



## **2. Equipments don't use x-rays**

1. Magnetic Resonance Imaging (MRI)
2. Ultrasound (US)
3. Gamma Camera (used in nuclear medicine)



### **3- Magnetic Resonance Imaging**

- Magnetic resonance imaging (MRI), or nuclear magnetic resonance imaging (NMRI), it uses a powerful magnetic field, radio frequency pulses and a computer to produce detailed pictures of organs, soft tissues, bone and virtually all other internal body structures. The images can then be examined on a computer monitor, transmitted electronically, printed or copied to a CD. MRI does not use ionizing radiation (x-rays).

**These images can be obtained in different body systems in different body planes:**

- 1. Axial**
- 2. Sagittal**
- 3. Coronal**



## **MRI unit consists of:-**

### **A- The scan unit**

The scan unit is usually housed in a room by itself and is the part of the MRI system seen by the patient. This room is often termed the scanner room.

It contains:


- 1. Magnet**
- 2. Movable Table**
- 3. Automatic Injector**
- 4. Body coils**

### **B- The operator control console.**

It is the room at which the operator can manage the MRI examination required

It Contains;

- 1. Computer**
- 2. Automatic Processing Unit**



**Magnetic Resonance Imaging or MRI are used in different radiological examinations which includes:**

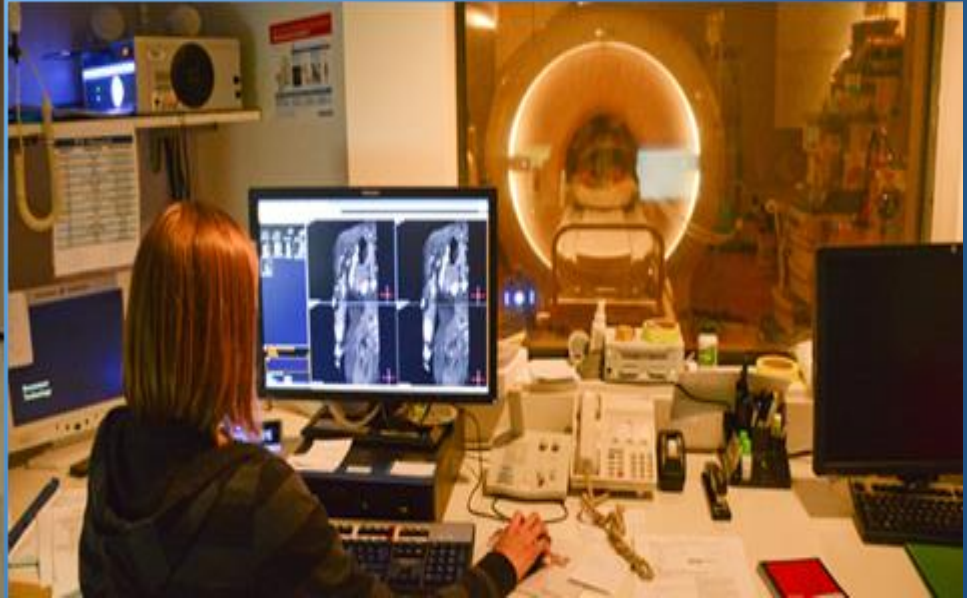
1. MRI Brain (with or without contrast )
2. MRI Abdomen (with contrast)
3. MRI Pelvis (with contrast)
4. MRI Sinus (with or without contrast )
5. MRI Knee (with or without contrast )
6. MRI of lower and upper extremes
7. MRI Joints(with or without contrast )
8. MR Angiography (with contrast)

**MRI provides much greater contrast between the different soft tissues of the body than (CT) does, making it especially useful in**

1. Neurology (brain - spine),
2. Musculoskeletal (knee – shoulder)
3. Cardiovascular, and oncological (cancer) imaging.



Scan Unit



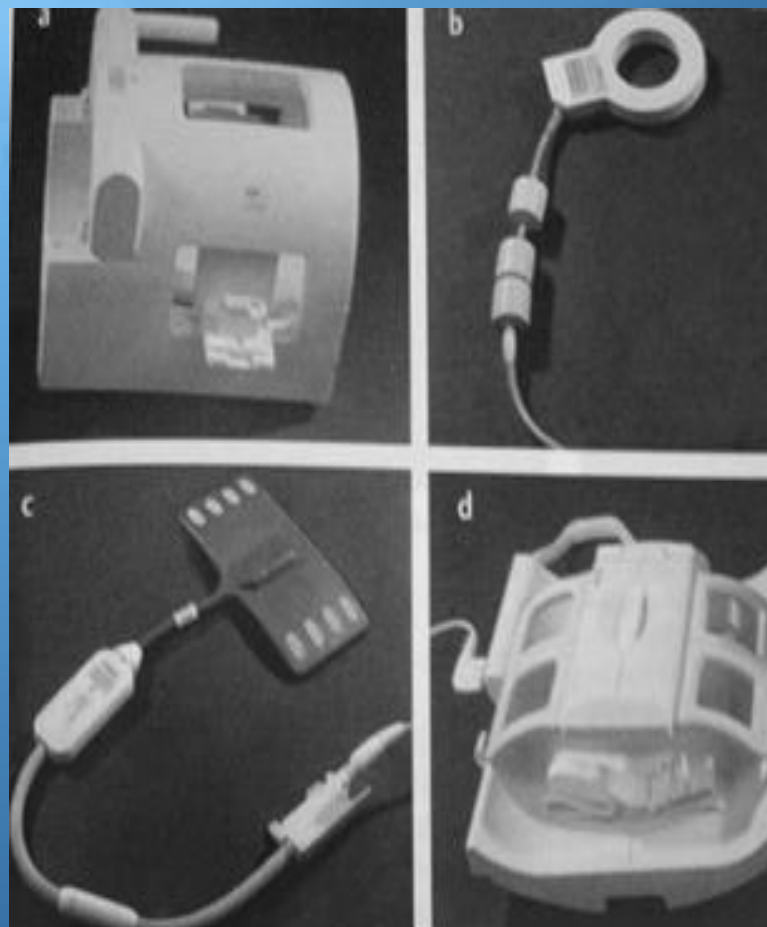
Operator control console

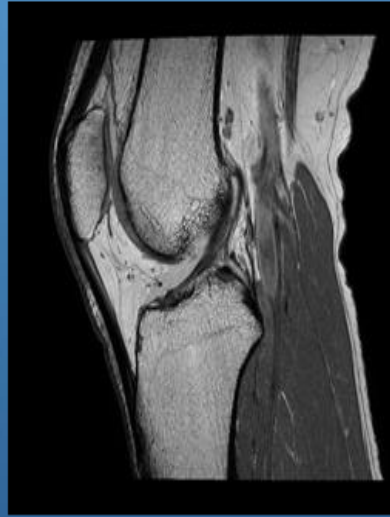
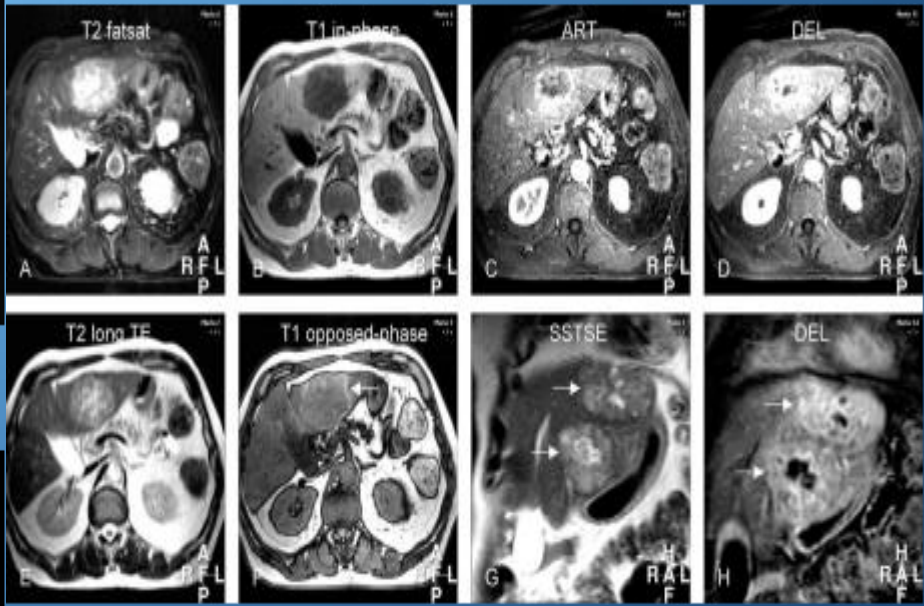
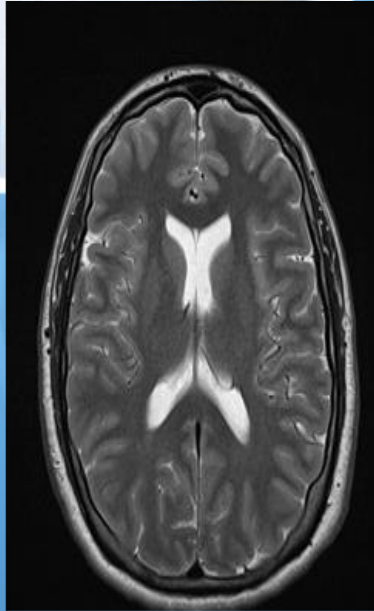
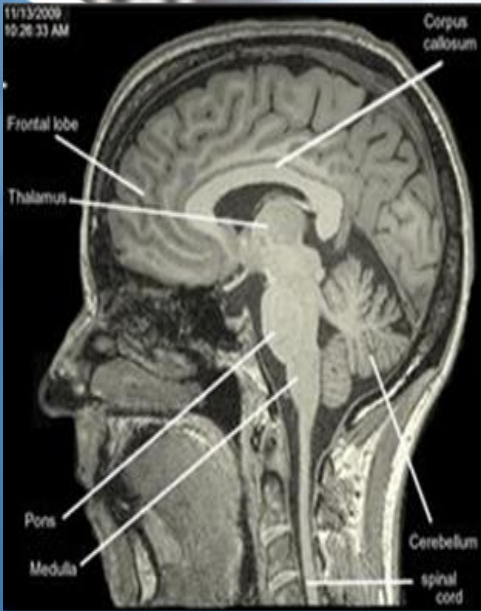




TIME MANAGE

## MRI Body Coils








## 4- Ultrasound (US)

- Ultrasound (sonography) is an imaging technique that uses high-frequency sound waves to produce images of organs and structures in the body.
- These images are produced by recording the reflections (echoes) of ultrasonic waves directed into the body.
- The technical terms for ultrasound commonly used in imaging and recording are sonography (sonic, meaning sound) or ultra-sonography (ultra high frequency).
- The term echosonography may also be used for this imaging process.



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- Sound wave frequencies heard by the human ear are called audible sound waves with higher frequencies than with audible sound are called ultrasound or ultrasonic, meaning "ultra high" frequency sound waves that are above audible sound.
  - The range of sound waves heard by the human ear is approximately 20 Hz to 20 kHz (20 to 20,000 cycles per second). For medical ultrasound, the range of sound waves used is from 1 to 17 MHz (1 to 17 million cycles per second).
  - Sound waves of this frequency are transmissible only in liquids and solids, not in air or gas, it is used to examine soft tissues (hepatobiliary system – urinary system – vascular system ...etc) and produces artifacts with high density systems like (skeletal system) and gases



## **Advantages of Ultrasound examinations are:**

- 1. Painless**
- 2. Harmless**
- 3. Don't use ionizing radiation.**
- 4. Studies have revealed no adverse biologic effects associated with the use of ultrasound.** This makes it a safe and preferred imaging modality for certain radiosensitive exams such as obstetrics, in which the fetus is spared any radiation exposure.

### **Ultrasound is consists of;**

- 1. Computer**
- 2. Monitor**
- 3. Transducers (Probes)**
- 4. Gel which is used as a medium between the probe and patient skin**



## **Transducers (probes)**

- It is the component that is used to transmit the ultrasound waves to the body organs and also receives the reflected these sound waves from these organs, then the received sound waves are transmitted to signal then to an image which is displayed on the monitor.



**Types of Transducers (probes) are:**

**1. Convex probe**

- This probe has a power of 3.5 MHz it is used to examine the deep organs (liver – spleen – kidneys...etc)

**1. Linear probe**

- This probe has a power of 5 - 7MHz it is used to examine the superficial organs (thyroid gland) and in Doppler examinations of the vascular system.

**1. Sector probe**

- It is used to examine the heart

**1. Endocavitary probe**

- This probe has a power of 7 – 12 MHz it is used to examine special organs
- (Prostate and its is called transrectal examination – uterus and it is called transvaginal examination).







## **Radiotherapy (Radiation Oncology)**

- Radiation oncology, commonly termed radiation therapy or radiotherapy, involves the use of ionizing radiation for treatment of cancer and some benign diseases. The equipment that is used in radiotherapy is called linear accelerator.