

Topic

Subject Code Subject Name

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: ULTRASOUND ARTIFACTS : BRI5T2

BASIC AND ADVANCED ULTRASOUND IMAGING

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ARTIFACTS IN ULTRASOUND

ULTRASOUND

- Ultrasound is defined as Sound frequencies beyond 20 KHz (ultra means beyond)
- Frequencies of between 3 and10 MHz are the most commonly used in medical diagnostic ultrasound.
- The ultrasound wave meets a boundary between two media, the energy is reflected, refracted, scattered and absorbed in the medium

ARTIFACTS

An artifacts arise from the incorrect display of anatomy or noise during imaging.

CAUSES:

Improperly functioning equipment Improper system operation Improper transducer placement Anatomical causes TWO MAIN SOURCES OF ARTIFACTS Propagation Attenuation

PROPAGATION ERRORS

- Reverberation artifact
- Refraction artifact
- Mirror image artifact
- Side lobe artifact
- Grating lobe artifact
- Ring down artifact
- Comet tail artifact
- **ATTENUATION ERRORS**
- Shadowing artifact
- Enhancement artifact

REVERBERATION ARTIFACT

Arises from multiple echoes generated two closely spaced interface reflecting ultrasound energy back and forth during the acquisition of the signal.

CAUSE

Multiple reflections between two highly reflective interfaces.

EXAMPLES

- Between a highly reflective interface and a transducer.
- Between reflective interfaces such as metal objects or air pockets (partially fluid filled areas of anatomy)











MANIFESTATION

It is manifested as multiple equally spaced boundaries with decreasing amplitude along a straight line from the transducer. REMEDY

Change the orientation of the probe using transducer of different frequency

MIRROR IMAGE ARTIFACT

Mirror image arifacts arise when an image arises close to a curved and strongly reflecting tissue interface. MANIFESTATION

Example

Interface of the liver and the diaphragm in abdominal imaging,

REMEDY

Beam orientation must be changed.









REFRACTION ARTIFACT

CAUSES

Refraction is a changes in the transmitted US beam direction to boundary with nonperpendicular incidence with two tissue have different speed in sound.

MANIPESTATION

Misplaced anatomic position in the image.

REMEDY

Change the position of the transducer and angle of incidence with the tissue boundaries.







Side lobe artifact were described as energy in an ultrasound beam from a single element or array transducer that falls outside the main lobe.

MANIFESTATION

- Echoes returning from tissues along the propagation directions of the lobe positioned in the image as if they occurred along the main beam.
- Sometimes side lobe artifact redirect diffuse echoes from adjacent soft tissue into an organ that is normally hypoechoic.
- Eg:Imaging of gall bladder,where the side lobes produce artifactual pseudo sludge in an otherwise echo free organ.



Present in both single and multi element. REMEDY

Apodization







 Diagram shows multiple beams of off-axis side lobe ultrasound energy encountering an object (black circle).

Side Lobe Artifact



The display assumes that the echoes returning from this off-axis object came from the main beam and misplaces and duplicates the structure.

SHADOWING ARTIFACT

CAUSE

Presence of highly attenuating such as bone or kidney stone or gall bladder stone.

MANIFESTATION

Partial or total shadowing distal to the structure.







ENHANCEMENT ARTIFACT

Acoustic enhancement is formed wherever sound waves travel for some distance through homogeneous fluid because of decreased attenuation of fluid. MANIFESTATION

Enhancement distal to the structure









GRATING LOBE ARTIFACT

Grating lobe occur with multi element array transducer and result from the division of a smooth transducer surface into a large number of elements. ultrasound energy produced at a large angle relative to the main beam.

MANIFESTATION

Miss directed energy can create a ghost images of off axis high contrast objects.

REMEDY

Reduced by using small size element in the array and gradient echo will be less









MOVEMENT ARTIFACT

BREATHING

CAUSE

Occurs when patient unable to hold the breath MANIFESTATION

Image distorted and blurred REMEDY

Breath hold



CONCLUSION

Knowledge of the artifacts help the operator to successfully interpret the image.



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