Using Portable Ultrasound to Support Cannulation

The tool of the 21st century

BC Vascular Educators Group

Updated January 2020

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Learning Objectives

UPON COMPLETION OF THIS PROGRAM, PARTICIPANTS WILL BE ABLE TO:

1. Describe the RN & LPN scope of practice in the use of portable ultrasound
2. Discuss the benefits of using ultrasound to support cannulation
3. Understand the mechanics of ultrasound
4. Describe the procedure for using ultrasound in assessing an access

Target group: Skilled & advanced cannulators

Scope of Practice & the Use of Ultrasound

BC College of Nursing Professionals (BCCNP)

RNs: Regulation 6 (1) (i) allows RNs to apply ultrasound without an order for the purposes of blood flow monitoring.

LPNs: Regulation 10 (ii) allows LPNs to apply ultrasound without an order for the purposes of blood flow monitoring.

For the purpose of the BC Renal guideline, these regulations have been interpreted to include transonic monitoring, fistula/graft assessment, needle tip confirmation and real-time guidance during cannulation of a fistula/graft.

Benefits of Using Ultrasound to Support Cannulation

- Provides an additional assessment tool
- Increases the accuracy of cannulation by helping with:
  - Selection of the best cannulation site (rope ladder or buttonhole sites)
  - Determining patency, depth, shape, size and direction of vessel
  - Identifying structures in the vessel (stents, patches, valves, etc.)
  - Allowing visualization of the position of the needle in real-time
- Fewer cannulation attempts reduces trauma for patients
- Fewer complications associated with cannulation
- Earlier identification of potential problems (e.g., thrombosis/clots, narrowing of vessel)

Allows you to confirm what you already know by a good physical assessment

Mechanics of Ultrasound

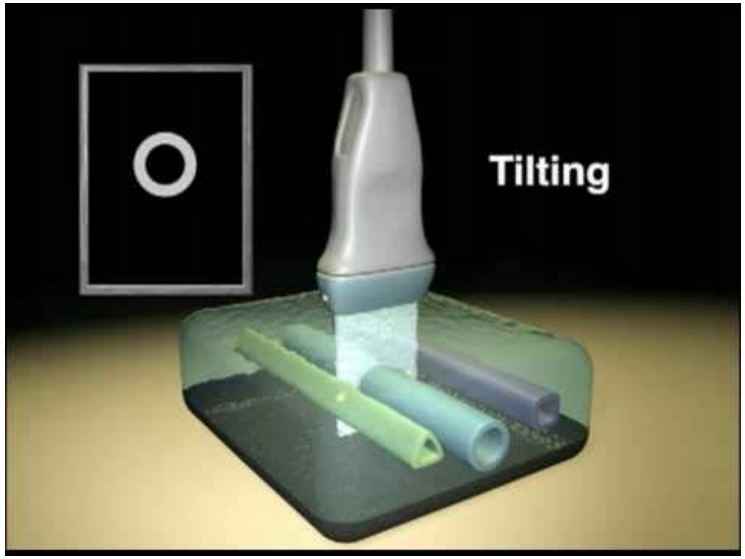
Ultrasound uses sound to produce an image

- Frequency is the number of Hertz or cycles that occur per second
- Humans hear in a range of 20 Hz to 20,000 Hz
- Ultrasound scanners use frequencies of 2-15 MHz (2,000,000 to 15,000,000 Hz!)
- Sound waves are emitted from the ultrasound probe, strike a surface and are “echoed” or reflected back to the probe. The reflected waves are picked up by the probe and relayed to the ultrasound machine
- The higher the density of the surface, the brighter the echoes

Mechanics of Ultrasound

Ultrasound probe

- Purpose is to act as a conduit for sound waves
- Produces a linear shaped image



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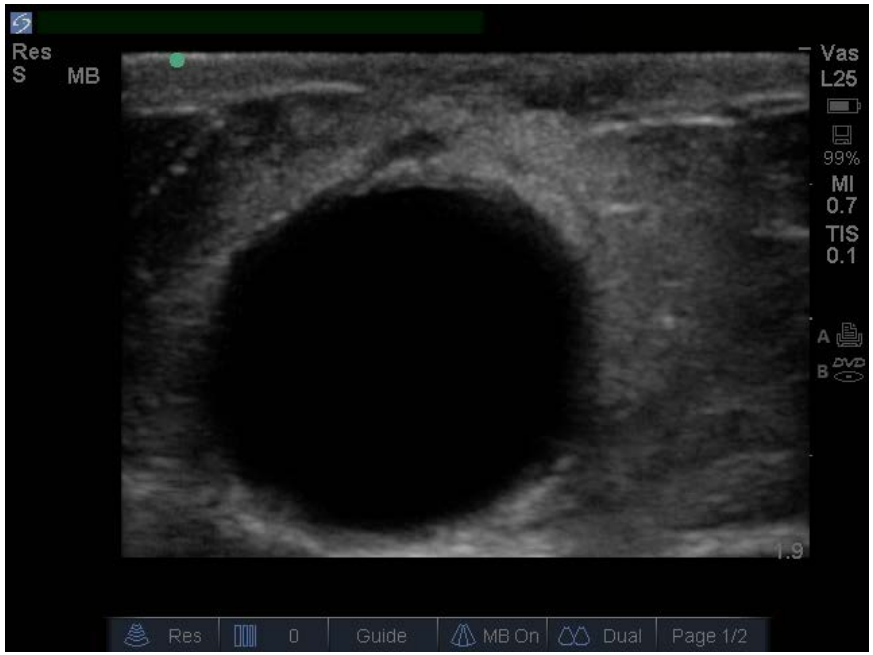
Mechanics of Ultrasound

Probe

- Produces a rectangular field of view
- Beam from probe is the thickness of a credit-card
- Produces a direct, real-time, cross-sectional view
- Allows for better visualization of superficial structures
- Ideal for vascular access cannulation



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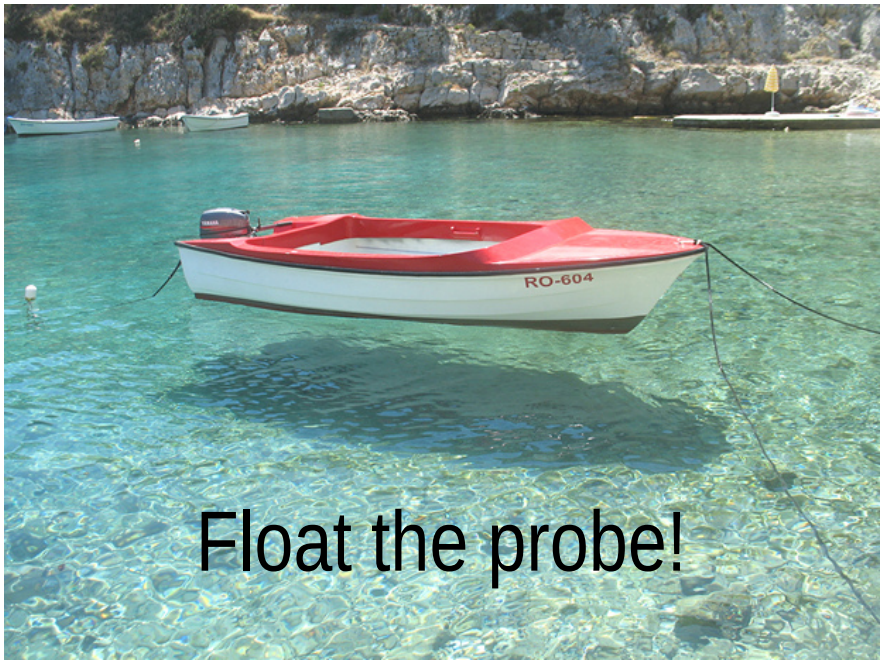
Mechanics of Ultrasound

Good probe principles

- Good body mechanics
- Relaxation
- Stability of the probe
- Look!



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Mechanics of Ultrasound

Probe covers

- Used to maintain universal precautions

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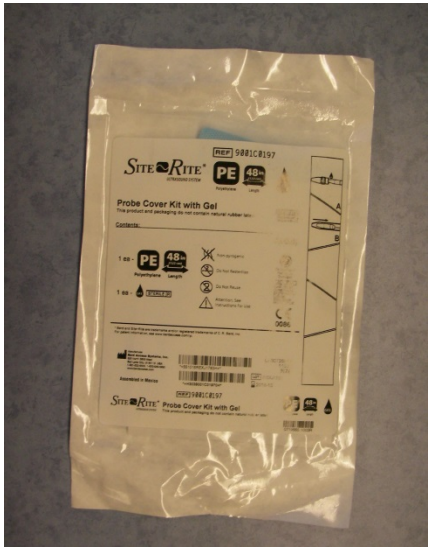
Mechanics of Ultrasound

Ultrasound gel

- Used as a medium between the probe and the patient
- Enhances sound waves emitted by the probe



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Mechanics of Ultrasound

Probe and screen buttons (controls)

- On/off/reset
- Depth
- Gain (contrast)
- Freeze image to print or save
- Measure/caliper

Ultrasound Controls

Depth

- Center vessel image vertically and horizontally by adjusting the depth to image the whole vessel
- 3 cm is a good place to start for the average adult

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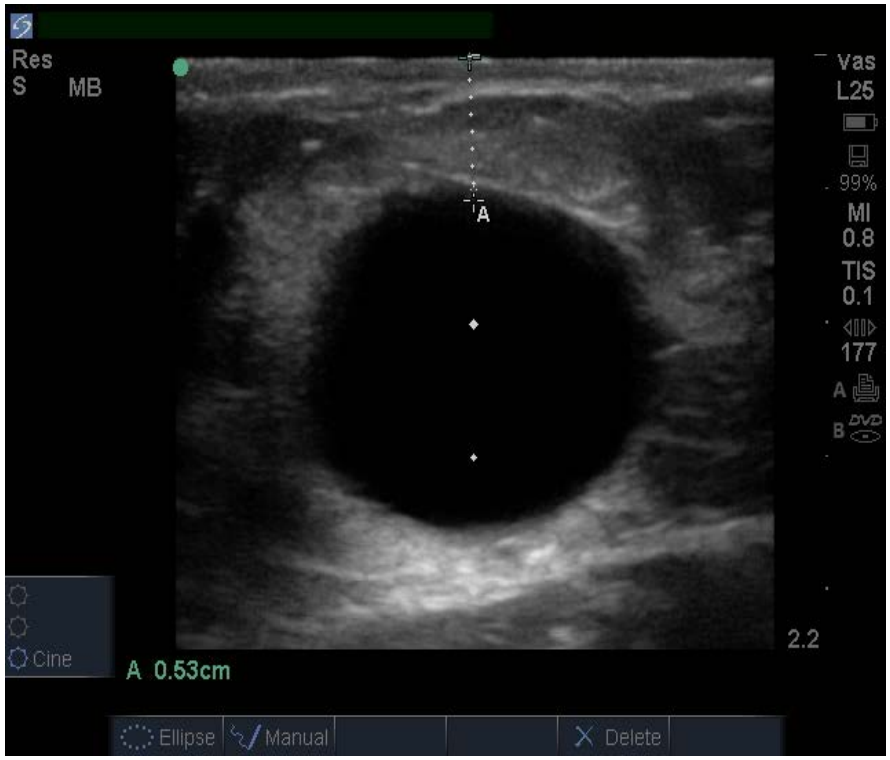
Ultrasound Controls

Depth

- Depth markers (white dots)
  - Large dots – 1 cm
  - Small dots - 0.5 cm
- Depth markers should be in the center of the vessel
- Superficial vessels: 1.5 cm setting
- Deep vessels: 6 cm setting



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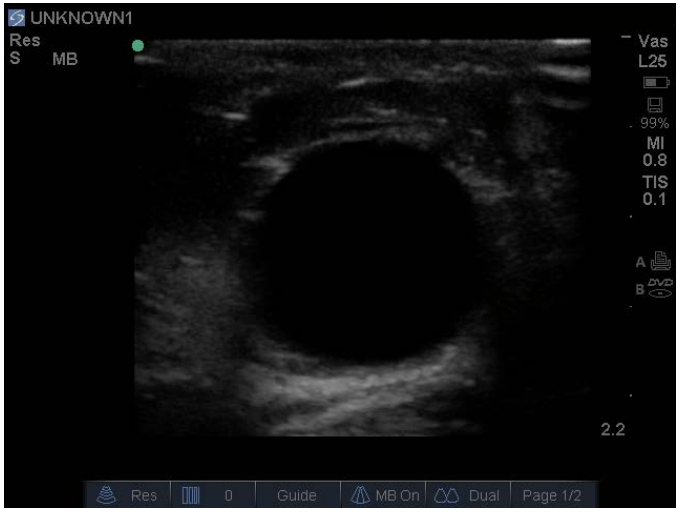
Ultrasound Controls

Gain (Contrast)

- Increasing and decreasing gain (contrast) allows the user to change the lighting of an object and the objects around them
- Generally, deeper vessels require a higher contrast
- Remember to adjust the contrast before adjusting the gain



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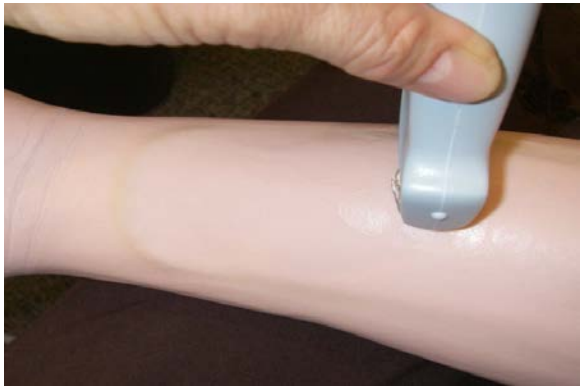
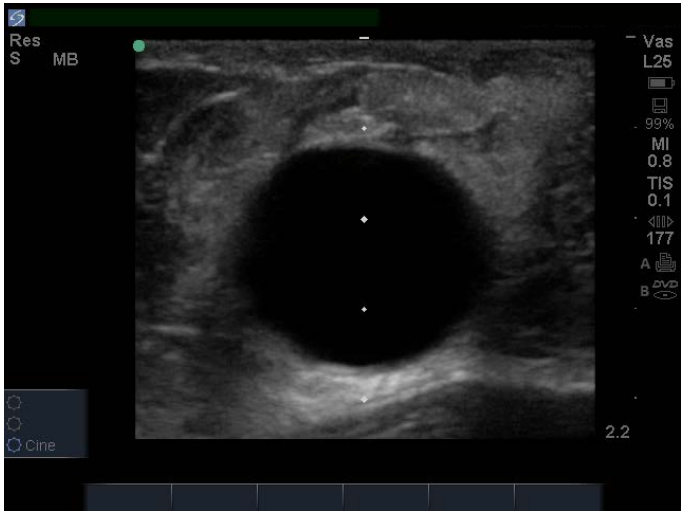
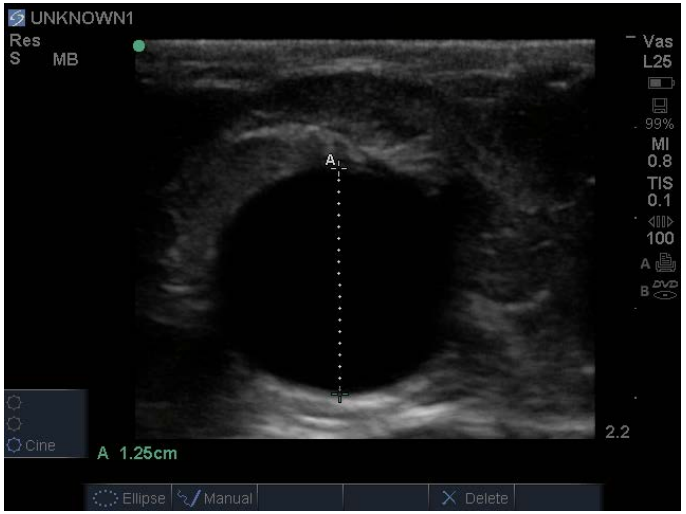
Ultrasound Controls

Freezing and vessel measurements







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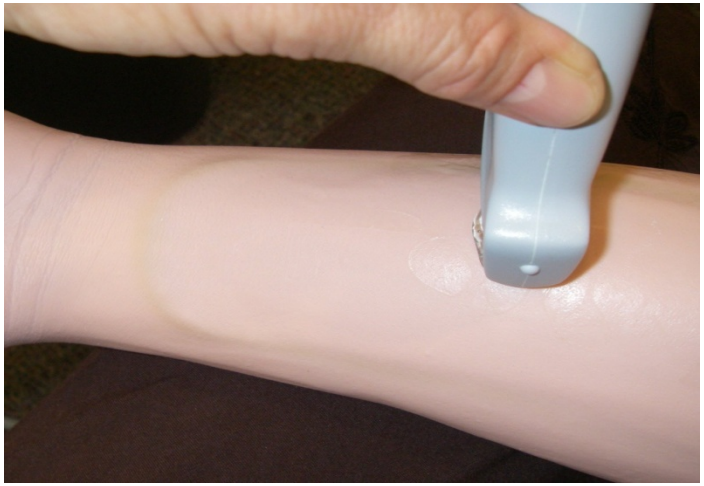
Ultrasound Mapping

Transverse (short axis) mapping



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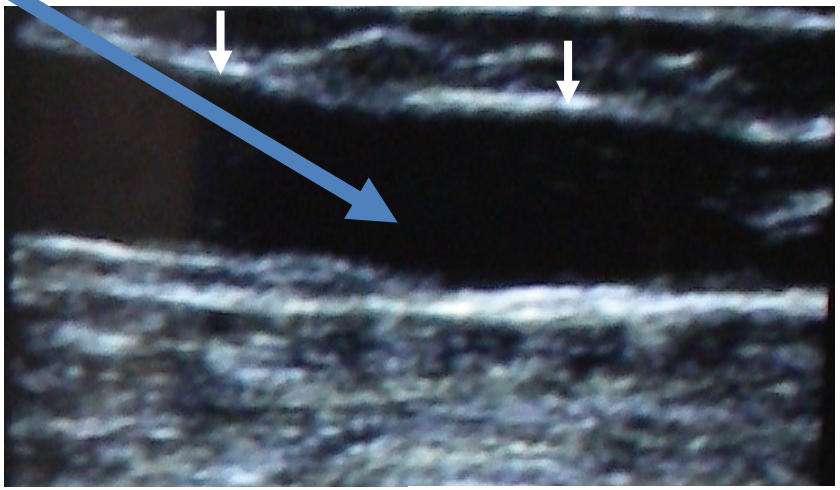
Ultrasound Mapping

Longitudinal (long axis) mapping

- This picture shows there is an area of the access that is straight enough for a fistula needle to be threaded completely.

- Note downward trend of vessel indicated by white arrows that show distance from skin to the vessel. This suggests fistula needle should not be flattened out too much



Procedure

Step 1: Obtain patient history

Review diagnosis and medical history

- Vascular access history
- Previous vascular access related complications such as thrombosis or stenosis

Procedure

Step 2: Gather equipment

- Ultrasound machine
- Gel
- Probe cover
- Clean gloves
- Tourniquet
- Skin Marker
- Washcloth
- Disinfectant

Procedure

Step 3: Prepare the environment

- Is there enough light? Is there too much light?
- Does any furniture need to be moved?
- Are you using good body mechanics?

Procedure

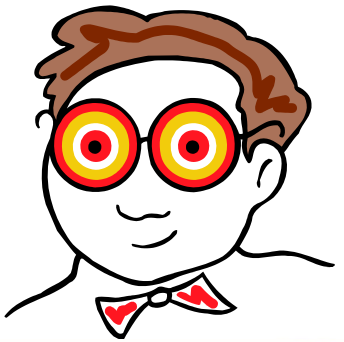
Step 4: Observe the patient.

- Is the patient comfortable?
- Are they anxious?
- Is the patient well positioned?
- Are they warm?

Procedure

Step 5: Look at the access

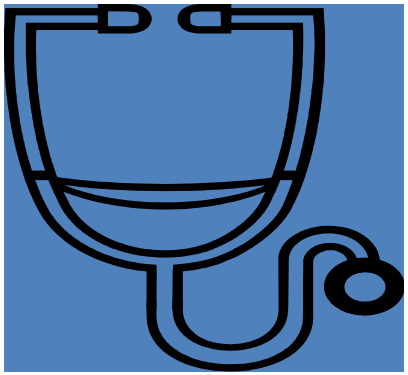
- Roll up the sleeve
- Assess the entire arm
  - Redness, swelling, pain, warm to touch, bruising, aneurysm formation
  - Compare with the other arm (numbness, tingling, discoloration)



Procedure

Step 6: **Listen** to the access

- Use your stethoscope
- Start at the anastomosis
- Listen to the entire access
- Note any changes in the pitch

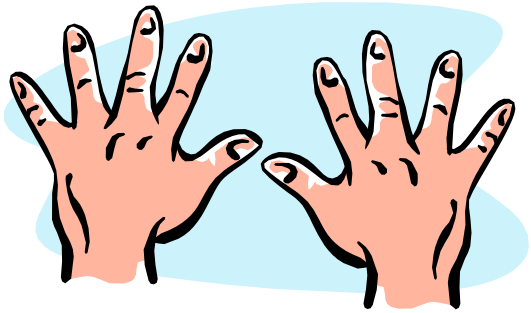


A thorough assessment will prevent needling a clotted access!

Procedure

Step 7: **Feel** the access

- Start at the anastomosis
- Use your finger tips
- Roll your fingertips across the vessel
- Palpate the entire vessel
- Repeat with a tourniquet
- Do not use a tourniquet on a graft



A thorough assessment will prevent needling a clotted access!

Procedure

Step 8: See the access

Step 8(a): Position the patient

- Patient comfort is equally important to the clinicians comfort
- Place patient's arm so that it is comfortable and easily accessible for cannulation

Procedure

Step 8(b): Prepare the ultrasound machine

- Confirm ultrasound settings

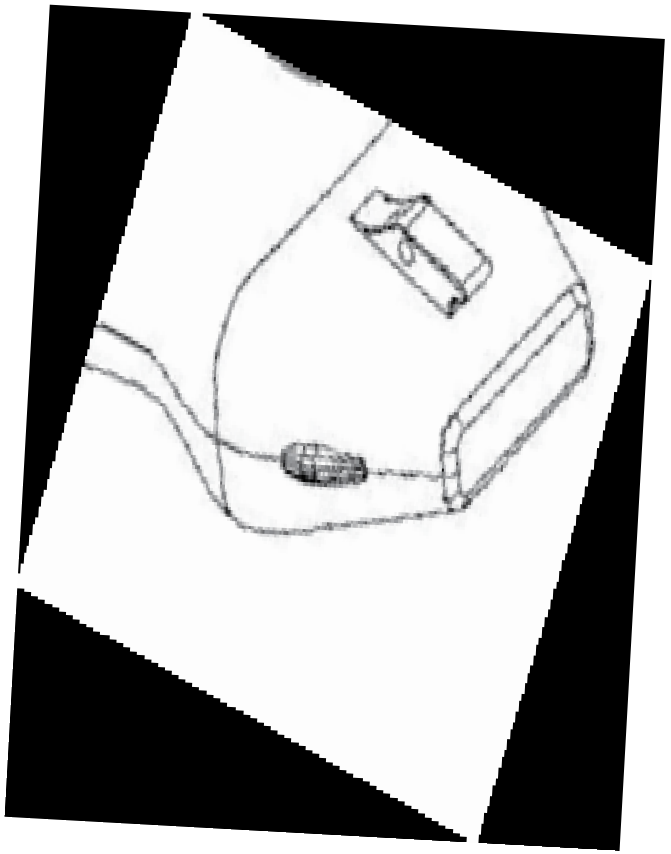
Step 8(c): Prepare the probe

- Apply Tegaderm to probe or add probe cover

Procedure

Step 8(d): Orientate the image

- Check the orientation of the probe
- Orientation markers provide a consistent transducer reference point



Procedure

Step 8(e): Scan the access

- Apply a moderate amount of gel to the patient's arm
- "Float the Probe" – pressure will cause the vessel to collapse
- Hold the probe so that it has complete contact with the skin and is perpendicular to the vessel
- Adjust the depth setting to centre the vessel
- Adjust the contrast/gain to increase the definition of the image
- Begin scanning with the probe in the transverse view in relation to the vessel

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Procedure

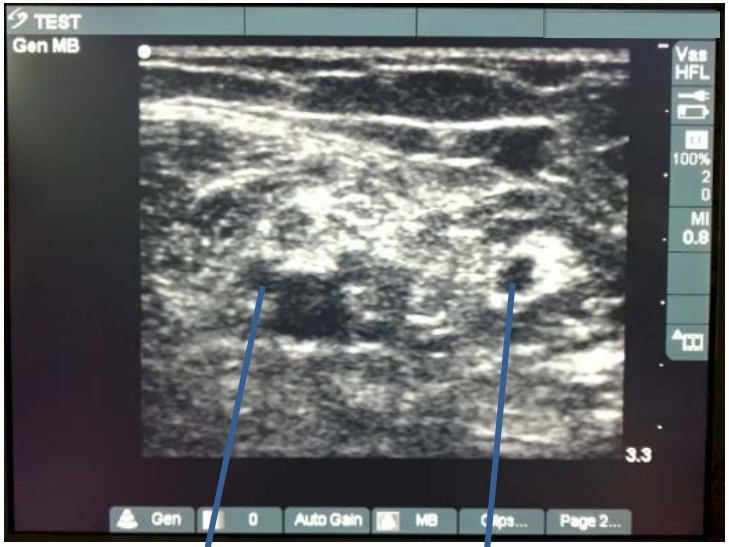
Step 8(f): Mark the location of the vessels

- Black dots may be used to show the location of the vessel (to ensure aneurysm is not being needled)
- Sharpie black felt pens work well and won't wash off

Ultrasound Images: Examples

Picture of compressing vessel

Normal vessel



Vein open

Veins beside
the artery

Same image with compression of veins, arteries do not compress

Veins are easily
compressed

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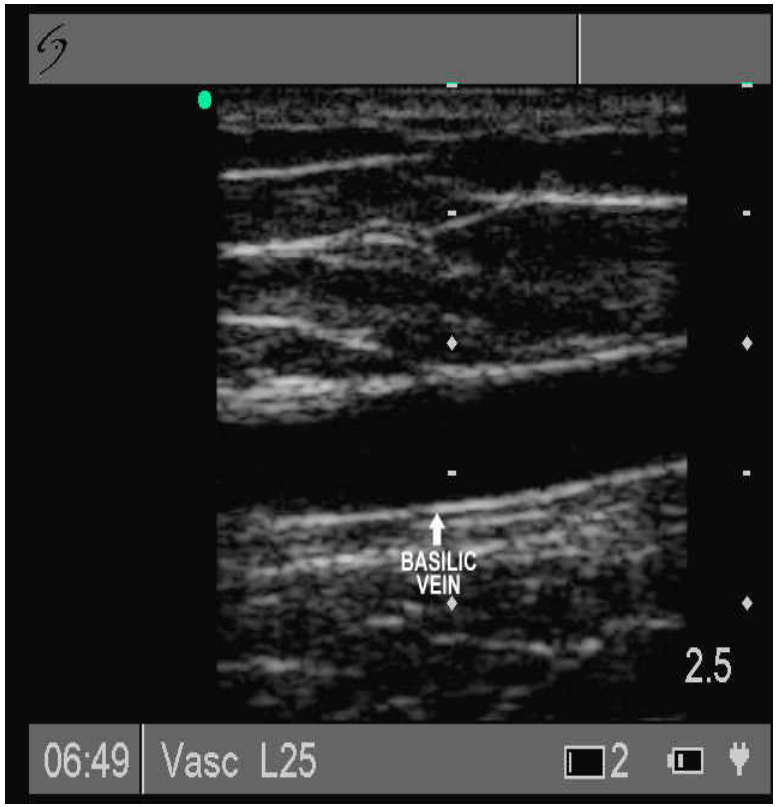
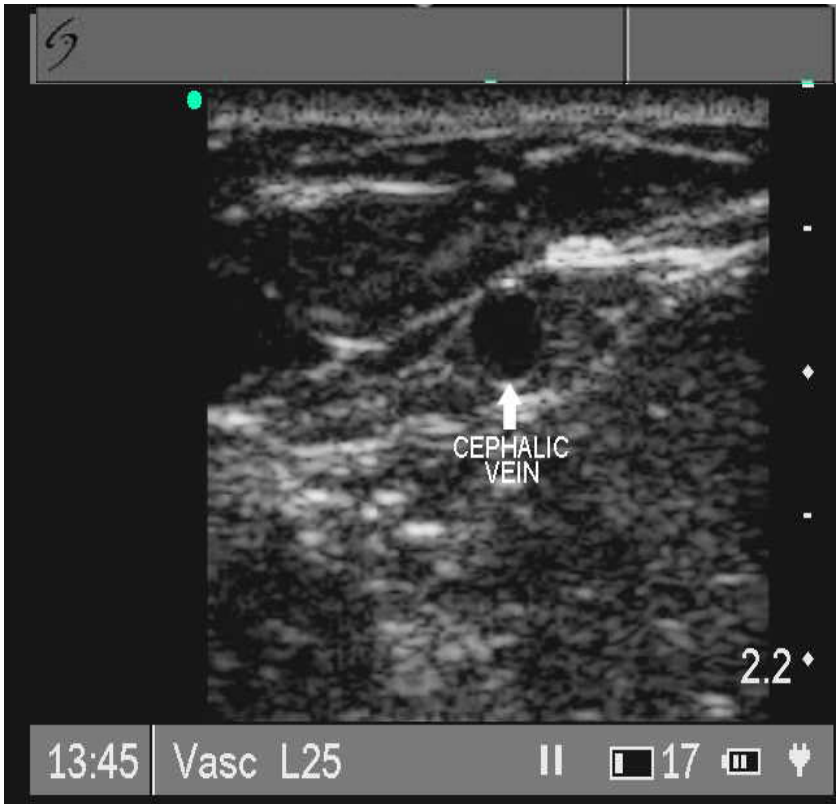
Different Views: Longitudinal vs Transverse





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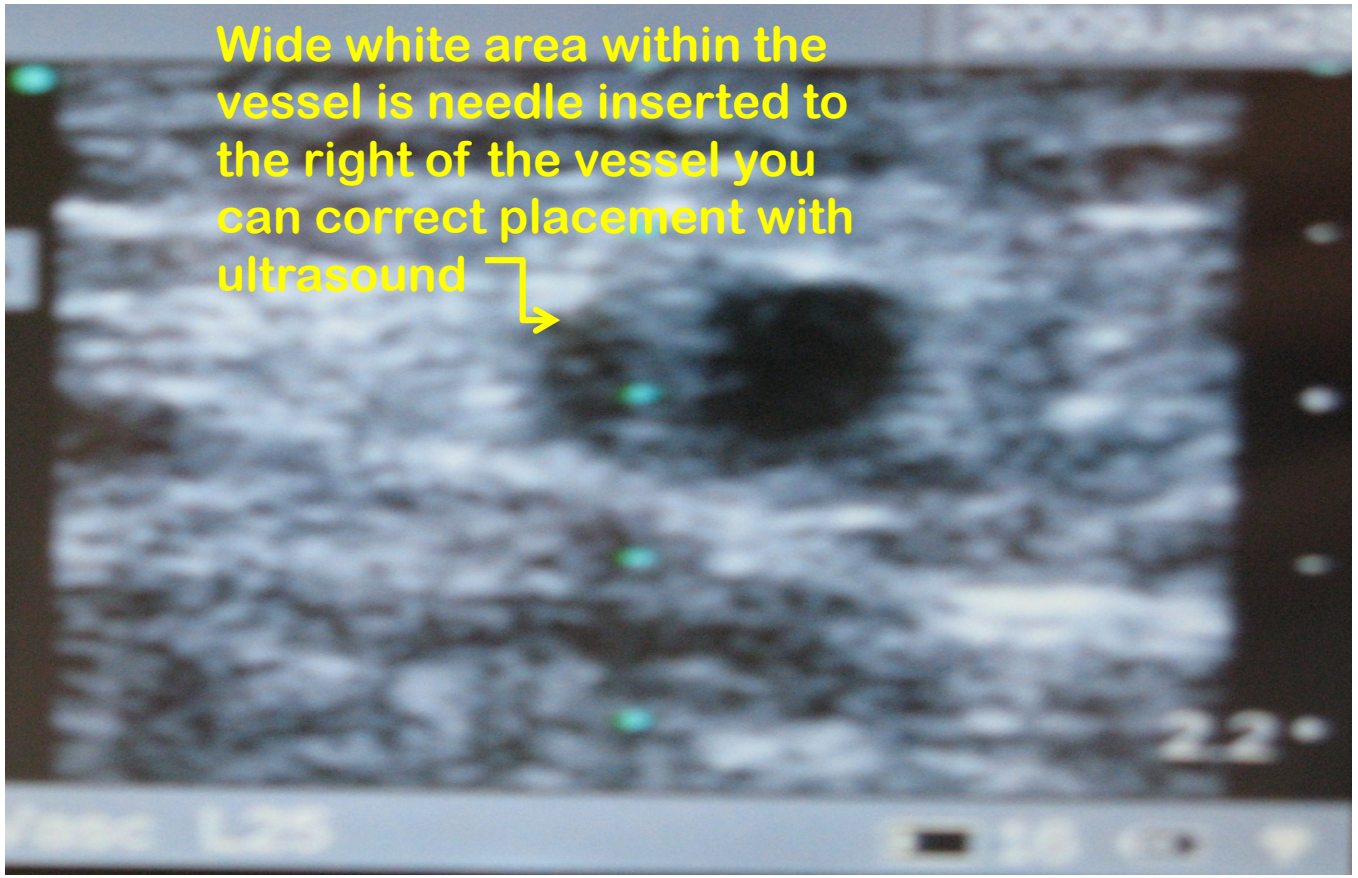
Visualize Incorrect Needle Placement



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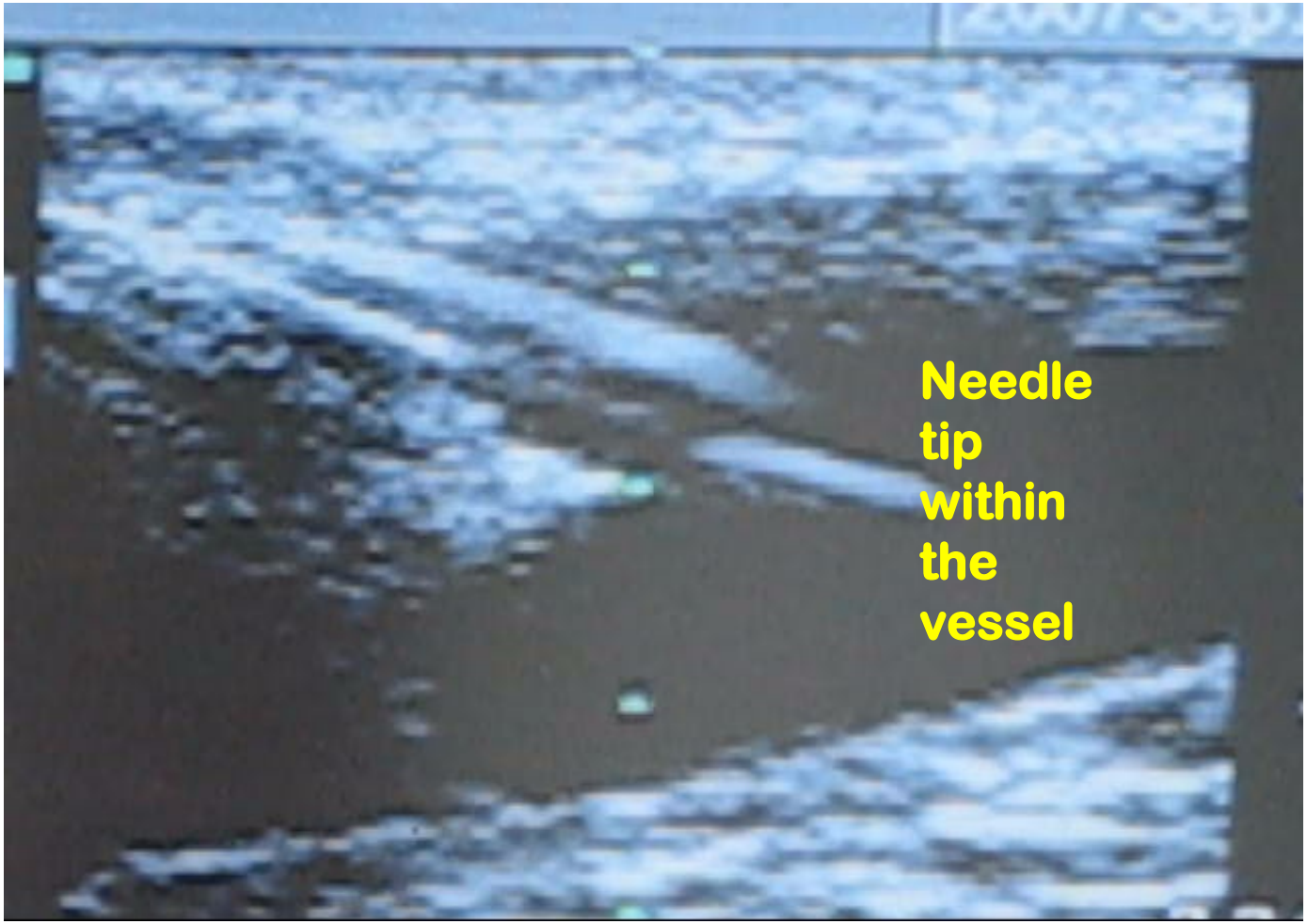
Longitudinal Needle Placement Check



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Correct Placement of Needle in the Vessel

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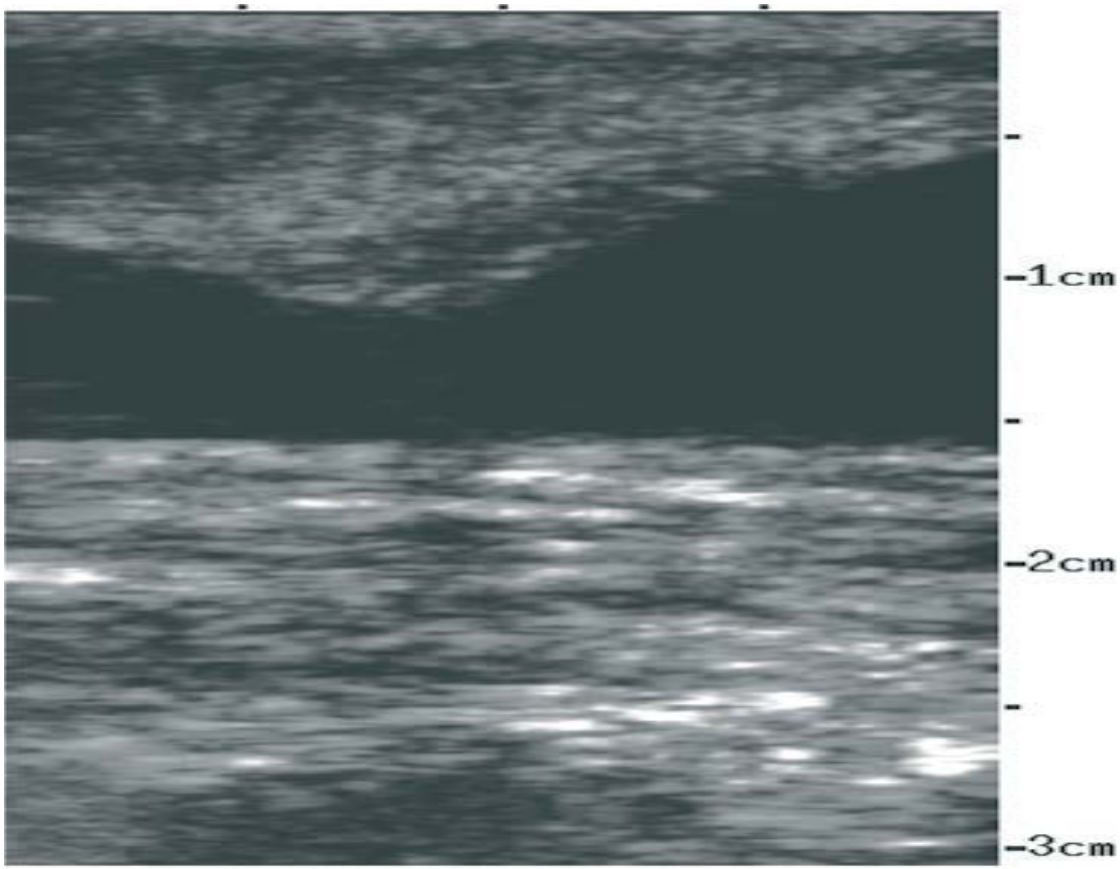
Vessel variations



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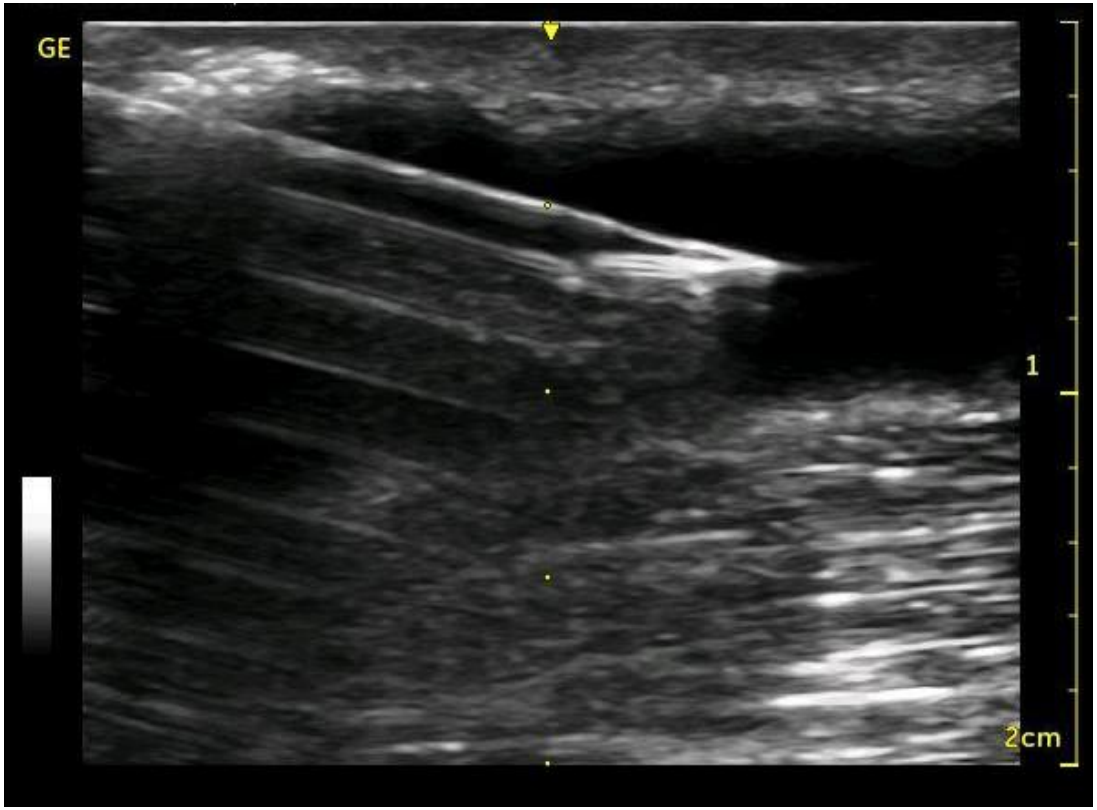
Needle placement with sound waves bouncing off needle



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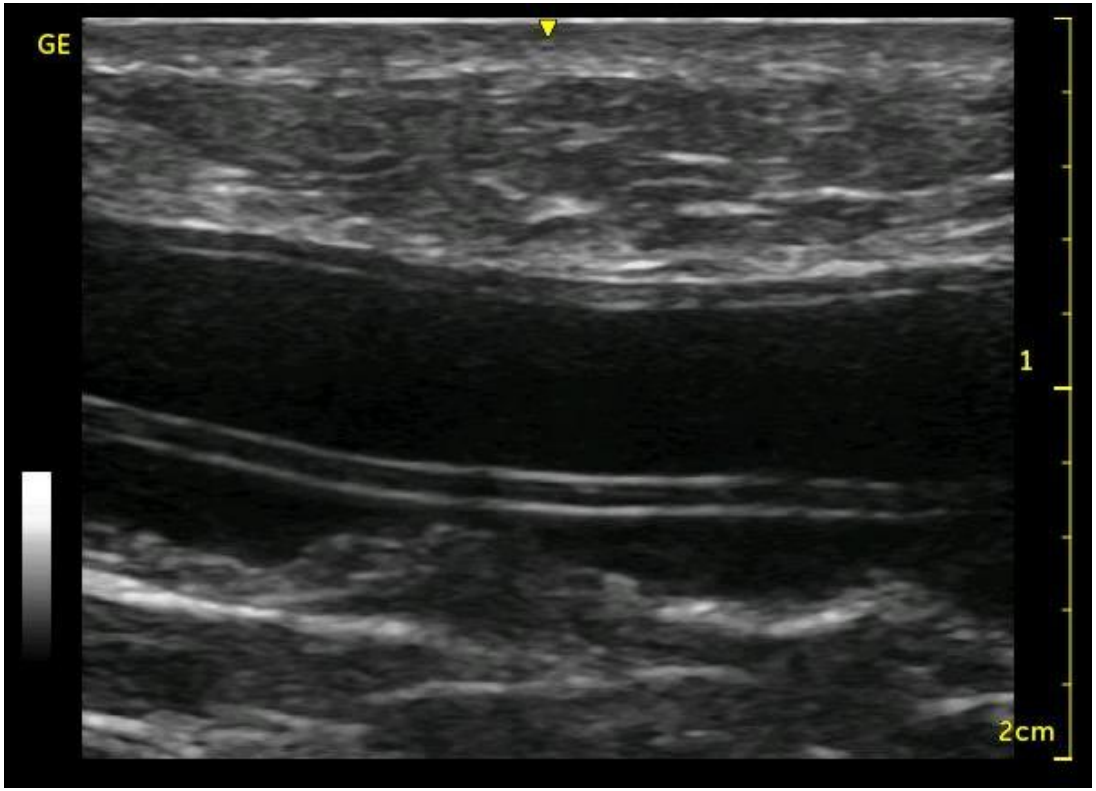
What a graft looks like with ultrasound



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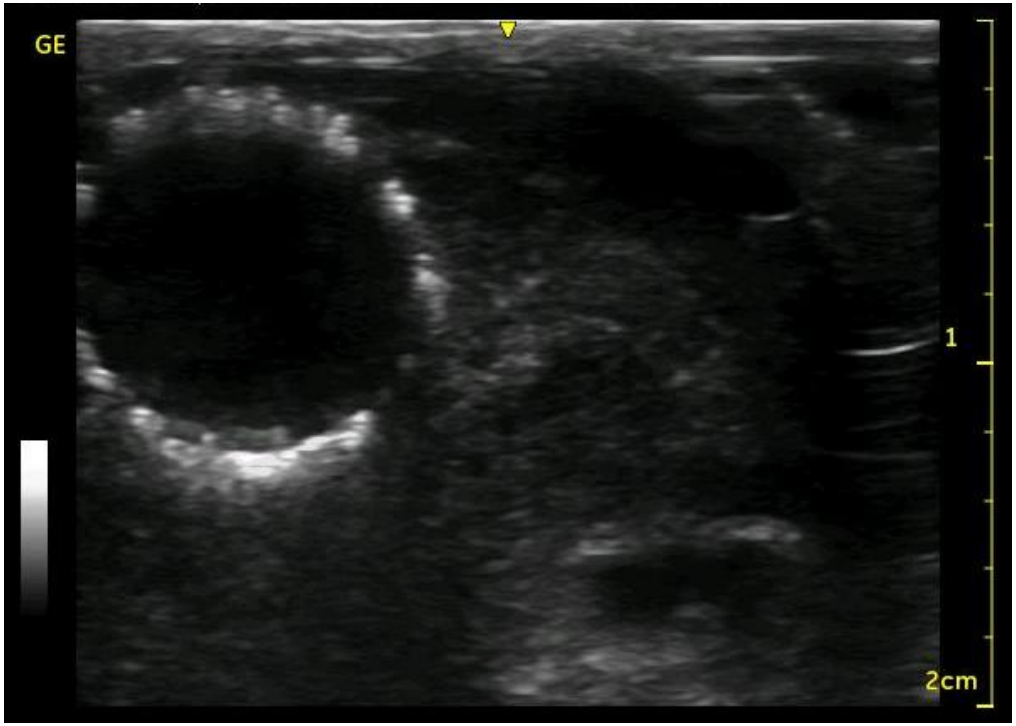
Identification of a stent (highlighted wires)



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Using Ultrasound to Identify Complications

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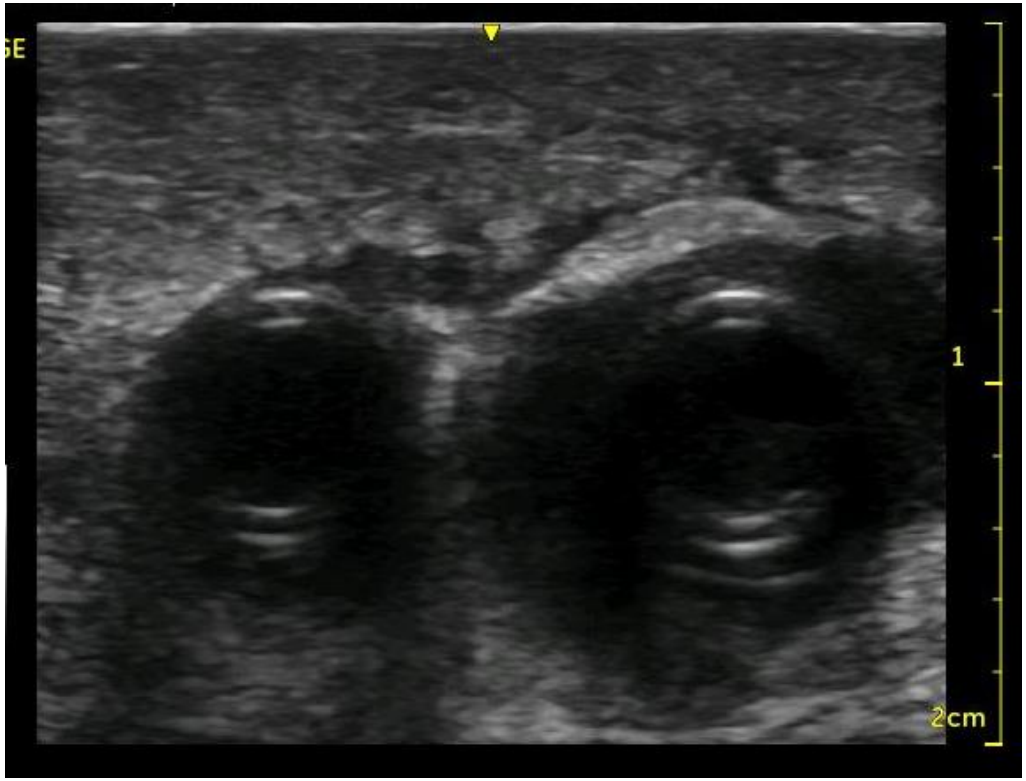
Seroma, Post graft insertion (black area around the graft)



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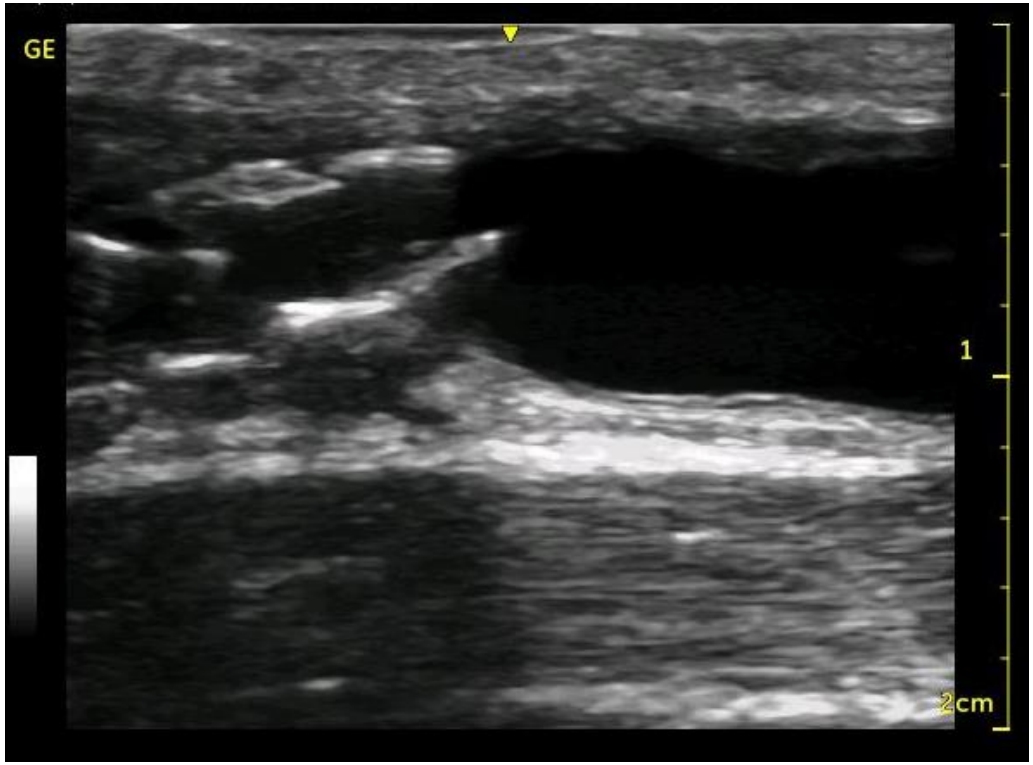
Stent that has been cannulated and disfigured. Cannulations should be avoided.



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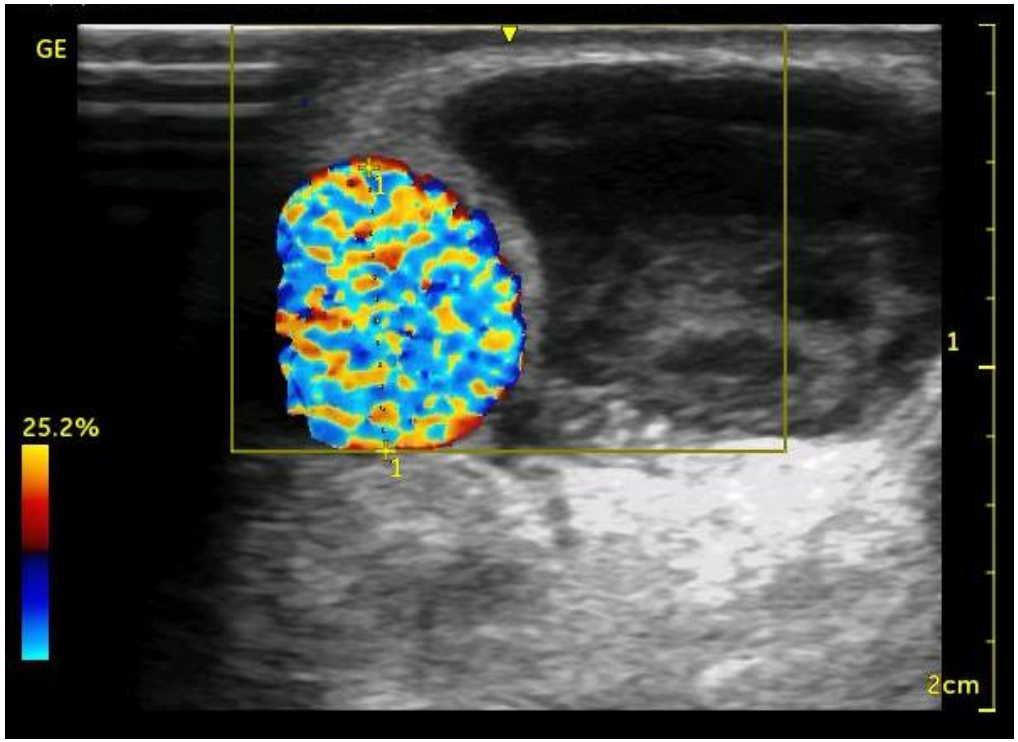
Pseudo aneurysm formation from miscannulation (black and grey area at the right side of the image beside the coloured vessel)



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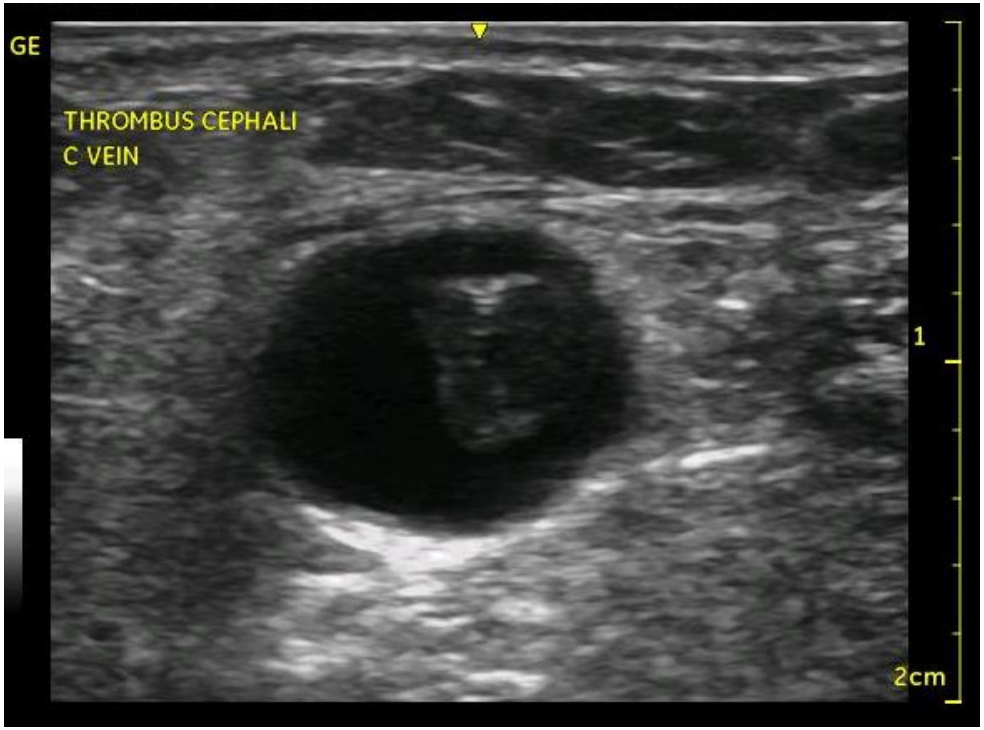
Clot, within the cephalic vein



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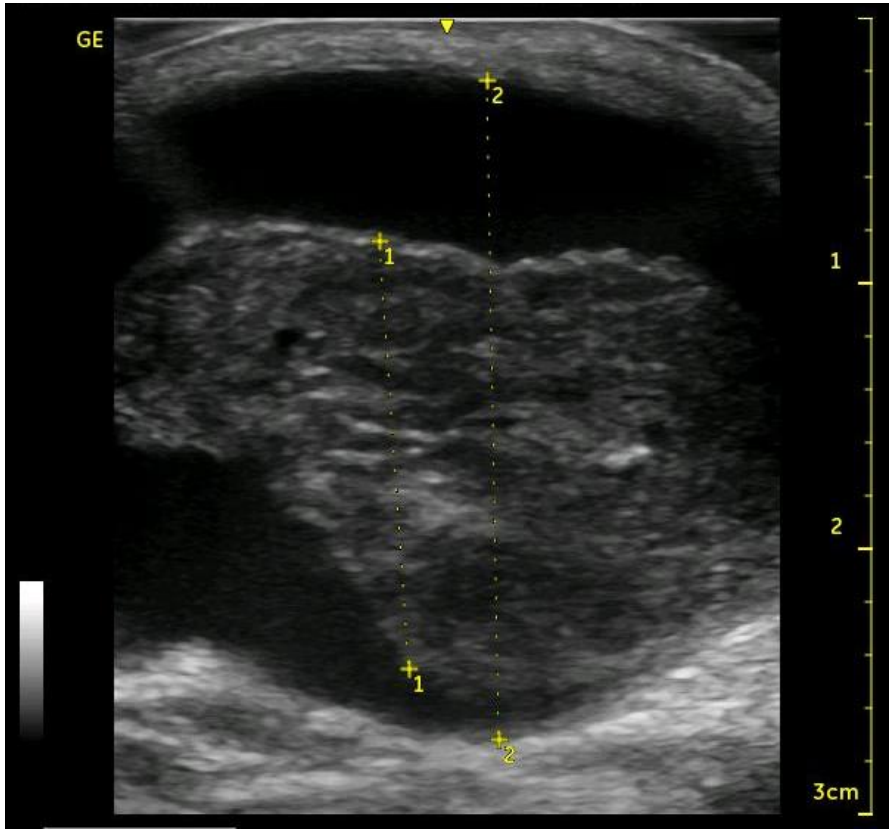
Clot in an aneurysm



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