جامعة المستقبل
AL MUSTAQBAL UNIVERSITY

كلية العلوم

قسم الفيزياء الطبية

MedicalPhysics

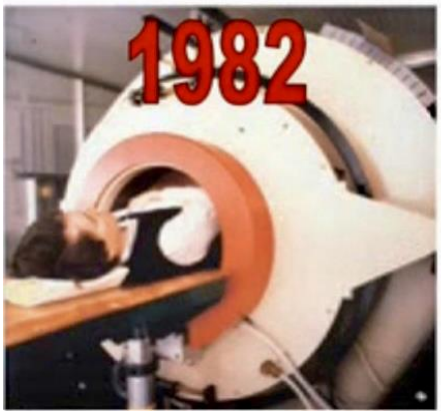
Lecture: (2) Practical part

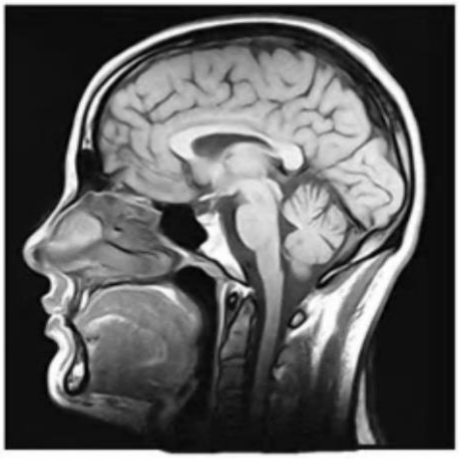
Subject: **Magnetic Resonance Imaging (MRI)**

3dr Stage

Lecturer: 1..By..Afrah Hussein & NoorAlhuda Ahmed

Magnetic Resonance Imaging (MRI) is:- a non-invasive imaging technology that produces three dimensional detailed anatomical images, by magnetic field and radio waves,. It is often used for disease detection, diagnosis,





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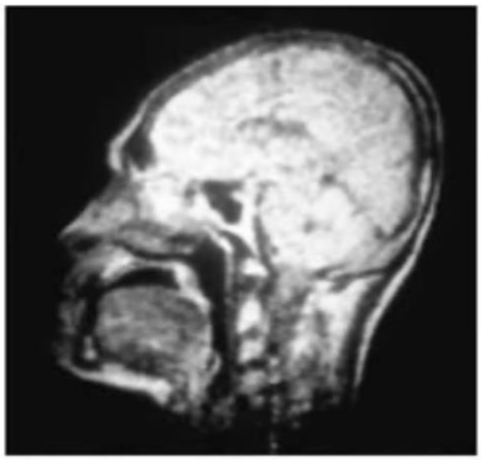

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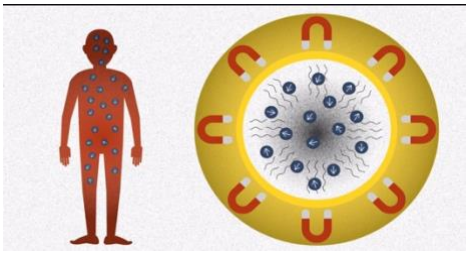
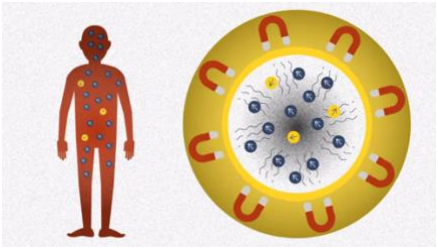
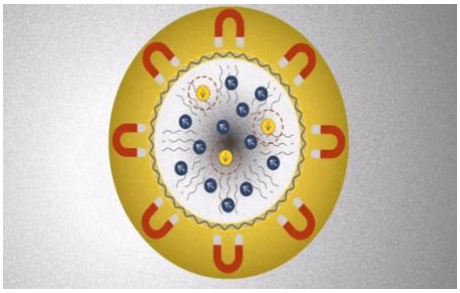
Principle of work:

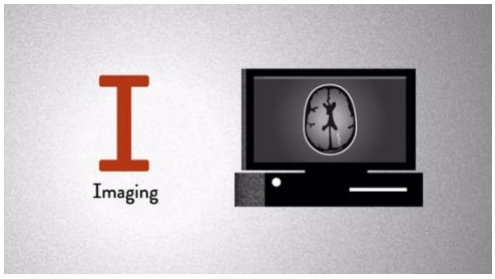
The device consists of a large solenoid electromagnet that generates a magnetic field around the patient, producing a 2-Tesla magnetic field. This field causes hydrogen atoms to magnetize and align their magnetic poles in the same direction. Due to their high sensitivity to magnetism and their abundance in the human body, this alignment occurs with enough hydrogen atoms (about one atom per million) to create the images,

When the body is exposed to radio waves, the energy level of many hydrogen atoms increases enough to produce a clear image of the area being scanned. The machine then detects the energy emitted back from the hydrogen atoms, which is used to create an image that represents the intensity of hydrogen in different parts of the body. Using these images, doctors can diagnose a variety of medical conditions.









Why it is performed:

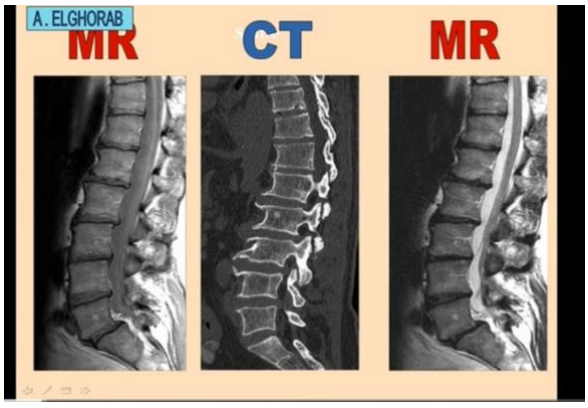
MRI is used by doctors to examine organs, tissues, and the skeletal system. It produces high-resolution images of the inside of the body, which help diagnose a wide range of conditions.

1. **Brain and spinal cord:**
   A special type of MRI known as functional MRI (fMRI) can be used to assess blood flow to specific regions of the brain. fMRI helps visualize brain anatomy and the areas responsible for vital functions like language and movement. This information can be used to guide brain surgery decisions.

2. **Heart and blood vessels:**
   MRI provides detailed images of the heart and vascular system.

3. **Internal organs:**
   MRI can examine the liver, bile ducts, kidneys, spleen, pancreas, uterus, ovaries, and prostate.

4. **Bones and joints:**
   MRI helps detect:
   - Joint problems caused by physical trauma , such as torn cartilage or ligaments.
   - Disc issues in the spine.
   - Bone infections.
   - Tumors in bones and soft tissues.



Risks:

Because MRI uses strong magnets, having metal in your body can pose a safety risk if the magnets attract it. Examples of metal that may be problematic include:

- Metal prosthetics.
- Artificial heart valves.
- Implanted defibrillators.
- Implanted medication infusion pumps.
- Implanted nerve stimulators.
- Pacemakers.
- Metal clips.
- Surgical pins, screws, plates, stents, or staples.
- Bullets, shrapnel, or other metal fragments.
- Intrauterine devices (IUDs).

If you have tattoos or permanent makeup, you should inquire whether these will affect the MRI. Some dark inks contain metals.
If you're pregnant or think you might be, inform your doctor before scheduling an MRI. The effects of magnetic fields on the fetus are not yet fully understood, and you might be advised to consider an alternative test.

Before the do MRI:

You can usually eat and take your medications as usual before an MRI. However, you will likely be asked to change into a hospital gown and remove any items that could interfere with the magnetic field, such as:

- Jewelry.
- Hairpins.
- Eyeglasses.
- Watches.
- Wigs.
- Dentures.
- Hearing aids.
- Bras with metal underwires.
- Makeup containing metallic particles.

During the procedure:

The MRI machine is like a long, narrow tube open at both ends. You lie on a moving table that slides into the tube's opening. A technician monitors you from another room and can communicate with you via a microphone.

If you are claustrophobic, you may be given medication to make you feel drowsy and reduce anxiety. Most people undergo the test without difficulty.

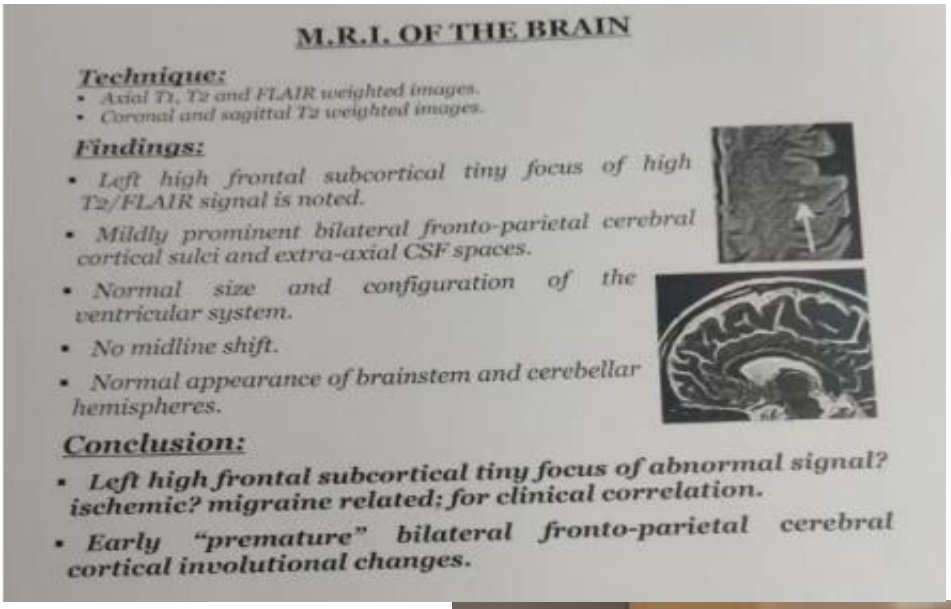
The MRI creates a strong magnetic field around you, and radio waves are directed at your body. This process is painless. You won't feel the magnetic field or the radio waves, and nothing will move around you.

During the MRI, the machine makes repetitive thumping or tapping noises. Wearing earplugs or listening to music can help block out these sounds.

In some cases, a contrast material, typically gadolinium, is injected through an IV in your hand or arm. The contrast enhances the visibility of certain details. Gadolinium rarely causes allergic reactions.

An MRI scan can last anywhere from 15 minutes to over an hour. You need to stay still, as movement can blur the images.

During functional MRI (fMRI), you may be asked to perform simple tasks, like pressing your thumb against your fingers, rubbing sandpaper, or answering simple questions. This helps identify the parts of the brain that control these actions.


M.R.I. OF THE BRAIN
Technique:
Axial T1, T2 and FLAIR weighted images.
Coronal and sagittal T2 weighted images.
Findings:
Left high frontal subcortical tiny focus of high T2/FLAIR signal is noted.
Mildly prominent bilateral fronto-parietal cerebral cortical sulci and extra-axial CSF spaces.
Normal size and configuration of the ventricular system.
No midline shift.
Normal appearance of brainstem and cerebellar hemispheres.
Conclusion:
Left high frontal subcortical tiny focus of abnormal signal? ischemic? migraine related; for clinical correlation.
Early "premature" bilateral fronto-parietal cerebral cortical involutional changes.

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1. **What does MRI stand for?**
   A) Magnetic Radiation Imaging
   B) Magnetic Resonance Imaging
   C) Molecular Resonance Imaging
   D) Magnetic Radio Imaging
   Answer: ?

2. **What is the strength of the magnetic field typically used in MRI machines?**
   A) 0.5 Tesla
   B) 1 Tesla
   C) 2 Tesla
   D) 3 Tesla
   Answer: ?

3. **Which atoms in the human body are primarily affected by the MRI magnetic field?**
   A) Oxygen atoms
   B) Nitrogen atoms
   C) Carbon atoms
   D) Hydrogen atoms
   Answer: ?

4. **What type of MRI is used to assess blood flow in the brain?**
   A) Structural MRI
   B) Diffusion MRI
   C) Functional MRI (fMRI)
   D) Magnetic Spectroscopy
   Answer: ?

5. **What is injected into the body during some MRI scans to enhance image clarity?**
   A) Saline solution
   B) Iodine-based dye
   C) Gadolinium
   D) Carbon dioxide
   Answer: ?