Radiology Techniques Department, College of Medical Technology, The Islamic University, Najaf, Iraq

Theoretical Radiation Physics

Third stage- Radiology Techniques Department

Lecture 5

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Radiation Physics precise specialization

2022A.D. 1444 A.H.

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the influencing factors on the velocity of the diagnostic ultrasound waves

The most important factors affecting the velocity of diagnostic ultrasound waves are two factors, the first is the **density**, that is , the density of the material medium in which the waves transmitted, and the second is the **compressibility** , it is the ability of the medium to compress, and since one of them works opposite to the other, if the density of the medium increases, the compressibility of the medium decreases , meaning that the medium exhibit a high resistance against compression , due to the large number of molecules and their proximity to each other, and this happens in liquid and solid materials, and when the density of the medium decreases, this leads to an increase in the compressibility of the medium, this is due to the decrease in the number of molecules and the spacing of each other, and this happens in the gaseous substances , and the figure (1) illustrates this.

Since the wave is any disturbance transmitted energy ,so the energy transfer through collisions between molecules of high density medium is faster than energy transfer through collision between molecules of low density

medium, and figure (2) shows the mechanism of energy transfer and wave propagation .
So the velocity of the diagnostic ultrasound wave in the solid material higher than its value in the liquid material , and this value is higher than the value of the velocity in the gaseous material, and this can be applied to biological tissues ,as the magnitude of the velocity of the diagnostic ultrasound wave in tissues with high density is higher than its value in low density tissues ,
as shown in the following table

Biologic material	Density (kg/m^3)	Velocity (m/sec)
fat	911	1475
brain	1046	1560
blood	1050	1570
muscle	1090	1580
Skull bone	1908	3360