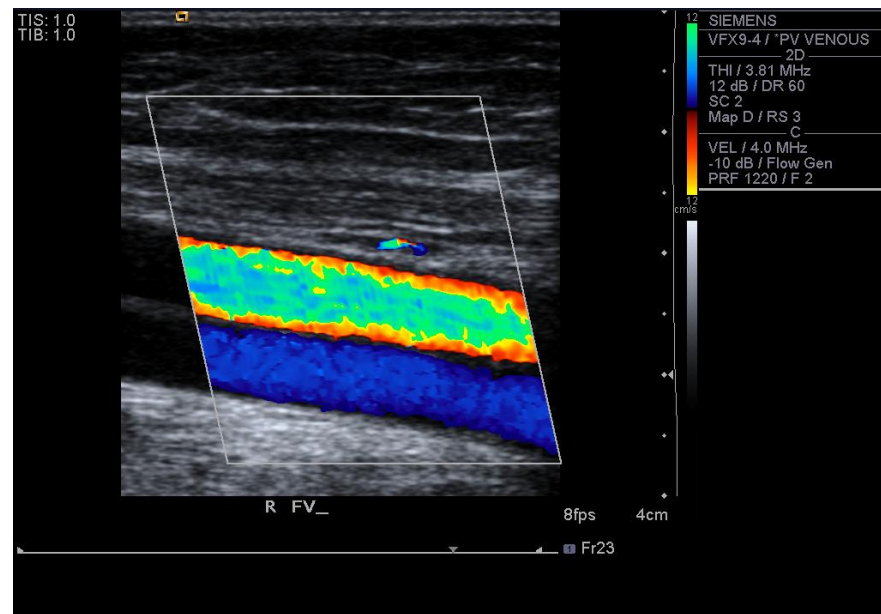
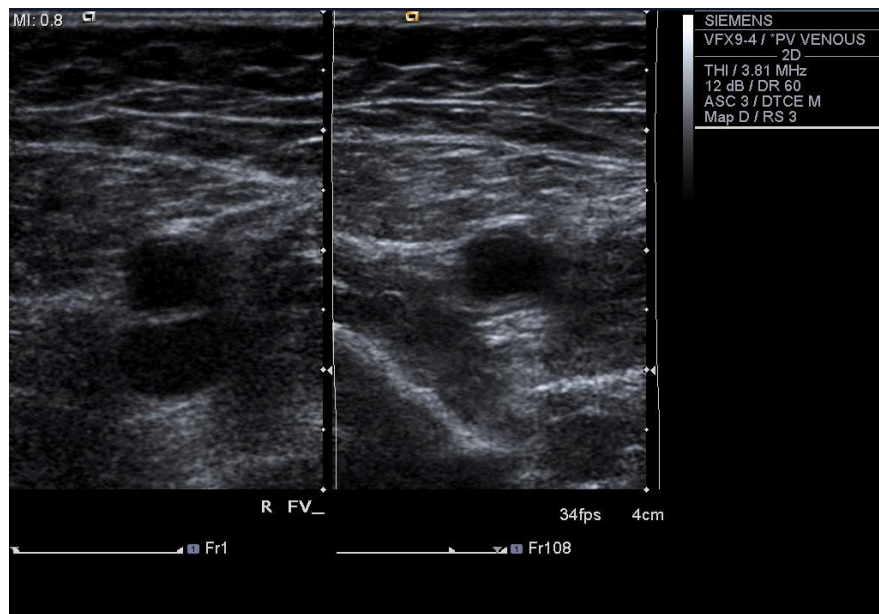
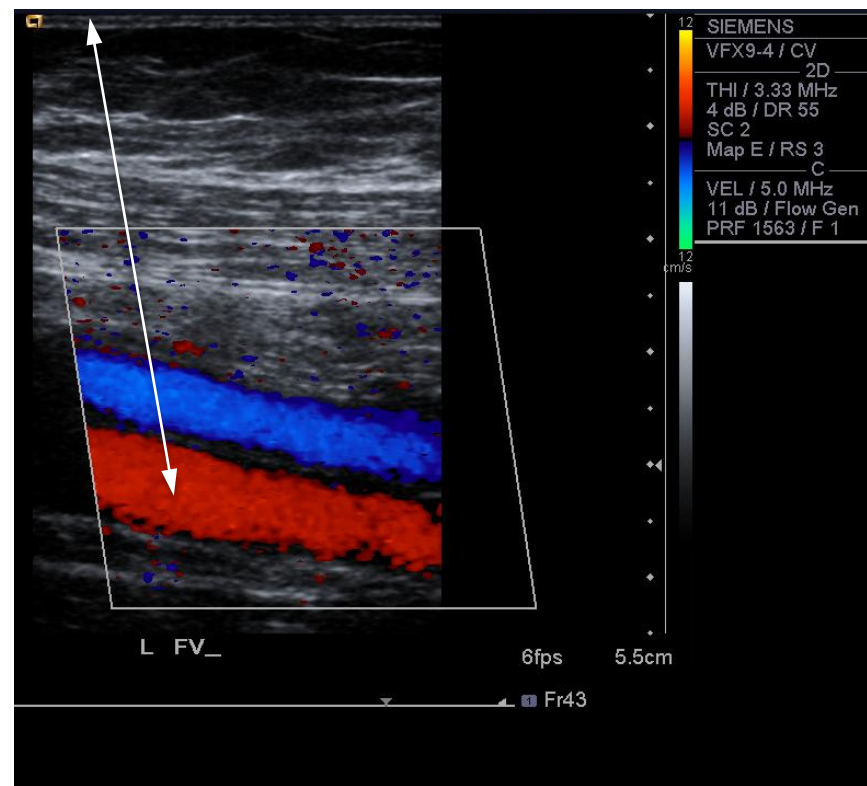
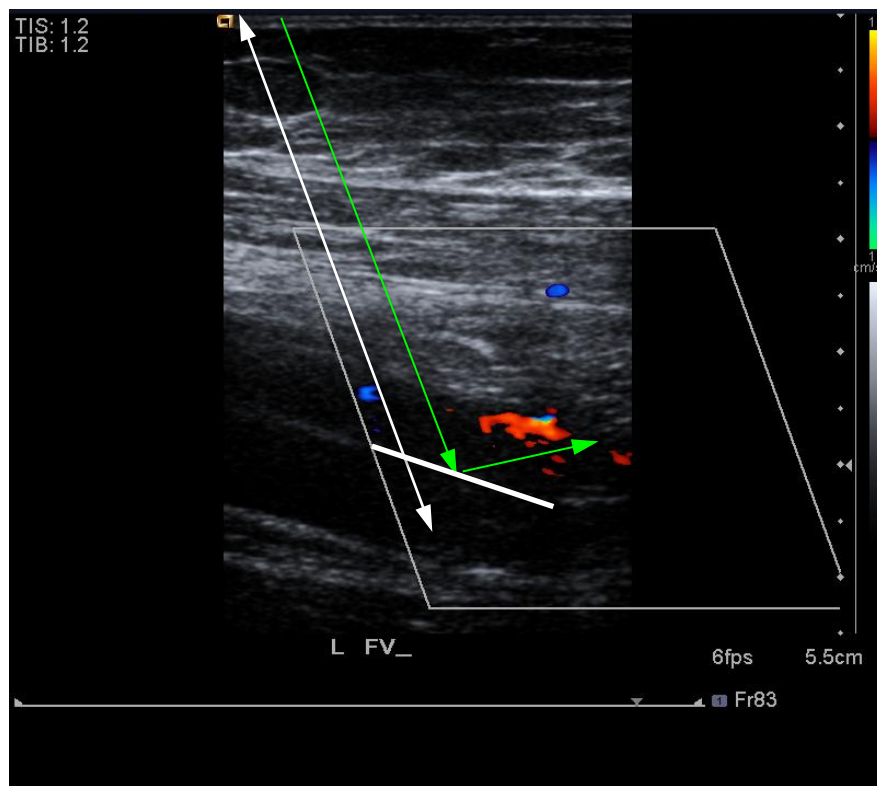


Question 1: Compression sonography (left image) is the gold standard for the diagnosis of DVT. Are there any advantages of color Doppler ultrasound (right image) over compression sonography in the diagnosis of DVT?



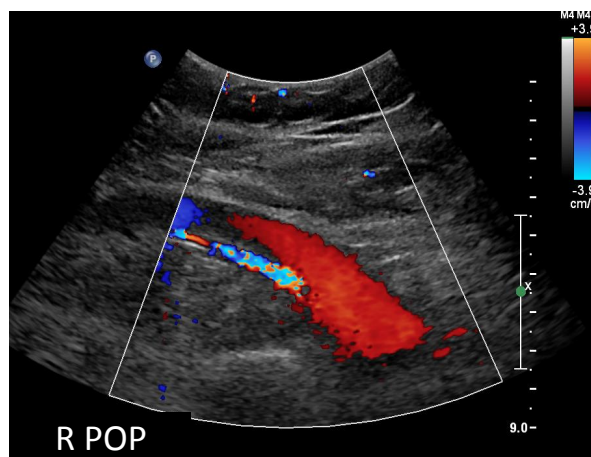
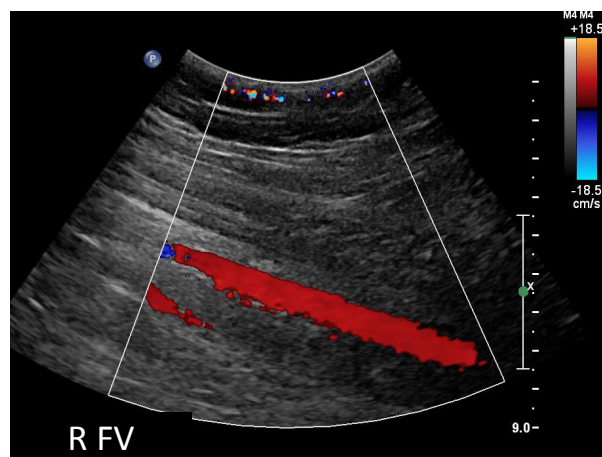
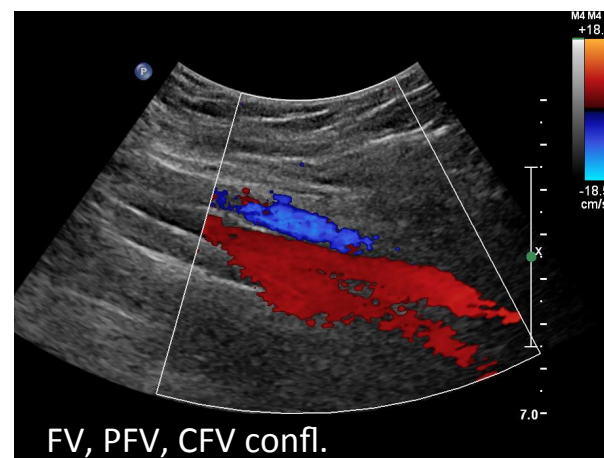
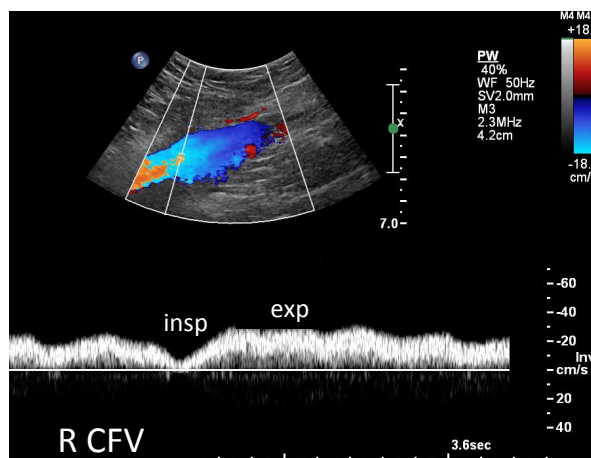
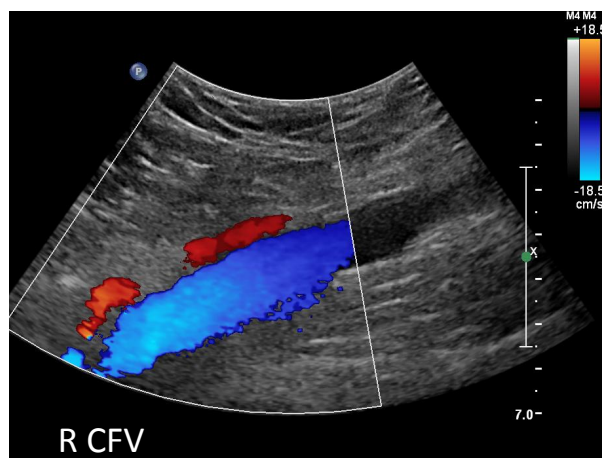
Model Answer: Color Doppler has several important advantages. First of all, color Doppler allows visualization of much larger segments of the vessel in one image. Secondly, color Doppler can demonstrate flow abnormalities in the vessel lumen due to small chronic thrombotic residua, fibrin or webs which could be easily overlooked during compression sonography. Color Doppler is more sensitive (longer pulses -> greater duty factor -> better signal to noise ratio) and can easily demonstrate flow in areas which are difficult or impossible to adequately visualize on 2D ultrasound, particularly vessels in large patients, patients with oedema or patients with unfavourable acoustic properties. Finally, basic flow characteristics such as phasicity or pulsatility can be observed on color Doppler whereas 2D ultrasound provides only anatomical information. For these reasons, continuous color Doppler examination of the deep veins should always be performed when assessing the deep veins for DVT.

Question 2: For the same sample site in the same vessel, Doppler shift is angle dependent. The higher the Doppler angle, the lower the Doppler shift. The two color Doppler images of the Femoral Artery and Vein below were obtained at the same site. No system settings were changed between the two images apart from beam steering. Why does the color Doppler image on the right show better sensitivity to flow despite a higher (more obtuse) Doppler angle?



Model Answer: The left image is obtained at a more favourable Doppler angle and the Doppler shifts generated by flow in the Femoral Artery and Femoral Vein will be higher. However, due to the beam steering and deep location of the vessel, the beam path is longer, so the beam will suffer greater attenuation therefore reducing the sensitivity (white arrows). Additionally, the acute angle at which the beam strikes the vessel wall may sometimes lead to a critical angle problem where the beam reflects off the wall without penetration into the vessel (green arrows).

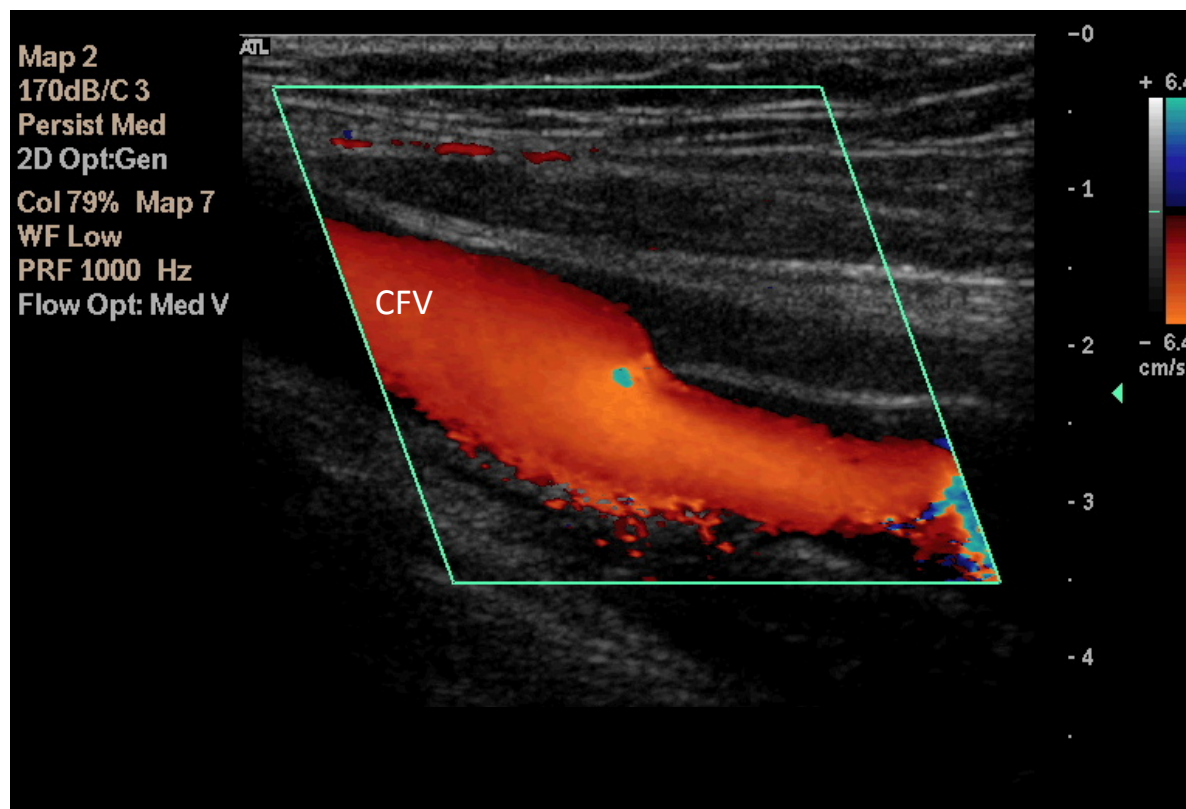
Question 3: The sonographer is performing a lower extremity “DVT scan” in a morbidly obese patient with acute weeping cellulitis in the calf. The calf is not scannable at all. Review the study the sonographer has performed. What comments can be made about this study?



Model Answer: In terms of the deep veins, the sonographer here has done all that was reasonably possible and has used a low frequency curvilinear array transducer to image the vessels. All vessels are widely patent on color Doppler and demonstrate good fill and consistent smooth flow characteristics. Isolated calf DVT cannot be excluded on this study because the calf is not accessible.

Question 4: Each image in the following section demonstrates a classic sonographic finding which can be encountered during duplex scan of the deep extremity veins. The image may be normal or contain anatomical variants or pathology.

Describe each image below and provide a diagnosis.



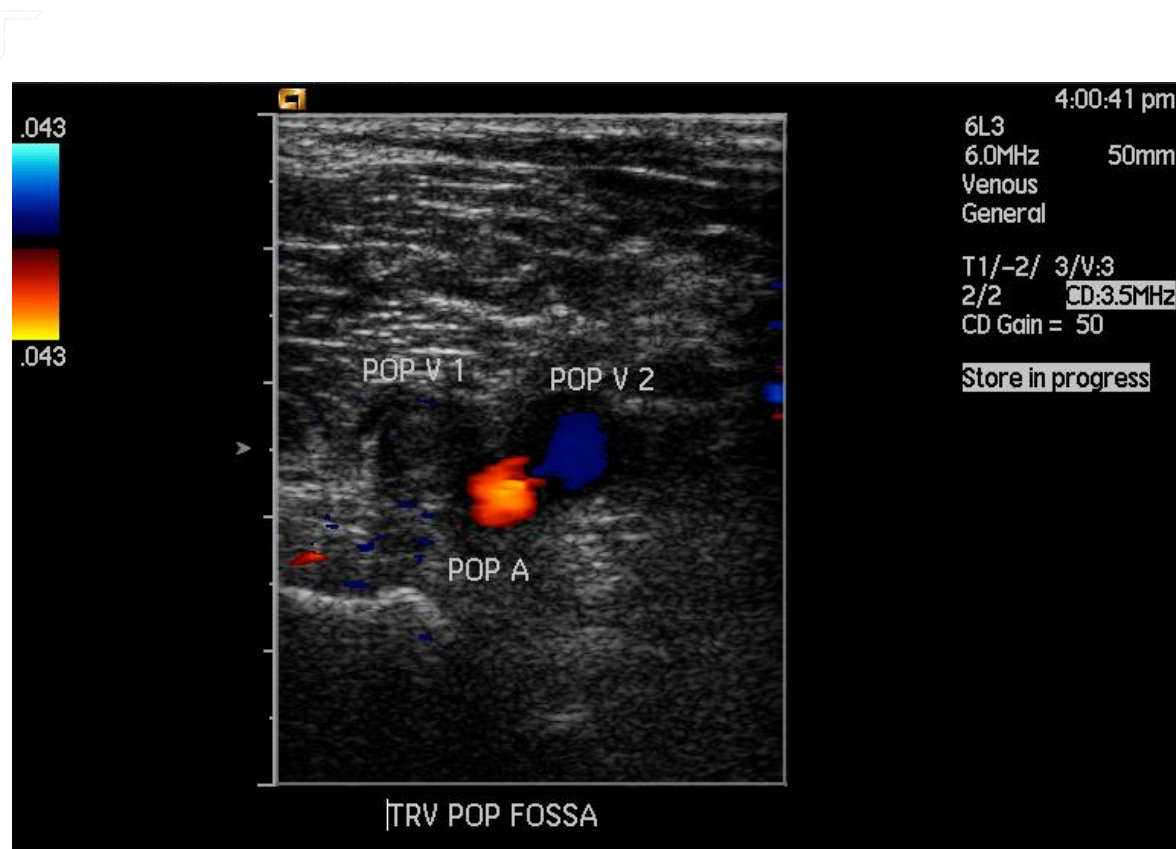
Model Answer: There is occlusive DVT involving the Femoral vein to the level of the PFV-FV confluence. Because the femoral vein is smaller than the PFV, it is likely the DVT is not acute.

Question 5: Describe the image and provide a diagnosis.



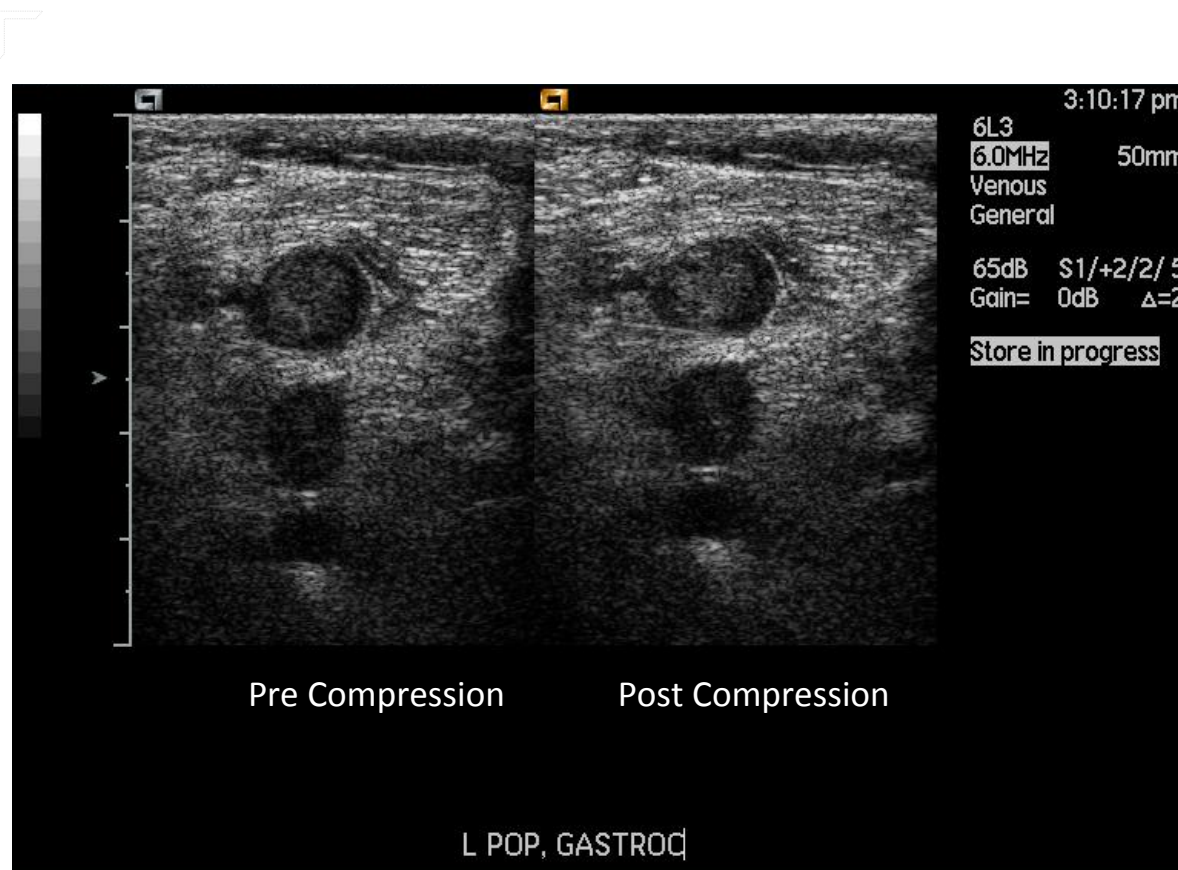
Model Answer: There is a duplication of the superior portion of the L POP vein in this image which is a normal anatomical variant present in approximately 20% of the population.

- Question 6:
- Describe the image and provide a a diagnosis.
 - What is the orientation of the sectional plane of the transducer in this image, considering that the Popliteal artery is displayed in Red color?



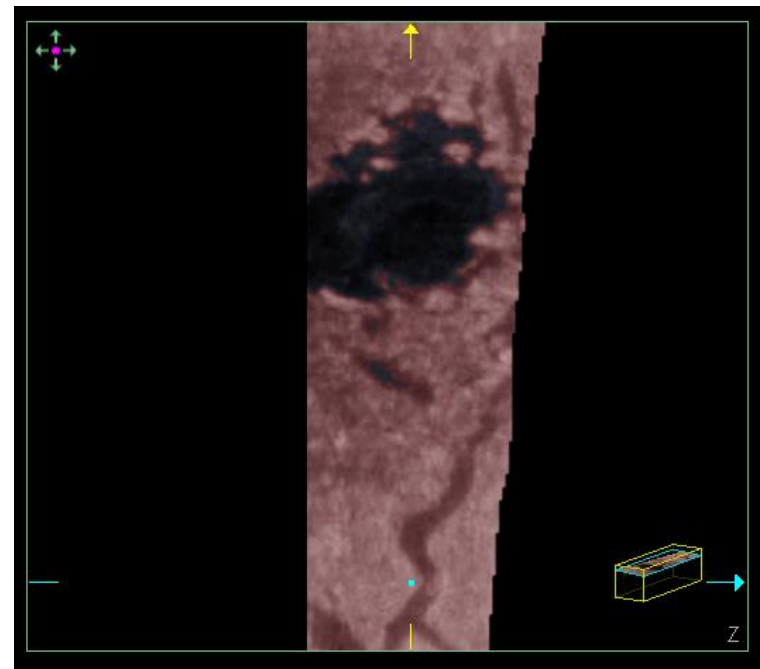
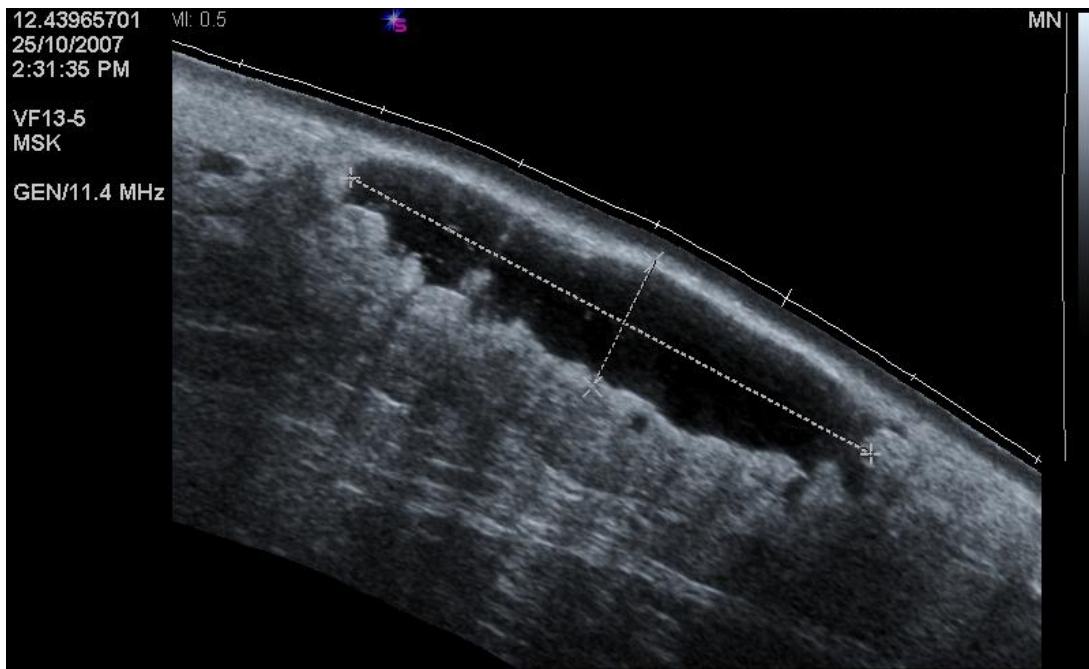
- Model Answer:
- Acute occlusive DVT is seen in one of two Popliteal Veins in this patient.
 - The operator is holding the transducer in transverse section of the Popliteal fossa but the transducer is angled inferiorly. With this approach, arterial flow passing through the scanplane generates a negative Doppler shift and the Popliteal artery is correspondingly displayed in Red color.

Question 7: Describe the image and provide a diagnosis.



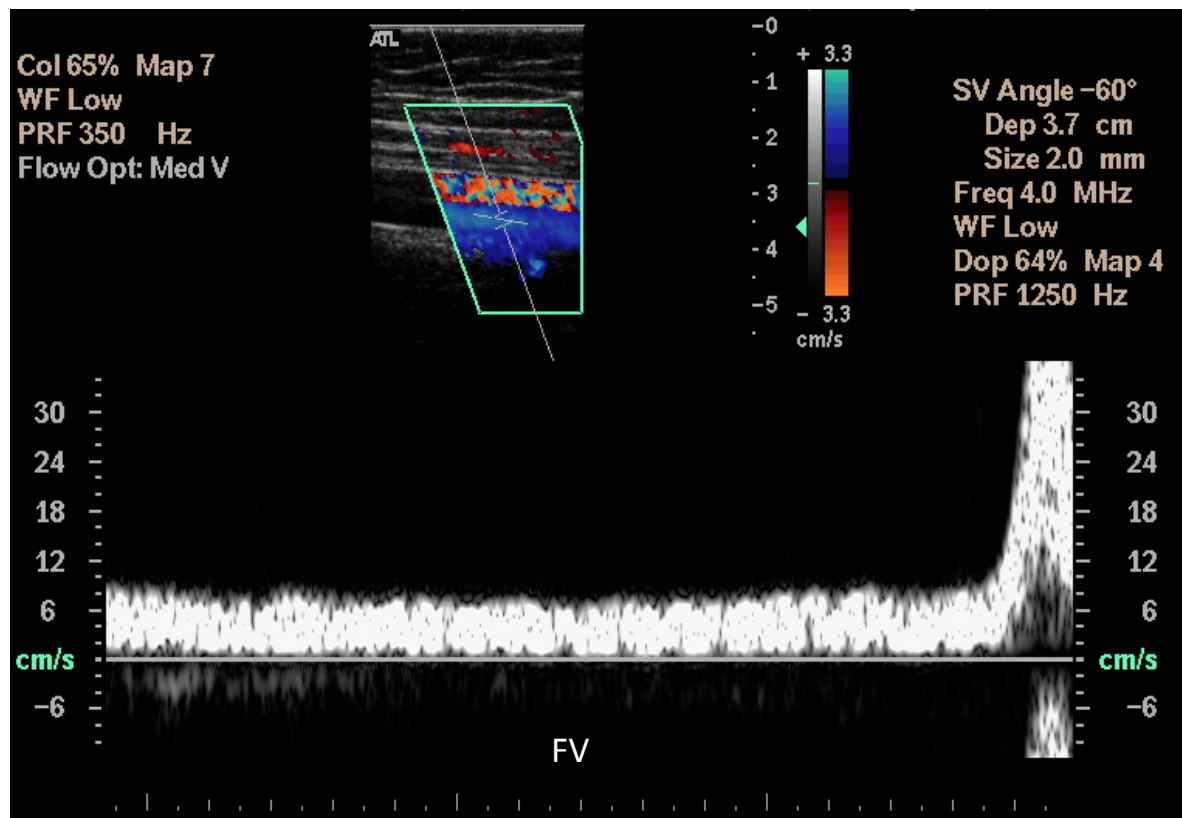
Model Answer: Acute DVT is seen in the Popliteal vein as well as the Gastrocnemius trunk.

Question 8: History: Recent varicose vein avulsions, now presents with pain, redness and swelling over one surgical site. Describe the image and provide a diagnosis.



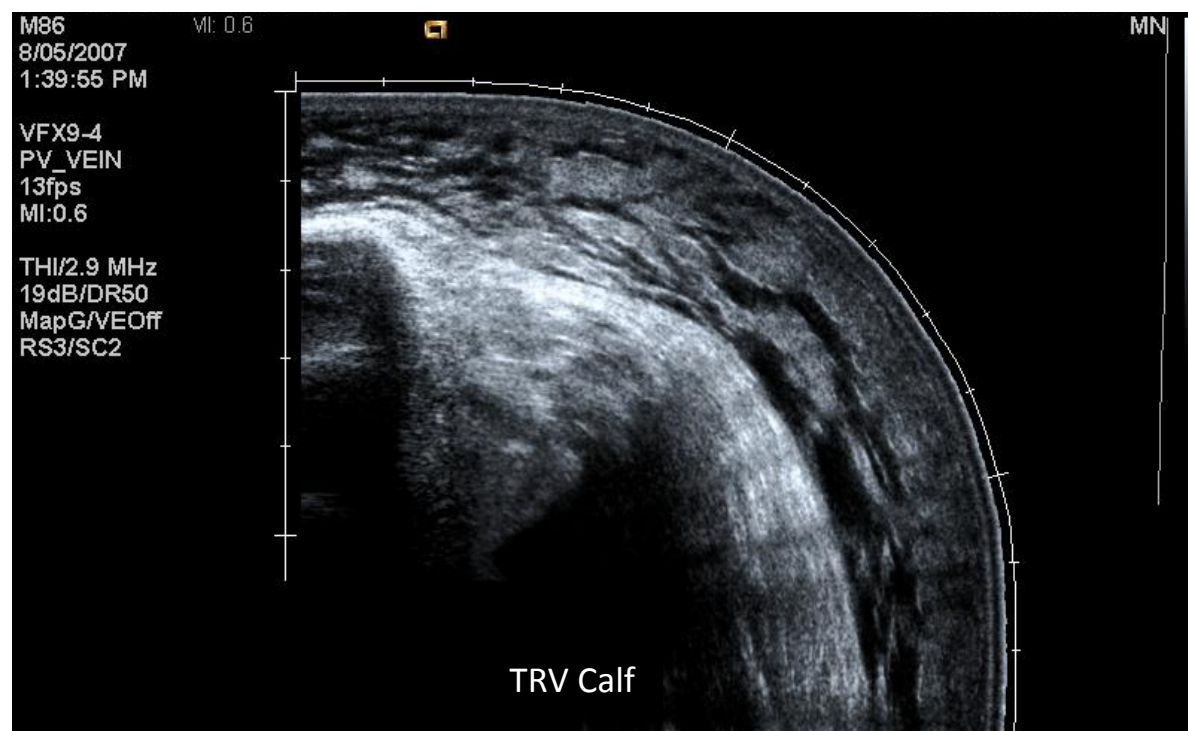
Model Answer: The area of interest demonstrates an irregular fluid-filled subcutaneous collection spanning some 4cm in width (see calibration marks on image) and 1cm deep. There is no discrete capsule or wall around the fluid. Ultrasound findings in combination with patient's clinical history strongly suggest the presence of a subcutaneous abscess.

Question 9: Describe the image and provide a relevant diagnostic comments.



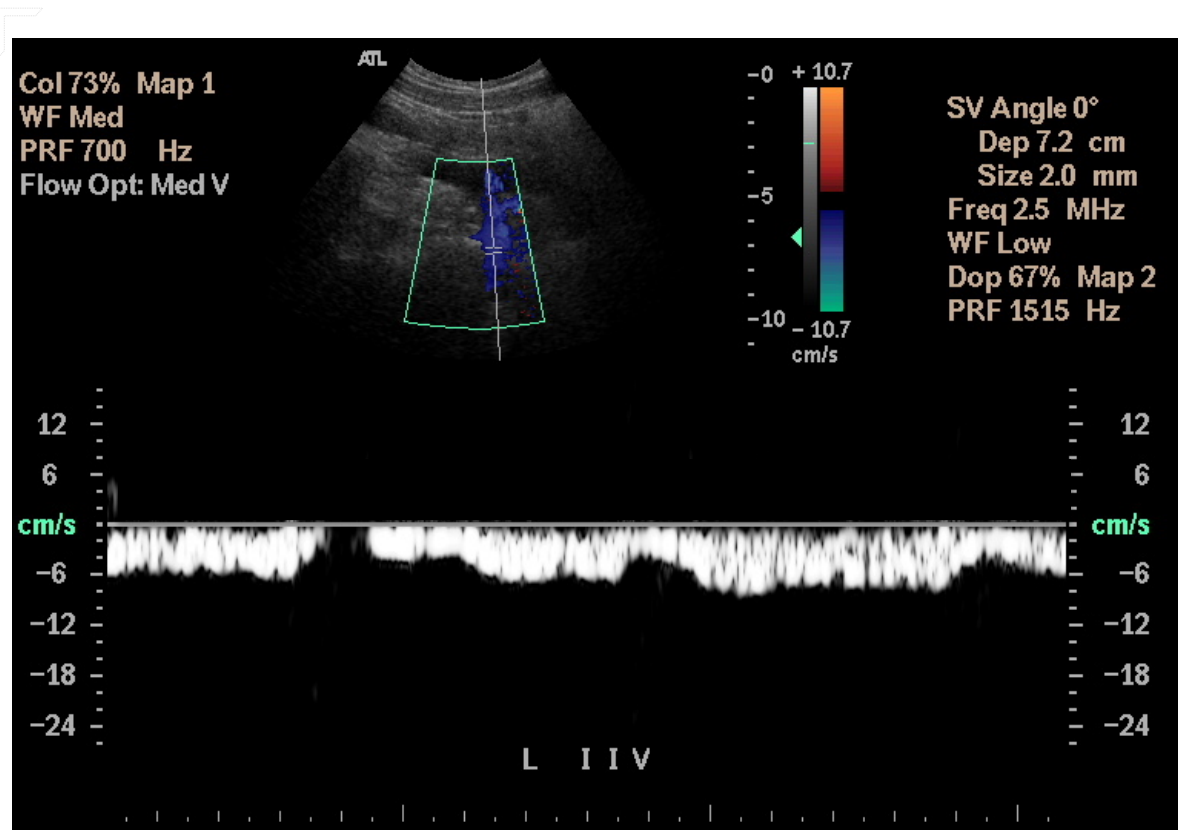
Model Answer: Flat aphasic augmentable flow is seen on this spectral trace of the Femoral Vein. The finding is suspicious for downstream venous obstruction. This could include proximal DVT or mechanical compression of the vessel by surrounding structures including May-Thurner Syndrome, Pregnancy, Pelvic or Abdominal mass.

Question 10: Describe the image and provide a diagnosis.



Model Answer: This panoramic image of the superficial soft tissues of the calf demonstrates subcutaneous oedema. Nothing more can be learned about its cause from this single image. In this case, the patient presented for DVT scan due to bilateral leg swelling. The DVT scan was negative, but the patient was noted to be in advanced stages of heart failure.

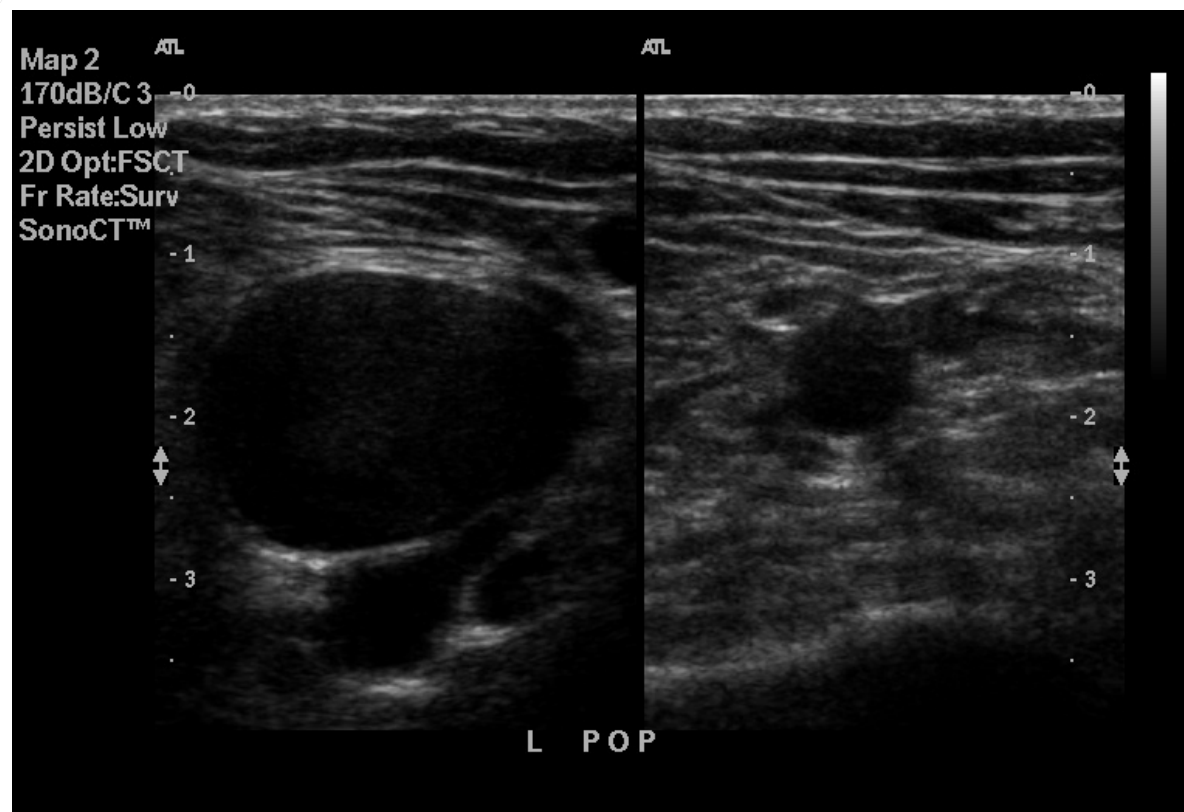
- Question 11:
- Describe the image and provide a diagnosis.
 - What do you think prompted investigation of this vessel?



Model
Answer:

- Flow in the Internal Iliac vein demonstrates continuously reversed flow. The patient has internal iliac vein incompetence.
- There may be several several reasons to assess the IIV. The IIV may act as a collateral in a patient with downstream DVT (such as occlusive DVT of the CIV) so the IIV may have been assessed for this reason. But perhaps a more common reason to scan the IIV is during venous assessment of pelvic veins in women suspected of pelvic venous competence, pelvic

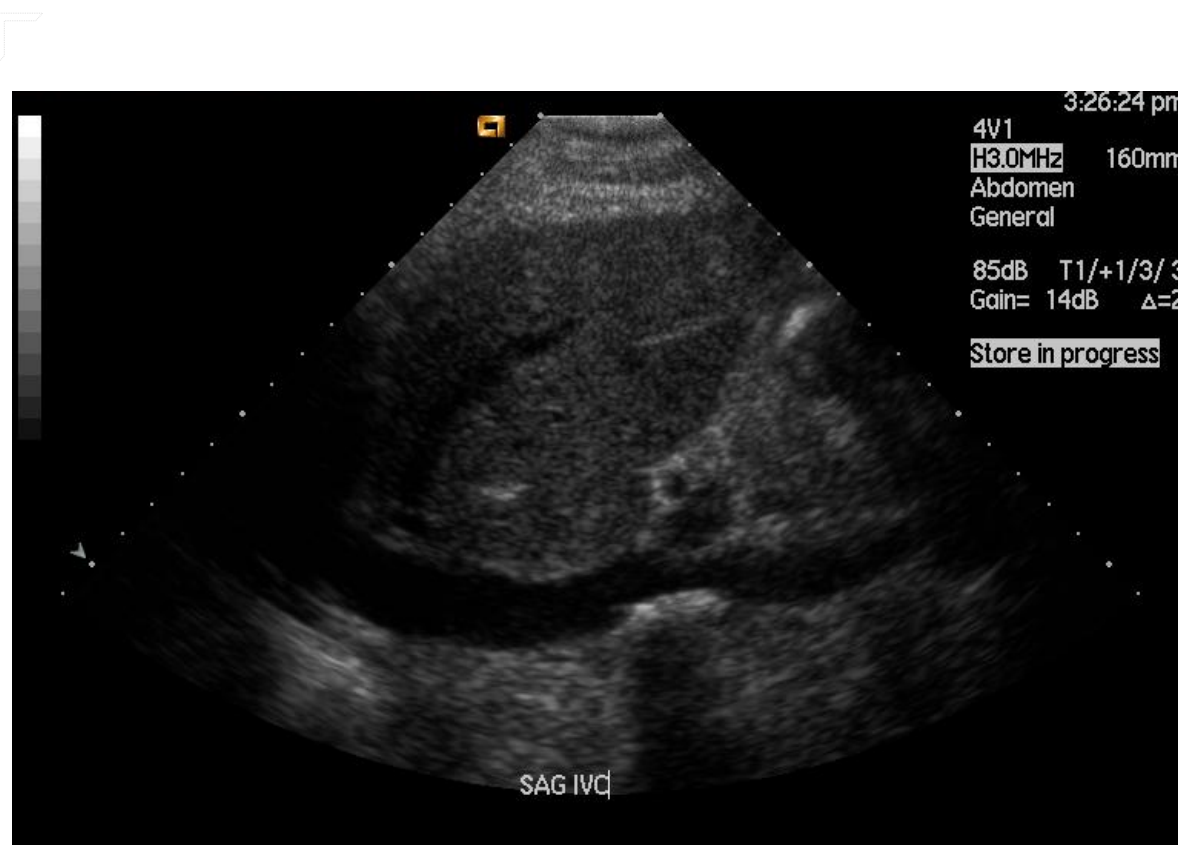
Question 12: Describe the image and provide a relevant diagnostic comment.



Model
Answer:

The Popliteal vein is large in diameter measuring nearly 20mm in transverse section in comparison with the Popliteal Artery at less than 10mm. The Popliteal vein is completely compressible. While benign Popliteal vein ectasia is sometimes encountered, focal increase in Popliteal vein diameter with diameter over 20mm should raise suspicion of Popliteal vein aneurysm. Beyond 20mm diameter, there is an increasing risk of thrombosis. The patient should be referred for vascular surgical opinion. Despite its large size, an ectatic or aneurysmal Popliteal vein is usually competent.

Question 13: Describe the image and provide a diagnosis.



Model Answer: Sagittal view of the IVC demonstrates an echogenic shadowing focus along the posterior border in line with the inferior border of the liver. Appearance is consistent with a phlebolith.

Question 14: Describe the image and provide a diagnosis.



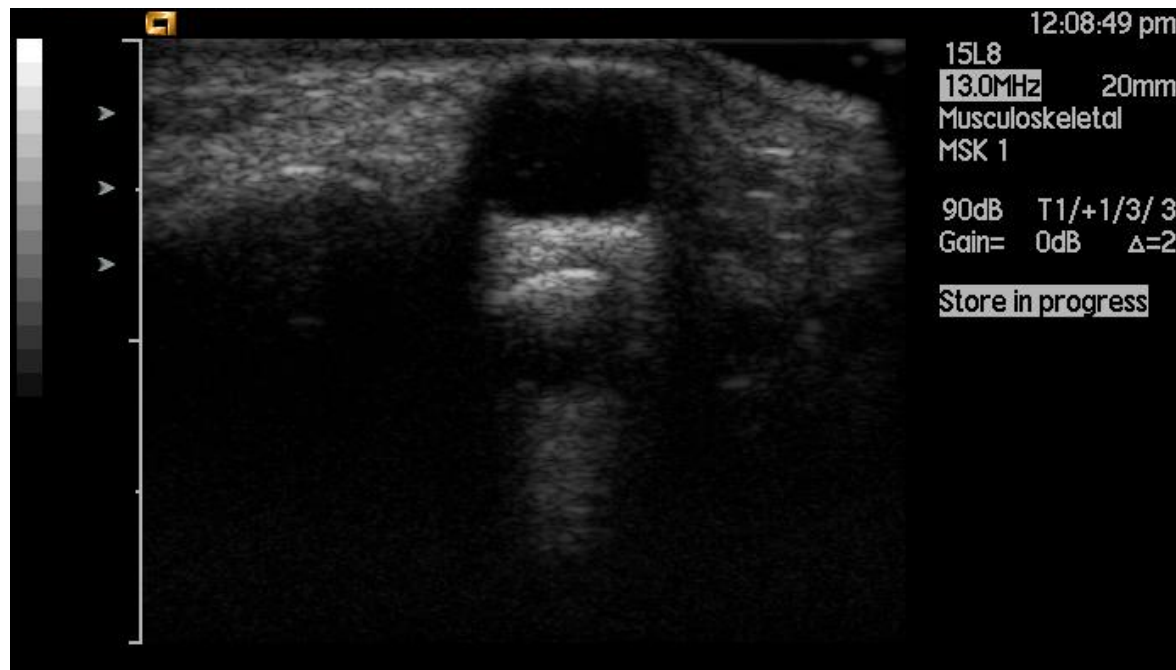
Model Answer: There is general dilation of the distal Soleal veins. The appearance can represent benign Soleal vein ectasia, but it can also be seen in patients with incompetent distal Soleal perforator(s). The veins should be assessed for competence and their peripheral extent should be scrutinized for the presence of associated incompetent perforators.

Question 15: Describe the image and provide a diagnosis.



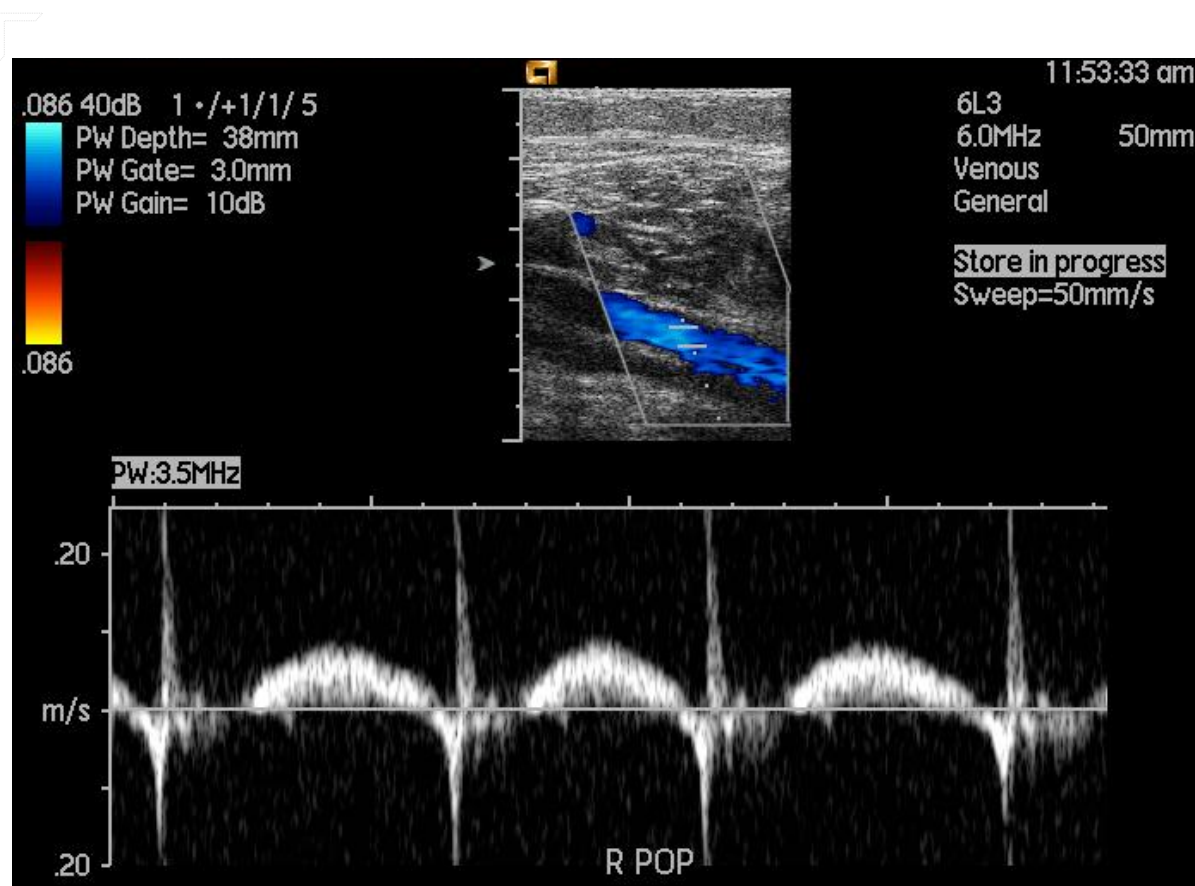
Model Answer: Echogenic linear intraluminal echoes of varying thickness are demonstrated within the Gastrocnemius vein. Appearance is consistent with chronic thrombotic residua and fibrin strands.

Question 16: Patient with extensive varicose veins complains of a painless palpable lump over the anterior aspect of the ankle. Ultrasound reveals an avascular round mass as shown below. Describe the image and give the most likely differential.



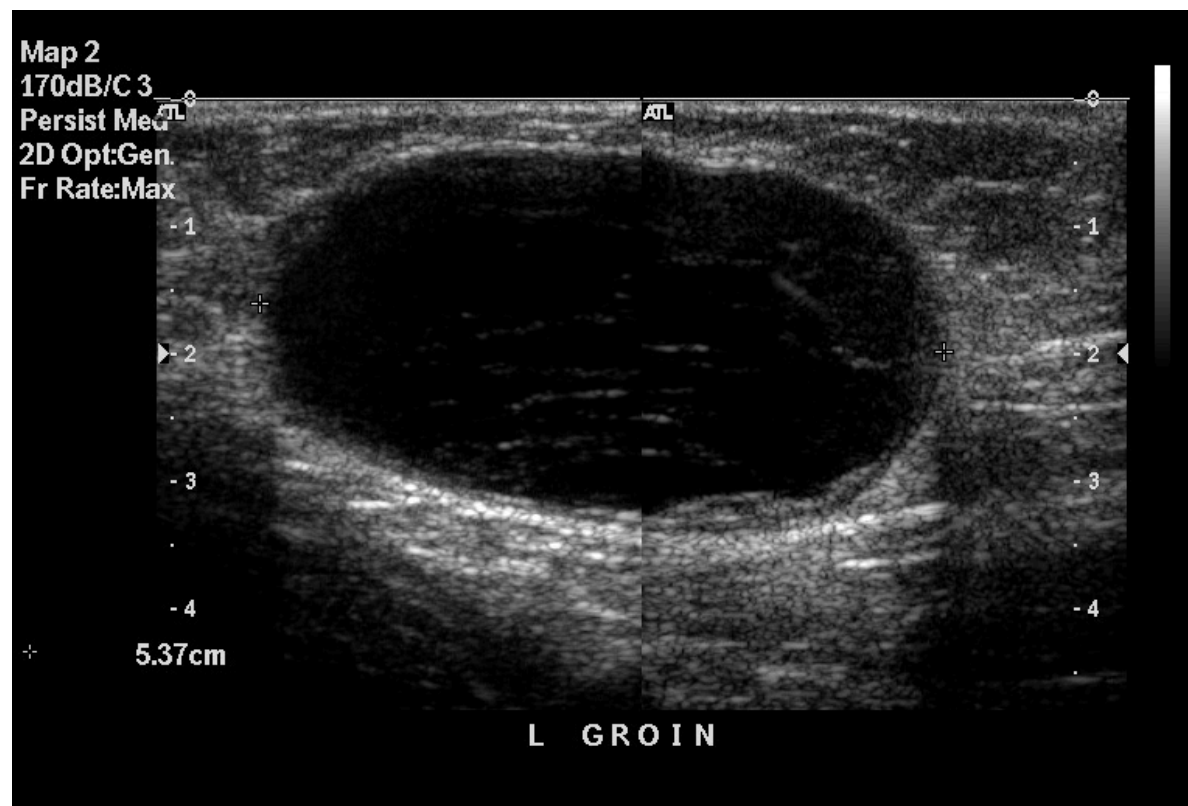
Model Answer: The palpable mass appears as an anechoic round simple cystic lesion associated with underlying ankle joint structures. In the vicinity of joints and synovial sheaths, a ganglion is a likely differential.

Question 17: Describe the image and provide a diagnosis.



Model Answer: Spectral Doppler waveform of the Popliteal vein is highly pulsatile. This is a sign of high central venous pressure commonly due to right heart failure or profound trisupid regurgitation.

Question 18: A groin lump is detected during duplex scan of the lower extremity. On questioning the patient reports it has been there for about a year ever since she had cardiac interventions following an MI. Describe the image and provide a diagnosis.



Model Answer: There is a oval well defined and well marginated lesion with a thick capsule and anechoic internal contents criss-crossed by a reticular pattern of fibrin strands. Appearance is characteristic of a hematoma.

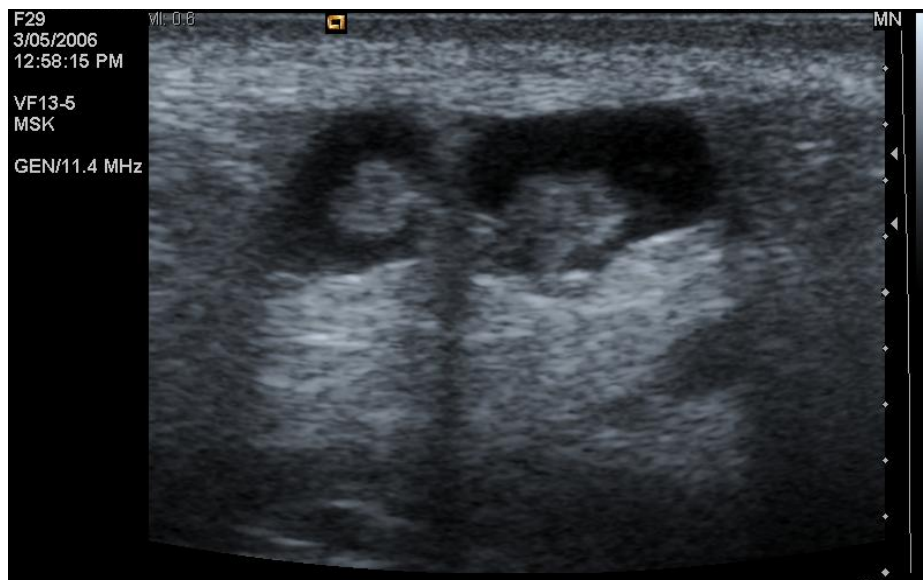
Question 19: A patient presents with hard swollen calf. The following panoramic view was obtained along the medial aspect of the calf from the knee peripherally.

Describe the image and provide a diagnosis.



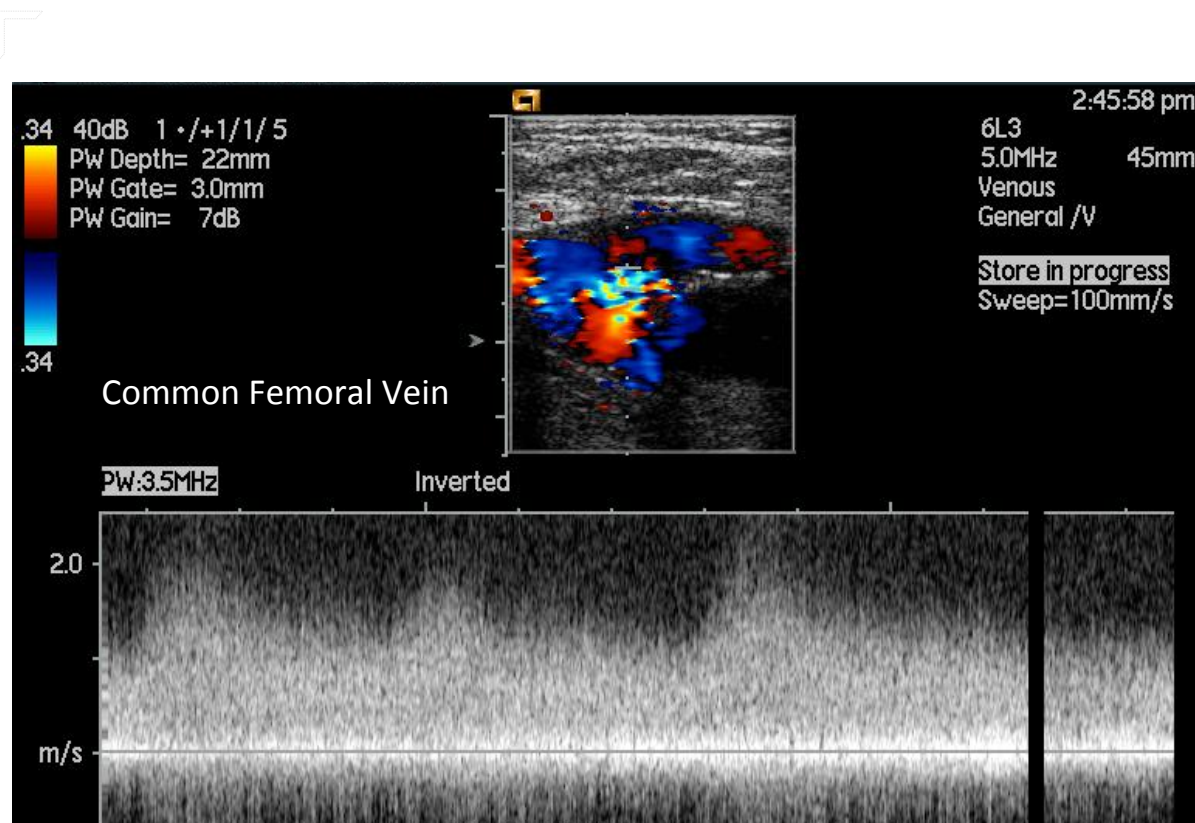
Model Answer: Panoramic image of the medial calf structures demonstrates a bi-lobed fluid collection at the level of the knee with a thin extension propagating peripherally along the fascial planes of the gastrocnemius muscle. Associated subcutaneous oedema is seen in the dependent part of the calf. Findings are characteristic of a ruptured Baker's cyst.

Question 20: The following appearance was noted by the phlebologist in the vicinity of the SFJ. Describe the image and provide a diagnosis.



Model Answers: Two lymph nodes are shown with mildly thickened cortex and increased vascularity. Appearance is suggestive of reactive nodes, but the appearance is non-specific.

Question 21: An elderly patient presents for lower extremity venous examination because of chronic unilateral leg swelling. Describe the image and provide a a diagnosis.



Model Answers: The CFV demonstrates high velocity turbulent arterialized signal. This is a classic finding for AV fistula. On questioning, the patient revealed the leg swelling came on after cardiac catheterization. This is undoubtedly an iatrogenic AVF.