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POCUS Image Archiving

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General principles for taking **Still Images**:

- Ensure that DEPTH is set to keep the area of interest on as much of the screen as possible
- Ensure that GAIN is set to an appropriate level to ensure the best contrast
- For patients with difficult scans, you may need to take multiple images of the same area from different angles
- Although high quality images may not always be possible, you should aim to take the best images you can generate. You want the images to be as clear as possible; tell the story you want to convey. For example "These clips clearly show that the patient did not have any free fluid on eFAST exam" or "These images show a normal kidney with no hydronephrosis"

General principles for taking **Cine Clips:**

- Slowly sweep through the area of interest
- Areas of interest should be swept in two different planes so the dimensions of the area of interest an be appreciated
- Utilize the zoom feature for small areas of interest such as the gestational sac

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Extended Focused Assessment with Sonography for Trauma (eFAST) Examination

A complete FAST exam requires scans of the RUQ, LUQ, and pelvis. The extended FAST (eFAST) adds scans of the anterior thorax to detect pneumothorax

Right Upper Quadrant (RUQ) Exam

Rationale:

The RUQ exam assesses for free fluid, as well as right sided pleural effusions. **Cine Clips** should be used for documentation in order to clearly show the entire interface of interest.

Cine Clip Requirements:

1. Hepatorenal interface:
- must illustrate the double density of kidney
- **entire length of the hepatorenal interface** should be seen including the superior and inferior poles of the kidney as **caudal tip of the liver**. It is often not possible to see the entire interface in one rib space or one clip. In this case, record several clips to visualize the entire interface.
- a slow sweep through the entire interface until the kidney disappears anteriorly and posteriorly

2. Pleural effusion:
- start with diaphragm visualized to at least "9 o clock"
- center the diaphragm on screen and record for two patient breaths

In the RUQ, free intra-peritoneal (IP) fluid tends to accumulate in Morrison's pouch (along the hepatorenal interface). It is not necessary to see the diaphragm to exclude IP fluid. However, visualizing the diaphragm allows you to exclude pleural fluid.

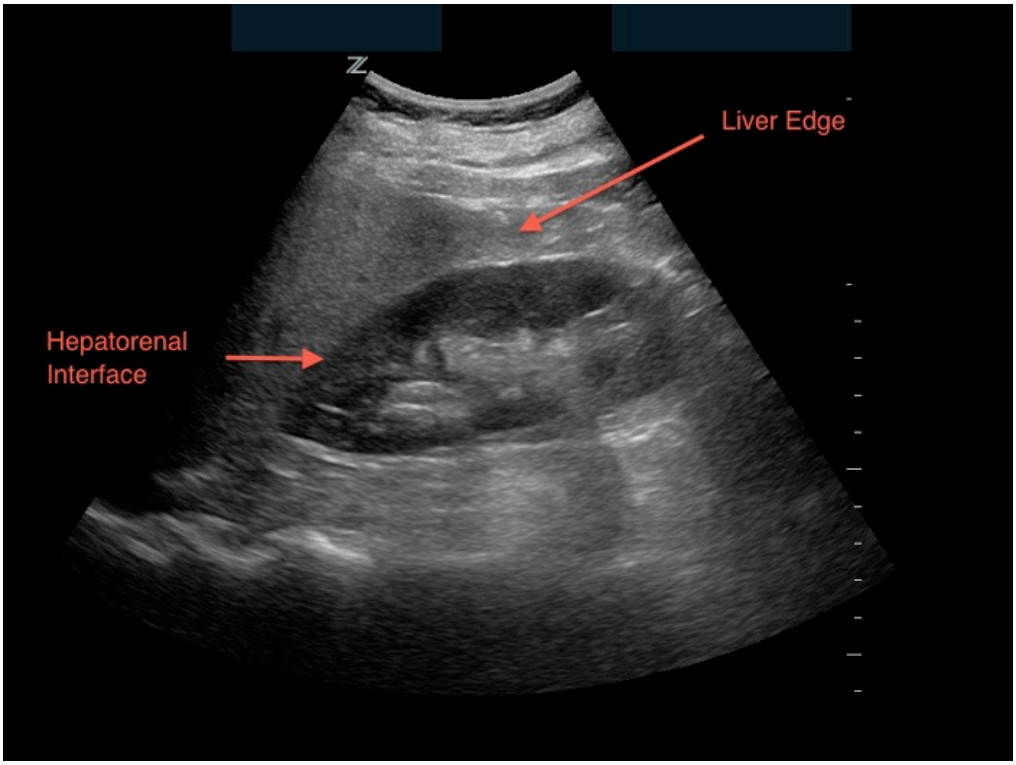


Fig 1: RUQ Scan - entire hepatorenal interface along with liver edge seen.

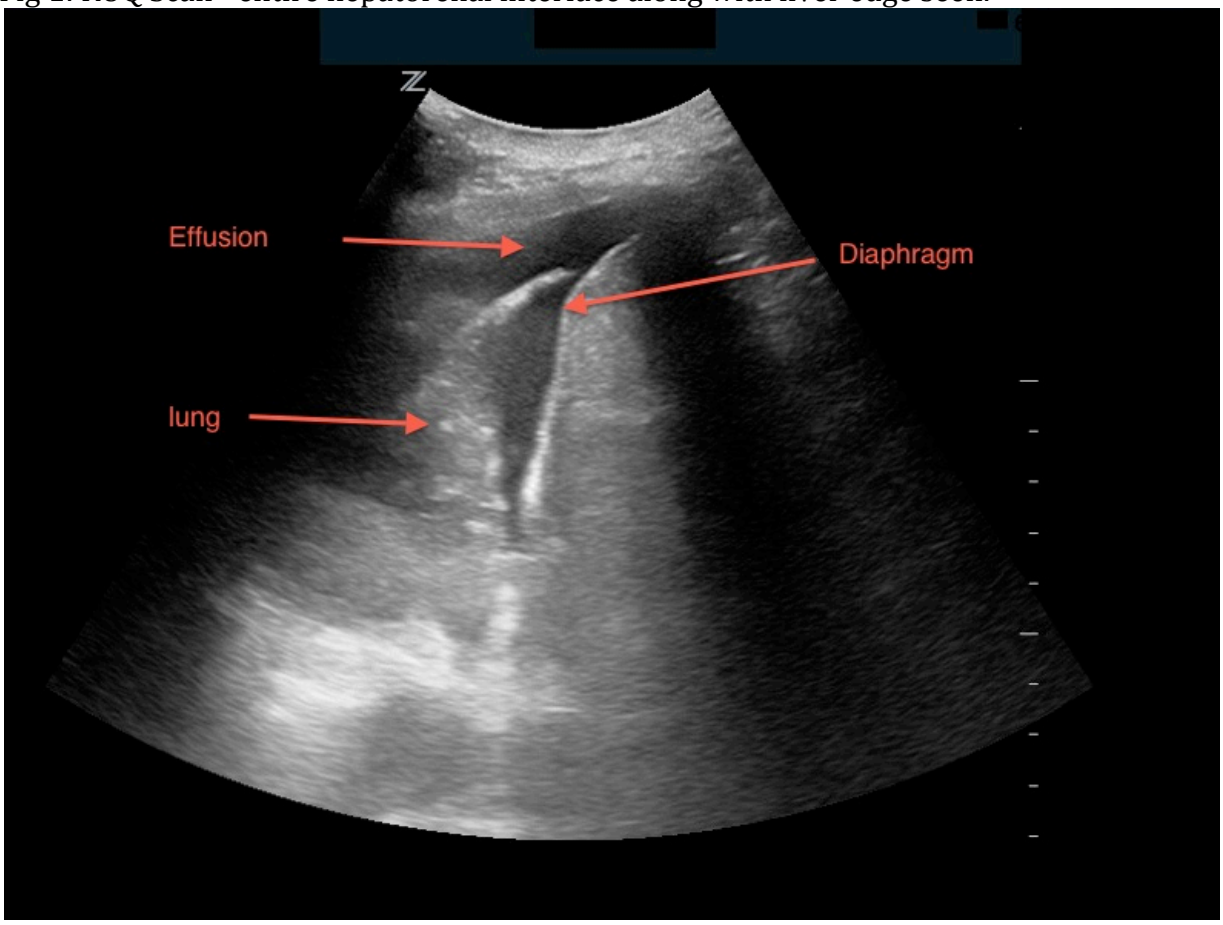


Fig 2: RUQ Scan - pleural effusion seen

Left Upper Quadrant (LUQ) Exam

Rationale:

The LUQ exam assesses for free fluid, as well as left sided pleural effusions. The first location that free fluid shows up in the abdomen is between the *diaphragm and the spleen*. Therefore, to exclude IP fluid in the LUQ, you must visualize the spleno-renal interface *and* the diaphragm to 9 o'clock. **Cine Clips** should be used for documentation in order to clearly show the entire interface of interest.

Cine Clip Requirements:

1. Splenorenal interface
- the entire interface is visualized including the tip of the spleen. (This may require taking several clips in patients with difficult scans to get the entire interface visualized)
- a slow sweep through the entire interface until the kidney disappears anteriorly and posteriorly

2. Diaphragm-spleen interface:
- the diaphragm is seen up to "9 o'clock"
- slowly sweep through the entire interface in the AP plane

2. Pleural effusion:
- start with diaphragm visualized to at least "9 o clock"
- center the diaphragm on screen and record for two patient breaths

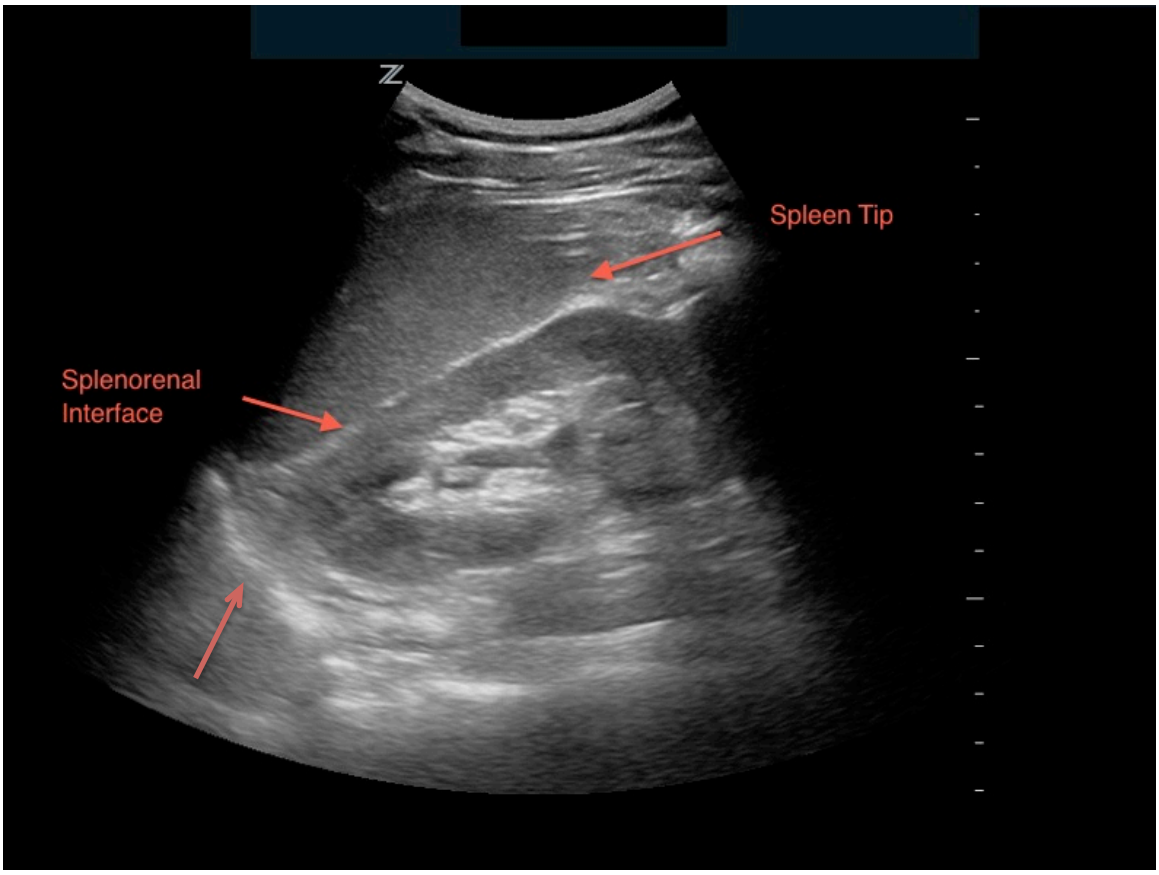


Fig 3: LUQ Scan - no free fluid

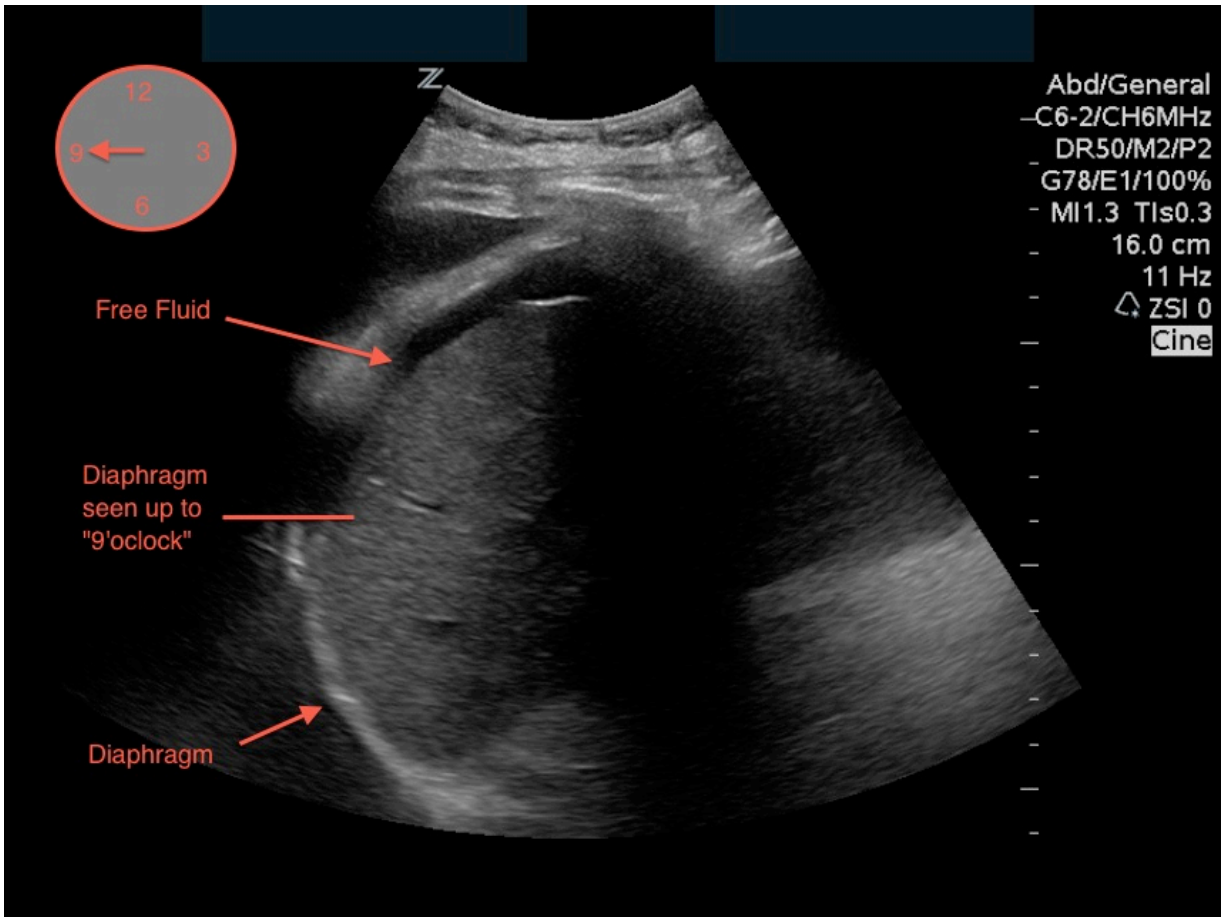


Fig 4: LUQ Scan - Diaphragm-Spleen interface seen to “9 o’clock”. Free fluid visualized

PELVIS Exam

Rationale:

The pelvis is examined for free fluid. **Cine Clips** should be used for documentation.

Cine Clip Requirements:

1. Pelvis Transverse:

- center the bladder on the screen
- sweep through rectovesicular pouch (males) or rectouterine/uterovesicular pouches (females) until bladder disappears either direction

2. Pelvis Sagittal:

- sweep through until bladder (and uterus) disappear in either direction

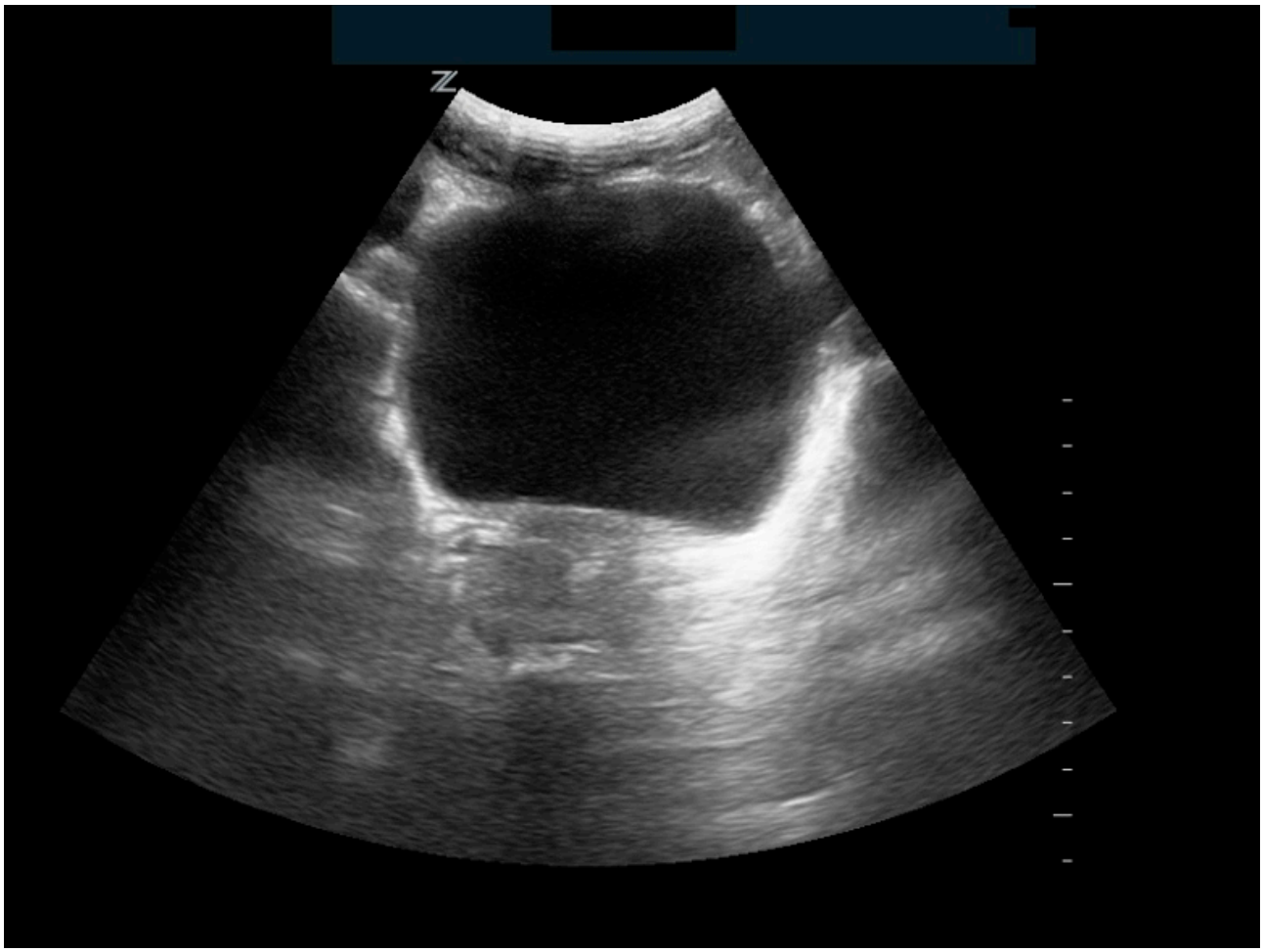


Fig 5: Bladder in Transverse Plane

Fig 6: Bladder in Saggital Plane

eFAST Cardiac and Lung Scans

Please see Cardiac POCUS Examination: ‘Subxiphoid and Parasternal Long View’ for the eFAST Cardiac scan image requirements

Please see Lung POCUS Examination: ‘Rule our pneumothorax’ for the eFAST Lung scan image requirements

Cardiac POCUS Examination

Rationale:

The Cardiac POCUS examination can be used to assess for a pericardial effusion, contractility of the ventricles, and LV/RV size determination. It is important to take **Cine Clips** of the various windows of the heart, as they are necessary to convey information about pathology. The curvilinear probe may give the best images of the subxiphoid region, whereas the phased array probe will often give the best images of the parasternal long, parasternal short, and apical 4 chamber.

Basic Cine Clip Requirements:

1. Subxiphoid View

- "7" sign of the inferior ventricle wall and septum is visible
- able to see the superior aspect of the entire pericardium
- sweep anteriorly and posteriorly until heart disappears in either direction

2. Parasternal Long Axis

- center the descending aorta, mitral valve, aortic valve on the screen
- clearly show left ventricle, right ventricle outflow tract, left atrium, aortic outflow tract

*Note: The marker changes sides with the cardiac settings using the phased array probe (cardiac probe)

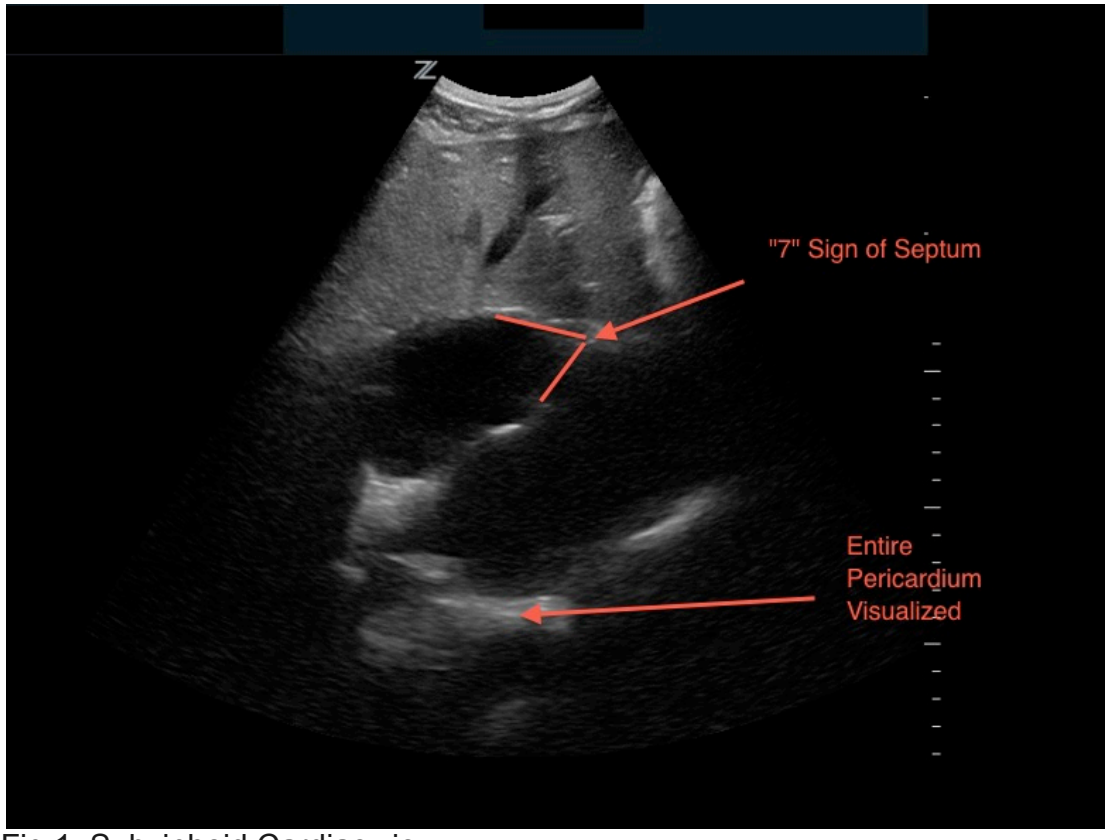


Fig 1: Subxiphoid Cardiac view

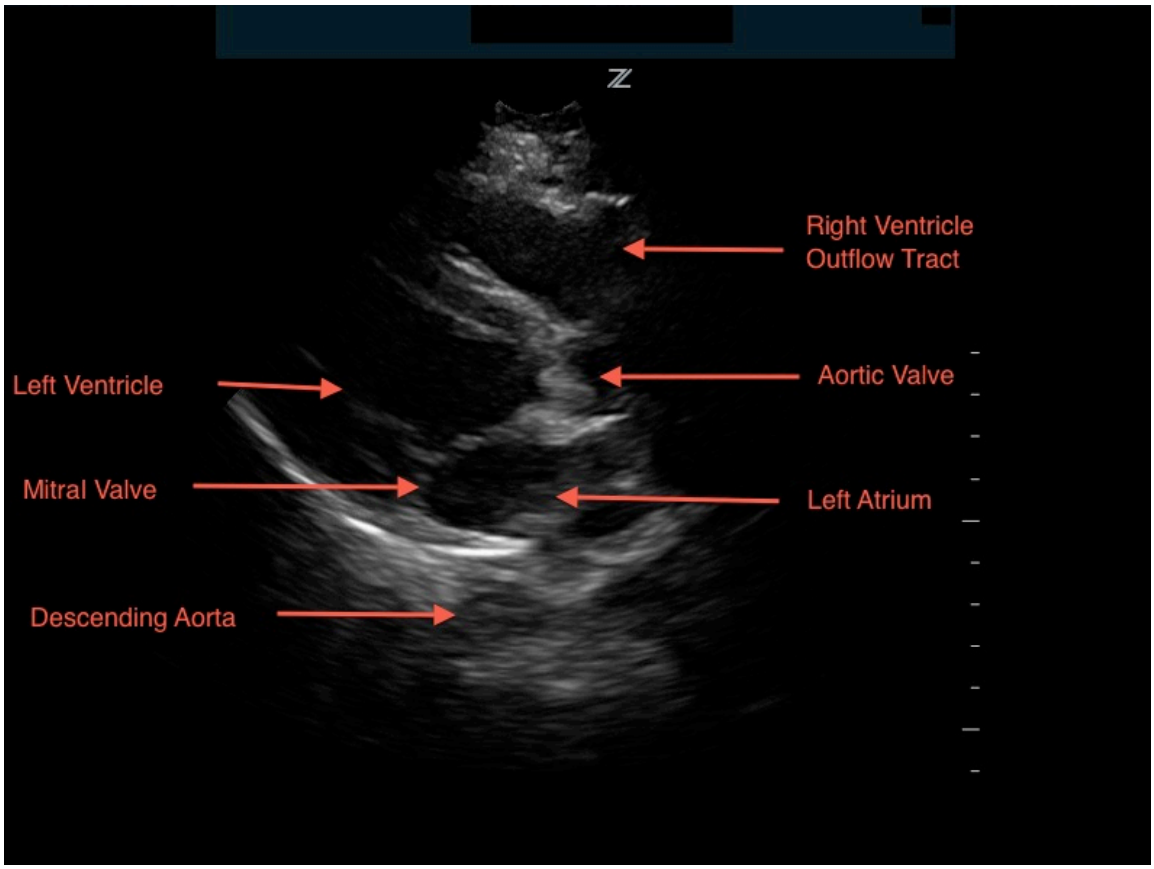


Fig 2: Cardiac Parasternal Long Axis

Advanced Cine Clip Requirements:

1. Parasternal Short Axis

- find papillary muscles and ensure true transverse (heart is circular in true transverse)
- record for 3 cardiac contractions

2. Apical 4 Chamber View

- left ventricle, right ventricle, left atrium, right atrium, tricuspid valve, mitral valve all clearly seen
- record for 3 cardiac contractions

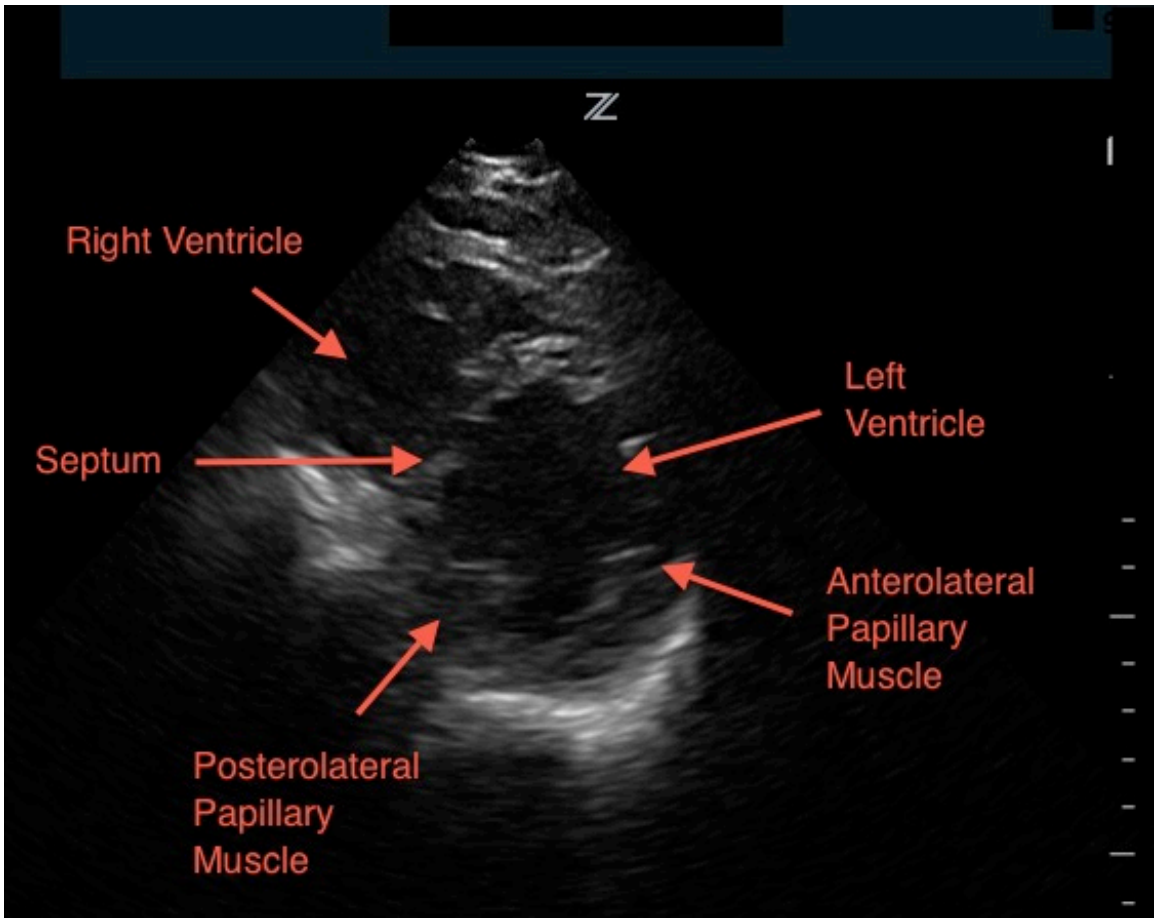


Fig 3: Cardiac Parasternal Short Axis

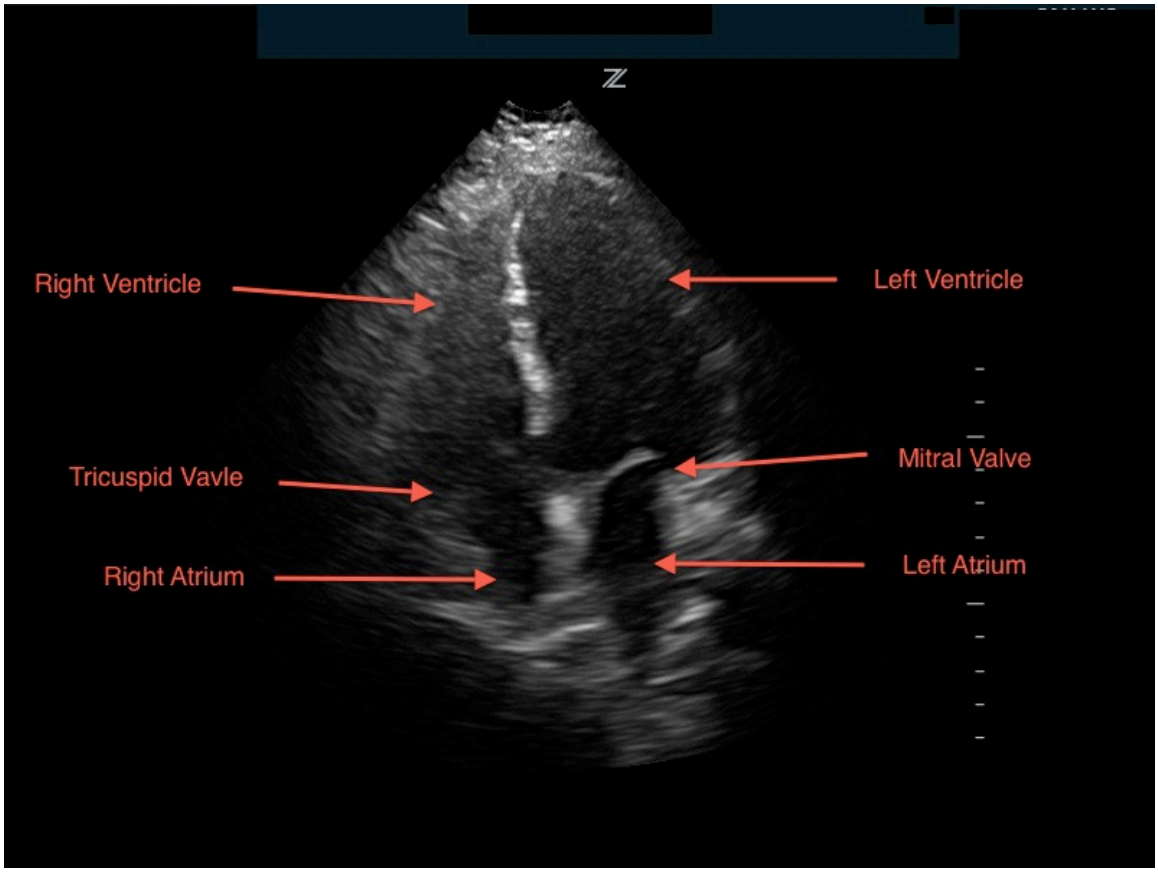


Fig 4: Cardiac Apical 4 Chamber

IVC POCUS Examination

Rationale:

The IVC exam is useful to assess a patient's intravascular fluid tolerance when decisions about administering more IV fluids are being contemplated. The initial landmark view is a transverse still image of the IVC and aorta in the subxyphoid region (figure 1). The next view should be EITHER a longitudinal **M-Mode image** (figure 2) or a longitudinal **Cine Clip** of the IVC. Take care not to apply too much pressure to the probe and falsely 'collapse' the IVC.

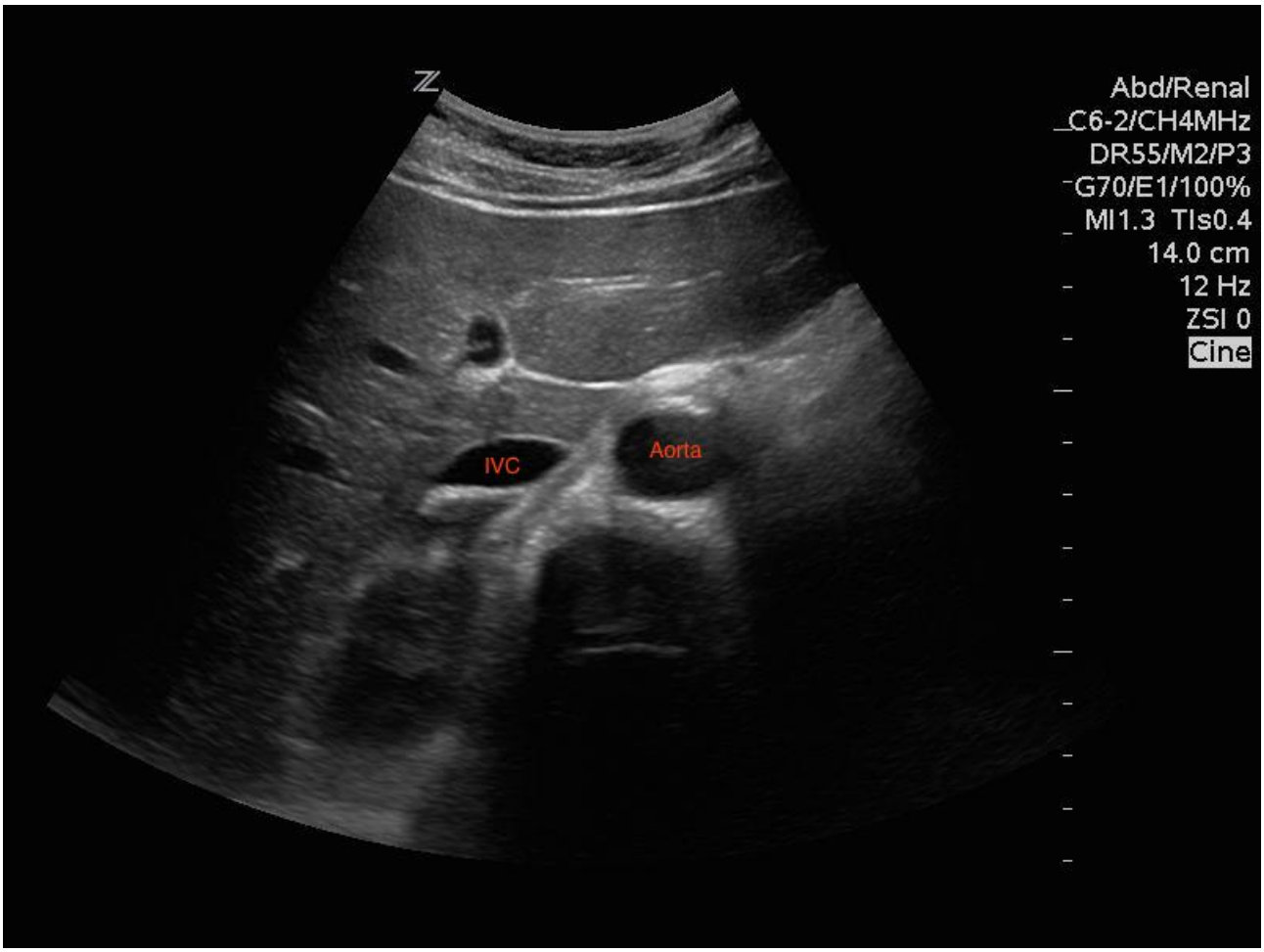


Figure 1: Transverse view showing the IVC and aorta in cross section.

M-Mode Image Requirements:

- In the sagittal plane, show right atrium connecting with the IVC at the level of the diaphragm
- measure IVC at level approximately 3cm distal to the diaphragm or 2cm distal to the middle hepatic vein
- To use M-Mode, place the cursor perpendicular to the IVC and record a still image.
- Measure the IVC in inspiration and expiration

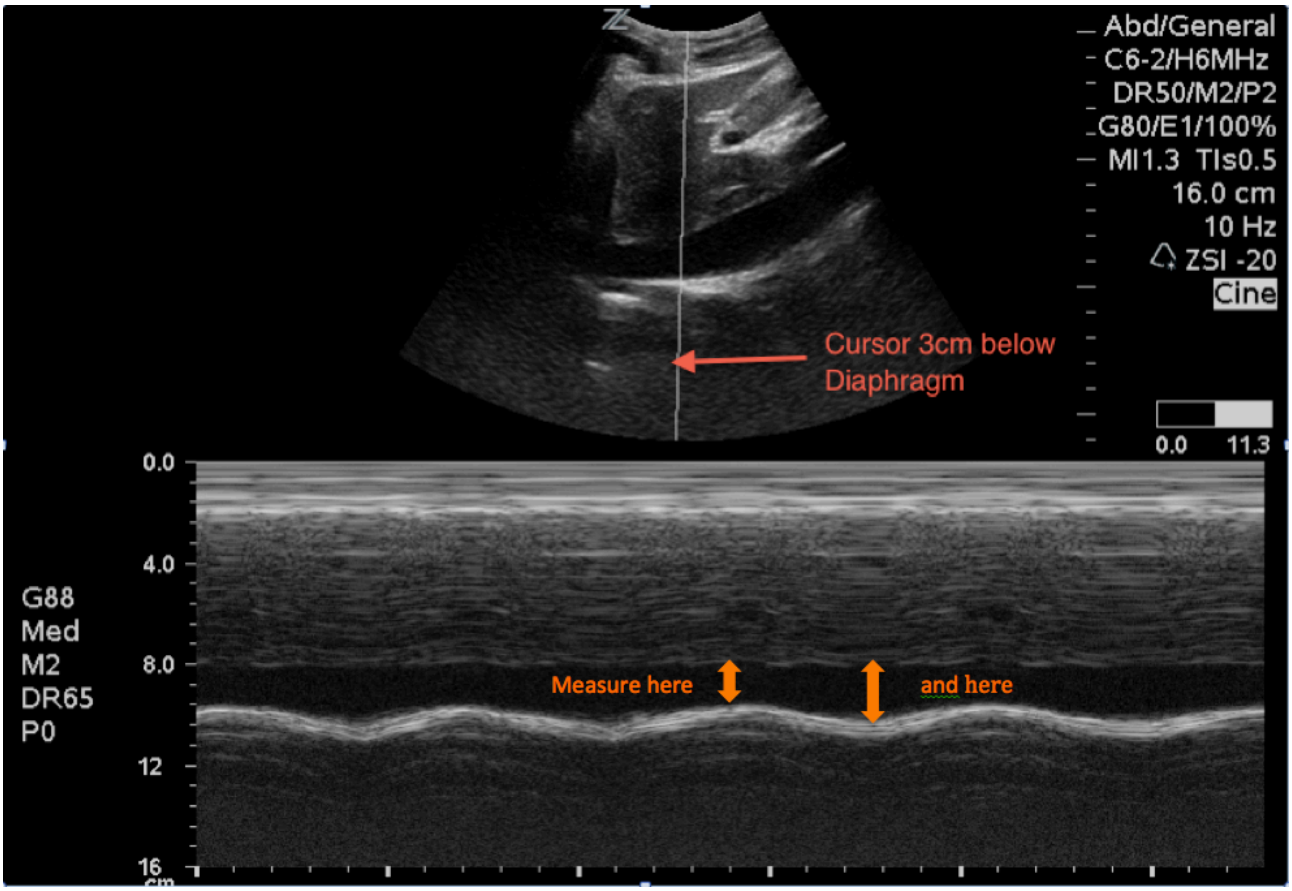


Fig 2: M-Mode of the IVC measured 3cm below the diaphragm and perpendicular to the IVC

Cine Clip Requirements:

- In longitudinal view show right atrium connecting to the IVC at the level of the diaphragm
- Show the IVC at the level 3cm inferior to the diaphragm or 2 cm distal to the hepatic viens
- Record a cine clip for two breaths to show changes in the IVC diameter with respirations

Aorta POCUS Examination

Rationale:

The Aorta exam is used to assess the size of the aorta and rule out a AAA. **Still images** may be used to document a normal aorta or a AAA.

Still Image Requirements:

1. SHORT axis

- show spine with shadow
- show aorta centered on screen
- measure aorta at its largest diameter
- may put calipers on still image and measure from anterior to posterior walls
- begin your scan at the xiphoid and end at the bifurcation
- must record images at the proximal (liver usually seen), mid, distal aorta (bifurcation)

2. LONG axis (if aneurysm is present)

- ensure aorta is centered in image
- purpose of this image is to show length of an aneurysm
- must record images of the proximal, mid, distal aorta

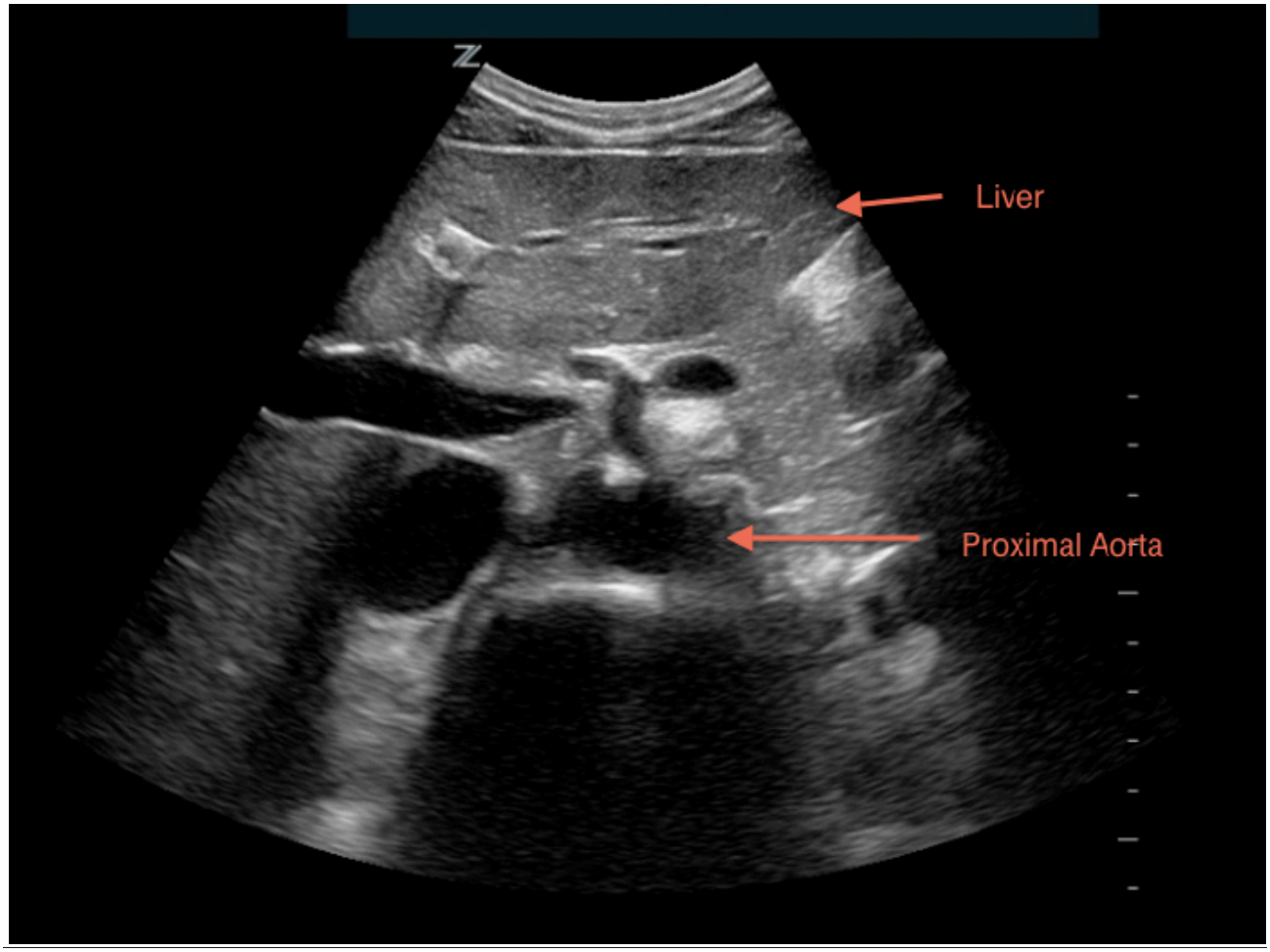


Fig 1: Proximal Aorta in short axis - liver visualized

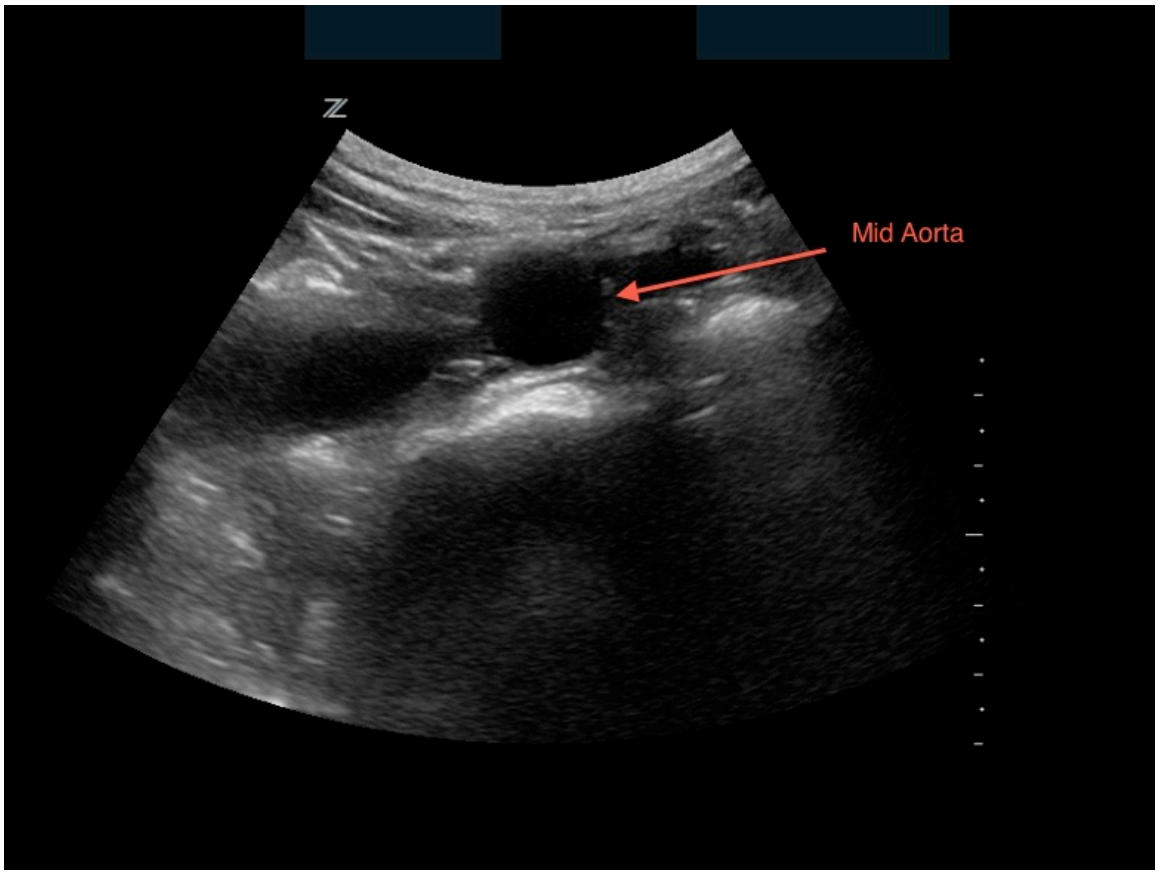


Fig 2: Middle Aorta in short axis

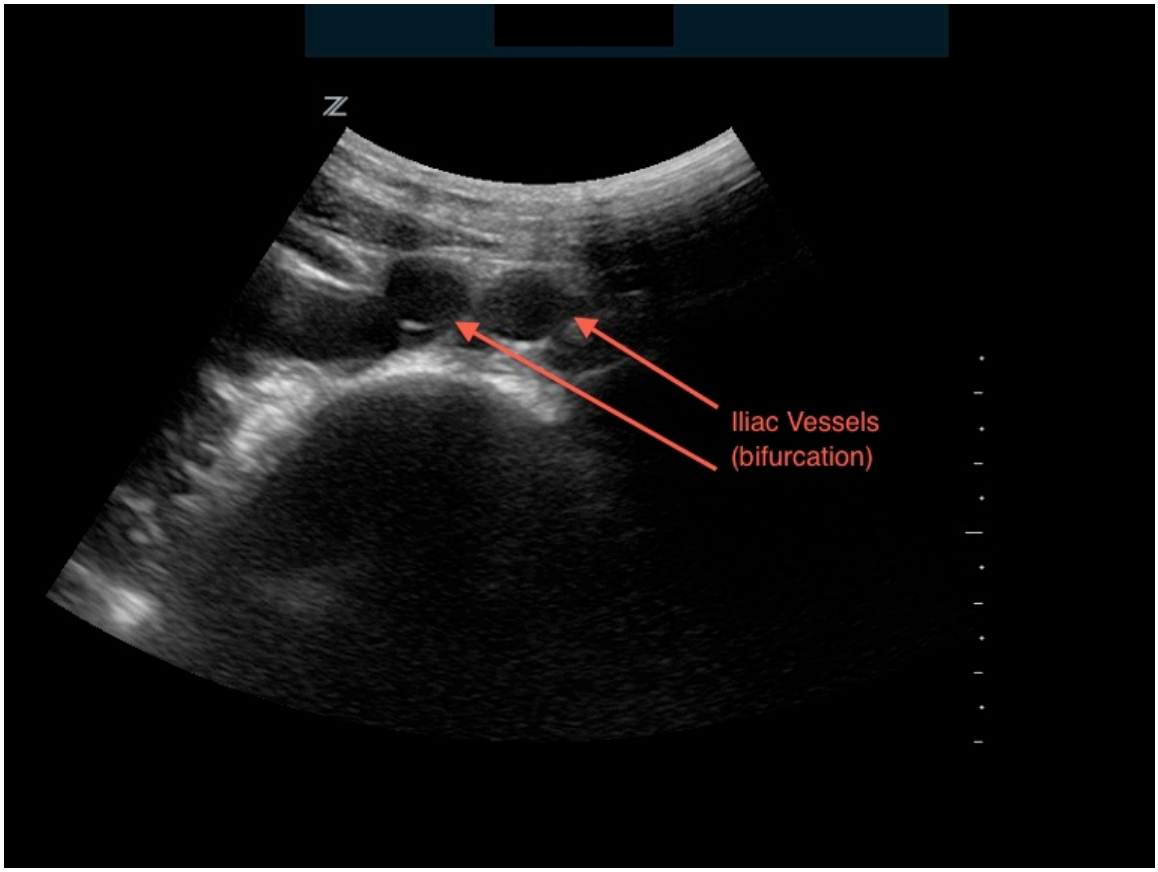


Fig 3: Distal Aorta in short axis - bifurcation seen with the iliac vessels

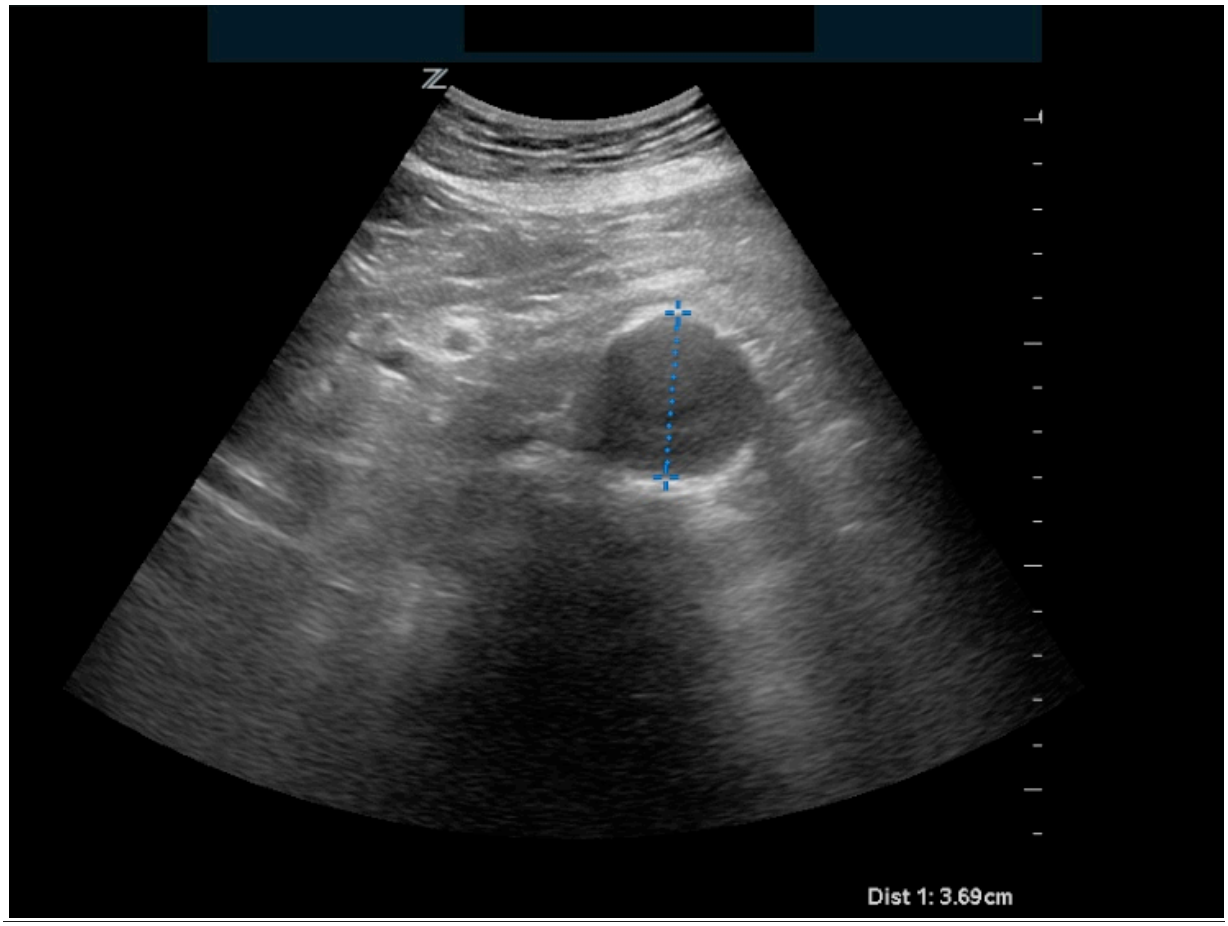


Fig 4: Aorta in short axis - 3.69cm aortic aneurysm seen

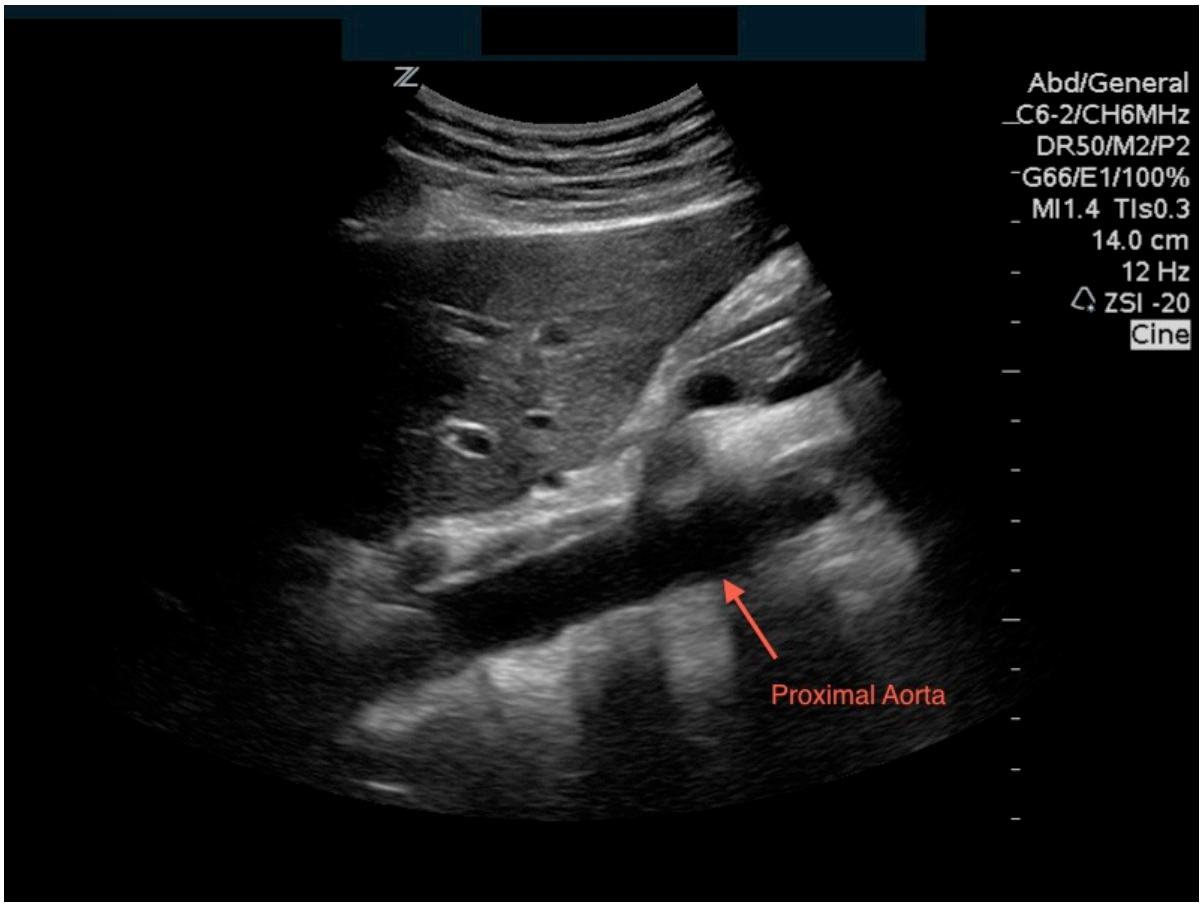


Fig 5: Proximal Aorta in long axis

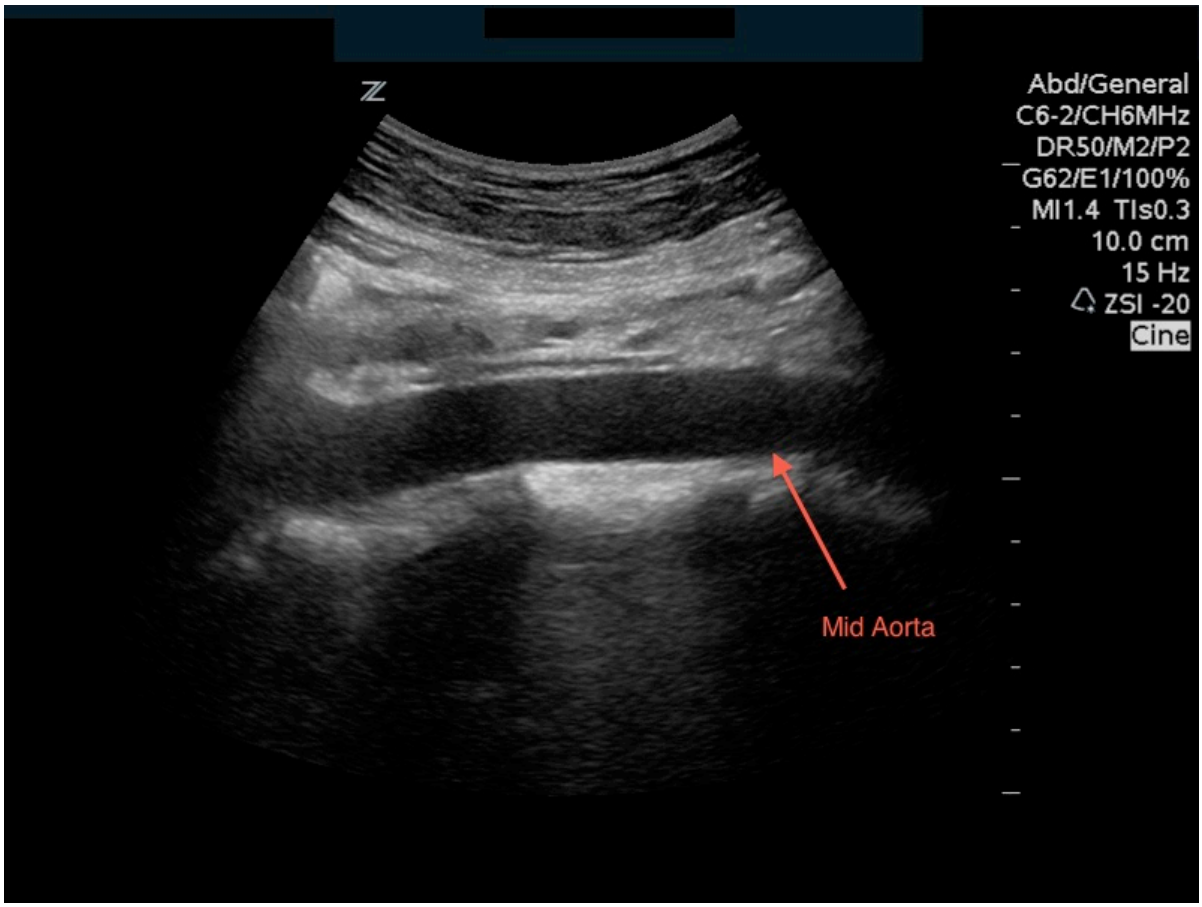


Fig 6: Middle Aorta in long axis

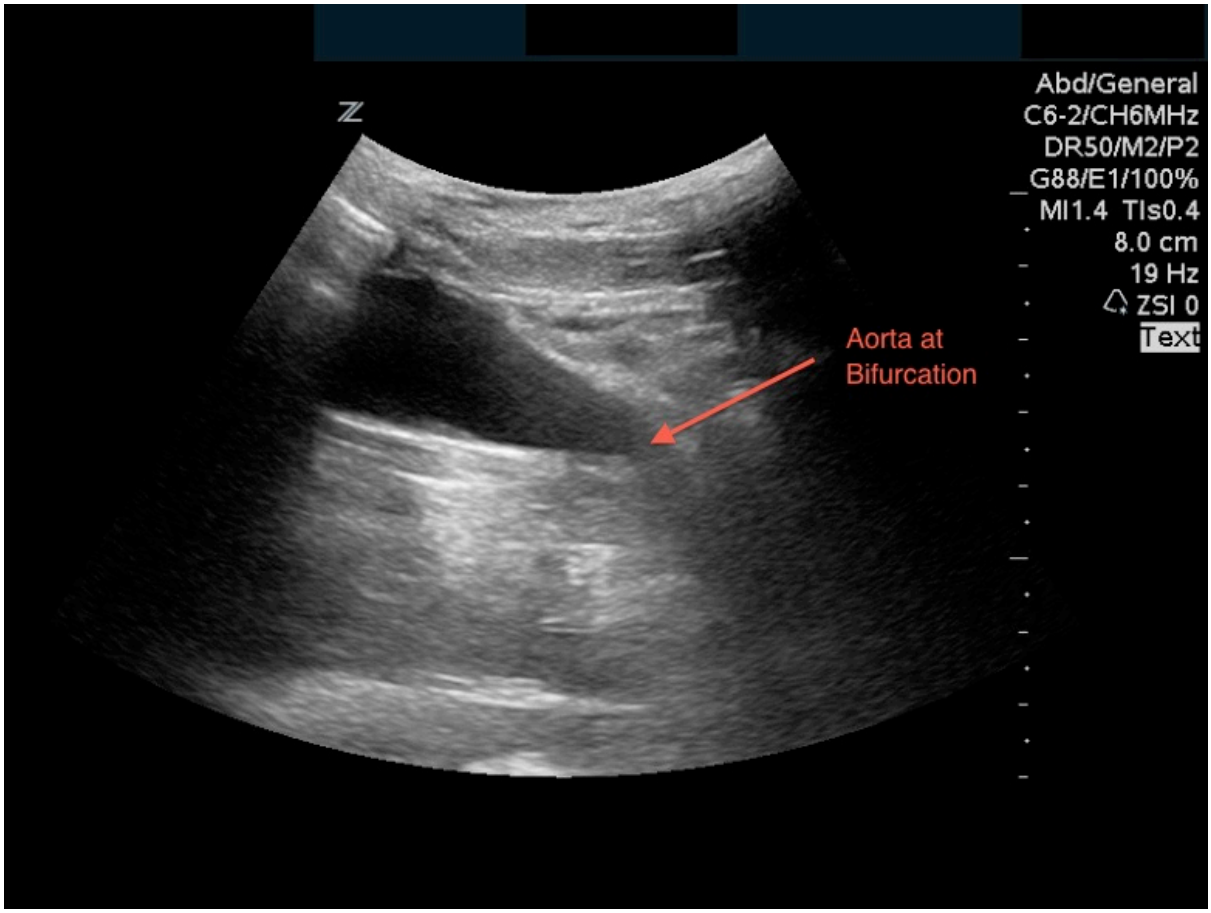


Fig 7: Distal Aorta in long axis - notice how it tapers at the level of the bifurcation

Lung POCUS Examination

Rationale:

The Lung POCUS exam can be used to rule out a pneumothorax and to assess for pulmonary edema**. Cine Clips** should be taken for each of these indications.

Clip Requirements:

1. Rule out Pneumothorax (Right Lung/Left Lung) - Use Linear/Phased/or Curvilinear Transducer

- place probe to anterior chest wall at the midclavicular line at the intercostal space between ribs 2-3 or 3-4 or the most anterior aspect of the chest in a supine patient
- two ribs with shadows should be seen on either side of the screen
- the pleural line should be seen between the two ribs
- record for two breaths to clearly show lung sliding +/- z lines (aka comet tails)

2. Pulmonary Edema - Use Linear/Phased/or CurvilinearTransducer

- probe should be placed between two ribs in the designated areas (see Fig 2)
- record for two breaths to clearly show B lines moving back and forth onto the screen
- if positive for B lines, need to record clips from zones 1 and 2 bilaterally
- if negative, should record clips in zones 3 and 4 bilaterally

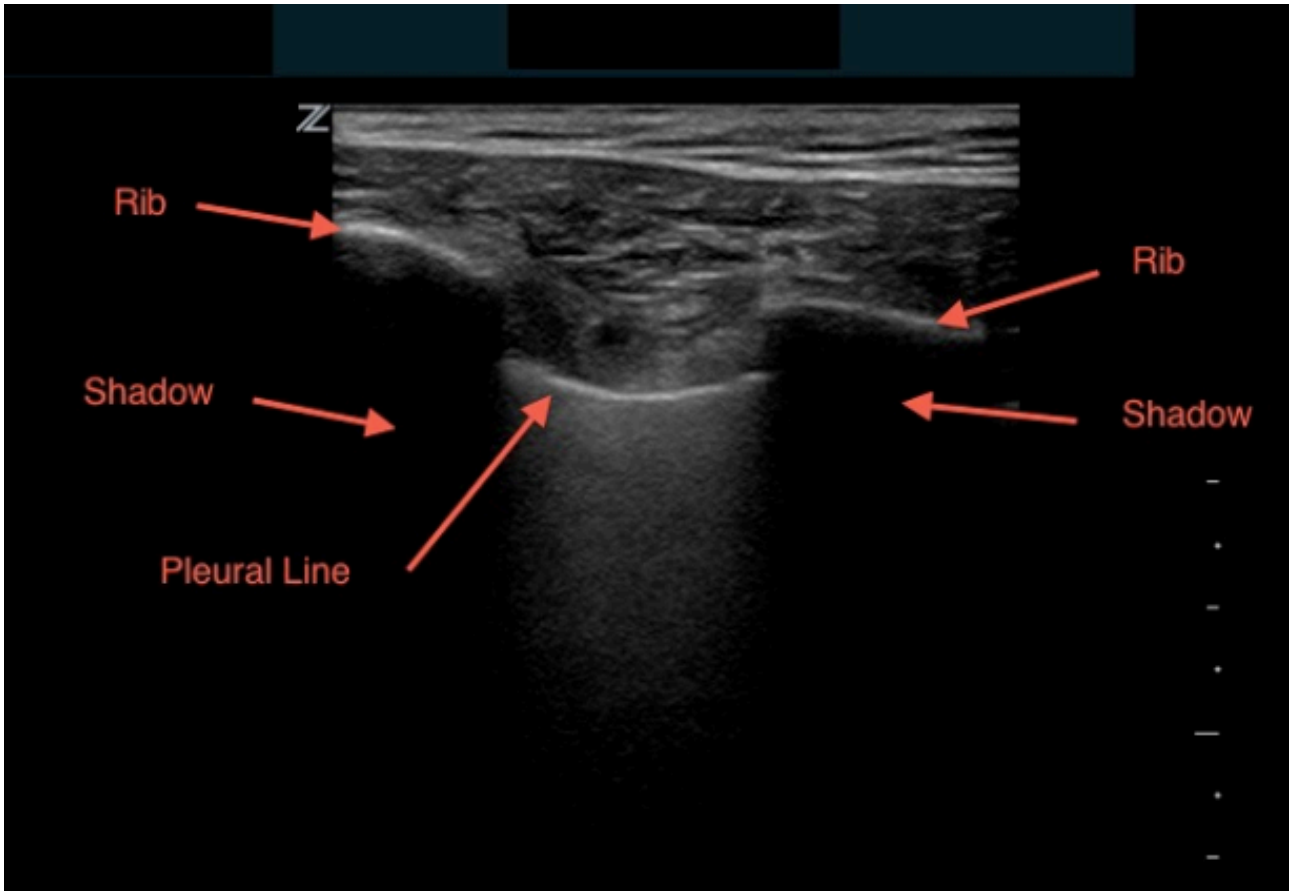


Fig 1: Pneumothorax scan

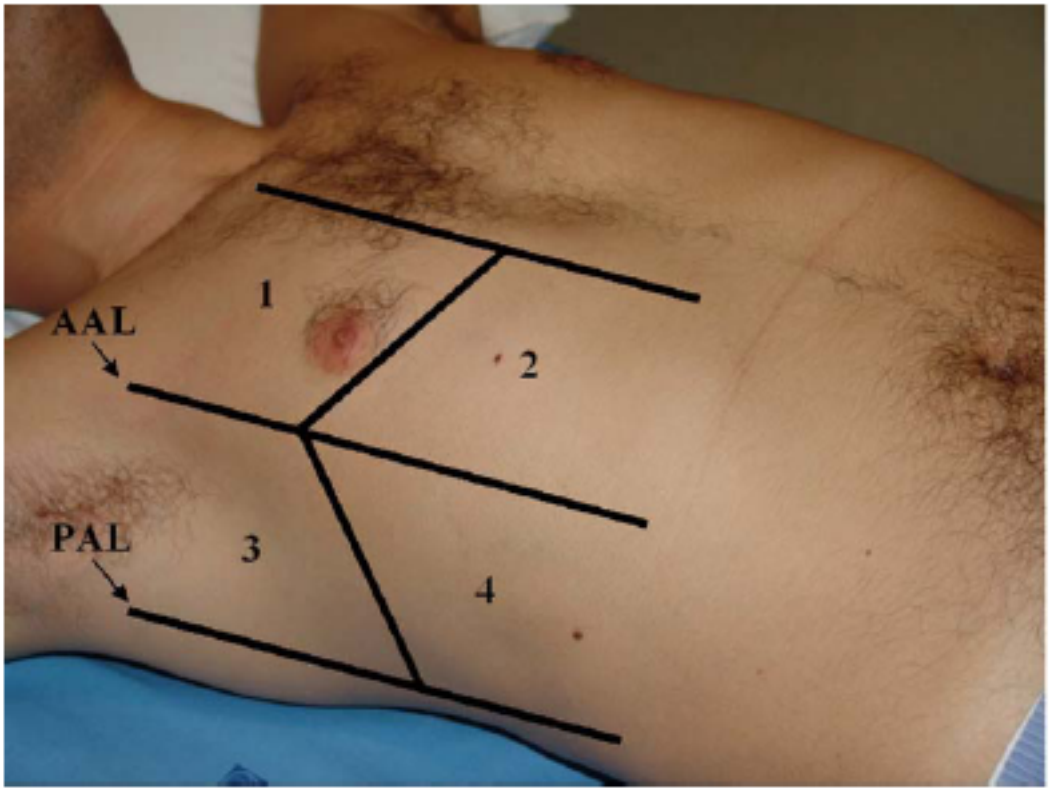


Fig 2: The lung consists of 8 zones total (4 each side). AAL = anterior axillary line, PAL = Posterior axillary line. Source: Volpicelli, G. (2006)

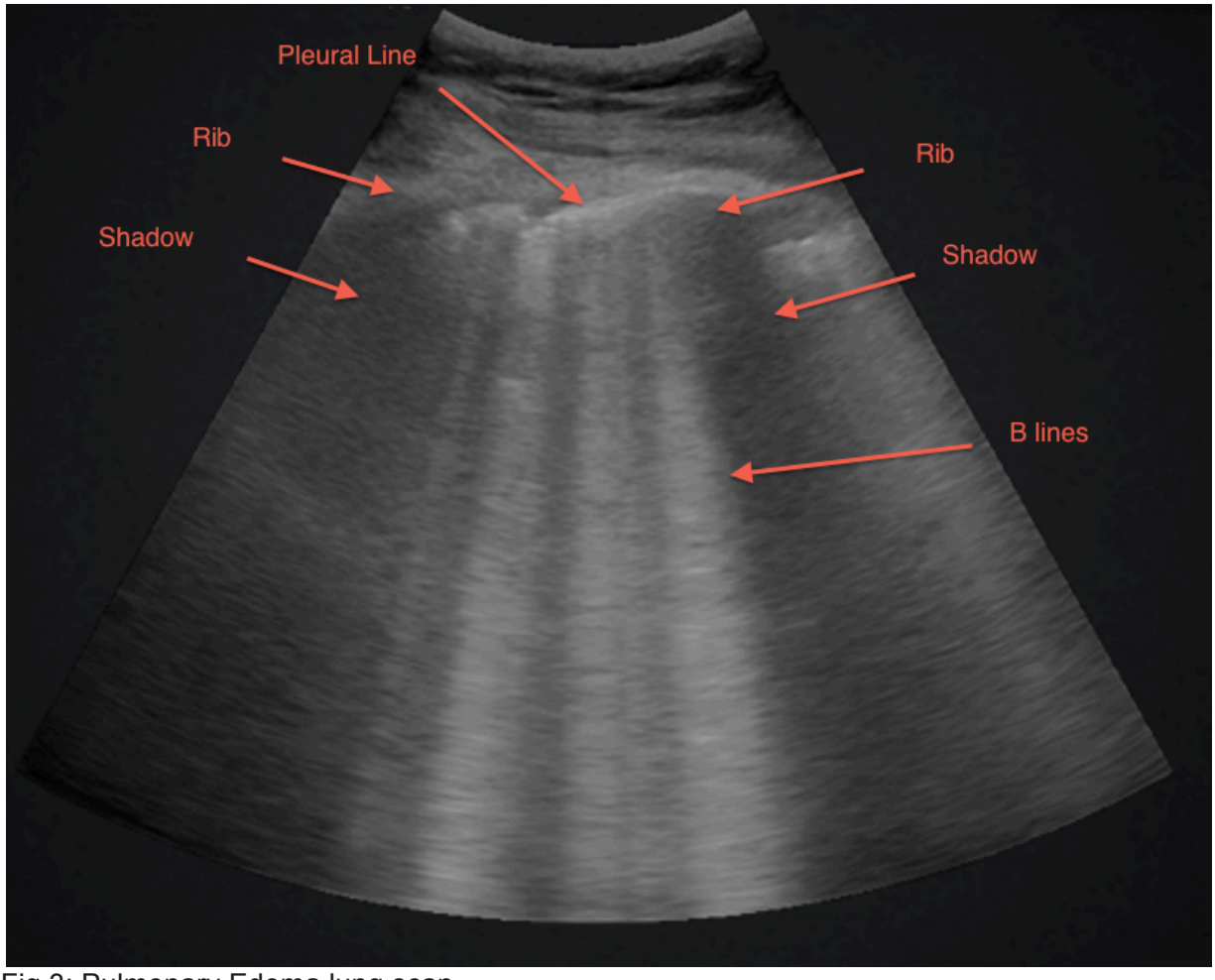


Fig 3: Pulmonary Edema lung scan

Renal POCUS Examination

Rationale:

The Renal POCUS exam can be used to assess for hydronephrosis. **Still Images** or **Cine Clips** may be used for archiving.

Still Image Requirements:

1. Longitudinal kidney (both sides)

- kidney identified by double density of cortex/medulla
- find the kidney at its largest length
- entire length seen with superior and inferior poles clearly visible

2. Transverse kidney (both sides)

- 3 still images of the superior, middle, and inferior poles
- kidney centered on screen for each

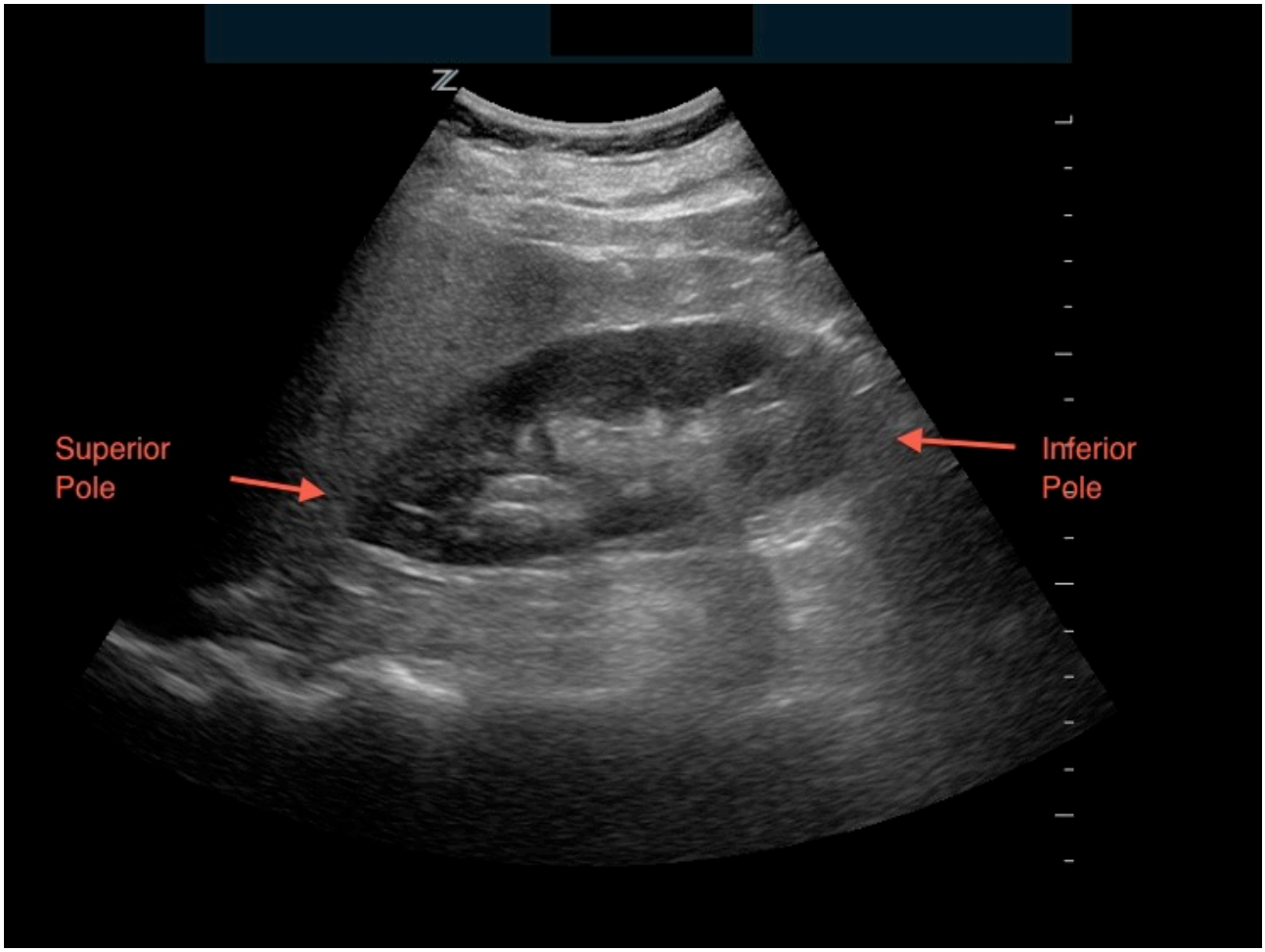


Fig 1: Longitudinal Kidney

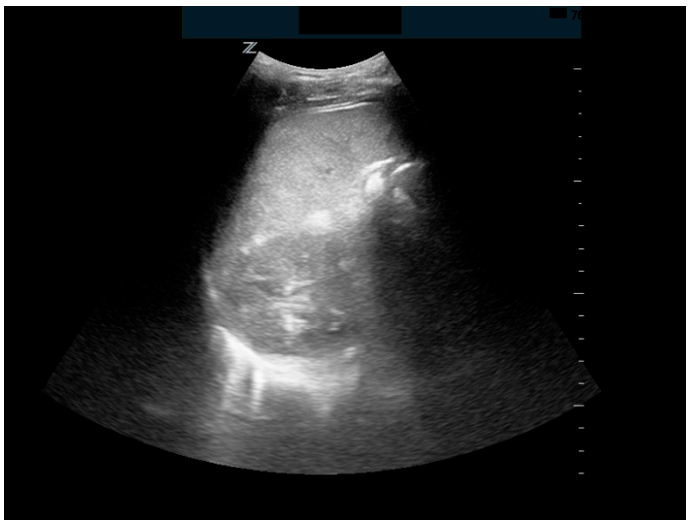


Fig 2: Superior pole (transverse)

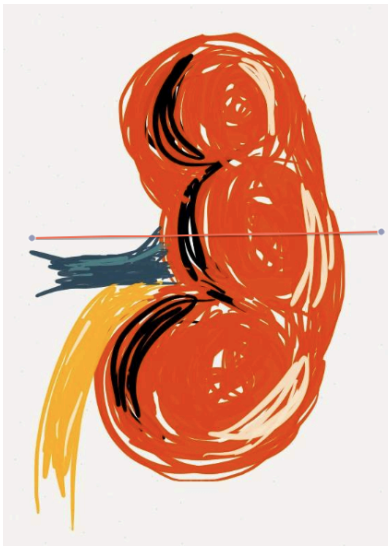


Fig 3: Middle Kidney (transverse)

Fig 4: Inferior Pole (transverse)

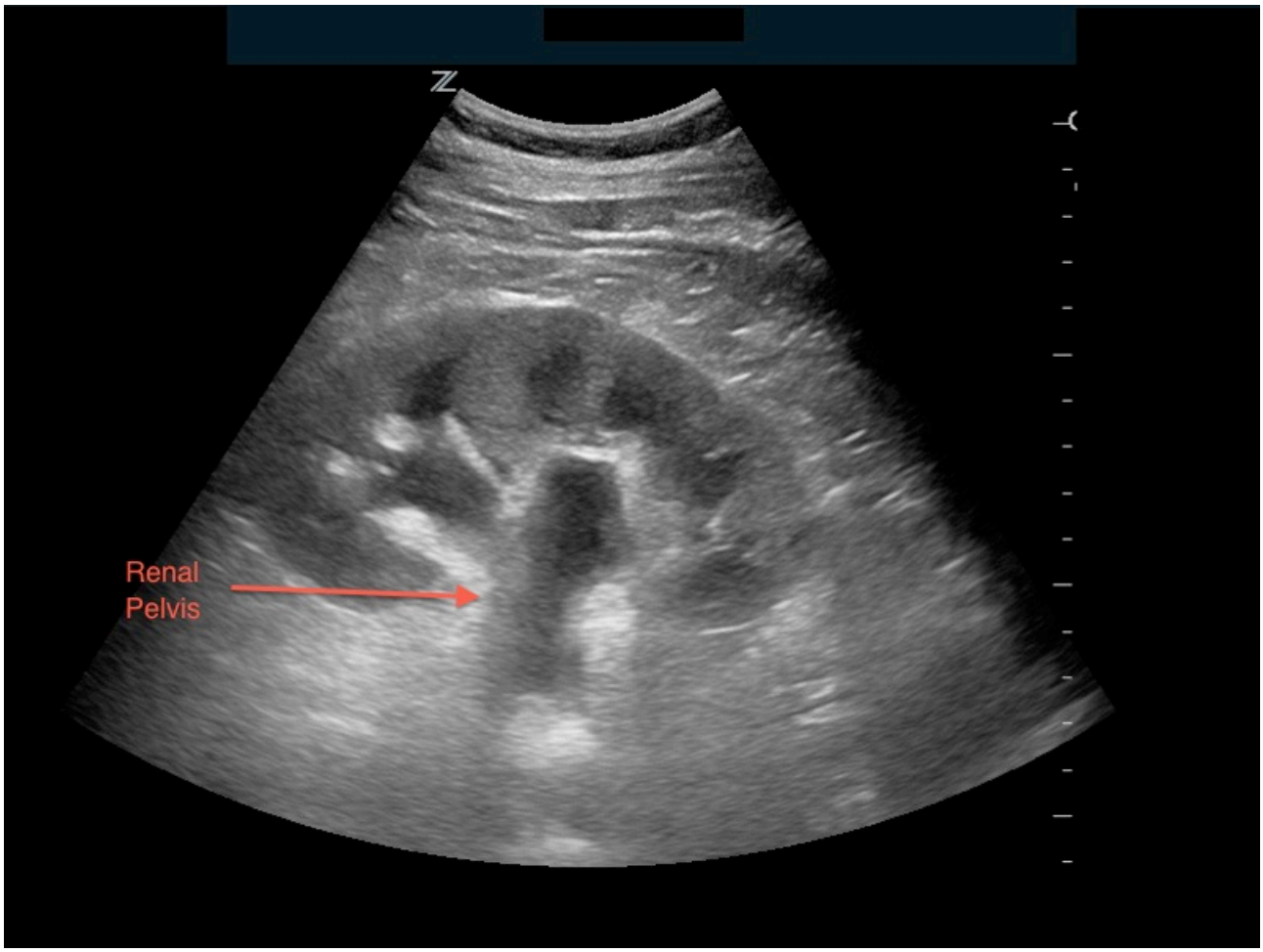


Fig 5: Moderate Hydronephrosis with dilated renal pelvis (longitudinal)

Cine Clip Requirements:

1. Longitudinal kidney

- kidney identified by double density of cortex/medulla
- upper and lower poles clearly visible
- sweep through the kidney until it disappears in either direction

2. Transverse kidney

- sweep/slide through the kidney until it disappears in either direction

Gallbladder POCUS Examination

Rationale:

The Gallbladder POCUS exam can be used to assess for cholelithiasis or cholecystitis. **Still images** may be taken for normal Gallbladders. If cholelithiasis is present, It is important to take **Cine Clips** of the entire gallbladder scan in two planes. If cholecystitis is present, it is important to take **still images** measuring the gallbladder wall.

Still Image Requirements:

1. Gallbladder in LONG axis

- gallbladder appears as long tubular structure
- main lobar fissure is seen connecting to the portal vein
- together these structures look like an “exclamation point!”
- must see the gallbladder neck

2. Gallbladder in SHORT axis

- gallbladder appears as circular structure
- take the image where the anterior gallbladder wall is the thickest
- callipers to measure the gallbladder wall should be placed on the anterior wall surface if the size is >3mm

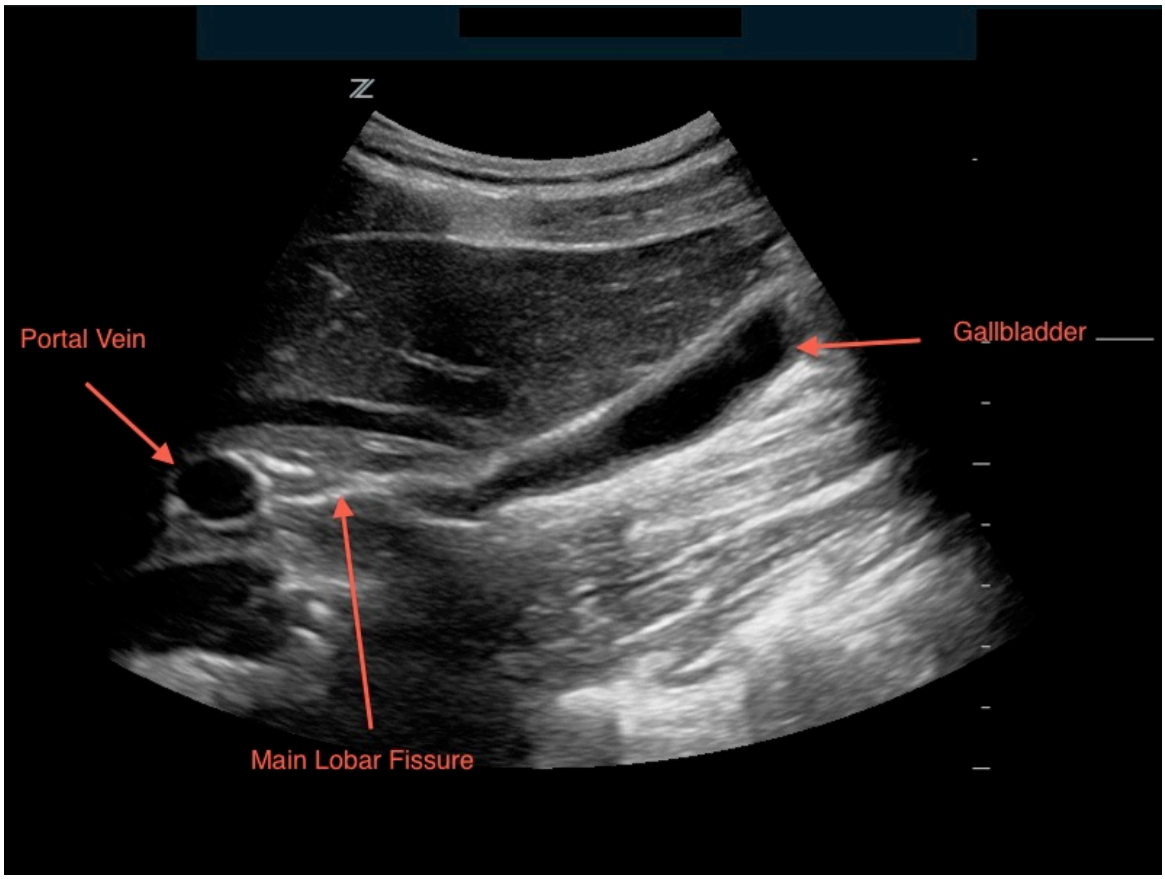


Fig: Gallbladder in long axis

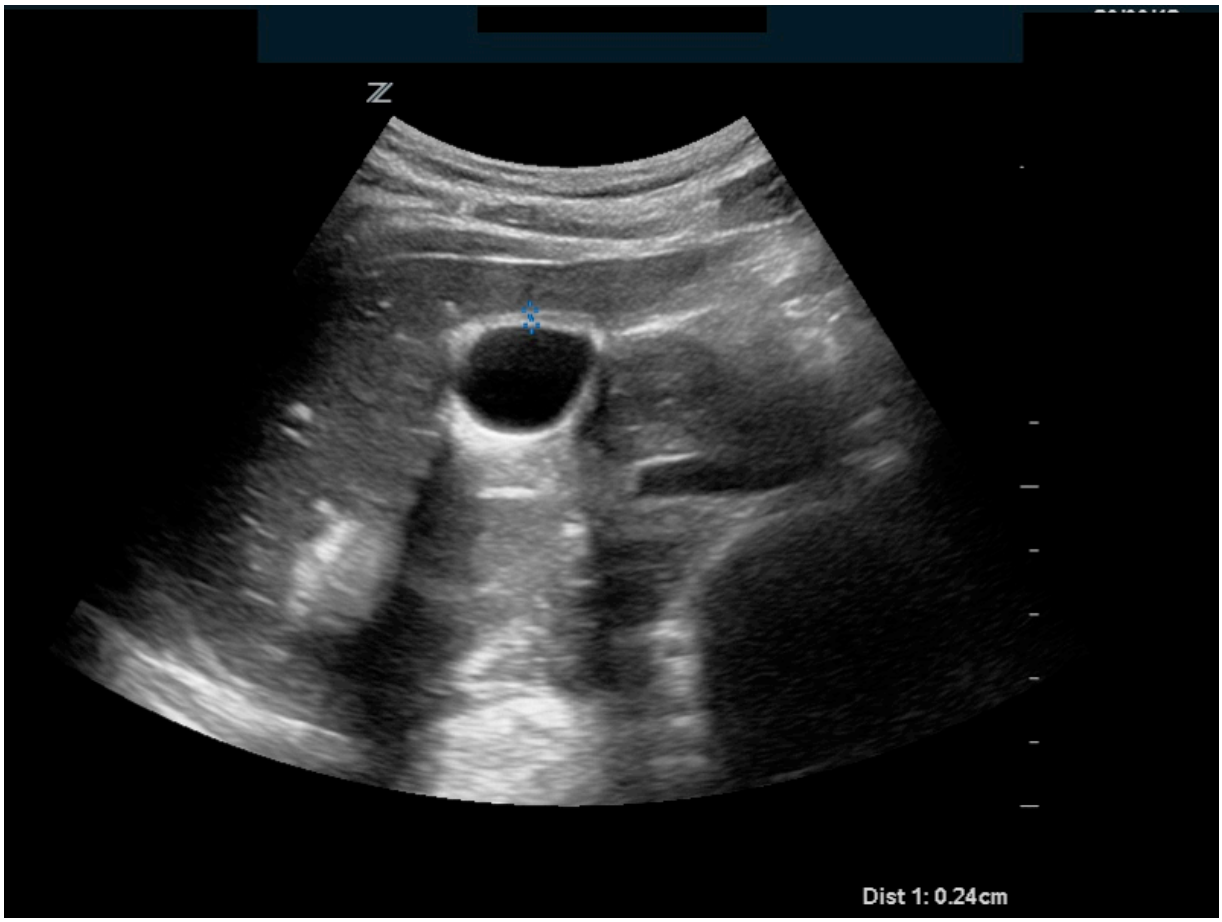


Fig 2: Gallbladder in short axis with Anterior Wall Measurement

Cine Clip Requirements:

1. Gallbladder in LONG axis

- if gallstones are present, do a sweep through the entire width of the gallbladder to give an appreciation for stone size, number, and position

2. Gallbladder in SHORT axis

- sweep in short axis until the gallbladder disappears from the screen on either side

First Trimester Bleeding POCUS Exam

Rationale:

This exam is used to **rule in** an Intra-Uterine Pregnancy.These **Cine Clips** image standards should be strictly followed to prevent misinterpretation and the negative consequences that can result.

Transabdominal View Clip Requirements:

1. Uterus in Long Axis

- bladder-uterine juxtaposition clearly seen (this can be recorded as a still image prior to sweep)
- entire uterus including fundus is visualized
- gestational sac is visualized if present and gain optimized to see endometrial reaction
- yolk sac or fetal pole visible
- myometrial mantle MUST be > 7mm at its thinnest portion
- sweep through entire uterus
- if difficult to see, Zoom into gestational sac and repeat sweep in an additional clip

2. Uterus in short axis

- bladder-uterine juxtaposition clearly seen
- gestational sac, yolk sac +/- fetal pole visible
- sweep through entire uterus
- if difficult to see, Zoom into gestational sac and repeat sweep in an additional clip

Fig 1. Transabdominal Uterus in Long Axis - IUP (Intrauterine Pregnancy) seen

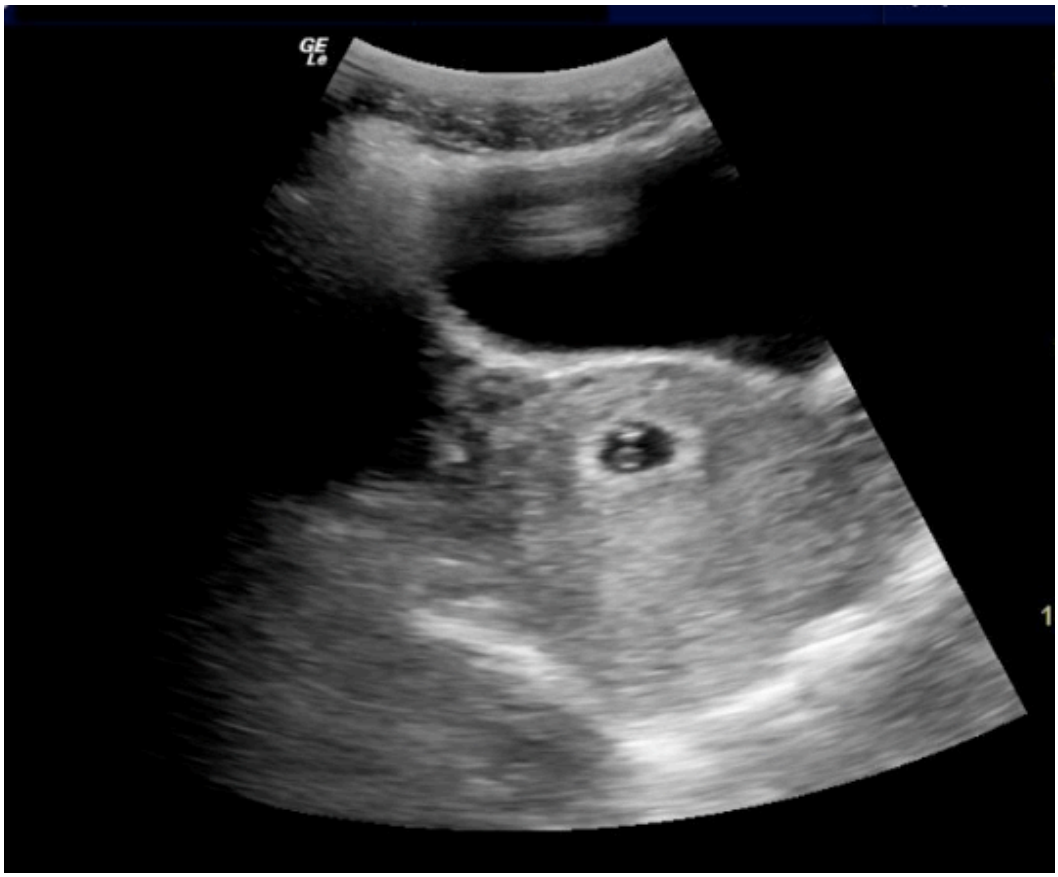


Fig 2. Transabdominal Uterus in Short Axis - IUP seen

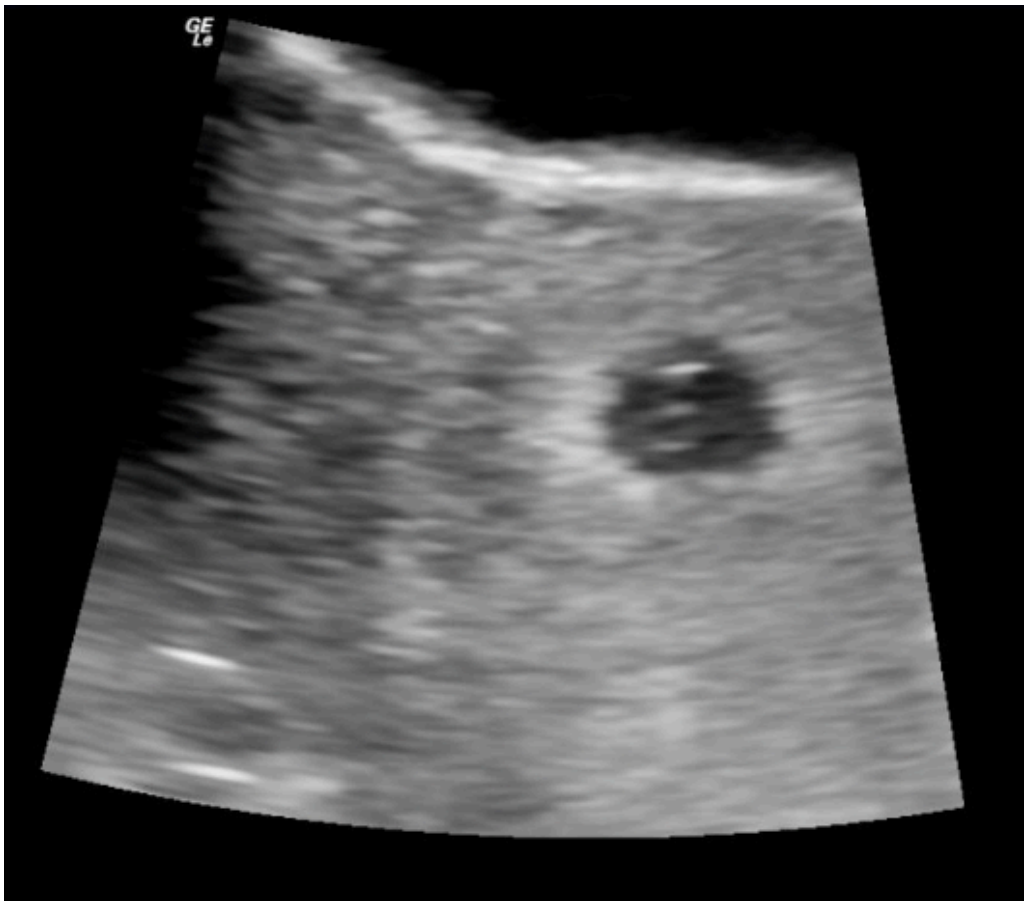


Fig 3. Transabdominal Uterus in Short Axis - Zoomed in view of gestational sac and yolk sac

Transvaginal View Clip Requirements:

1. Uterus in Long Axis

- bladder seen left of screen
- gestational sac, yolk sac +/- fetal pole visible
- sweep through the entire uterus
- if difficult to see, Zoom into gestational sac and repeat sweep in an additional clip

2. Uterus in Short Axis

- gestational sac, yolk sac +/- fetal pole visible
- sweep through the entire uterus
- if difficult to see, Zoom into gestational sac and repeat sweep in an additional clip

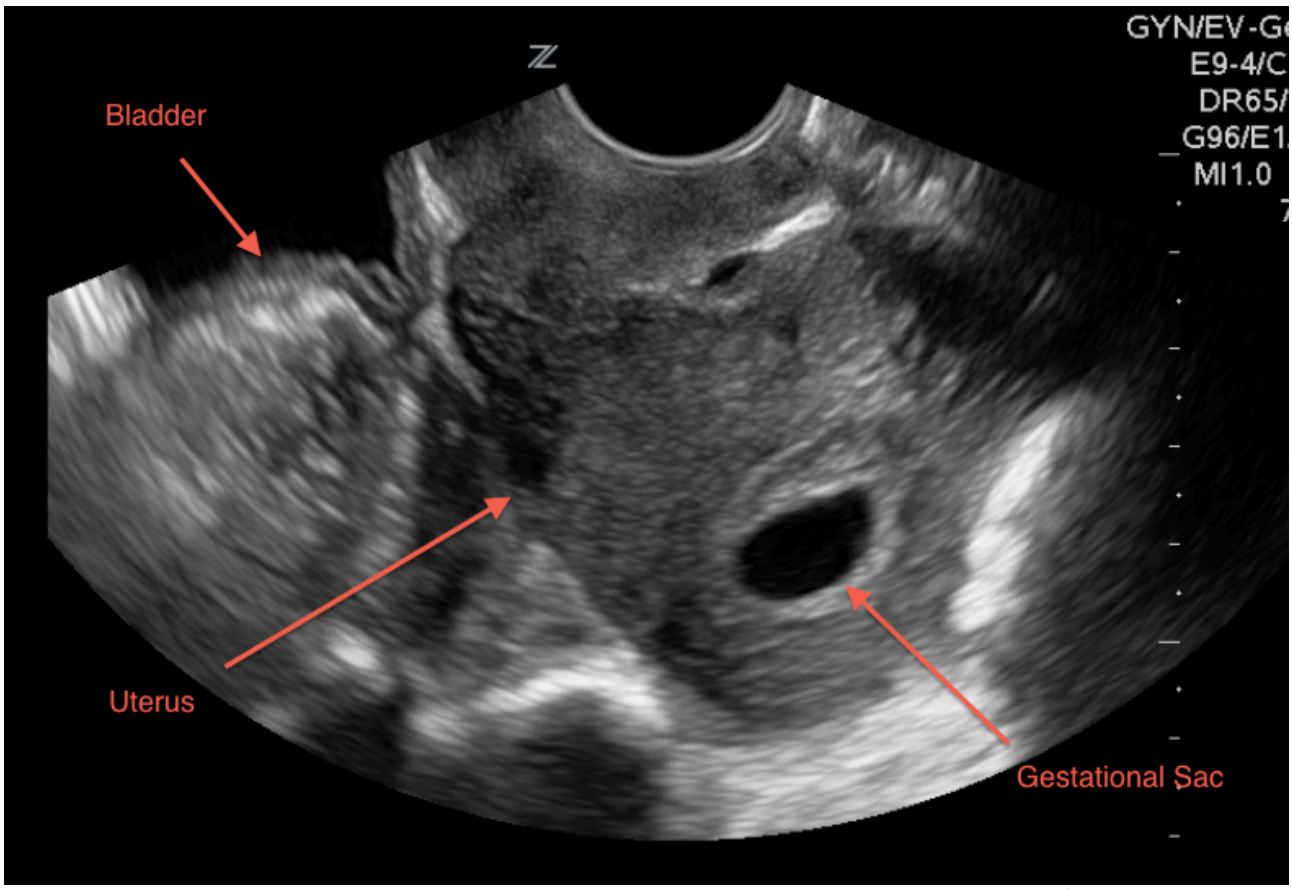


Fig 3. Transvaginal Uterus in Long Axis - gestational sac seen, but NDIUP (No Definitive Intrauterine Pregnancy)

Fig 4. Transvaginal Uterus in Short Axis - gestational sac seen, but NDIUP

Fig 5. Transvaginal Uterus in Short Axis - Zoomed in on gestational sac, NDIUP

DVT – Lower Extremity POCUS Examination

Rationale:

The DVT-LE POCUS examination should be used as part of an algorithm involving clinical pre-test probability for DVT. The linear probe should be used for the highest resolution although the curvilinear probe maybe considered should the size of the leg preclude assessment with the linear probe. Caution is advised whenever inadequate views are obtained and comprehensive imaging should be obtained.

Use the vascular presets. A combination of still and cine clips are obtained with the dual image function of the ultrasound machines. The left side of the image is the still image while the right side of the image is the cine clip demonstrating active compression. Note that this is the minimum imaging archiving requirement and that this does not replace adequate training and QI.

Image Requirements:

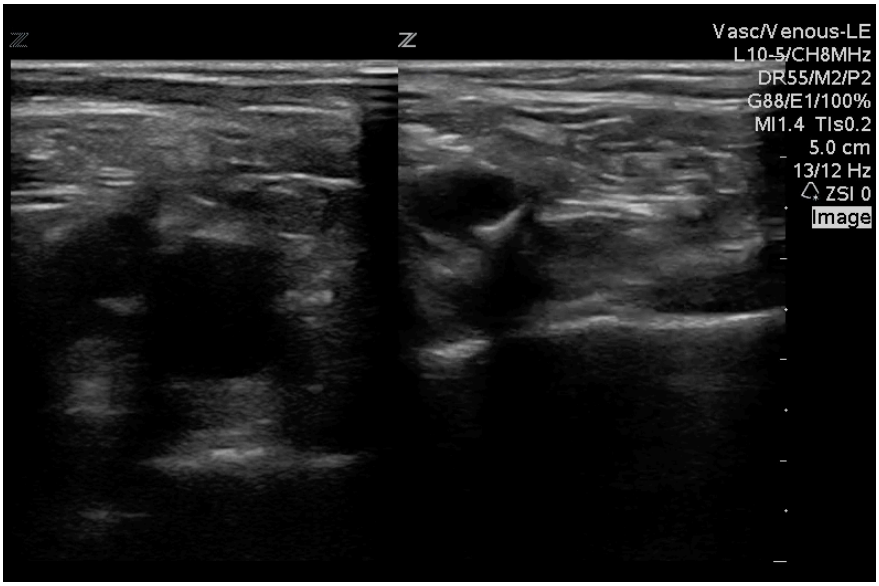
Zone 1

1. Common Femoral Vein (CFV)
2. Sapheno-Femoral Junction (SFJ)
3. Proximal Femoral Vein (PFV)

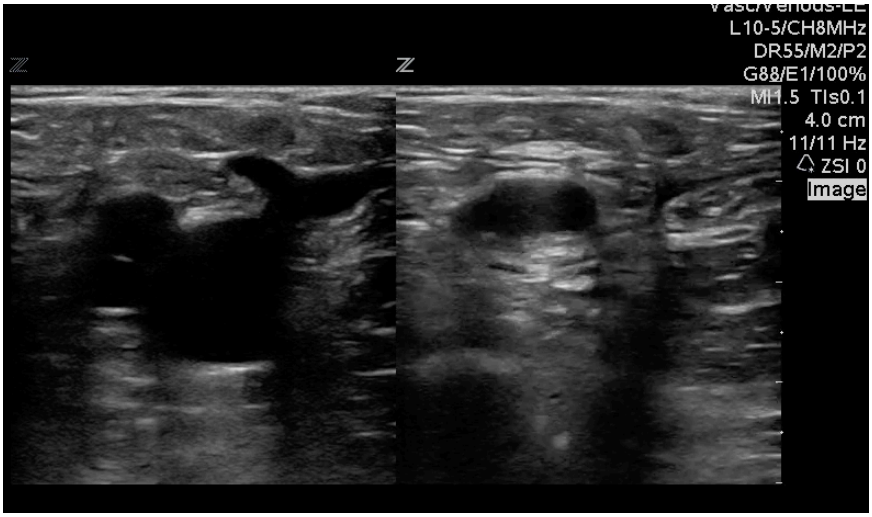
Zone 2

1. Distal Femoral Vein (DFV)
2. Popliteal Vein (PV)
3. Trifurcation

Zone 1 – Image 1:CFV

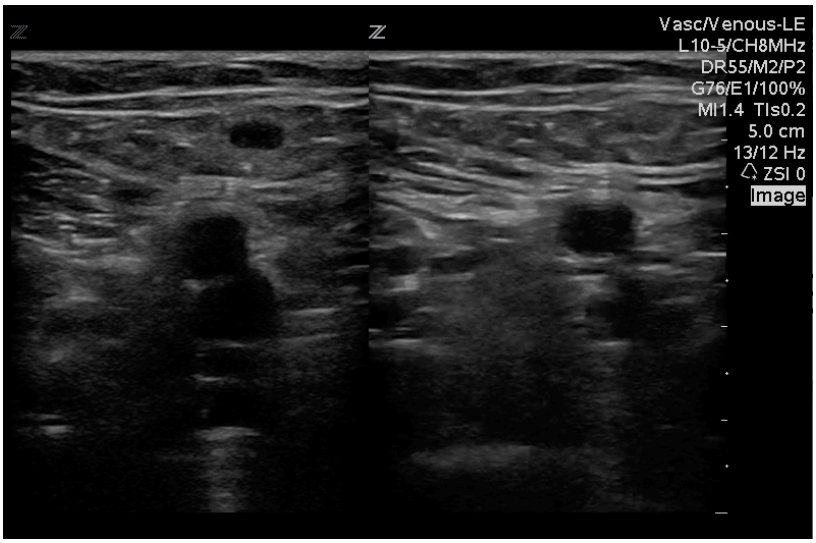


Zone 1 – Image 2: SFJ



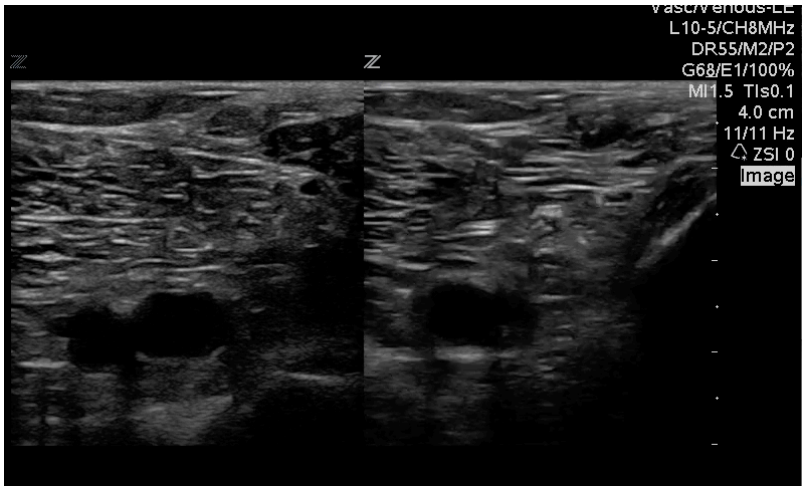
Zone 1 – Image 3: Prox FV

note that this at the level where the FV splits into superficial (prox) and profundus



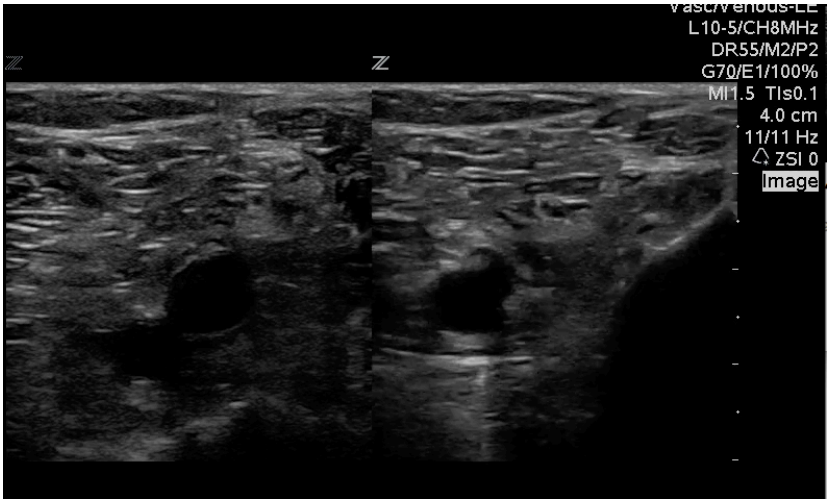
Zone 2 – Image 1 Distal FV

start in the pop fossa and note the distal FV side by side with the distal FA



Zone 2 – Image 2 – PV

Distal FV comes into near field to the distal FA



Zone 2 – Image 3 – Trifurcation

PV splits into at least 3 other veins