JAYOTI VIDYAPEETH WOMEN'S UNIVERSITY, JAIPUR

FACULTY OF PHYSIOTHERAPY & DIAGNOSTICS

Faculty Name   :   JV'n Ankita

Program   :   BSc.RT 5th Semester

Course Name   :   Modern Imaging in Diagnosis.

Topic Name   :   Computerized Tomography (CT) Scan. – Basic

Program Outcome- It plays an important role in health sector, provides knowledge about the Diagnostics of any injury , illness or disability in the human body by the help of various modalities or machineries.

Course Outcome-

- Develop an understanding of the subject.

- Understand the role of modern imaging.

- Understanding the practical aspects of Advancement of imaging..

Academic Day starts with –Greeting with saying **'Namaste'** by joining Hands together following by 2-3 Minutes Happy session, Celebrating birthday of any student of respective class and **National Anthem**.

Previous Session- **Magnetic Resonance Imaging. (Basics)**

Topic to be discussed today- Today We will discuss about- **Computerized Tomography (CT) Scan. – basic.**

❖ Lesson deliverance (ICT, Diagrams & Live Example)- ICT, Diagrams

➢ Diagrams

Introduction & Brief Discussion

COMPUTERIZED TOMOGRAPHY (CT) SCAN : An English engineer and inventor, Sir Godfrey Hounsfield is often credited as one of the pioneers of CT scanning. In the early 1970s, he developed the mathematical algorithms and computer techniques necessary to reconstruct cross-sectional images from X-ray data. His work led to the creation of the first commercially viable CT scanner, which he called the "EMI Scanner."

- The word "Computed" refers to the use of computer algorithms and calculations to reconstruct images.
- The word "tomography" part of the term comes from the Greek words "tomos," meaning "slice," and "graphia," meaning "describing" or "recording."

Principle of M.R.I :-

The internal struction of the body can be reconstructed y the multiple projection of any organ.

Modalities :-

In a CT scan, various technologies and modalities are employed to create detailed cross-sectional images of the body's internal structures. Here are the main modalities used in CT scanning:

➢ **X-ray Generation**: The primary modality used in CT scanning is X-ray technology. An X-ray tube emits a focused beam of X-rays that passes through the body. The varying degrees of X-ray attenuation by different tissues and structures within the body are used to create the image.

➤ **X-ray Detection**: The X-ray detector array captures the X-rays that have passed through the body. These detectors measure the intensity of the X-rays after they've interacted with the body's tissues.

➤ **Rotating Gantry**: The CT scanner consists of a rotating gantry that houses the X-ray tube and the detector array. This gantry rotates around the patient, capturing X-ray images from multiple angles.

➤ **Computer Reconstruction**: The collected X-ray data is sent to a computer, where sophisticated mathematical algorithms are used to reconstruct cross-sectional images or slices of the body. These algorithms involve complex calculations to transform the attenuation data into detailed images.

➤ **Three-Dimensional (3D) Reconstruction**: Many CT scanners are capable of creating three-dimensional reconstructions of the scanned area. By stacking the individual cross-sectional slices, a 3D representation of the internal structures can be generated.

➤ **Contrast Agents**: In some cases, contrast agents are used to enhance the visibility of specific tissues or blood vessels during the CT scan. These contrast agents, usually containing iodine or barium, are administered orally, intravenously, or rectally, depending on the area being examined.

Equipment used in CT scan :-

A CT scan involves several key pieces of equipment that work together to capture X-ray data and create detailed cross-sectional images of the body. Here are the main components of a CT scanning system:

➤ **Gantry**: The gantry is the main circular structure of the CT scanner that houses the X-ray tube and the detector array. It rotates around the patient during the scanning process to capture X-ray images from different angles.

- **X-ray Tube**: The X-ray tube emits a focused beam of X-rays that passes through the body. The intensity and duration of the X-ray exposure are controlled to optimize image quality while minimizing radiation dose.

- **Detector Array**: The detector array consists of multiple detector elements that measure the intensity of X-rays that pass through the body. These detectors convert X-ray energy into electrical signals, which are then processed to create images.

- **Patient Table**: The patient lies on a motorized table that moves through the center of the gantry during the scan. The table's movement and position can be controlled precisely to capture images of specific areas of interest.

- **Control Console**: The CT technologist operates the scanner from a control room separated from the scanning area. The control console allows them to set scan parameters, monitor the scan in progress, and ensure patient safety.

- **Computer System**: A powerful computer system is used for image reconstruction, processing, and display. It processes the X-ray data collected by the detectors and creates cross-sectional images of the body.

- **Display Monitor**: The reconstructed images are displayed on a monitor, allowing radiologists and other medical professionals to analyze the images in detail and make diagnostic assessments.

- **Patient Positioning Devices**: Various devices, such as straps, pads, and immobilization devices, may be used to help position the patient comfortably and accurately during the scan.

- **Injection System (for Contrast)**: In cases where contrast agents are used to enhance the visibility of specific structures or blood vessels, an injection system delivers the contrast agent through an IV line.

- ➤ **Accessories**: Other accessories like patient safety intercom systems, emergency stop buttons, and radiation shields are also present to ensure patient safety and facilitate smooth operation.
- ➤ **Power Supply and Cooling Systems**: CT scanners require stable power supply and cooling systems to ensure the X-ray tube and other components operate effectively and safely.

Application of C.T. Scan :-

1. **Diagnosis and Detection:**

- ➤ Trauma and Injuries:

    CT scans are crucial for assessing and diagnosing fractures, internal bleeding, and other traumatic injuries.

- ➤ Cancer Detection:

    CT scans are commonly used to detect and monitor tumors, helping to determine their size, location, and extent.

- ➤ Infections:

    CT scans can reveal infections, abscesses, and other inflammatory conditions within the body.

- ➤ Vascular Issues:

    CT angiography is used to visualize blood vessels and diagnose conditions like aneurysms, stenosis, and blood clots.

- ➤ Lung Diseases:

    CT scans are effective for diagnosing lung conditions like pulmonary embolism, lung cancer, and pneumonia.

2. **Treatment Planning and Monitoring:**

- ➤ Surgery:

    CT scans provide detailed anatomical information that assists surgeons in planning and performing procedures.

➢ Radiation Therapy:

CT scans aid in precise radiation therapy planning by mapping tumor locations and surrounding healthy tissue.

➢ Cancer Treatment:

CT scans are used to monitor the effectiveness of cancer treatments over time.

3. Neuroimaging:

➢ Brain Conditions:

CT scans help diagnose and evaluate brain tumors, hemorrhages, strokes, and other neurological conditions.

➢ Head Trauma:

CT scans are essential for assessing head injuries and identifying brain damage.

4. Abdominal and Pelvic Imaging:

➢ Digestive System:

CT scans can diagnose conditions like appendicitis, diverticulitis, and inflammatory bowel disease.

➢ Kidneys and Urinary System:

CT scans are used to identify kidney stones, tumors, and other urinary tract issues.

➢ Reproductive Organs:

 CT scans help diagnose conditions affecting the reproductive organs.

5. Orthopedics:

➢ Joint and Bone Conditions:

CT scans provide detailed images of bones and joints, aiding in the diagnosis of conditions like arthritis, fractures, and joint disorders.

6. **Cardiovascular Imaging:**
➤ Coronary Artery Disease:

CT angiography can assess coronary artery disease and the condition of the heart's blood vessels.

7. **Dental and Maxillofacial Imaging:**
➤ Dental Issues:

CT scans assist in dental implant planning and diagnosing dental conditions.

8. **Pediatric Imaging:**
➤ Pediatric Conditions:

CT scans are used in children to diagnose and assess various medical conditions.

9. **Emergency Medicine:**
➤ Emergency Situations:

CT scans quickly provide information about injuries or conditions that require immediate medical attention.

10. **Research and Medical Education:**
➤ Anatomical Study:

CT scans aid in studying anatomical structures and advancing medical knowledge.

➤ Medical Education:

  CT images are used to educate medical students, residents, and healthcare professionals.

University Library Reference-

  ➤ The Physics Of Radiology and Imaging by K. THAYALAN
  ➤ Textbook of Radiology for Residents and Technicias by S. K. BHARGAVA

- Suggestions to secure good marks to answer in exam-
  ➤ Explain answer with key point of the answers

Questions to check understanding level of students-

  ❖ What do you mean C.T. SCAN.?
  ❖ What is the principle of C.T. Scan ?
  ❖ What type of modalities is used in C.T. Scan ?
  ❖ Describe the types of Equipment used in C.t scan ?
  ❖ Write 5 important application of C.T. scan ?

Next Topic- **Computerized Tomography (CT) Scan. – (advantage, disadvantage & limitation).**

National song' Vande Mataram'