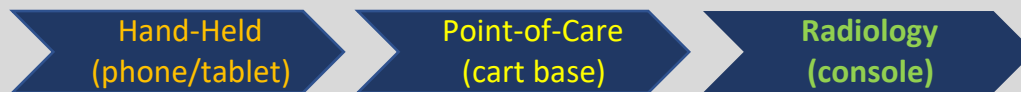




TRANSCRANIOPLASTY ULTRASOUND (TCUS) – SUGGESTIONS TO GET STARTED “POINT OF CARE” ULTRASOUND SYSTEMS

What System to Use?

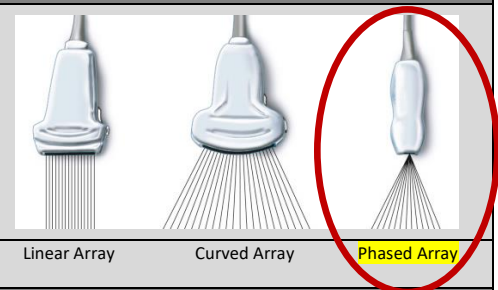
- The best ultrasound to start is the one you have access to for immediate use. Image quality varies between systems and user visual perception so there is no one right answer.
- Ultrasound technology has made significant improvements recently so explore them all to find the best one for your budget and clinical needs. Set GOOD-BETTER-BEST expectations for image quality, capability, and functionality based on the following generalization:



Probe Recommendations:

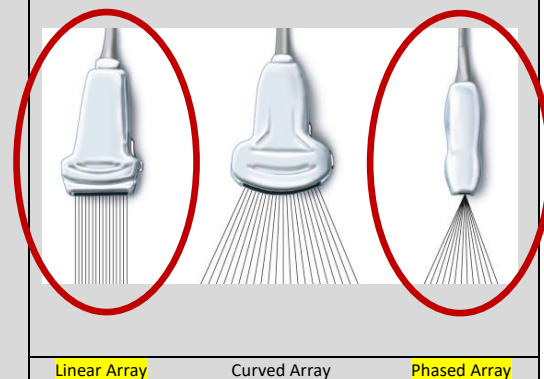
Neuro Anatomy – Phased Array (Sector) is best

- Small footprint (size) best matches the size of ClearFit Covers (2-3cm).
- Low frequency optimizes penetration for visualization of deeper structures like ventricles and skull base.
- Beam shape provides a large field of view from the small footprint probe.



Neuro Vascular – Two probes to consider

- Linear Array Probe is Best for EC-IC Bypasses
 - Designed for vascular assessment and well suited for larger ClearFit Disks.
 - High frequency provides great image quality and optimal frame-rates for shallow vessels.
 - Beam steering improves doppler shift for better sensitivity to blood flow.
- Phased (Sector) Array Probe is Best for Transcranial Doppler of Intracranial Arteries.
 - Low frequency penetrates deeper to visualize the Circle of Willis.





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TCUS Orientation:

- Probe orientation marker is a notch or groove on the side of the probe which corresponds to the orientation marker on the screen (blue dot generally found on the top left of the image)
- Neuroanatomy: scan in the coronal plane with the blue dot on the probe pointed to the patient's right side. The ultrasound image has a corresponding blue dot to indicate the orientation to the patient's right side.
- Neurovascular: scan transverse to image the vessels in cross section. Turn sagittal to elongate and orient the blue marker in the direction of flow.

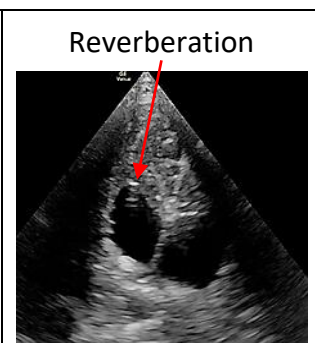
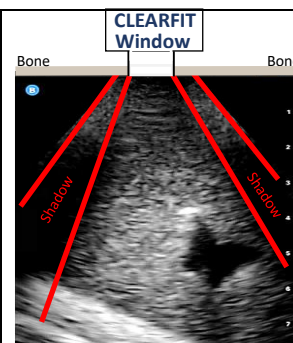


TCUS Tips to Remember

- Ideal first ultrasound is 12-24 hours post-procedure (allows air to reabsorb).
- Follow up ultrasounds need to be aware of the uneven skin surface caused by stapling and suturing for closure. Solve by using extra ultrasound gel to displace the air between the probe and skin surface to provide the sound beam a direct path and eliminate air artifact.
- Ultrasound Interference: early research suggests topical hemostatic agents, collagen-based overlays (ie Tachosil®), and some dural substitutes (ie DuraMatrix®) may interfere with ultrasound penetration.
- Presets and protocols are designed to optimize image quality but serve as a starting point. Other variables like room brightness and patient age may require further adjustments.

Artifacts...these can help or trick you

- Shadow – ultrasound does not penetrate through air or bone. Image on right shows edges of probe in contact with bone. Solve by using more gel and repositioning probe.
- Reverberation – repeating lines in an ultrasound that show up deeper to a structure (ie catheter). Can help find a shunt/catheter placed in a ventricle.



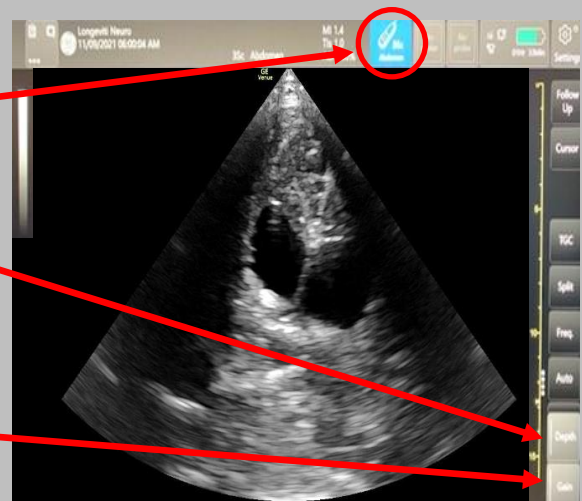


Neuroanatomy Ultrasound...Getting Started

General Neuroanatomy Settings

(Settings Applicable to All Systems)

- 1 Select "Abdominal" Preset
 - Ideal for penetration and soft tissue differentiation
 - Select first then edit parameters as desired
- 2 Depth approx. 12-16cm
 - This provides a full field of view to the skull base
 - Adjust to focus on anatomy of interest
- 3 Gain between 70-80%
 - Image brightness will vary with ambient light
 - Adjust as desired to optimize the image



Neuroanatomy Landmarks

(Images from Coronal Orientation)

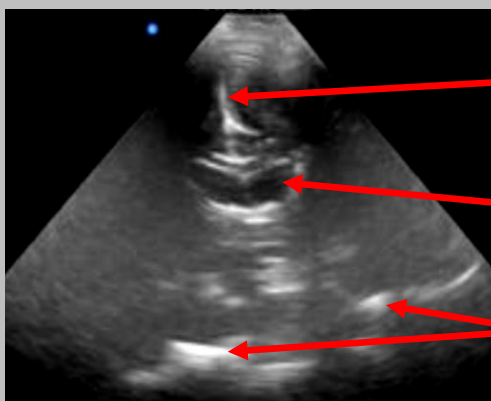


Image from "Hand-Held" System

Midline Falx
Center White Line

Ventricles
Black "butterfly" Shape

Skull Base
White Bone Border

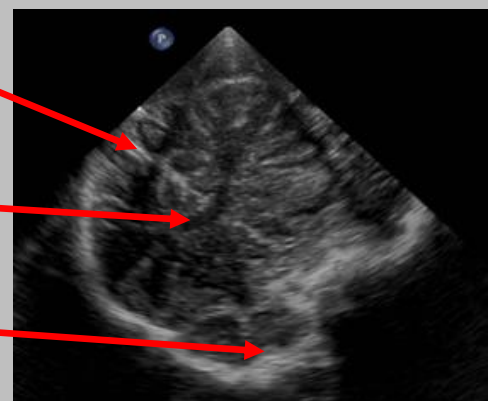


Image from Console System



Neurovascular Ultrasound...Where to Start?

Settings for EC-IC Bypass (Linear Probe)

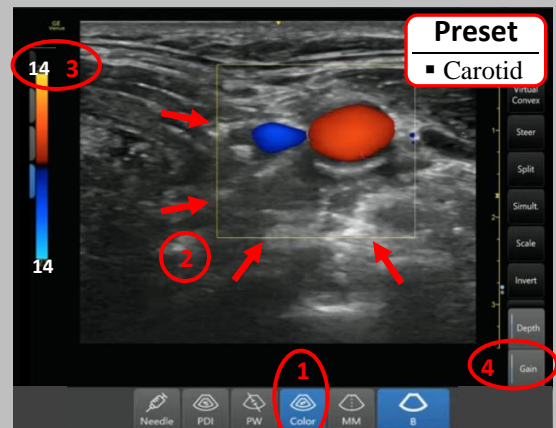
(Settings Applicable to All Systems)

General B-Mode Setting

- Preset: select “Carotid” usually found under vascular
- Depth: 3-4cm, adjust as needed
- Gain: 60-80%, adjust as needed

Color Doppler Setting

- 1 Activate “Color” doppler” **MODE**.
- 2 Adjust color box **SIZE** from touchscreen or console. “**STEER**” color box left/right with the general principle of positioning the bottom of the box in the direction of the deepest part of the vessel.
- 3 Adjust color “**SCALE**” so color fills inside the vessel.



4 Adjust “Color Gain” (60-80%) when COLOR is activated. * The General principle is to increase to see color speckles then scale back slightly until speckles are gone.

Settings for ClearFit Transcranial Doppler (Phased Array Probe)

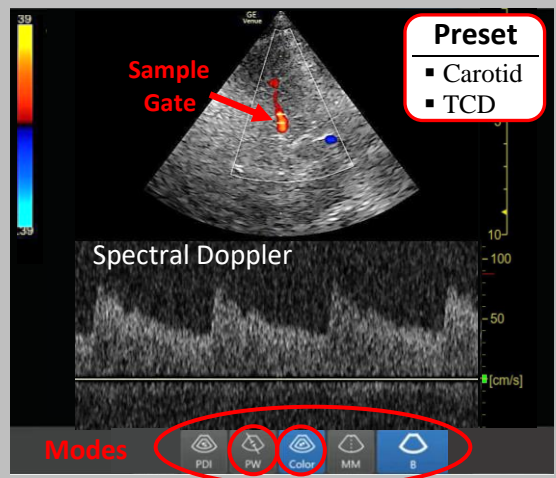
(Settings Applicable to All Systems)

General B-Mode Setting

- Preset: select “TCD” (Transcranial Doppler) or “Carotid”.
- Depth: 8-10cm, adjust as needed.
- Gain: 60-80%, adjust as needed.

Doppler Settings

- Activate “Color” doppler **MODE** and adjust as above
- Activate “PW” (Pulse Wave) doppler” **MODE**
Place PW “sample gate” on the vessel and location of interest to capture velocities in this precise sampling area. Press PW again to activate spectral tracing.
- Adjust spectral scale, gain, and baseline to optimize graph.





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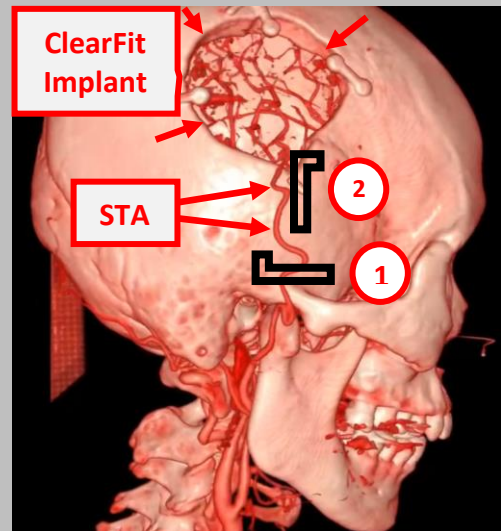
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Neurovascular Considerations

(Image from Dr. Erez Nossek)

- **Begin** scanning the STA in transverse (#1 in image) anterior to the ear and follow it distally.
- **A doppler shift** will only occur if motion is detected travelling TO or AWAY from the probe. Consider tilting the probe to create a slight angle which will enhance the doppler shift and improves the doppler color.
- Improve longitudinal scans (#2 in image) by touching the bottom of the color box and steering it toward the deepest part of the vessel.
- Doppler settings need adjustment to optimize visualization.

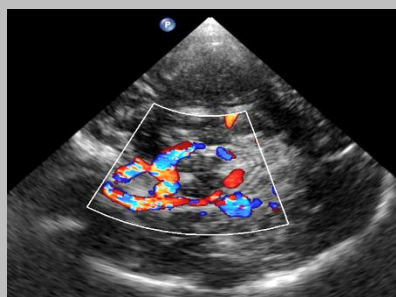


Longeviti Sample Images

Ventricles through a ClearFit Cover



Circle of Willis doppler through a ClearFit disk



Indirect bypass under a ClearFit OTS disk

