

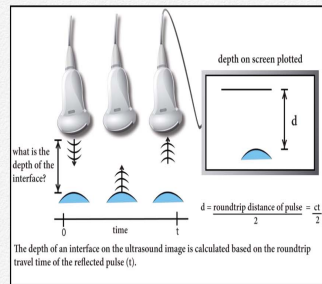
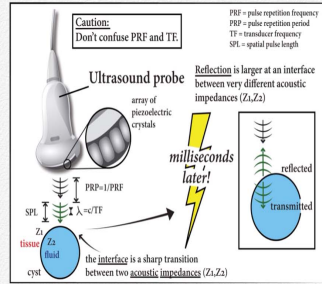
1. How Ultrasound Works

These are the 4 basic ultrasound concepts you need to know:

- (1) The probe sends out a short pulse of sound and listens for echoes using an array of piezoelectric crystals.
- (2) Interfaces in the tissue, like the wall of a cyst, reflect some of that sound back to the probe, and transmit the rest of the sound deeper into the tissue. Reflections from deeper interfaces require longer to return to the probe.
- (3) The display that we see (A-, B-, M-modes) shows how much sound was recorded at a particular time delay from the initial pulse. By assuming that sound travels at a particular speed ($c = 1540 \text{ m/s}$ in soft tissue), the time delay (t) is attributed to a tissue depth (range equation):

$$\text{Depth} = \frac{ct}{2}$$

- (4) If the machine calculates shifts in the frequency of the sound, it can also display the velocity of the blood flowing in parts of the tissue. Usually, a collection of frequency shifts are measured at a given point in space. The entire distribution of velocities can be displayed versus time for that point (Spectral doppler). The average velocity (Color Doppler) or its absolute value (Power doppler) can also be displayed.



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