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Program B.S Radiology

Subject CT Procedure

Assignment viva CT Procedure

Semester 6th

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Q1:- what are the major differences between CT scan and MRI scan?

Ans:-

CT scan

→ A computed Tomography (CT) scan uses x-rays to make detailed pictures of structure inside of the body.

→ CT scan uses multiple x-rays, taken at different angles, to produce the cross-sectional imaging.

→ The two most commonly used testes besides x-rays are CT scans and MRIs, both of which provide more detail than x-rays.

→ If you need specialized imaging, it can be helpful to understand the operation and uses for a CT scan.

→ The CT scan show cross-sect-

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CT scan

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ional pictures of the body accomplish this with different Techniques.

→ CT Scan uses X-rays.

→ CT Scan are more common.

→ less expensive.

→ CT Scan are creating detailed images of internal body parts.

→ Doctors can then analyze the images to detect abnormalities, such as fractures in bones, tumors, organs, joint damage.

→ CT Scan also called CAT.

→ Some people refer to a CT scan as a CAT scan, which stands for computerized axial tomography.

During a CT scan, a person lies down in a large machine called CT scanner.

→ The scanner sends images to a computer.

→ Common uses for a CT scans include examining or looking for:

- x Tumors
- x bone fractures
- x internal bleeding
- x cancer development and response to treatment.

→ CT scans usually require the person to lie down on a bed that then moves into the scanner.

→ They will need to remain very still during the scans so that the machines can take clear images.

→ In cases, the technicians will leave the room during the scan, but the person can talk to them via an intercom link.

→ CT scans are safe procedures.

→ CT machine takes several x-ray images of the body from

different angles.

→ During CT scans, a person receives a very small dose of radiation, but doctors usually do not consider this harmful.

→ CT scans use ionizing radiation, which has the potential to affect biological tissues.

→ CT scans and x-rays may not be safe during pregnancy.

→ CT scan, a doctor may recommend using a contrast dye to make the images clearer.

→ Some people may react badly to certain types of dye.

→ CT scan work 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.
- CT scans may be better choice due to their more open design.
 - CT scan a making a diagnosis in an emergency.
 - Doctors can identify if the stroke occurred from hemorrhaging or a blocked artery.
 - easily availability.
 - Shows up acute bleed.
 - Quick procedure.
 - Good visualization of bony structures and calcified lesions.
 - Can detect or exclude the presence of more serious problems.
 - CT scan faster.
 - CT scan procedure is very simple and does not require anesthesia.
 - Lasts 5-10 minutes procedure.
 - CT scan can be performed with no risk to medical implants or metal.
 - Better choice for imaging injuries from trauma, staging cancer, and diagnosing conditions in blood vessels.

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MRT Scans

→ MRI Scans is a test that uses a magnetic and pulses of the radio wave energy to make pictures of organs and structures inside the body.

→ No radiation exposure.

→ Detailed pictures in soft tissues.

→ Doctors commonly use MRI Scans to diagnose issues with bones, organs, and joint including those that affect the:

x ankles

x breasts

x brain

x heart

x joints

x wrist

x blood vessels.

→ MRI stands for Magnetic resonance imagery.

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→ MRI taken at diff angles, to produce the cross-sectional imaging.

→ The MRI show cross-sectional pictures of the body, but they accomplish this with different techniques.

→ If you need specialized imaging, it can be helpful to understand the operation and uses for MRI scan.

→ The most commonly used tests of MRI.

→ MRI scans are ~~two~~ methods that create detailed images of internal body parts such as bones, joints, and organs.

→ Doctors order MRI scans to help diagnose a wide range of medical conditions.

→ MRI scan uses strong magnetic fields and radiowaves.

→ MRI scan are more expensive.

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- MRI Scan produce more detailed images.
- MRI Scan not easily available.
- Doctors can analyze the images to detect abnormalities, such as fractures in bones, tumours, organs, soft tissues, joint damage.
- This types of scan uses radio waves and magnets to create images.
- During a MRI Scan, a person lies down in an MRI Scanner, which ~~that creates~~ is a machine that creates a constant magnetic field and uses radio waves to bounce off water molecules and fat cells in the body.
- The Scanner also sends image to a computer.
- MRI Scan produce a better image than CT Scan.

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- However, they may still avoid using MRI scans, especially during the first trimester, as a precaution.
- MRI scans do not use radiation.
- ~~The~~ MRI use strong magnetic fields. People must let their technicians know if they have any form of medical implant, such as a pacemaker, insulin pump, cochlear implant.
- MRI scans produce loud sounds, so people usually wear earplugs or headphones ^{to} dull the noise.
- individuals with claustrophobia may find MRI scanners difficult to tolerate, although several types of open MRI scanner now exist to get around this problem.
- MRI scans, a doctor may advise using a contrast dye to make the image clearer.
- Some people may react badly

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to certain types of dye.

→ MRI scan produce a more detailed image of soft tissues, ligament, organ.

→ problems that may be easier to see with an MRI scan include soft tissues damage, torn ligaments, and herniated disks, spinal canal stenosis.

→ ~~at least~~ at least 30 minutes procedure

Contraindications for MRI

→ Artificial ~~non~~ metal heart valves

→ Artificial joints.

→ Brain aneurysm clips

→ Dentures

→ Eye implants

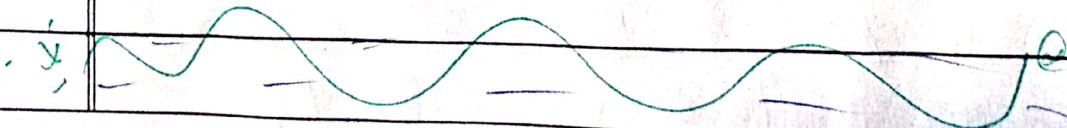
→ Implanted metal wires, rods, screw, plates.

→ IUDs

→ Pacemakers

→ Pregnancy

→ obesity



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Q2:- Which 3D reformation techniques are commonly used in Musculo-skeletal CT imaging? Explain them.

Ans:- Introductions

→ Musculoskeletal applications of three-dimensional (3D) imaging were among the first to be developed and remain its most common clinical application, as this noninvasive method offers a unique tool to characterize the bone morphology and so understand the architecture and kinematics of normal and pathologic joints in vivo.

→ Indeed, accurate evaluation of complex anatomy or complex spatial relationship between the lesions and adjacent anatomic structures plays a major role in clinical application of 3D imaging, as it represents

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a dramatic improvement over the use of Planar cross-sectional imaging alone.

→ This imaging has been shown to have an impact on diagnosis and surgical management in a number of skeletal applications including trauma, malformations and tumours.

Three-dimensional reformation Techniques

→ Different 3D rendering techniques have proved a valuable tool in the diagnosis of various pathologic findings and for therapy planning in musculoskeletal disorders.

→ For 3D post-processing, three different algorithms are commonly used.

→ The Surface Shaded display (SSD) algorithm takes the first voxel encountered along a projection ray that exceeds a user-defined threshold value

of that and defines the position and attenuation value of that voxel as the surface of the object.

→ ~~The~~ No additional information along the projection ray contributes to the viewed image.

→ The surface is derived from only a small percentage (less than 10%) of the available CT data.

→ All structures are shown in the same color, and information about the attenuation of a structure is lost completely.

→ Therefore, SSD images are only capable of demonstrating gross 3D relationship but fail to display lesions hidden beneath the bone surface.

→ It is not adequate for the visualization of structures that do not have naturally well-differentiated surfaces.

- > As a result of this technical disadvantage some, especially undislocated, fractures may be under-diagnosed.
- > In addition, SSD also tends to demonstrate stair step artifacts.
- > An advantage of this technique is that of today's graphic computers are optimized for the display of surface models.
- > Applications in surgical planning (e.g. for virtual planning in corrective osteotomy, for maxillo-facial reconstruction) take advantage of this capability that allows surface models to be interactively repositioned and manipulated.
- > The (MIP) technique evaluate each voxel along a line from the viewer's eye through the volume of data and

Selects the maximum voxel value, which is then used as the displayed value.

→ MIP has proved to be particularly useful in creating angiographic images from CT and MRI imaging.

→ MIP usually has superior accuracy compared with SSD in CT angiography.

Q3. What is the function of "Suxe Start" in CT imaging?

Ans: Suxe Start.

→ Planning the scan delay using the Suxe Start bolus tracking tool is illustrated:

→ The selected scan plane, just above the origin of the coronary arteries, is chosen to start the scan at the optimal time by monitoring the arrival of the contrast bolus in a

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region of interest (ROI) placed in the descending aorta.

→ Important landmarks in ~~this~~ this plane are the sternum anteriorly and the descending aorta posteriorly.

→ Also seen in this plane are a segment of the pulmonary trunk and a portion of the anterolateral chest wall.

→ The ROI in the descending aorta is used to monitor the increase in Hounsfield units (HU) after initiation of contrast injection.

→ The scan delay after contrast injection can be determined in one of the two ways:

(1) by injection of a test bolus to determine the patient's individual circulation time and optimize the spiral scan parameters accordingly.

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(2) by bolus tracking, with automatic triggering of the scan once a predefined HU threshold has been reached.

- use of the test bolus method increases the total amount of contrast injected and may be inaccurate because the circulation time may vary.

→ contrast agent injection is usually followed by an automatic 40ml intravenous saline flush administered at a flow rate of 4mls^{-1} which serves to wash out the right ventricle and improve coronary artery visualization.

→ Precontrast baseline attenuation is also measured in the descending aorta.

→ In our experience, good results are achieved using a threshold of 180HU when baseline attenuation is in the

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range of approximately ~~atten-~~
~~uation~~ 30-60 HU.

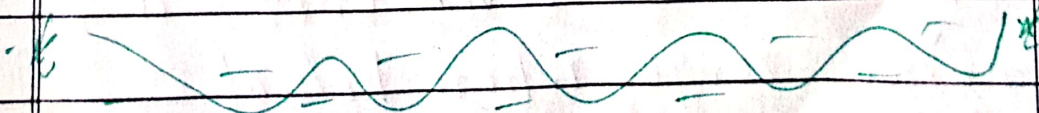
→ on the basis of our experience,
 we recommend the use of
 the SureStart bolus tracking
 option b/c it consistently
 yields good-quality images.

Fig. 9a.5 Start of the helical
 coronary examination

→ The position of the Sure
 Start has been defined
 on the basis of the Planning
 Scan (Panel A).

→ Next, a continuous low-dose
 scan (30-50 mA) is acquired
 at the level of the start
 of the spiral scan for triggering
 the spiral scan after IV contrast
 administration (Panel B).

→ Contrast arrival can be
 tracked in real time.



Q4:- what are the major differences between single slice CT and multislice CT?

Ans:- Single Slice CT

→ The origin of word "tomography" is from the Greek word "tomos" meaning "slice" or "section" and "graph" meaning "drawing".

→ Single slice CT uses x-ray in a single detector.

→ The single slice CT scan had an x-ray source and single detector.

→ Data acquisition involved moving both the tube and detector across the scanning plane to acquire a series of transmission measurements.

→ All data collected through a 180 degree rotation.

→ Single slice CT covers only a narrow range when helical scanning is performed with a thin

slice. e.g 1-mm slice.

→ Parts of single slice CT scan.

① Crantry

- x-ray tube
- High voltage generator
- Detector
- Pre-patient collimator
- Post-patient collimator

② Table/couch

③ UPS

④ Control panel

→ Limitations of single slice CT:

- speed performance
- MPR low accuracy
- image quality and artifacts
- More intravenous contrast.

→ single slice CT scan had an x-ray source a single detector.

→ Data acquisition involved moving both the tube and detector across the scanning plane to acquire a series of transmission measurements.

- The absorbed dose during clinical examination of the head, thorax, abdomen and Pelvis performed with a single-slice CT scanner and new multi-slice CT system was measured and compared.
- Technical parameters, defined at installation and memorized on the two CT machines relate to standard-sized patient and were considered the reference standard.
- The comparison showed that the multi-slice scanner delivers a higher dose compared to the single-slice detector.
- Single slice, the disease remains undiagnosed in its early stages due to low image quality.
- Later on, when the difficulties are aggravated, the patient is referred for high-quality scans and sometimes so

So much times is lost that the diseases go untreatable.
→ A single slice scanner emits more harmful rays as compared to the multi-slice scanner.

Multislice CT

- The multi-slice computed tomography.
- Multiple slice CT scanners, first introduced in 1998, could take 4 separate images in each rotation.
- Since then, technology has improved and now, the CT scanners can take between 6 and 16 separate images in a single rotation.
- Multi-slice CT has better diagnostic ability than the traditional single slice CT.

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→ Multi-Slice CT, several detectors are closely placed to gather multiple layers of data in one go.

→ Multi-slice CT is a multiple detectors.

→ Multi-Slice can work sequential and spiral mode also.

→ Multislice CT these are row of detectors.

→ Part of the Multislice CT Scan.

② Prant & Y

① x-ray tube

② High voltage generator

③ Laser Light

④ Cooling system

⑤ Row of detectors.

⑥ Variable collimator

⑦ control panel.

→ Advantage

① 3D image

② change the field area

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- (3) → less contrast medium required
- (4) Reduce motion Artifact
- (5) Improved spatial resolution
- (7) Perform special contrast study (biphasic, CP Angiograms).

→ Disadvantages

- (1) Expensive
- (2) Ring artifact
- (3) Delivers High dose of Radiation.

→ MSCT has very high capacity to detect problems which are also the reason for their popularity in recent times.

→ uses a single detector array.

→ And hence greater volume of patient is scanned in a single rotation.

→ The image quality is way much better than its traditional counterpart.

→ Better image quality results

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- in the ~~can~~ early and precise diagnosis of diseases, which eventually means saving a lot of suffering and money.
- The scanners used work at very high speed.
 - where it takes around 10 minutes on a conventional single-slice CT to do a scan, the multi scanner can do the job within a few seconds and even more efficiently.
 - Due to the less time taken, the multislice CT scan can be done on people in restless stage.
 - those who are unconscious.
 - This also helpful with children as it is difficult to get ~~them~~ them to lie in one position for a long time.
 - The emission of radiation is very low.
 - Single slice scanner emits

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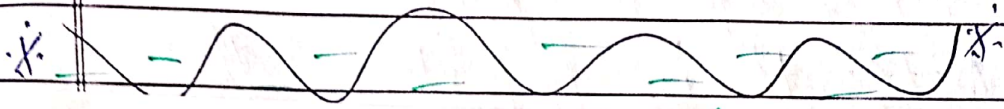
- more harmful rays as compared to the MSCT.
- For this reason, a MSCT is favoured for children.
 - Non-invasive Angiography can only be done on an MSCT.
 - In angiography, MSCT helps in creating a 3D image with precise visualization of arteries & veins.
 - 3D images of the bones, ribcage, spine etc can be obtained in MSCT which results in better assessment of the fractures and give better images for the surgeon to operate upon the patient.
 - It has been found in multiple studies that MSCT lead to less repeatability as the images are good to diagnose in only one scan.
 - This avoids unnecessary cost and

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radiation to the patient.

- Multi-slice scanners mean that it takes less time to complete a CT scan.
- Additionally, the amount of radiation is reduced.



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Q5:- what are general protocols for performing CT contrast studies?

Ans:- Computed Tomography (CT), Abdomen and Pelvis.

→ CT of the abdomen and pelvis is a diagnostic imaging test used to help detect diseases of the small bowel, colon and other internal organs and is often used to determine the cause of unexplained pain.

→ CT scanning is fast, painless, noninvasive and accurate.

→ In emergency cases, it can reveal internal injuries and bleeding quickly enough to help save lives.

→ Tell your doctor if there a possibility you are pregnant and discuss any recent illnesses, medical conditions, medications you are taking, and allergies.

- You will be instructed not to eat or drink anything for a few hours beforehand.
- If you have a known allergy to contrast material, your doctor may prescribe medications to reduce the risk of an allergic reaction.
- These medications must be taken 12 hours prior to your exam.
- Leave jewelry at home and wear loose, comfortable clothing.
- You may be asked to wear a gown.

x' What is CT Scanning of the abdomen Pelvis?

- CT, more commonly known as a CT or CAT scan, is a diagnostic medical imaging test.
- Like traditional x-rays, it produces multiple image or

pictures of the inside of the body.

- The cross-sectional images generated during a CT Scan can be reformatted in multiple planes.
- These images can be viewed on a computer monitor, printed on film or by a 3D printer, or transferred to a CD or DVD.
- CT images of internal organs, bones, soft tissues and blood vessels provide greater detail than traditional x-rays, particularly of soft tissues and blood vessels.

∴ What are some common uses of the procedure?

- This procedure is typically used to help diagnose the cause of abdominal or pelvic pain and diseases of the internal

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- organs, small bowel and colon, such as:
- infections such as appendicitis, pyelonephritis or infected fluid collections also known as abscesses.
 - inflammatory bowel diseases such as ulcerative colitis or Crohn's disease, pancreatitis, ovaries & bladder as well as lymphoma.
 - kidney and bladder stones.
 - AAA, injuries to abdominal organs such as spleen, liver, kidney or other internal organs in cases of trauma.
 - CT scanning of the abdomen/pelvis is also performed to:-
 - guide biopsies and other procedures such as abscess drainages and minimally invasive tumor treatments.
 - such organ transplants.

⑤ How should I prepare?

→ You should wear comfortable loose-fitting clothes to your

Exam.

→ Metal objects, including jewelry, eyeglasses, dentures and hairpins affect the CT images.

⑥ What does the CT equipment look like?

→ Computer, gantry, loudspeakers, microphone, operators, control room, couch, detectors, camera opening.

⑦ How does the procedure work?

→ In many ways, CT scan work like other x-ray exams.

→ Different body parts absorb x-rays in different amounts.

→ This difference allows the doctor to distinguish body parts from one another on an x-ray or CT images.

a What will I experience during and after the procedure?

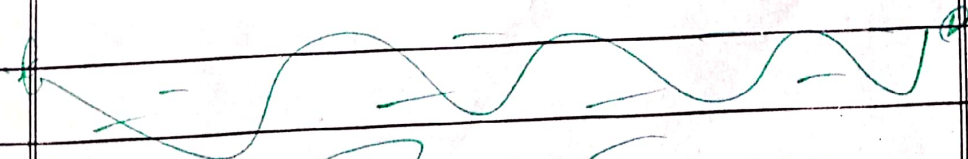
-> CT exams are generally painless, fast, and easy.

-> with MDCT, the amount of time that the patient needs to lie still is reduced.

b Who interprets the results and how do I get them?

- A radiologist, a doctor specially trained to supervise and interpret radiology exams, will analyze the images.

-> The radiologist will send an official report to the doctor who ordered the exam.



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