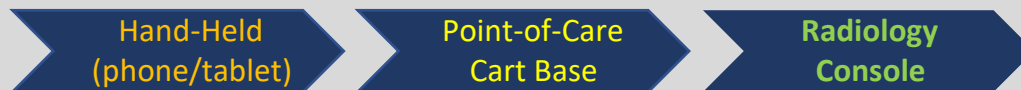




## TRANSCRANIOPLASTY ULTRASOUND (TCUS) – SUGGESTIONS TO GET STARTED “HAND-HELD” ULTRASOUND SYSTEMS

### What System to Use?

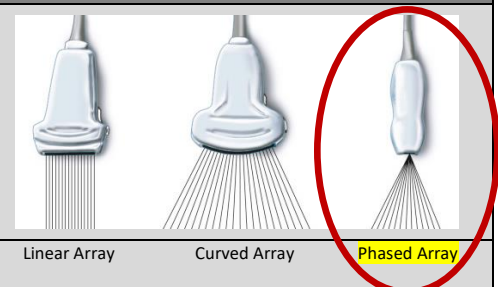
- The best ultrasound to start is the one you have access to for immediate use. Image quality varies between systems and user visual perception so there is no one right answer.
- Ultrasound technology has made significant improvements recently so explore them all to find the best one for our budget and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



### Probe Recommendations:

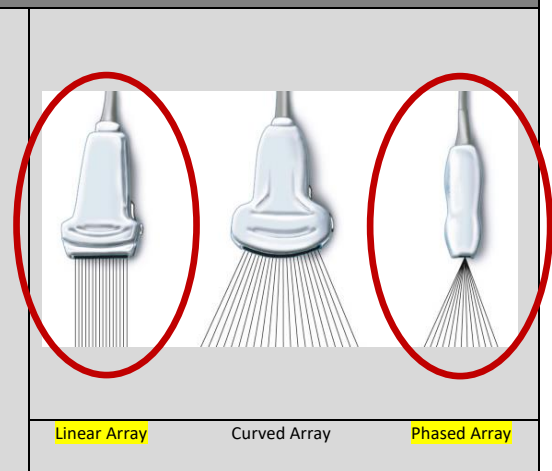
#### Neuro Anatomy – Phased Array (Sector) is best

- Small footprint (size) best matches the size of ClearFit Covers (2-3cm).
- Low frequency optimized 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 (dot) corresponds to the orientation marker on the screen (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.

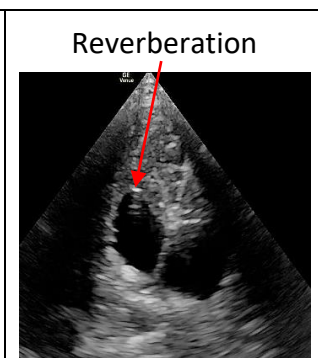
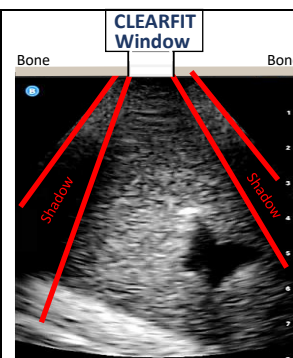


## TCUS Tips to Remember

- 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.





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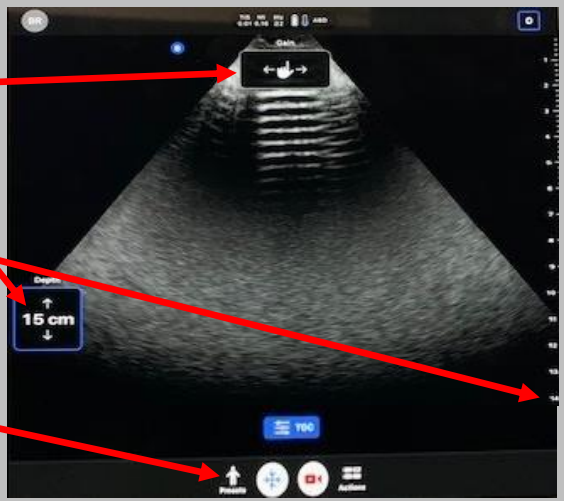
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## General Neuroanatomy Settings

(Settings Applicable to All Systems)

- 3** Gain between 70-80%
  - Image brightness varies with ambient lighting
  - Move finger left & right on screen to adjust
- 2** Depth approx. 14-16cm
  - Adjust to see anatomy of interest
  - Move finger up & down on screen to adjust
- 1** Select "ABDOMINAL" Preset
  - Ideal for penetration and soft tissue differentiation
  - Select first then make adjustments to improve



## Neuroanatomy Landmarks

(Images from Coronal Orientation)

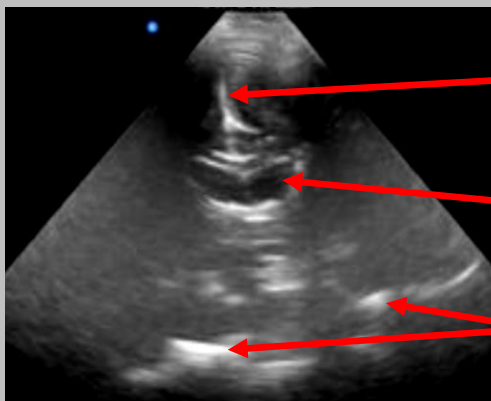


Image from "Hand-Held" System

- Midline Falx**  
Center White Line
- Ventricles**  
Black "butterfly" Shape
- Skull Base**  
White Bone Border

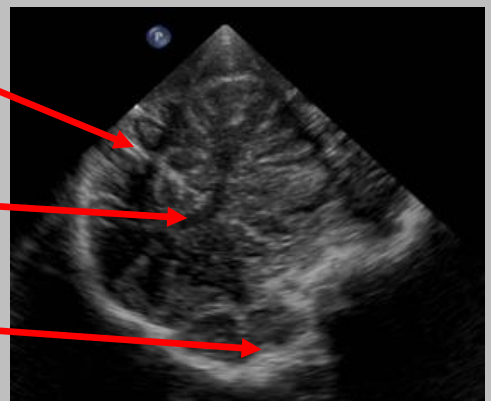


Image from Console System



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## Settings for EC-IC Bypass (Linear Probe Preset)

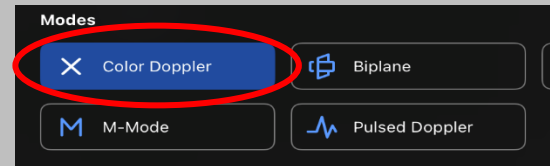
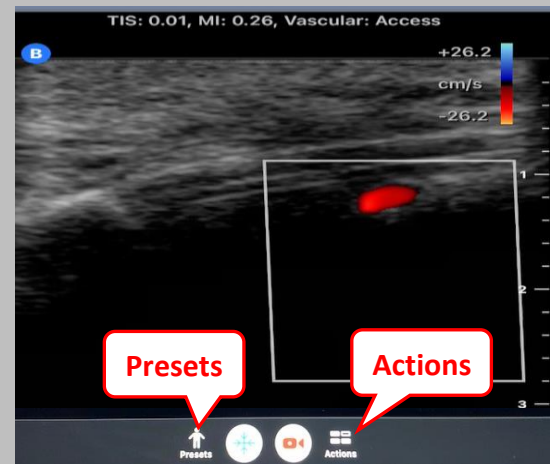
(Settings Applicable to All Systems)

### General B-Mode Setting

- Preset: select “Vascular Deep Vein”
- Depth: 3-4cm, adjust by moving finger up/down on screen
- Gain: 70-80%, adjust by moving finger left/right on screen

### Color Doppler Setting

- Select “Actions” then “Color Doppler” under Modes.
- Place finger in color box and move as needed.
- Color box size and “Steering” adjusted by touching markers on side and bottom of box. General principle is to steer the box left/right and position the bottom of the color box in the direction of the deepest part of the vessel.
- Color Gain: 70-80%. When COLOR is activated, moving finger left/right across screen adjust the color gain.  
\*General principle is to increase to see color speckles then scale slightly until gone.
- Leave flow speed on the default “HIGH” flow setting.



## Settings for ClearFit Transcranial Doppler (Phased Array Probe)

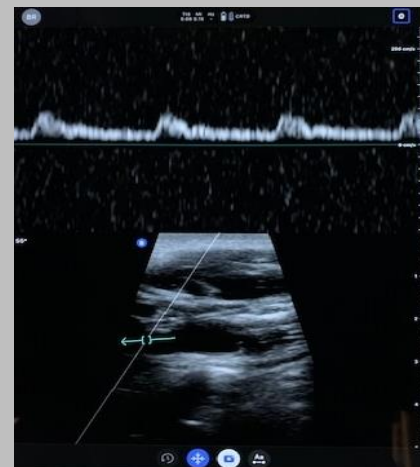
(Settings Applicable to All Systems)

### General B-Mode Setting

- Preset: select “Vascular: Carotid”
- Depth: 6cm, max allowable with pulsed wave doppler
- Gain: 70-80%, adjust by moving finger left/right on screen

### Doppler Setting

- Preset: select “Actions” then “Pulsed Doppler”
- Use finger to place sample volume in vessel and align arrow to be parallel with vessel walls.
- Press “Start Spectrum” on the upper left of the image to start the spectral trace. Select “Update B-Mode” to refresh the image and realign to the best doppler location.

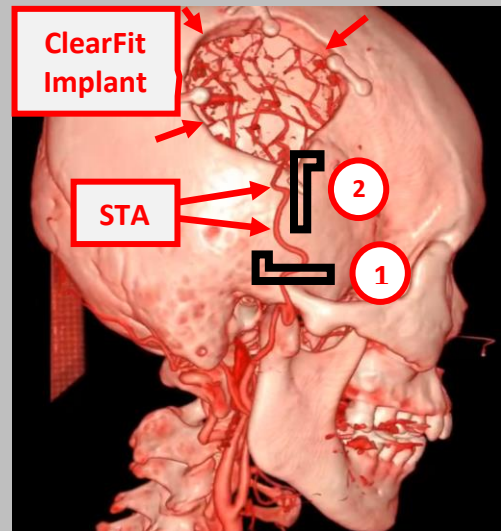




## Neurovascular Considerations

(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.

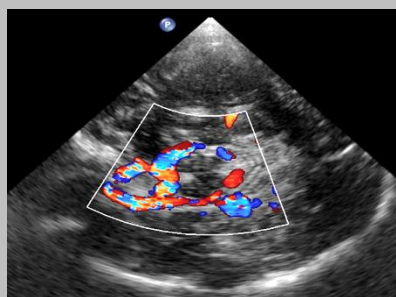


## Longeviti Sample Images

Ventricles through a ClearFit Cover



Circle of Willis doppler through a ClearFit disk



Indirect bypass under a ClearFit OTS disk

