**TAQ 3**

**1. Explain the principle of ultrasound scanning by referring to the way ultrasound waves behave when performing a scan for possible kidney stones.**

Ans.

Ultrasound uses high-frequency sound waves and their echoes for imaging. For detecting kidney stones using an ultrasound first HF sound pulses are transmitted into the body. These waves then travel inside the body and hit the kidney stones. Some of the sound waves get echoed back by the kidney stones. These echoes are received and passed on to the computer, which uses the given data, the speed of sound in the tissue and, the time difference in the wave and its echo to calculate the distance of the kidney stones from the probe. Using the calculated distances, the computer then generates an image.

Reference List

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Physics.utoronto.ca. (2017). How Ultrasound Works. [online] Available at: https://www.physics.utoronto.ca/~jharlow/teaching/phy138\_0708/lec04/ultrasoundx.htm [Accessed 8 Aug. 2017].

**4. Explain the use of ultra-sonography to develop 3d images of the baby's tissue in a mother's womb.**

Ans.

3-D ultrasound is an imaging technique which is fundamentally similar, in principle, to the 2-D ultrasound imaging. It is usually used in foetal imaging applications. In 3-D sonography, volume data is also collected. Which means that slightly different 2-D images are taken by reflected sound waves which are at slightly different angles to each other. Then these 2-D images are sent to a computer where a high speed software integrates the two images to calculate the volume data and create a 3-D image of the foetus.

The 3-D ultrasoung technology has to perform the extra steps of volume data acquisition, analysis of this data and finally create a 3-D image for display. Volume data is majorly acquired via 3 methods. By **freehand movement** of the probe emitting high-frequency sound waves. This may or maynot have position sensors included in the setup. **Sensors embedded in the probe** head to calculate the angle of incidence of sound waves. **Array of sensors** in the form of a matrix. This uses a single swipe to generate multiple 2-D images which are then analysed to generate a 3-D sonograph. This method has the added advantage that the operator can choose any view of interest.

Reference List

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**5. Use the example above to discuss the applicability, benefits and limitations of ultra-sonography techniques. You will need to consider such issues as cost, safety and image quality.**

Ans.

In ultra-sound the patient is never exposed to radiation, therefore this imaging technique is much safer than other radiological imaging techniques. There are no known harmful side-effects of ultra-sound on human biengs and fetuses. In contrast to radiological imaging techniques, which require big hardware and lot of computing power, the hardware required is minimal for the ultra-sound scan and hence it is easily portable.

This technology is capable of capturing images of soft tissues which are usually not shown on radiological images. Due to no usage of radiation in this technique it can be safely used for pre-natal scanning too. Also, this imaging process is capable of showing images in real-time. For detecting small cracks and air-gaps in heavy machinery and tools, ultra-sound is the preferred way of imaging. Ultra-sound technology is easily accessible and since it requires very less resources and computing power, it is much less expensive than some of the radiological imaging processes. Since the hardware is small and less in ultra-sound, the power requirements are also less for this setup when compared to the radiation techniques.

Ultra-sound has the limitations of generating low quality images when compared to radiation techniques. Also, getting good images of tissue deep in the body is not possible because of the frequency limitations of the ultra-sound waves. It can not be used to scan and image gas filled parts of the body, so it is not useful for diagnosing lung and digestive tract related problems. It can not be used, also for detecting calcification of the breast tissue.

Reference List

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