MUM IMS

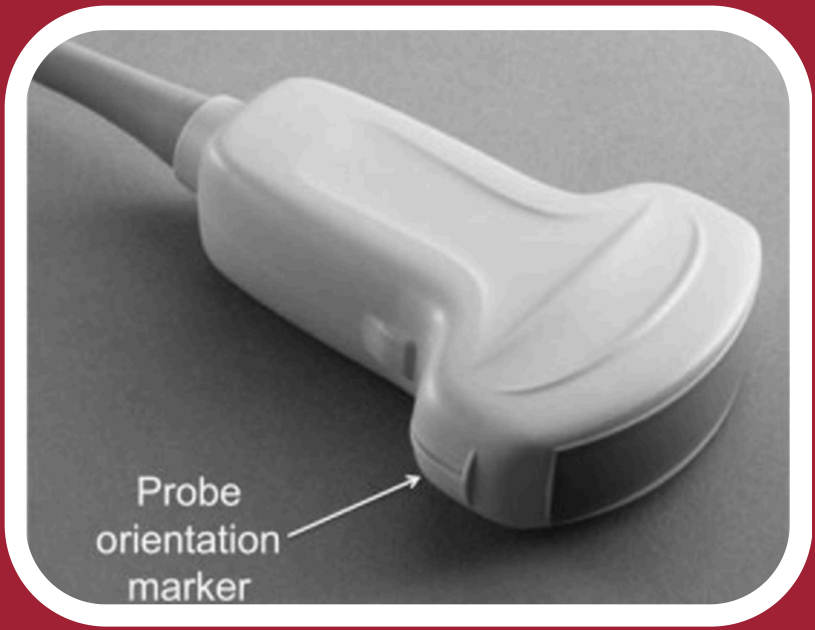
ULTRASOUND BASICS

Types of Knobs

	Frequency	Application
Phased array 	1-5 MHz	• Cardiac views • Smaller footprint enables imaging between rib spaces
Curvilinear 	2-5 Mhz	• Abdomen & pelvic structures views • Provides cardiac and lung imaging but is limited by a large footprint
Linear 	Higher frequency 5-15 Mhz	• Superficial structures < 8 cm

Footprint is the part of the ultrasound probe that is in contact with the body

Probe Orientation

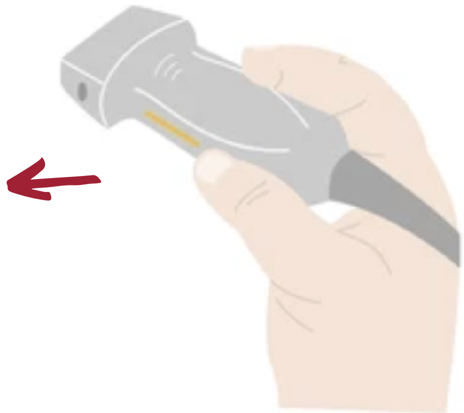


Transverse vs Longitudinal views on Ultrasound

Longitudinal

Probe orientation marker
to the patients' HEAD

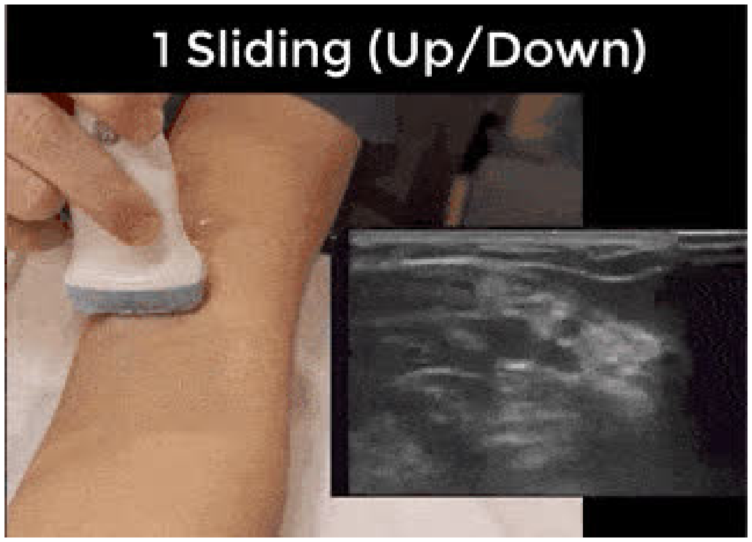
Transverse



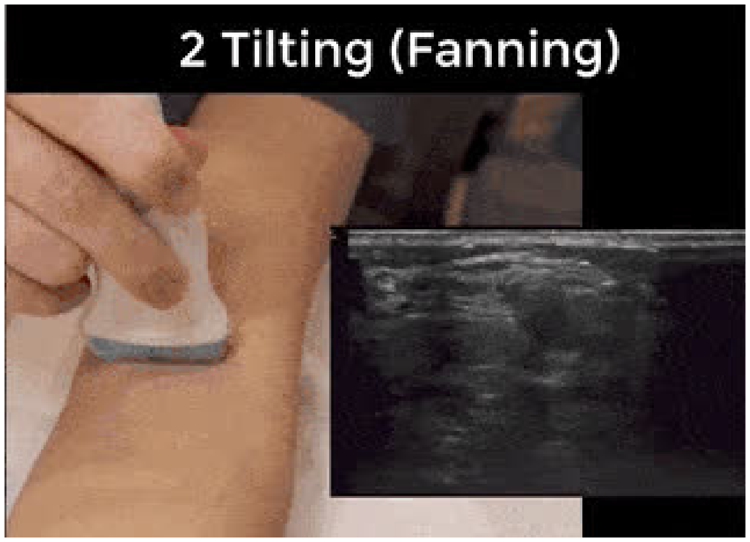
Probe orientation marker
to the patients' RIGHT

Probe Movements

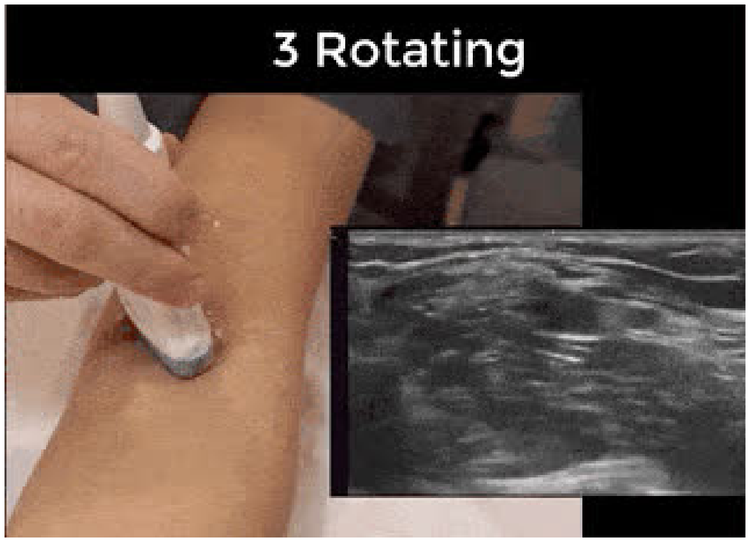
SLIDING



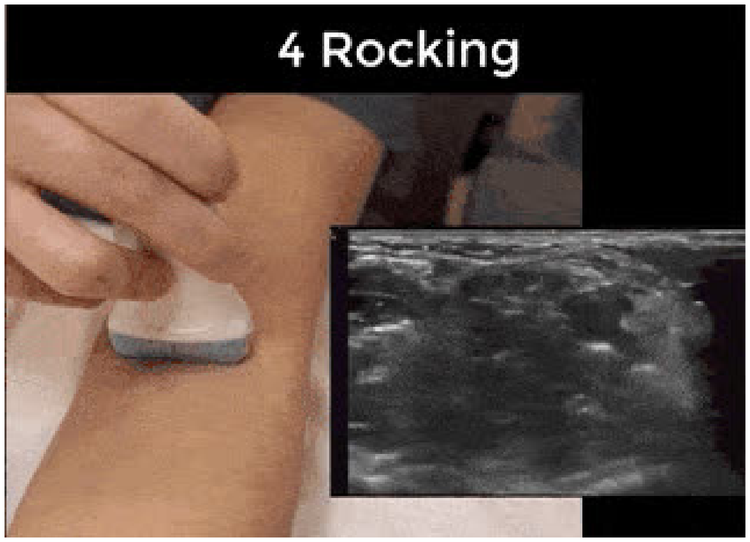
FANNING/TILTING



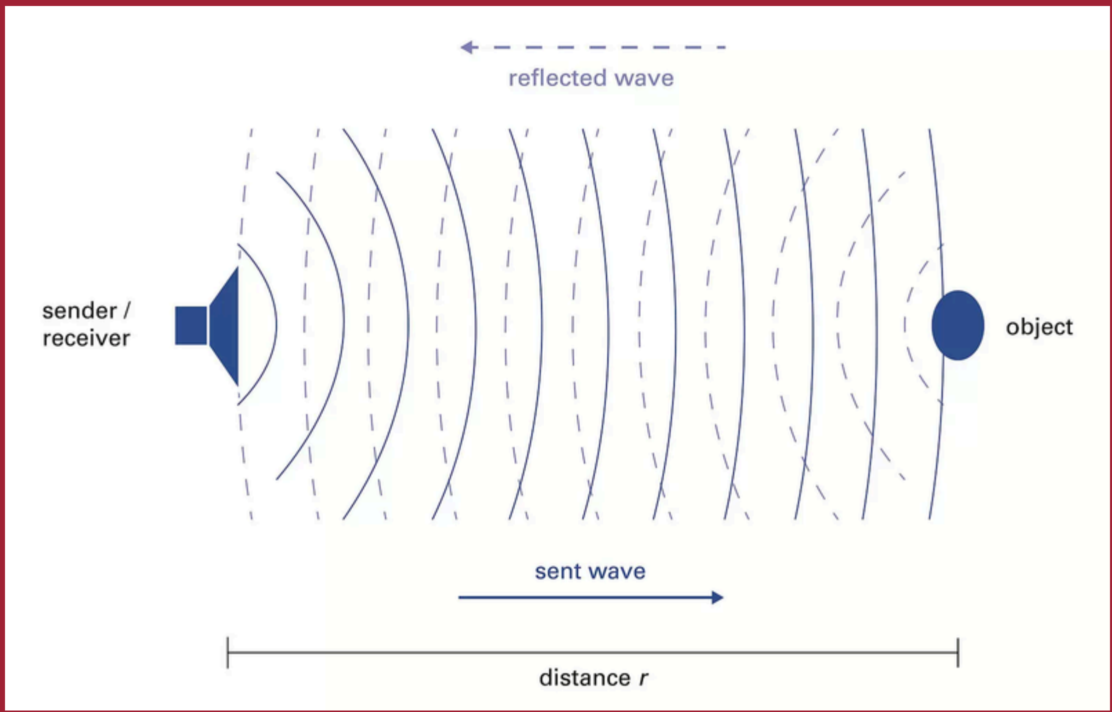
ROTATING



ROCKING



Physics of Ultrasound



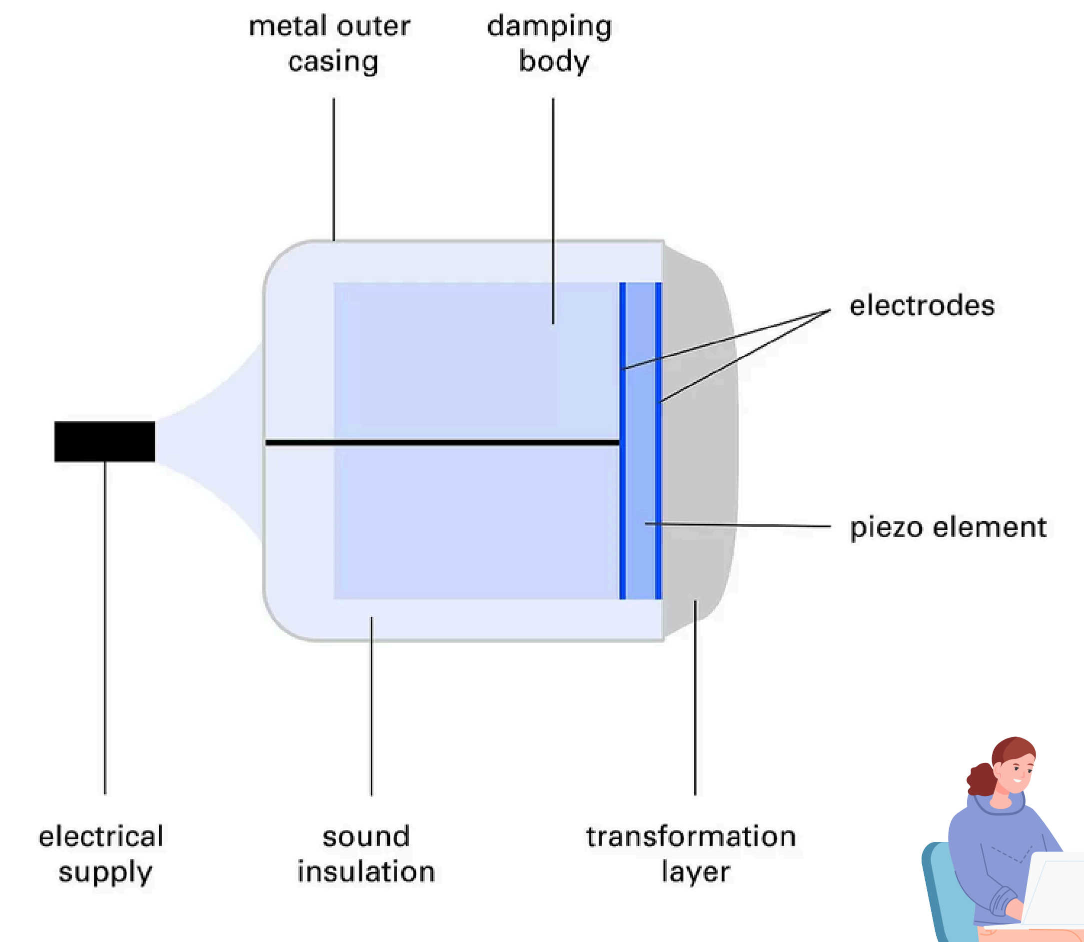


Image credit: Jacaranda Physics 1 2nd Edition © John Wiley & Sons, Inc.

- Ultrasound utilises piezoelectric materials to generate and detect high frequency sound waves.
- Time taken for ultrasound waves to return to the detector in the ultrasound knob will denote distance. Longer time of flight translates to a structure appearing deeper while the converse is true.

Utilising high frequency ultrasound waves will create higher resolution images with lower penetration and vice versa

Ultrasound Terminology

Hyperechoic (bright)

Bright due to increased reflection of sounds waves as compared to surrounding structures

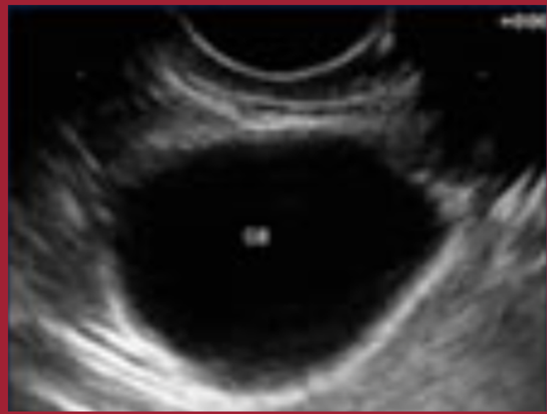
Bone, fat, stone

Hypoechoic (dark)

Darker due to reduced reflection of sounds waves as compared to surrounding structures

Suspicious thyroid nodules and thyroid tumours, lymph nodes

Anechoic (black)



Black due to little to no reflection of sound waves as compared to surrounding structures

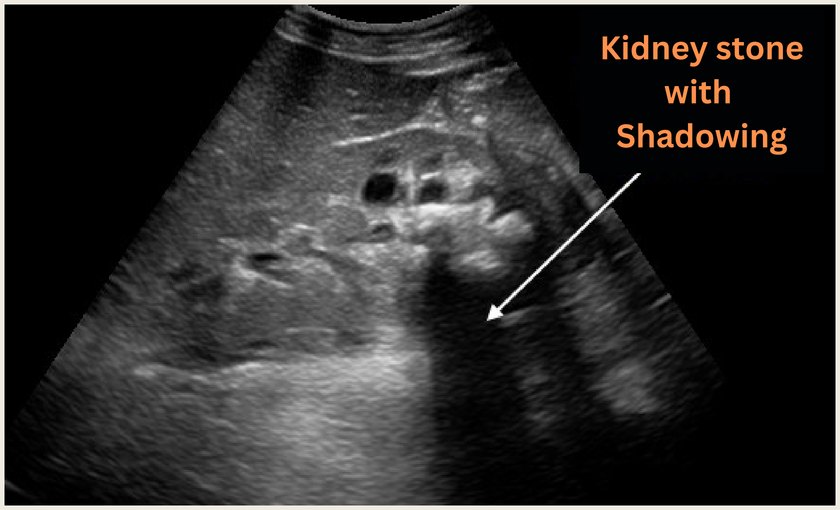
Cystic fluid and blood

Ultrasound Artefacts

Posterior shadowing

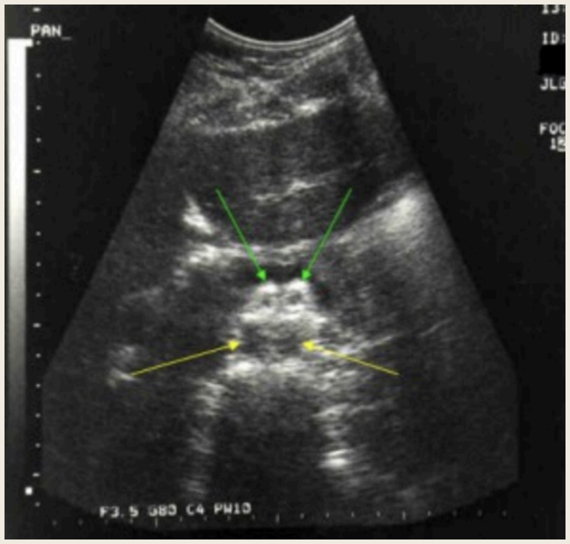
Relative lack of signal from deeper structures due to transmitted sound waves reflecting from a dense superficial structure or absorbed by surrounding superficial structures.

Returning signals from the deeper structures are of lower amplitude or none at all, lesser energy detected, relatively darker or black images will be generated on the screen.

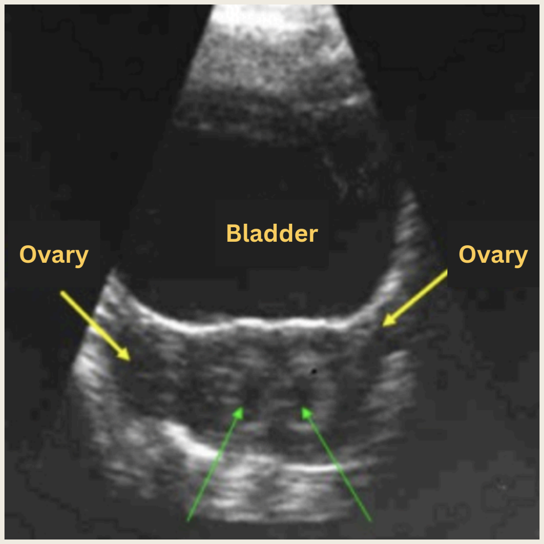


Refractions

Due to sound waves crossing structures of different densities leading to bending/refraction of sound waves and returning of the sound waves from altered paths



Double aorta artefacts

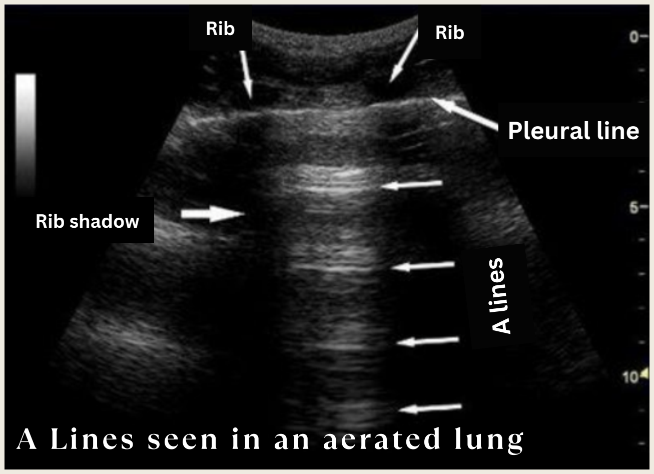


Disappearing twin artefacts

Ultrasound Artefacts

Reverberations

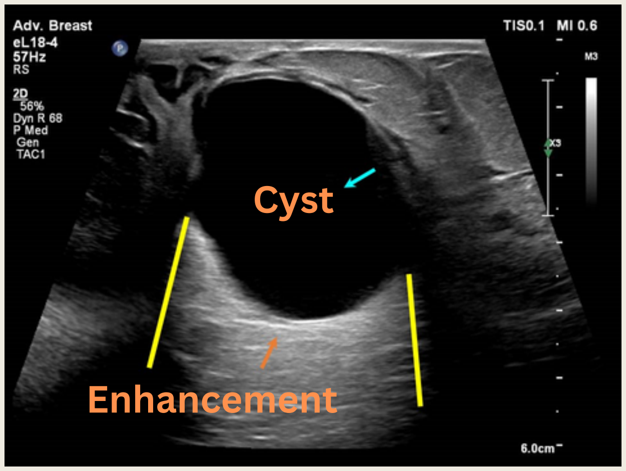
Due to reflection of the same beam back and forth from a structure leading to a misinterpretation of the sound wave originating from deeper structures



A Lines seen in an aerated lung

Posterior enhancement

Relative increased signals posterior/deeper to a superficial structure containing lower attenuation/less dense structure such as a cystic lesion.

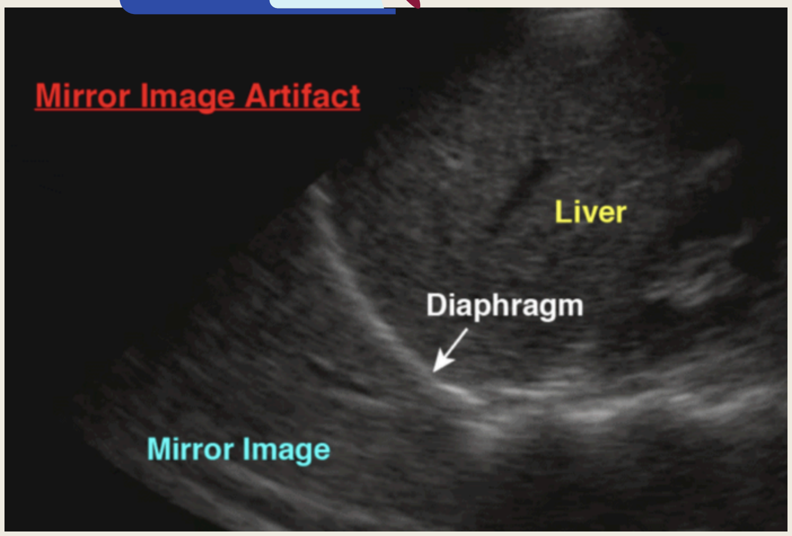


Mirror image

Due to reflection of sound waves from a highly reflective surface and encountering another structure in its path to then finally reaching the receiver of the ultrasound probe.

This leads to misinterpretation of the returning sounds waves originating from a deeper structure or a returning sound wave that has travelled for a greater time and distance.

Seen in a normal patients where liver appears as an image above the diaphragm



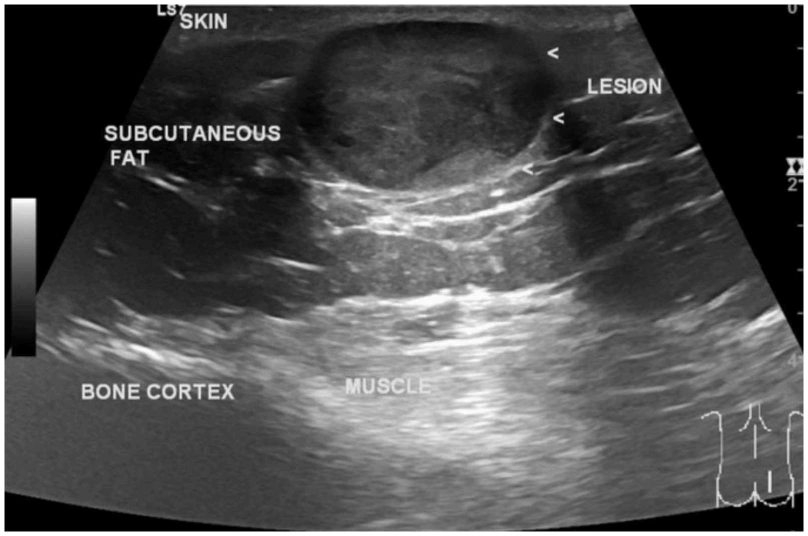
Benefits & Limitations of Ultrasound

Benefits

- No radiation risk and very safe
- Inexpensive
- Quick mode of imaging for certain conditions and situations

Limitations

- Operator dependent: quality of views and images is subjective to operator competency
- Unable to distinguish between types of fluids: i.e. unable to differentiate between blood and free fluid



References

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