Non-invasive diagnostic techniques

Design

Non-Invasive diagnostic techniques| | X-rays| An X-ray machine is essentially a camera. Instead of visible light, however, it uses X-rays to expose the film. X-rays are like light in that they are electromagnetic waves, but they are more energetic so they can penetrate many materials to varying degrees. When the X-rays hit the film, they expose it just as light would. Since bone, fat, muscle, tumors and other masses all absorb X-rays at different levels, the image on the film lets you see different (distinct) structures inside the body because of the different levels of exposure on the film. Ultrasound| Ultrasound or ultrasonography is a medical imaging technique that uses high frequency sound waves and their echoes. The technique is similar to the echolocation used by bats, whales and dolphins, as well as SONAR used by submarines. | Thermography| | MRI| MRI scanners vary in size and shape, and some newer models have a greater degree of openness around the sides.

Still, the basic design is the same, and the patient is pushed into a tube that's only about 24 inches (60 centimetres) in diameter. The biggest and most important component of an MRI system is the magnet. There is a horizontal tube — the same one the patient enters — running through the magnet from front to back. This tube is known as the bore. But this isn't just any magnet — we're dealing with an incredibly strong system here, one capable of producing a large, stable magnetic field. The strength of a magnet in an MRI system is rated using a unit of measure known as a tesla. Another unit of measure commonly used with magnets is the gauss (1 tesla = 10, 000 gauss).

The magnets in use today in MRI systems create a magnetic field of 0. 5-tesla to 2. 0-tesla, or 5, 000 to 20, 000 gauss. When you realize that the Earth's magnetic field measures 0. 5 gauss, you can see how powerful these magnets are. Most MRI systems use a superconducting magnet, which consists of many coils or windings of wire through which a current of electricity is passed, creating a magnetic field of up to 2. 0 tesla.

Maintaining such a large magnetic field requires a good deal of energy, which is accomplished by superconductivity, or reducing the resistance in the wires to almost zero. To do this, the wires are continually bathed in liquid helium at 452. 4 degrees below zero Fahrenheit (269. 1 below zero degrees Celsius) [source: Coyne]. This cold is insulated by a vacuum. While superconductive magnets are expensive, the strong magnetic field allows for the highest-quality imaging, and superconductivity keeps the system economical to operate.

|