Know Your Knob!
A practicum of Ultrasonography
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Objectives

• To learn basic ultrasound physics
• To learn the important knobs on the machine
• To improve real time needle guidance skills
• To improve your image and transfer skills across all models of ultrasounds.

Full Disclosure

• This presentation borrows heavily from Brull et al in Regional Anesthesia and Pain Medicine; Vol 35, No.2, Supplement 1, March/April 2010.

What is ultrasound?

• Cyclic sound pressure beam which penetrates a medium, and then measures the reflection signature, creating an image

The dials you need to know

• Power
• Frequency
• Gain
• Time Gain Compensation
• Depth
• Focus

This is what an ultrasound beam looks like
Key Word: Resolution

- Axial resolution: the ability to distinguish between 2 objects at different depths in line with the axis of a beam
- Lateral resolution: the ability to distinguish between 2 objects beside one another at the same depth, perpendicular to the beam
- Temporal resolution: rate at which the images are produced

Gain

- Changes amplification of raw returning signal
- Increases brightness
- Increases background noise and artifact

Time Gain Compensation (TGC)

- Allows you to adjust gain and different field depth
- Should help counter attenuation at deeper depth and different tissue densities
**Depth**
- Maximizes temporal resolution
- Selects appropriate aspect ratio (ratio of width to height)

**Focus**
- Sets where the beam converges (Frenzel Zone) to its narrowest point (Focal zone) and then diverges (Fraunhoffer Zone).
- Maximizes lateral resolution

**Other Terminology**
- "In Plane"
- "Out of Plane"

**Other Terminology**

**Key Words**
- "Align"
Key Words
“Rotate”

Key Words
“Tilt”

OK! Let’s Trouble Shoot.

What’s Wrong?
Low Gain!

What Wrong?
Too high frequency

What’s Wrong?
Someone messed with your TGC!
<table>
<thead>
<tr>
<th>What’s Wrong?</th>
<th>What’s Wrong?</th>
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<tbody>
<tr>
<td><img src="image1" alt="Image" /></td>
<td><img src="image2" alt="Image" /></td>
</tr>
<tr>
<td>In too deep!</td>
<td>Gain Too High!</td>
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