NAME:

Mehboob ur Rahman

ID :

13817

Department

Bs (Radiology)6th semester

Final term

Viva assignment

Question no 1:

Ans: Difference between CT scan and MRi

CTscan:

.A computed Tomography (CT) scan uses x ray to make detailed pictures of structures inside of the body .

.CT scan:

.Quick and painless

.Cost less than MRI

. .Better availability compared to MRI

.shows up acute bled

.Good visualization of bony structures and calcified

.Can detect or exclude the presence of more serious problems

.Exposure to ionizing radiation

.Resolution

.Beam Harding artifacts

.injection of a contract medium (dye) can cause kidney problems or result in allergic or injection - site reactions in some people

.Some procedures require anaesthesia

MRI:

Magnetic resonancec imaging (MRI) is a test that uses a magnetic field and pulses of radio wave energy to make pictures of organ and structures inside the body .

MRI:

.No radiation exposure

.Good resolution

.3 -D reconstruction

.Good Gray - white differrntion

.Adjust settings based on characteristics of the lesion
.Gadolinium contrast is relatively nontoxic
. High cost
. Some patients ineligible because of pacemakers , other metal
.clcustrophobia
.lengthy and noisy procedure
.Limited availability

Question no :3

Ans :

Sur start:

The use of state-of-the-art helical CT scanners allows for ultra fast examination of larger regions of the body. Due to the short examination time, optimum utilization of the intravenous contrast medium bolus is of extreme importance. The Sure Start function grants this in a very simple way.

Planning the individual scan delay on the Aquilion 64 using the SureStart bolus tracking tool is illustrated in . 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 region of interest (ROI) placed in the descending aorta . Important landmarks in 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.

Start of the helical coronary examination. The position of the SureStart 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. The continuous scan is started not earlier than 15 s after initiation of contrast administration for reasons of radiation protection and to ensure optimal opacification of the target vessels. Contrast arrival is measured in an ROI in the descending aorta (arrowhead and small circle in Panel B). The continuous increase in HU in the ROI over time is represented in Panel C in the form of a graph. The breathing command starts once the defined threshold of 180 HU has been reached. The scan then starts with a 3-s delay to allow the heart rate to normalize after inspiration. The arrows in Panel D represent cursor movements and can be clicked to correct the position of the ROI in the descending aorta if necessary and also displayed the elapsed time. Ao ascending aorta

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, or (2) by bolus tracking, with automatic triggering of the scan once a predefined Hounsfield 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 40-ml intravenous saline flush administered at a flow rate of 4 ml s−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 180 HU when baseline attenuation is in the range of approximately 30–60 HU. On the basis of our experience, we recommend the use of the SureStart bolus tracking option because it consistently yields good-quality images.

Question no :4
Ans: Defference between single slice Ct and multi slice Ct

1: Single Slice CT scan:

.The single slice Ct scan had and X ray soruce and a single detector .

.Data acquisition involved moving both the tube and detector across the scanning plane to acquire a serious of transmission measurements.
.All data collected through a 180 degree rotation.
.High patient dose
.slow performance
.MRP low low accuracy
.low image quality
.Artifacts

2: Multi slice CT scan

.The Multi slice Ct special because multiple detectors are placed next to each other so the CT scan can collect multiple slice data at the same time (single slice).
.The multi slice can work sequential and spiral mode also .

.perform special contract study (biphase ,ct angiograms)
.limiting Radiation dose
.Improved spatial resolution
.Reduce motion artifact
.less contrast medium required
.change the field area
.3D image
.Expensive
.Delivers High Dose of Radiation
.Ring artifact
.

Question no : 5
Ans

Computed Tomography (CT) - Abdomen and Pelvis
Computed tomography (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's a possibility you are pregnant and discuss any recent illnesses, medical conditions, medications you're 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.

What is CT Scanning of the Abdomen/Pelvis?
Computed tomography, more commonly known as a CT or CAT scan, is a diagnostic medical imaging test. Like traditional x-rays, it produces multiple images or pictures of the inside of the body.

The cross-sectional images generated during a CT scan can be reformatted in multiple planes. They can even generate three-dimensional images. 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 tissue 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 organs, small bowel and colon, such as:

infections such as appendicitis, pyelonephritis or infected fluid collections, also known as abscesses.
inflammatory bowel disease such as ulcerative colitis or Crohn's disease, pancreatitis or liver cirrhosis.
cancers of the liver, kidneys, pancreas, ovaries and bladder as well as lymphoma.
kidney and bladder stones.
abdominal aortic aneurysms (AAA), injuries to abdominal organs such as the spleen, liver, kidneys 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.
plan for and assess the results of surgery, such as organ transplants.
stage, plan and properly administer radiation treatments for tumors as well as monitor response to chemotherapy.
How should I prepare?
You should wear comfortable, loose-fitting clothing to your exam. You may need to wear a gown during the procedure

Metal objects, including jewelry, eyeglasses, dentures and hairpins, may affect the CT images. Leave them at home or remove them prior to your exam. You may also be asked to remove hearing aids and removable dental work. Women will be asked to remove bras containing metal underwire. You may be asked to remove any piercings, if possible.

You will be asked not to eat or drink anything for a few hours beforehand, if contrast material will be used in your exam. You should inform your physician of all medications you are taking and if you have any allergies. If you have a known allergy to contrast material, your doctor may prescribe medications (usually a steroid) to reduce the risk of an allergic reaction. To avoid unnecessary delays, contact your doctor before the exact time of your exam.

Also inform your doctor of any recent illnesses or other medical conditions and whether you have a history of heart disease, asthma, diabetes, kidney disease or thyroid problems. Any of these conditions may increase the risk of an adverse effect.

Women should always inform their physician and the CT technologist if there is any possibility that they may be pregnant.

What does the CT equipment look like?
The CT scanner is typically a large, donut-shaped machine with a short tunnel in the center. You will lie on a narrow examination table that slides in and out of this short tunnel. Rotating around you, the x-ray tube and electronic x-ray detectors are located opposite each other in a ring, called a gantry. The computer workstation that processes the imaging information is located in a separate control room. This is where the technologist operates the scanner and monitors your exam in direct visual contact. The technologist will be able to hear and talk to you using a speaker and microphone.

How does the procedure work?
In many ways, a CT scan works 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 image.

In a conventional x-ray exam, a small amount of radiation is directed through the part of the body being examined. A special electronic image recording plate captures the image. Bones appear white on the x-ray. Soft tissue, such as the heart or liver, shows up in

shades of gray. Air appears black.

With CT scanning, several x-ray beams and electronic x-ray detectors rotate around you. These measure the amount of radiation being absorbed throughout your body. Sometimes, the exam table will move during the scan, so that the x-ray beam follows a spiral path. A special computer program processes this large volume of data to create two-dimensional cross-sectional images of your body. These images are then displayed on a monitor. CT imaging is sometimes compared to looking into a loaf of bread by cutting the loaf into thin slices. When the image slices are reassembled by computer software, the result is a very detailed multidimensional view of the body's interior.

Refinements in detector technology allow nearly all CT scanners to obtain multiple slices in a single rotation. These scanners, called multi-slice or multidetector CT, allow thinner slices to be obtained in a shorter amount of time. This results in more detail and additional view capabilities.

Modern CT scanners can scan through large sections of the body in just a few seconds, and even faster in small children. Such speed is beneficial for all patients. It's especially beneficial for children, the elderly and critically ill – anyone who finds it difficult to stay still, even for the brief time necessary to obtain images.

For children, the CT scanner technique will be adjusted to their size and the area of interest to reduce the radiation dose.

For some CT exams, a contrast material is used to enhance visibility in the area of the body being studied.

How is the procedure performed?
The technologist begins by positioning you on the CT exam table, usually lying flat on your back. Straps and pillows may be used to help you maintain the correct position and remain still during the exam.

Many scanners are fast enough that children can be scanned without sedation. In special cases, sedation may be needed for children who cannot hold still. Motion will cause blurring of the images and degrade the quality of the examination the same way that it affects photographs.

If contrast material is used, depending on the type of exam, it will be swallowed, injected through an intravenous line (IV) or, rarely, administered by enema.

Next, the table will move quickly through the scanner to determine the correct starting position for the scans. Then, the table will move slowly through the machine as the actual CT scanning is performed. Depending on the type of CT scan, the machine may make several passes.

You may be asked to hold your breath during the scanning. Any motion, including breathing and body movements, can lead to artifacts on the images. This loss of image quality can resemble the blurring seen on a photograph taken of a moving object.

When the exam is complete, you will be asked to wait until the technologist verifies that the images are of high enough quality for accurate interpretation.

The CT examination is usually completed within a few minutes. However, if you are required to drink oral contrast you will be asked to arrive approximately two hours prior to your scan time or begin drinking the contrast at home prior to arriving.

What will I experience during and after the procedure?
CT exams are generally painless, fast and easy. With multidetector CT, the amount of time that the patient needs to lie still is reduced.

Though the scan is painless, you may have some discomfort from remaining still for several minutes or from placement of an IV. If you have a hard time staying still, are very nervous, anxious or in pain, you may find a CT exam stressful. The technologist or nurse, under the direction of a doctor, may offer you some medication to help you tolerate the CT exam.

If an intravenous contrast material is used, you will feel a pin prick when the needle is inserted into your vein. You may feel warm or flushed while the contrast is injected. You also may have a metallic taste in your mouth. This will pass. You may feel a need to urinate. However, this is a contrast effect and subsides quickly.

If the contrast material is swallowed, you may find the taste mildly unpleasant; however, most patients can easily tolerate it. You can expect to experience a sense of abdominal fullness and an increasing need to expel the liquid if your contrast material is given by enema. In this case, be patient, as the mild discomfort will not last long.

Many patients also receive an iodine-based contrast material intravenously (injected into a vein) to help evaluate blood vessels and organs such as the liver, kidneys and pancreas.

When you enter the CT scanner, you may see special light lines projected onto your body. These lines are used to ensure that you are properly positioned. With modern CT scanners, you may hear slight buzzing, clicking and whirring sounds. These occur as the CT scanner's internal parts, not usually visible to you, revolve around you during the imaging process.

You will be alone in the exam room during the CT scan, unless there are special circumstances. For example, sometimes a parent wearing a lead shield may stay in the room with their child. However, the technologist will always be able to see, hear and

speak with you through a built-in intercom system.

With pediatric patients, a parent may be allowed in the room but will be required to wear a lead apron to minimize radiation exposure.

After a CT exam, the technologist will remove the intravenous line used to inject the contrast material. The tiny hole made by the needle will be covered with a small dressing. You can return to your normal activities.

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.

Follow-up exams may be needed. If so, your doctor will explain why. Sometimes a follow-up exam is done because a potential abnormality needs further evaluation with additional views or a special imaging technique. A follow-up exam may also be done to see if there has been any change in an abnormality over time. Follow-up exams are sometimes the best way to see if treatment is working or if an abnormality is stable or has changed.

What are the benefits vs. risks?
Benefits
Viewing a CT scan, an experienced radiologist can diagnose many causes of abdominal pain or injury from trauma with very high accuracy, enabling faster treatment and often eliminating the need for additional, more invasive diagnostic procedures.
When pain is caused by infection and inflammation, the speed, ease and accuracy of a CT examination can reduce the risk of serious complications, such as those caused by a burst appendix or an infected fluid collection and the subsequent spread of infection.
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.
CT can be performed if you have an implanted medical device of any kind, unlike MRI.
CT imaging provides real-time imaging, making it a good tool for guiding minimally invasive procedures such as needle biopsies and needle aspirations of many areas of the body, particularly the lungs, abdomen, pelvis and bones.
A diagnosis determined by CT scanning may eliminate the need for exploratory surgery

and surgical biopsy.
No radiation remains in a patient's body after a CT examination.
X-rays used in CT scans should have no immediate side effects.
Risks
There is always a slight chance of cancer from excessive exposure to radiation. However, the benefit of an accurate diagnosis far outweighs the risk.
The effective radiation dose for this procedure varies.
Women should always tell their doctor and x-ray or CT technologist if there is any chance they are pregnant.
CT scanning is, in general, not recommended for pregnant women unless medically necessary because of potential risk to the unborn baby.
The risk of serious allergic reaction to contrast materials that contain iodine is extremely rare, and radiology departments are well-equipped to deal with them.
IV contrast manufacturers indicate mothers should not breastfeed their babies for 24-48 hours after contrast material is given. However, the most recent American College of Radiology (ACR) Manual on Contrast Media reports that studies show the amount of contrast absorbed by the infant during breastfeeding is extremely low. For further information please consult the ACR Manual on Contrast Media and its references.
Because children are more sensitive to radiation, they should have a CT exam only if it is essential for making a diagnosis and should not have repeated CT exams unless absolutely necessary. CT scans in children should always be done with low-dose technique.
Radiology departments tailor the radiation dose for CT scans, especially when scanning children, so that the benefits of the scan far outweigh any possible risks from the exposure to diagnostic radiation.
What are the limitations of CT Scanning of the Abdomen/Pelvis?
A person who is very large may not fit into the opening of a conventional CT scanner or may be over the weight limit—usually 450 pounds—for the moving table.

CT scanning of the abdomen may not be as sensitive in identifying gallstones as ultrasound of the abdomen.

Alternate imaging techniques such as plain films, gastrointestinal (GI) contrast exams and ultrasound are preferred for evaluation of acute abdominal conditions in babies, such as vomiting or blood in stool.

For some conditions, including but not limited to some liver, kidney, pancreatic, uterine or ovarian abnormalities, the evaluation and diagnosis with MRI may be preferable over CT scanning.

Question no 2
Ans :

Although Magnetic Resonance Imaging (MRI) is the

modality of choice for imaging the musculoskeletal system; Spiral CT remains a viable alternative. Spiral CT is faster, less expensive, easily available and has the potential to evaluate a wide range of musculoskeletal diseases, thus making it an important diagnostic tool [1]. The availability of new algorithms and better computer generated software for multiplanar and 3-D image reconstruction has further enhanced the importance of Spiral CT in musculoskeletal imaging.

The use of 3-D reconstructions of spiral CT in the musculoskeletal system is of tremendous advantage to patients in whom CT is desired to delineate the presence and extent of congenital anomalies, traumatic injury, tumour, infection and inflammation [2]. It also has specific role in postoperative evaluation, especially when the results of plain radiography fail to answer the doubts of the orthopaedic surgeon regarding satisfactory alignment of complex fractures [3]. 3-D CT imaging is able to compensate for streak artifacts due to the presence of metallic implants such as plates, pins and prostheses and because of this it is an established modality for postoperative cross-sectional imaging in

orthopaedic patients also.
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Table 2

Protocols used for data acquisition for 3-D CT imaging

Region Slice thickness Table speed Field of view (FOV)

(mm) (mm/s) (mm)

Skull 1 2-3 160-180

Craniofacial 1 3 180-200

Tumours 2 4 120-180

Pelvic trauma 2 3 120-150

Avascular necrosis 2 4-5 120-150

of femoral head

Post Op evaluation 3 5-6 120-150

Results

The axial and 3-D SSD images of the patients under study were analysed. A total of 6 patients with developmental anomalies of the skull underwent 3-D CT scanning; of these 3 patients had primary craniostenosis, two had craniofacial fibrous dysplasia and one had Apert's syndrome.

Craniofacial trauma formed the largest group on whom 3-D CT studies undertaken, a total of 15 patients were evaluated using this imaging modality. Various fractures of the mandible, maxilla and orbit could be accurately delineated. 3-D CT

imaging was performed in 10 patients with bone tumours; of these 3 patients had osteosarcoma of the femur, 2 had osteochondroma of the femur and tibia, 2 patients had calcified meningiomas and 3 had ameloblastoma of the mandible.

A total of 12 patients with complicated fractures of the pelvis were evaluated with 3-D CT.

Five patients with avascular necrosis of the head of femur underwent 3-D CT to assess and grade the severity of necrosis.

Post operative evaluation of the musculoskeletal system is an important indication of 3-D CT imaging and in the present study 12 patients underwent CT scanning with 3-D reconstructions for evaluation of their post operative status.
The role of 3-D imaging in post operative status evaluation is unsurpassed as compared with other imaging modalities. Plain radiographs do not provide the required information, moreover there is so much of overlap of adjacent structures that correct interpretation is not always possible. MRI may be contraindicated due to the presence of metallic implants or may produce artifacts which interfere with accurate interpretation of images. 3-D CT imaging not only provides accurate

delineation of the bony contours and relationship of the bones forming the joints, it also assesses the spatial relationship of the orthopaedic hardware to the parent bone. In the present study 12 patients underwent 3-D CT imaging for evaluation of their post operative status; out of these 5 patients had undergone craniofacial surgery with metallic implants, 3 had undergone hemimandibulectomy with fibular grafts (Fig 8) and 4 patients had internal fixation implants in the pelvis. Cross sectional imaging in post operative patients has traditionally been a source of frustration for both the radiologist and the orthopaedic surgeon because CT images are limited by streak and MR images by susceptibility artifacts. Spiral CT with advanced 3-D imaging eliminates most streak artifact and produces high-quality images depicting perfectly the relationships between hardware, bones and joints.

Thus spiral CT is a powerful modality for evaluation of the musculoskeletal system, particularly when coupled with advanced 3-D imaging features. This modality of imaging has become an important part in the evaluation of musculoskeletal disease and its inclusion in routine musculoskeletal imaging protocols has changed the diagnosis and management in a significant number of case.

THE END