# CT AND MRI SCANS

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# OBJECTIVES

- Introduction
- Basic principles of CT and MRI
- Indications
- Drawbacks and limitations
- Differences between CT and MRI
- Conclusion

## CT SCAN

## MRI SCAN

# COMPUTED TOMOGRAPHY

- . Computed tomography, more commonly known as "CT scans", are cross sectional, three dimensional gray scale images.
- It is common imaging modality in modern clinical medicine
- With advancements in technology, it is rapidly replacing many diagnostic radiographic procedures.

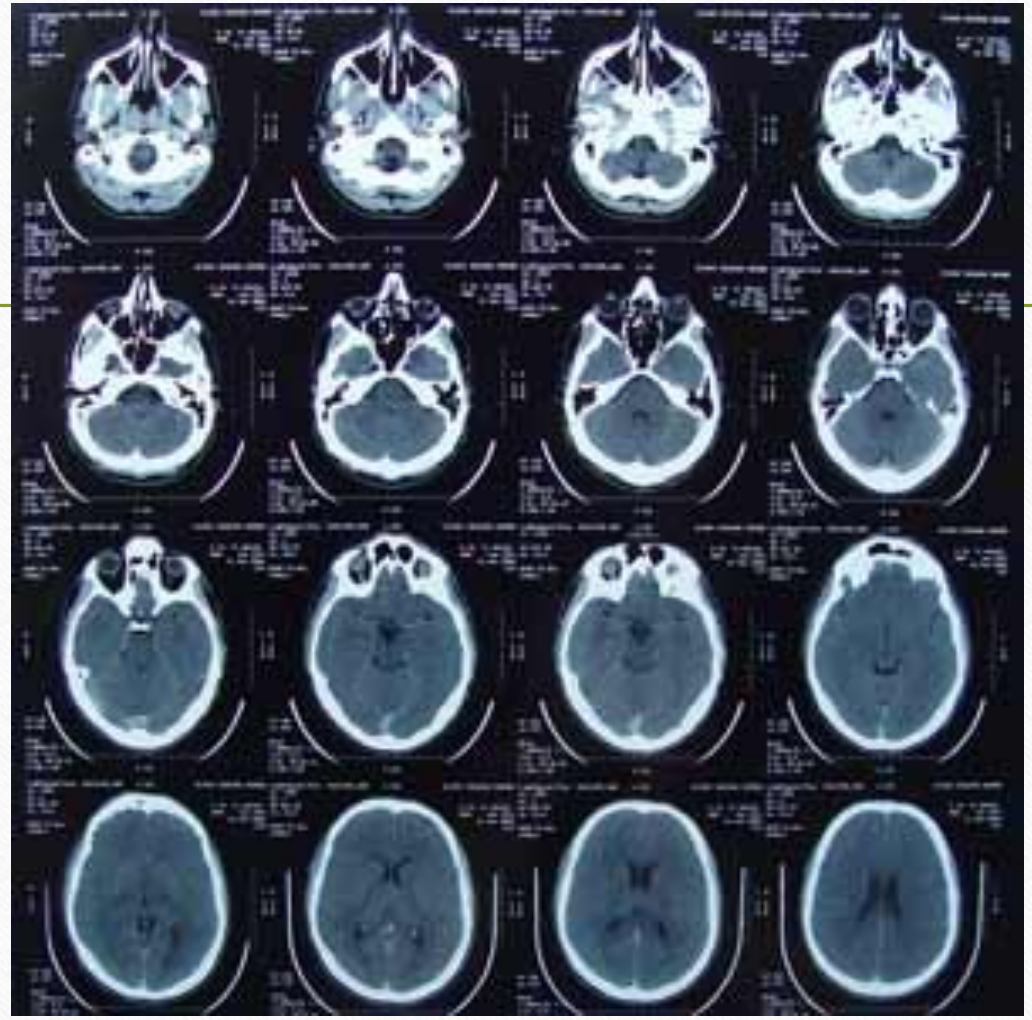
- CT images use x- rays which are electromagnetic radiations to obtain a thin axial image of the patient- a “slice”.
- To obtain CT images, the beam of x-rays and the x-ray detector circle around the patient, continuously producing and detecting a thin beam of x-rays that pass through the patient.
- This is in contrast to radiographs, where a stationary x-ray beam source and detector are used.

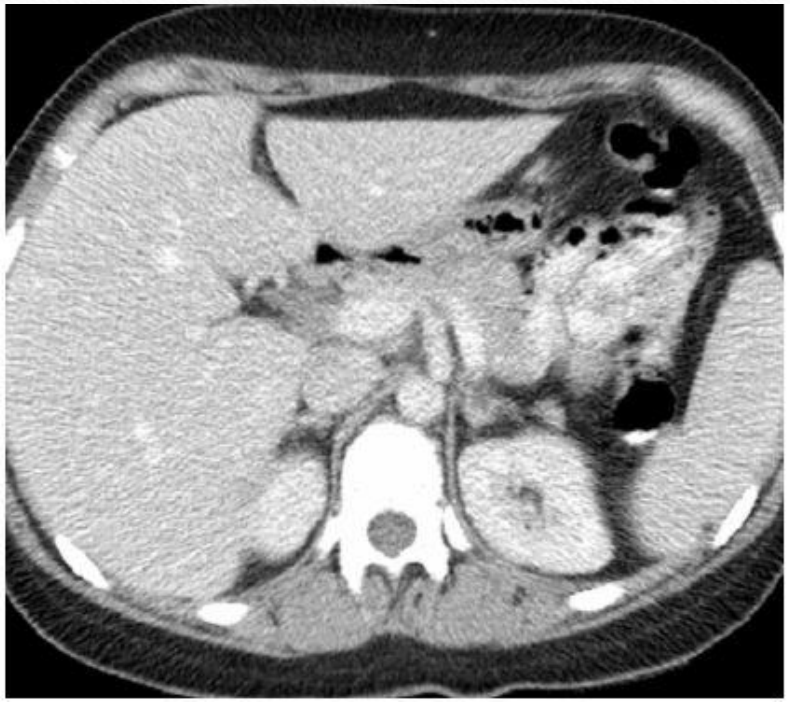
# PRINCIPLE

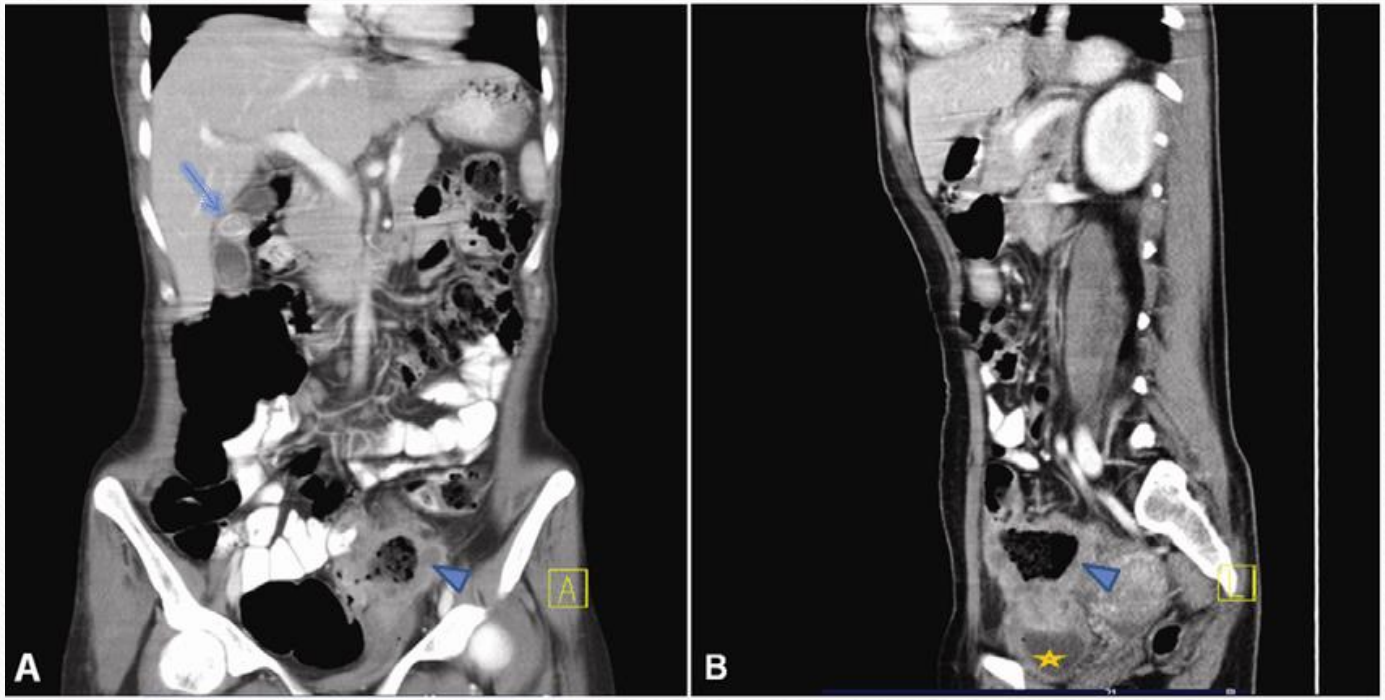
- The patient lies on a table that slowly moves through a circular tube, called the gantry.
- The gantry houses the generator that produces the x-rays as well as a specialized x-ray detector.
- The two are located 180 degrees apart from one another. The generator and detector move in unison around the patient, continuously transmitting a thin beam of x-rays through the patient.

- The scanner emits x-rays towards the patient from a variety of angles – and the detectors in the scanner measure the difference between the x-rays that are absorbed by the body, and x-rays that are transmitted through the body

- Those that are not absorbed by the patient are sensed by the detector and transmitted to a computer.
- The data is analyzed and an image produced which represents one "slice" of the patient.






A
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# USE OF IV CONTRAST

- To aid in the differentiation of structures seen on CT, particularly if they are of similar density, intravenous contrast dye (x-ray dye) is often used.

- The dye is composed of iodine which is quite dense and therefore attenuates x-rays, thus appearing white on CT.
- The dye is administered to the patient by intravenous injection.
- When this is done, tissues in the body will take up the contrast. The more dye that a tissue takes up, the lighter shade of gray it appears on CT; the more it is said to "enhance".

# INDICATIONS OF CT SCAN

- CT scanning is the ideal imaging modality in **emergency cases**.
- It is often the choice of examination for trauma patients in the emergency room (due to its quick scan times).
- It is more efficient when an immediate diagnosis is required such as intracranial bleeds, dissection of a blood vessel, or renal stones.

# DRAWBACKS & LIMITATIONS

- The biggest drawback of CT is that it utilises **radiation** that can potentially be harmful, especially with younger patients and children.
- However, the benefits often outweigh the risk, and there has been an upward trend in the use of CT in diagnostic imaging.
- Absolutely contraindicated in pregnancy.

# DRAWBACKS & LIMITATIONS

- Deranged Renal function tests
- Allergic reactions to IV contrast
- Human error in reading scans
- Not very good at depicting soft tissue
- In order to change the image plane you have to move the patient, unlike with MRI.

# Benefits vs. Risks

**Benefits:**

- CT scanning is painless, noninvasive and accurate.
- A major advantage of CT is its ability to image bone, soft tissue and blood vessels all at the same time.
- Unlike conventional x-rays, CT scanning provides very detailed images of many types of tissue as well as the lungs, bones, and blood vessels.
- CT examinations are fast and simple; in emergency cases, they can reveal internal injuries and bleeding quickly enough to help save lives.
- CT has been shown to be a cost-effective imaging tool for a wide range of clinical problems.
- CT is less sensitive to patient movement than MRI.

# MAGNETIC RESONANCE IMAGING

- Magnetic resonance imaging (MRI) is primarily a medical imaging technique most commonly used in Radiology to visualize the structure and function of the body.
- It provides detailed images of the body in any plane.
- MRI provides much greater contrast between the different soft tissues of the body than does computed tomography (CT), making it especially useful in neurological, musculoskeletal, cardiovascular, and oncological imaging.

- Unlike CT, it uses no ionizing radiation, but uses a powerful magnetic field to align the (usually) hydrogen atoms in water in the body.
- MRI uses a computer and the physical properties of magnetic fields and radio waves to produce high quality sectional images of the inside of the body .

- MRI produces images of the anatomy without the use of radiation found in x-ray or CT scanning
- It is the safest way to get the clearest pictures of the human anatomy
- The typical MRI examination consist of 5-20 sequences taking a few minutes each.

# INDICATIONS

- Occult fractures
- Marrow abnormality
- Ligament pathologies
- Tendon pathologies
- Muscular injuries
- Infection
- Bone and soft tissue tumour
- Labral pathologies

# INDICATIONS

- To date, MRI has been particularly valuable in scanning the brain and spine.
- Through brain and spine scans, MRI can detect multiple sclerosis in its earliest stages, tumors, brain and spine disease, and fluid in the skull.
- Heart scans can show plaque build-up in arteries.
- It can detect cancer and other diseases in the kidneys, ovaries, uterus and liver.

**Advantages of MRI:**

- Non-invasive;
- No in-depth limitation (allows whole brain/eye imaging);
- Does not rely on light (cataract OK);
- Longitudinal monitoring;
- Quantitative/semi-quantitative
- Multimodality (structure, metabolism, functional, etc.)

**Disadvantages of MRI:**

- Ferromagnetic implants X (projectile effect)
- Long scan time
- Sensitive to Motions (motion artifact)
- Claustrophobia X (anaesthesia might be needed)
- Pregnancy not preferred; kids require short scan time
- High cost


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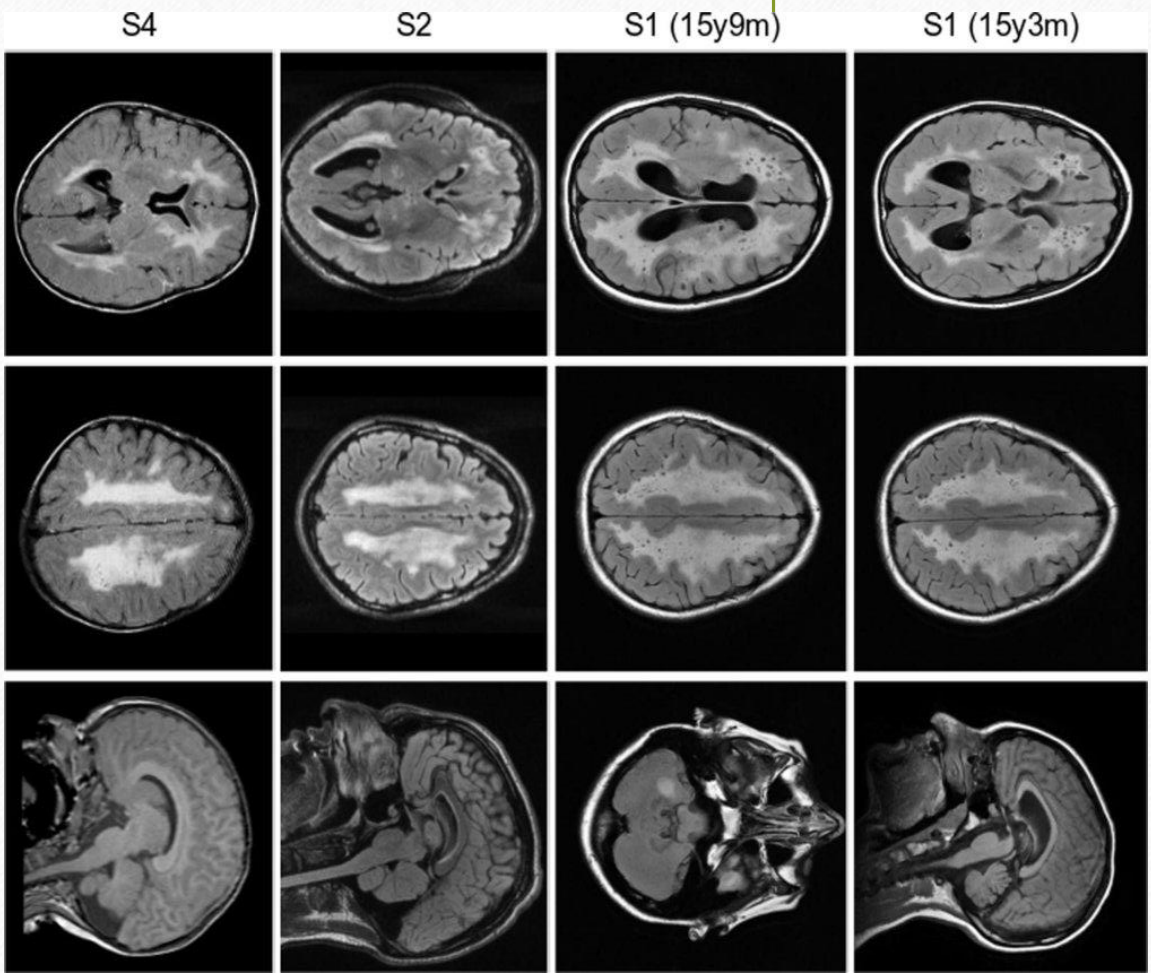
S4
S2
S1 (15y9m)
S1 (15y3m)

# DIFFERENCES BETWEEN CT &MRI

- CT Scans are usually cheaper while MRI is expensive investigation and not readily available
- CT Scans are typically better at showing bones than MRI and used to view bone injuries, but less effective at showing the soft tissue.
- An MRI is best used to examine soft tissue in ligament and tendon injuries, spinal cord injuries, brain tumors, etc.

- CT scans  are mostly indicated in emergency room for internal injuries from car accidents or other types of  trauma.
- MRI is not for emergency imaging.
- MRI scans take a lot longer than CT scans. A CT is usually completed within 5 minutes to take an image, while an MRI scan can take anywhere from 30 minutes to 2 hours in some cases.
- CT scans can be harmful to the patient, while MRI's have no known biohazards

# CONCLUSION

- **CT, COMPUTERIZED TOMOGRAPHY** uses x-ray technology to create pictures from different areas around the body and translates them into cross sections of the patient's tissues and organs.

- **MRI, MAGNETIC RESONANCE IMAGING** use of magnetic fields and radio waves to give a detailed cross- sectional image of a patient's organs and other structures so doctors can give an accurate interpretation.

# THANKYOU