Equipment Techniques of Magnetic Resonance Imaging

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By

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Lecture 11: Comparison between CT vs. MRI

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Magnetic Resonance Imaging

Magnetic Resonance Imaging (MRI) is based on the principles of nuclear magnetic resonance (NMR), a spectroscopic technique used by scientists to obtain microscopic chemical and physical information about molecules. The technique was called magnetic resonance imaging rather than nuclear magnetic resonance imaging (NMRI) because of the negative connotations associated with the word nuclear in the late 1970's. MR detects subtle changes in the magnetism of the nucleus, the tiny entity that lies at the heart of the atom. This is probing deeper than X-rays, which interact with the clouds or shells of the electrons that orbit the nucleus. MR is a truly powerful modality. At its most advanced, MR can be used not just to image anatomy and pathology but to investigate organ function, to probe in vivo chemistry and even to visualize the brain thinking.

- **MR involves an amazing combination of advanced science and engineering, including the use of superconductivity, cryogenics, quantum physics, digital and computer technology**
- **It is an imaging method based principally upon sensitivity to the presence and properties of water, which makes up 70–90% of most tissues.**
- **Energy Used : Magnetic Field and Radio Waves**

Magnetic Resonance Imaging

Closed MRI

Open MRI

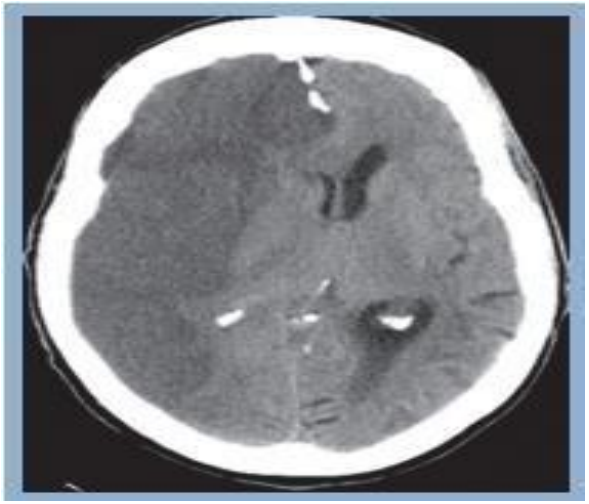
CT scan (Computed Tomography) work

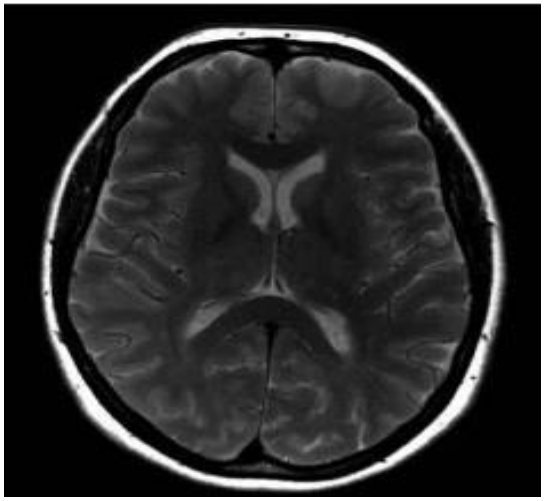
CT scan works by taking multiple X-rays at various angles and then utilizes those X rays to form a three-dimensional image of whatever organ system is being examined. A computer examines all of the various X-rays taken at different angles and synthesizes the images to form a three-dimensional computer model of internal organs.

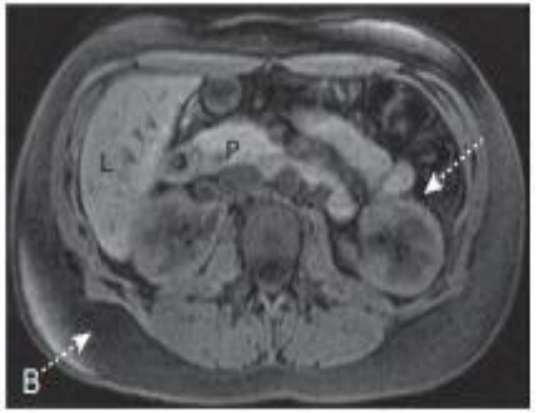
MRI (Magnetic Resonance Imaging) scan work

MRIs use and send superconducting magnet and radiofrequency waves into the body. The magnetic field lines up atoms either in a north or south position with a few atoms that are unmatched (keep spinning in a normal fashion). When radiofrequency is added, the unmatched atoms spin in an opposite direction, and when the radiofrequency is turned off those unmatched atoms return to the normal position emitting energy. The energy emitted sends a signal to the computer and the computer uses mathematical formulas to convert the signal into an image.

CT vs. MRI







CT vs. MRI

CT

- CT scans utilize X-rays to form images inside the body
- Exposure to ionizing radiation (X-rays)
- CT scans are quick, painless, and noninvasive.
- MRI scans are costlier than CT scans.
- different soft tissues can Seen but not well characterized

MRI

- while MRI (magnetic resonance imaging) uses powerful magnetic fields and radiofrequency pulses
- MRIs do not ionizing radiation (X-rays).
- MRI scans are not invasive, but they are noisy, take more time, and may cause claustrophobia (anxiety due to being in the enclosed space of the machine).
- MRI scanners may cause a safety issue due to its strong magnets.
- MRIs provide more detailed information about the inner organs (soft tissues) such as the brain, skeletal system, reproductive system and other organ systems than is provided by a CT scan.