

**Radiology Techniques
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Theoretical Radiation Physics

Third stage- Radiology Techniques Department

Lecture 9

By

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Some observations through the use of the diagnostic ultrasound waves

1-The negative role of gas(air):

Because of the large difference between the acoustic impedance of the gas (air) and the acoustic impedance of the tissues, a large ratio of the intensity of the incident waves will be reflected at the acoustic boundary, and this makes the remaining intensity that will penetrate into the patient's body very weak, and thus the intensity is not sufficient to obtain information about the tissues located behind The sound boundary , and thus the gas or air is an obstacle to the transmission of waves to the tissues located behind the sound boundary

2- The need for coupling gel:

It is necessary to put a suitable gel or oil material between the surface of the transducer and the patient's skin to expel the air in order to reduce the large difference in acoustic impedance between

the air and the skin, thus ensuring the transmission of waves inside the patient's body.

3-acoustically homogenous media:

They are media in which the acoustic impedance is constant, there are no reflected sound waves within the media in which the acoustic impedance remains constant, where the specular reflection coefficient becomes zero, and this means that there is no acoustic boundary within these media, and this happens in the liquid cavities, where they are considered empty regions of reflected waves, so the acoustically homogeneous medium is considered empty region of reflected waves.

4-The layer needed to match the impedance of piezoelectric crystal:

At the front face of the transducer there is a layer of material with acoustic impedance (Z) appropriate to reduce the difference between the crystal impedance and the skin impedance, and this means reducing the reflection of waves at the

boundary between the skin and the transducer, and this ensures the transmission of waves into the patient's body and their return to the crystal.

(Non specular reflection of ultrasound waves (scattering))

This type of reflection occurs when the dimensions of the acoustic boundary are equal to the length of one wave or less than the length of one wave, and in which the angle of reflection is not equal to the angle of incidence ($i \neq r$), and this means that the waves are reflected in different directions, and thus the process of reflection is not subject to the first law of specular reflection, and since The incident waves and the normal from incident point on the reflecting surface (acoustic boundary), and the reflected waves do not all lay in one plane, so the reflection process is also not subject to the second law of specular reflection, so this type of reflection is called non specular, or

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scatter(because it is an irregular reflection).

Where the non-specular reflection is useful in detecting small organs.