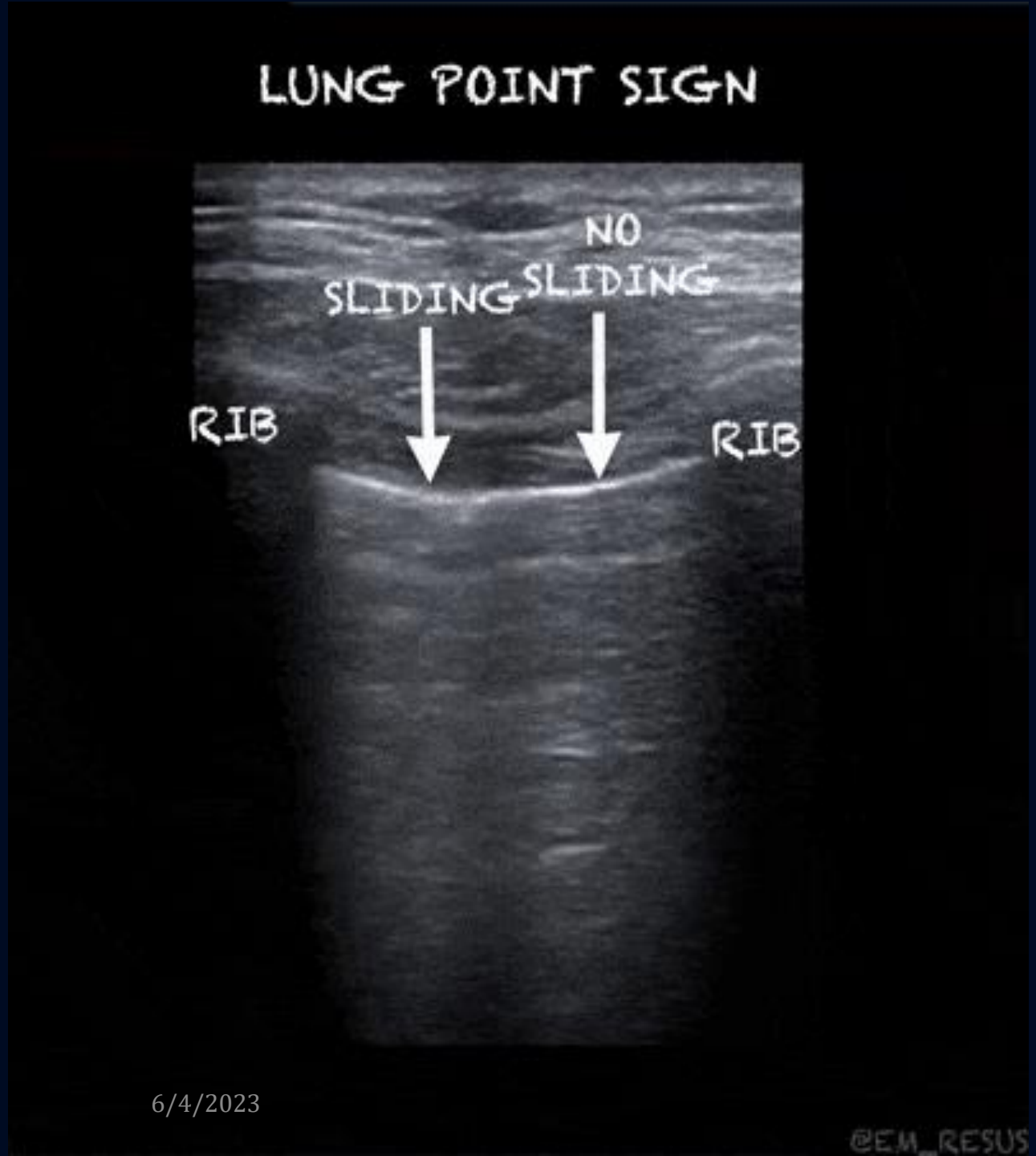
Normal transthoracic view

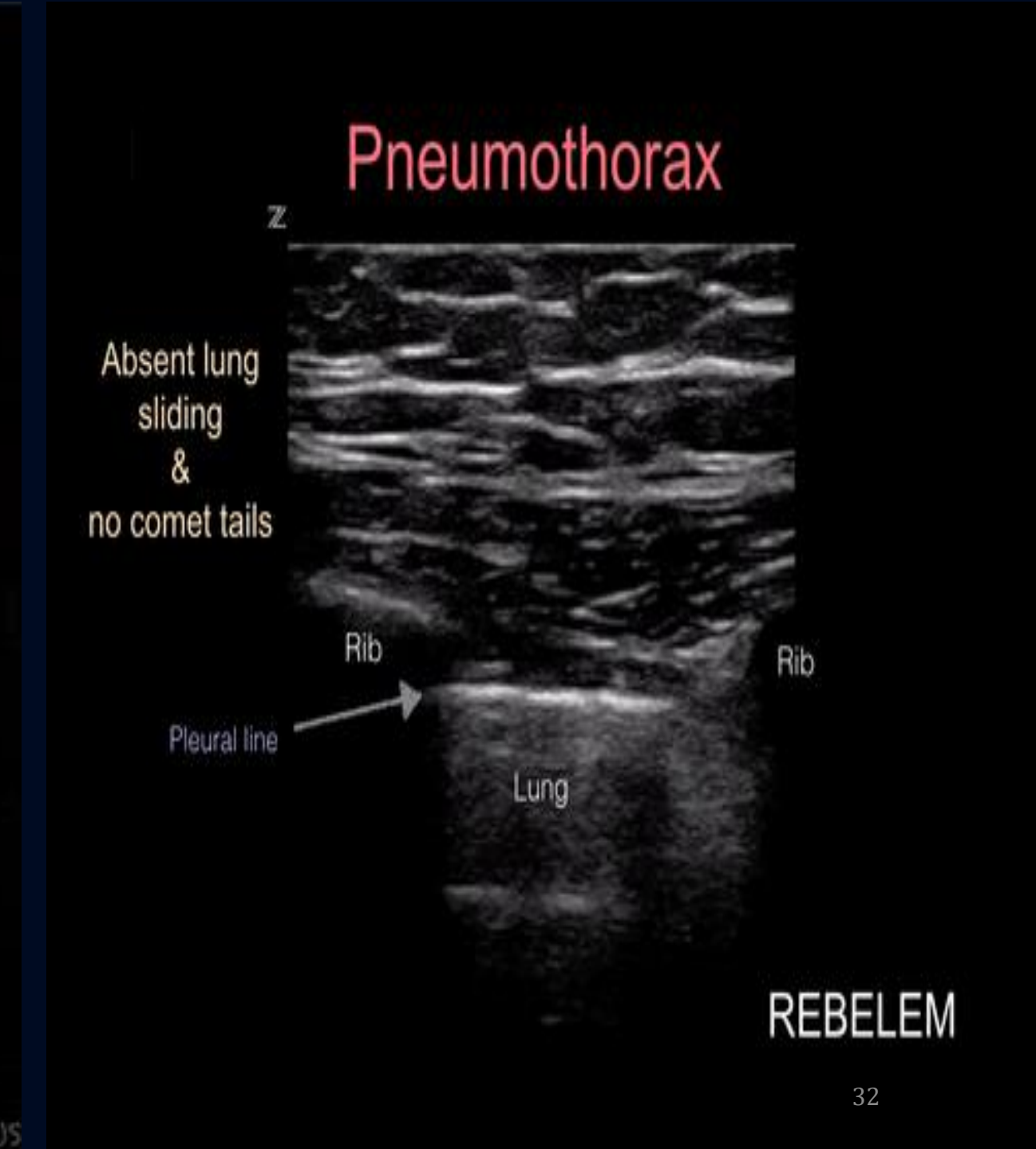







Normal Lung
Pneumothorax
M Mode Marker
at Pleura
No Motion
Chest Wall
Waves
Positive
Motion Lung
Beach
No Motion
Chest Wall
No Motion
Lung
Seashore Sign
Barcode/Stratosphere Sign

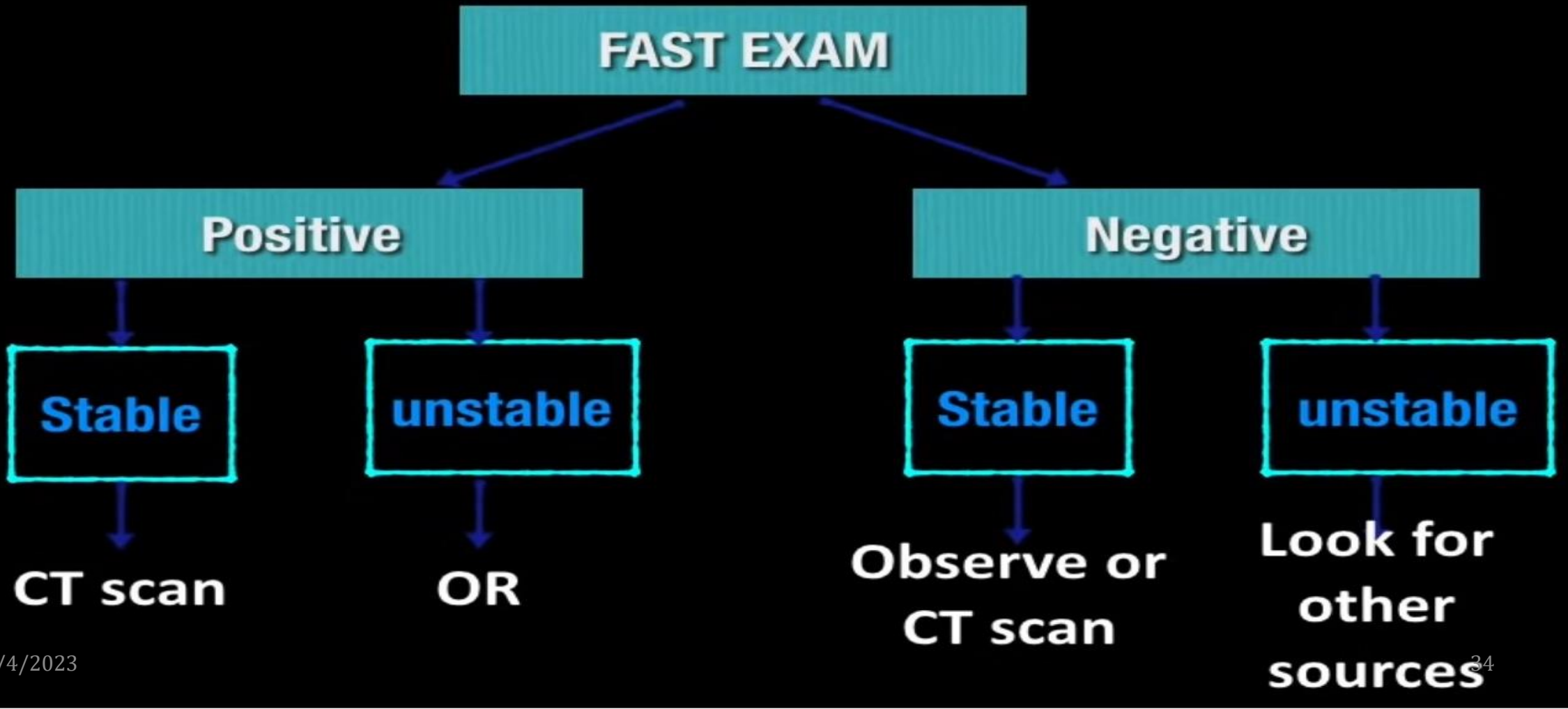

LUNG POINT SIGN
SLIDING
NO SLIDING
RIB
RIB
@EM_RESUS


Pneumothorax
Absent lung sliding & no comet tails
Rib
Rib
Pleural line
Lung
REBELEM

Questions you are trying to answer

1. Intra-peritoneal hemorrhage?
2. Hemothorax?
3. Traumatic pericardial effusion?
4. Pneumothorax?

Proposed Protocol FAST Results from an International



Limitation :

- ✓ Operator dependent.
- ✓Obesity.
- ✓Subcutaneous emphysema.
- ✓Non-specific(type of fluid, origin of the fluid…"Ascites due to chronic illness“) ..
- ✓Generally require greater than 250ml free fluid to be detected.

Warnings and Common Errors

- ✓ Knowledge of surface and underlying anatomy is crucial in determining initial proper placement of transducer.
- ✓ A normal E-FAST examination does not rule out traumatic intra-abdominal injury.
- ✓ Be aware of anatomical variants.

Tips and Tricks

- ✓ Dim the lights if possible to help increase contrast and assist gain adjustment.
- ✓ Decrease the depth when switching from the cardiac to abdominal and then to thoracic views.
- ✓ Remember that not all fluid appears anechoic (e.g, clotted blood may have mixed echogenicity).

REFERENCES

1. Introduction to Bedside Ultrasound: Volume 1 ,Matthew Dawson & Mike Mallin.
2. www.ultrasoundvillage.com
3. Dorothy Habrat, How To Do E-FAST Examination, MSD Manuals, Mar 2021.


ANY
QUESTIONS?