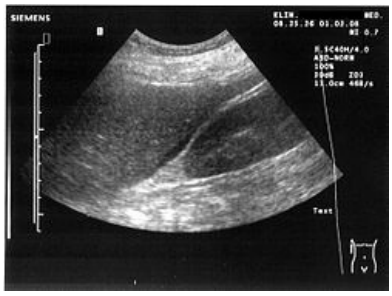
Ultrasound imaging

An ultrasound imaging device is a machine that is commonly used to examine underlying features of the human body. Its advantages are that no surgery is needed in order to obtain a clear picture of entities such as kidney stones. Ultrasound can of course be used elsewhere for inanimate items, when an unseen internal object must be inspected. This report will consider humans as the studied specimen.



Ultrasound image

Device principle

The most important part of an ultrasound machine is the hand-held transducer. This transducer emits sound waves. These sounds waves have a frequency in the range of 2 to 20 MHz meaning that people are unable to hear them. A gel on the surface of the skin allows the waves to transmit easier from the source to the target without having to pass through the air. The wave then moves through various types of tissue with different acoustic impedances. This affects the amount of the wave that is reflected back towards the transducer. The detector inside the device then picks up these different intensities of vibrations and converts them in to an image of the said area. The image received is in 2D as this makes it most clear to the professional operating the machine and because a single planar scan is most accurate with ultrasound measurement devices.

Imaging principle

The basic calculations of ultrasound imaging have to do with acoustic impedance. Acoustic impedance can be summarized as, opposition to the flow of sound through a surface. Also the equation listed below describes the very nature of this term.

$$Acoustic\ impedance = Density * Velocity$$

If a targeted object is deep one must use a low frequency whilst when something superficial is observed, it is necessary to use a higher frequency. This way more clear results can be observed due to the fact that low frequencies can travel farther whilst high frequencies provide a better image but at shorter ranges.

In conclusion, ultrasound imaging is highly focused on the acoustic impedances of various mediums. The waves of sound that are reflected back to the detector in the transductor are converted in to graphs and then to a clear 2D image. With this technology it is possible to examine the human body without the need for surgery or other procedures.

Links

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External links

Bibliography

http://www.ndt-ed.org/EducationResources/CommunityCollege/Ultrasonics/Physics/acousticimpedance.htm