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2025

Medical Equipments, Terminology and Examples of Diagnostic Equipment

Abbreviations

- DICOM: Digital Imaging and Communications in Medicine
- PACS: Picture Archiving and Communication System
- DR: Digital Radiography
- MRI: Magnetic Resonance Imaging
- CT: Computed Tomography
- PET/CT: Positron Emission Tomography-CT
- DEXA: Dual-Energy X-ray Absorptiometry
- LINAC : Linear Accelerator
- USG: ultrasound sonography
- HIS: Hospital Information System
- RIS: Radiology Information System

Medical Equipment

1) DIAGNOSTIC EQUIPMENT

2) LIFE-SAVING DEVICES

3) SURGICAL INSTRUMENTS

4)MONITORING DEVICES

5) TREATMENT EQUIPMENT

Diagnostic Equipment

- Hospitals invest millions in acquiring and maintaining diagnostic equipment.
- Some Examples:
  - **Imaging Equipment:** CT, DR, MRI, PET/CT, USG, DEXA, Gamma Camera, Mammography, Optical coherence tomography (OCT), Endoscopes
  - **Laboratory Equipment:** Blood Analyzers, Microscopes, Urinalysis Equipment, DNA Analyzers
  - **Electrodiagnostic Equipment**: Electrocardiogram (ECG), Electromyography (EMG), Electroencephalography (EEG)

Life Saving Devices

- Critical for providing immediate care in emergency situations
- Hospitals ensure these devices are readily available in the necessary departments.
- Defibrillators, Ventilators, Infusion Pumps, Hemodialysis Machines, Anesthesia Machines, Oxygen Concentrators are the some examples to these devices.

Surgical Instruments

- Used by surgeons during operations and they assist surgeons in cutting, holding, retracting, and suturing.
- Hospitals regularly sterilize and maintain surgical intstuments to prevent infections.
- Scalpel, scissors, surgical saws, forceps, clamps, retractor, catheters and many others.

Monitoring Devices

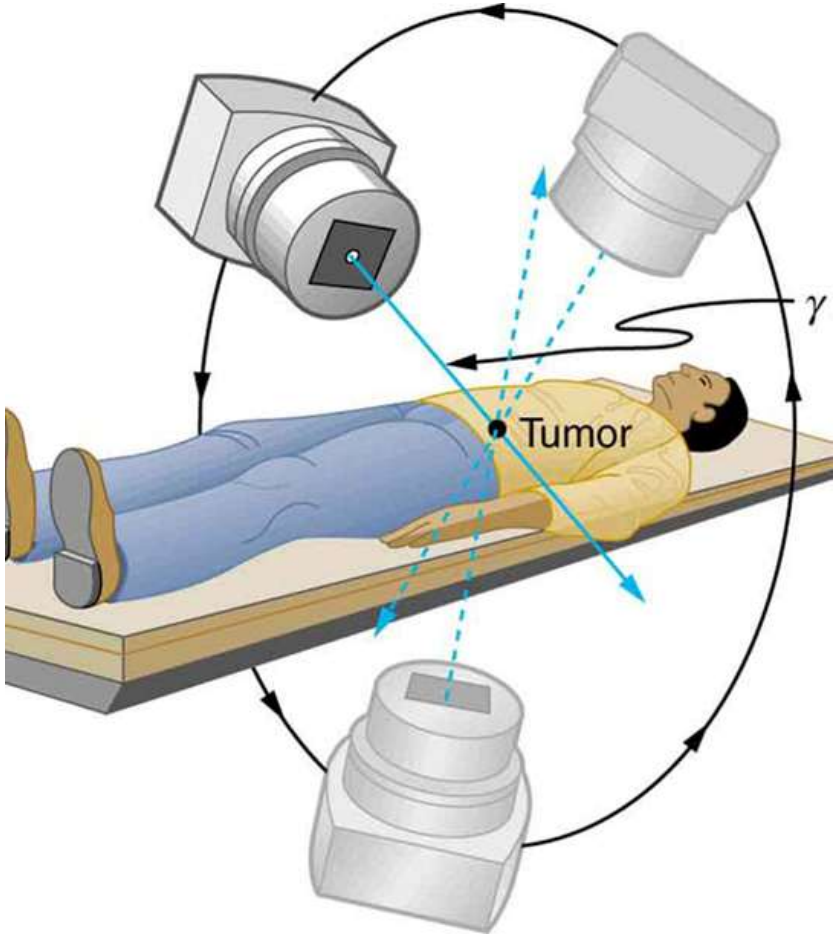
- Aid in monitoring patients vital signs and overall health status.
- These devices help healthcare providers quickly detect any changes in a patient's condition and make timely interventions.
- Blood pressure monitors, pulse oximeters, cardiac monitors, Glucometers, ICU Monitors.

Treatment Equipment

- Administer medications, fluids and treatments to patients.
- Hospitals ensure proper functioning of treatment equipment to deliver effective care
- Nebulizers, dialysis machines, electrotherapy devices, Laser operation devices, LINAC

Radiotherapy

- Radiotherapy, also known as radiation therapy, is a medical treatment that uses high-energy radiation to kill cancer cells or shrink tumors
- It works by damaging the DNA inside cancer cells, preventing them from growing and dividing.
- Radiotherapy can be used alone or in combination with chemotherapy or surgery



Radiotherapy

- External Beam Radiation is common type of radiotherapy, where radiation (X-rays) is delivered from outside the body using a machine called a linear accelerator (LINAC).
- Before starting radiotherapy, detailed imaging such as CT scans or MRI scans are used to locate the tumor and surrounding structures.
- Radiation oncologists then determine the appropriate dose and treatment schedule based on the size, location, and type of cancer.

DİKKAT !
RADYASYON
ALANI
HAMİLELER
VE
HAMİLELİK ŞÜPHESİ
OLANLAR
GİREMEZ

OPERATION ROOM

BIOCHEMISTRY

PATHOLOGY

STERILIZATION

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Examples of Diagnostic Equipment in Radiology

Digital Radiography

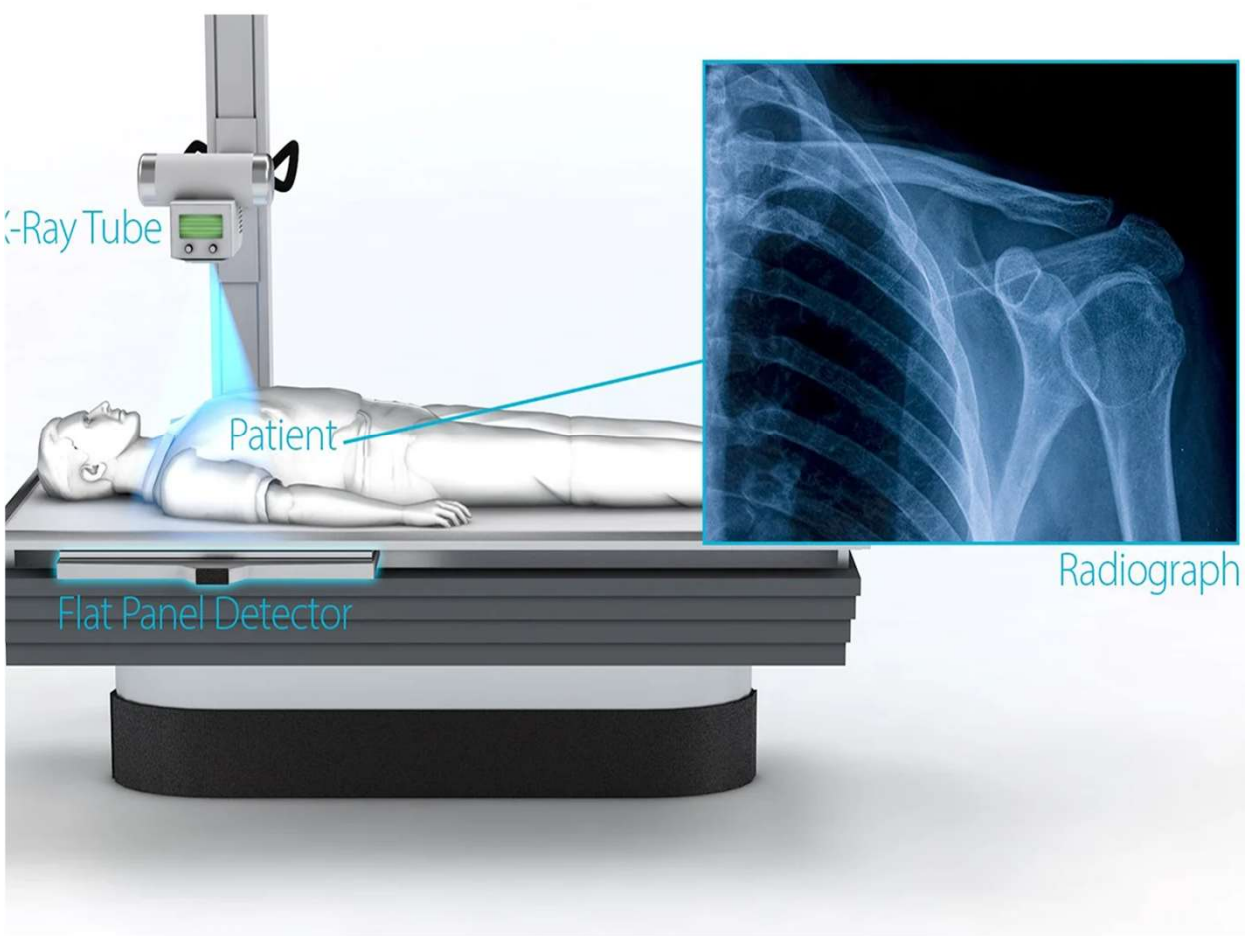
- Digital Radiography (DR) is an advanced form of X-ray imaging where digital X-ray sensors are used
- Components
  - X-ray Source
  - Digital Detector (Flat Panel)
  - Image Processing Software
- Output is DICOM image.

Digital Radiography Workflow

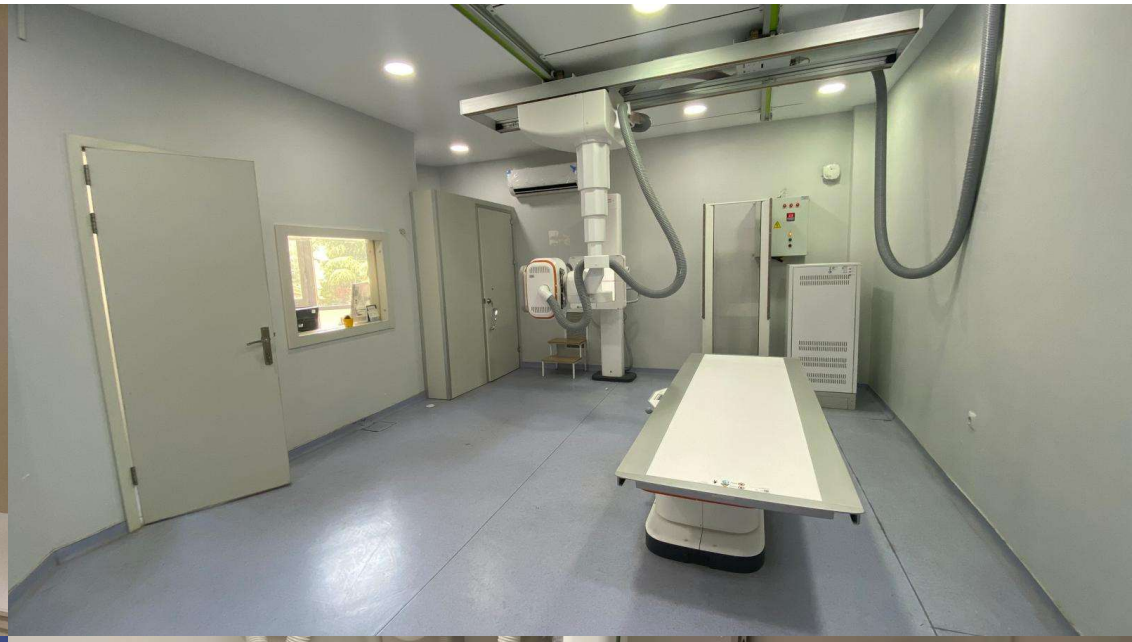
Patient Positioning: The patient is positioned, and the digital detector is placed appropriately.

Exposure: The X-ray source is activated, and the digital detector captures the image.

Image Acquisition: The captured image is instantly transmitted to PACS Server to be stored and distributed.

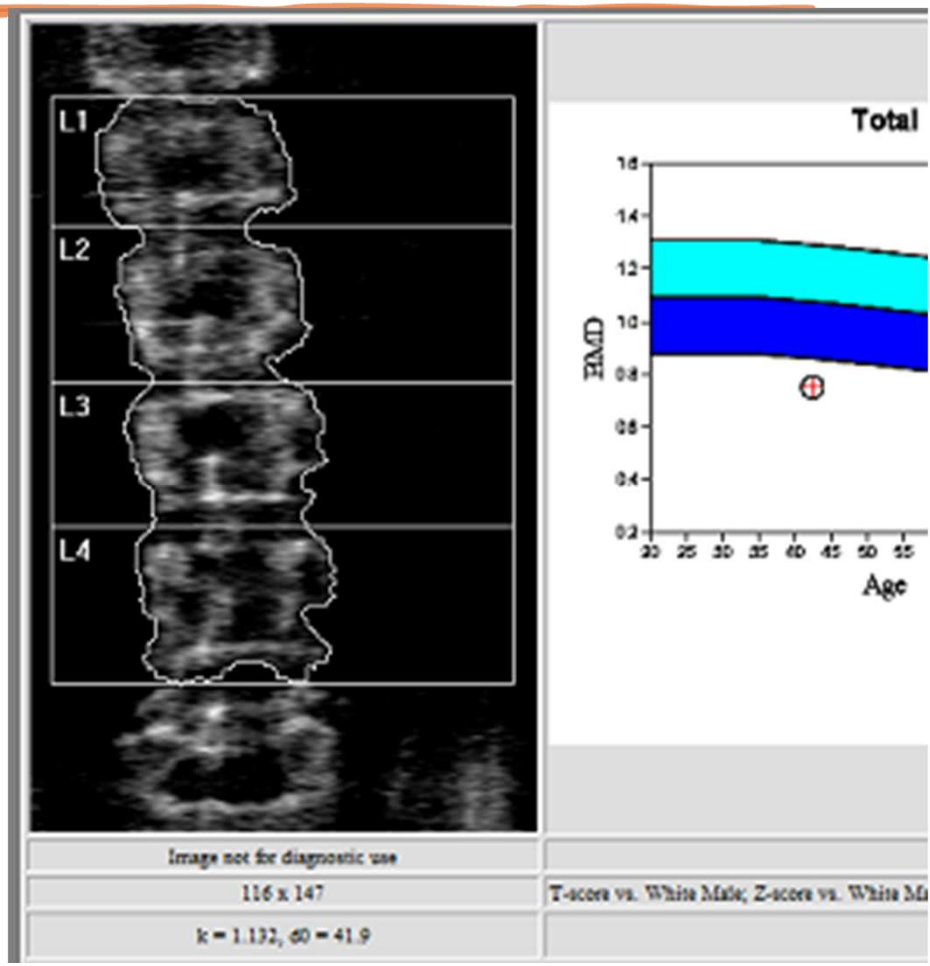


DRGEM



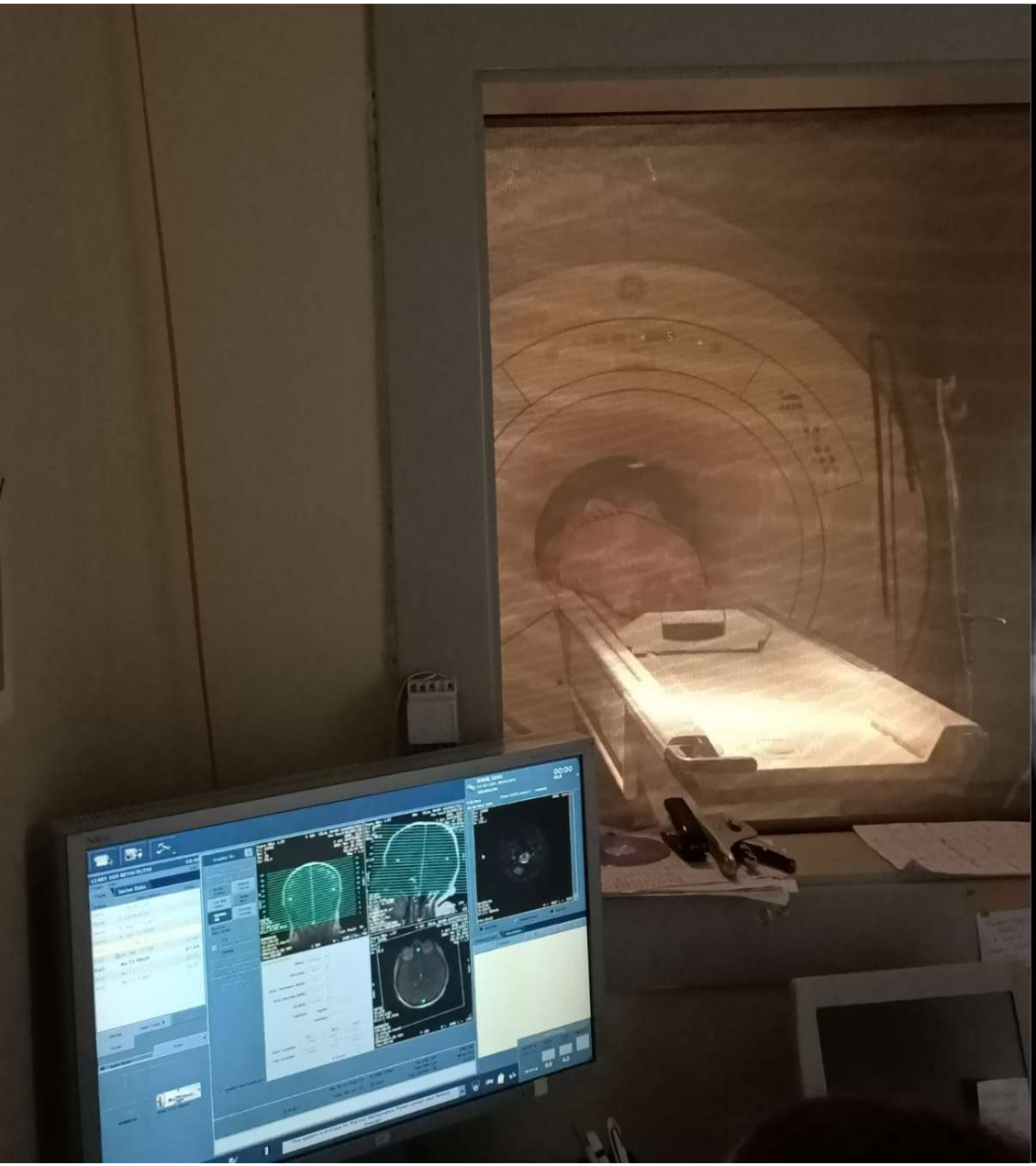
DEXA (Dual-Energy X-ray Absorptiometry)

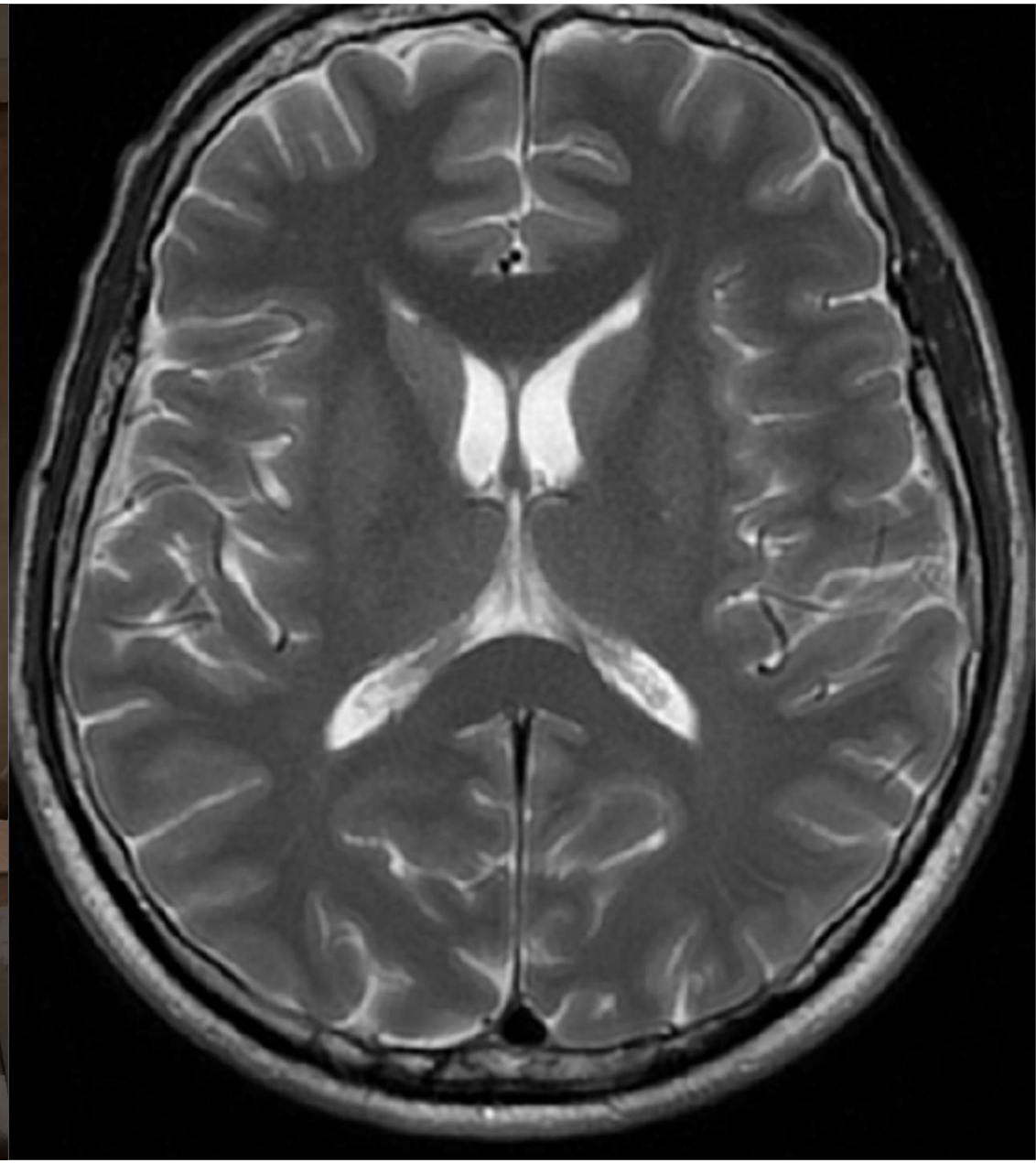
- The main purpose of a DEXA scan is to measure the density of bones, typically in the spine, hip, or forearm. It helps in evaluating bone strength and identifying the risk of fractures and diagnose osteoporosis.
- Output is some numeric ratios T-score and Z-score.
- Output can be stored in PACS as a report.
- It has low radiation compared traditional X-rays.



Magnetic Resonance Imaging (MRI)

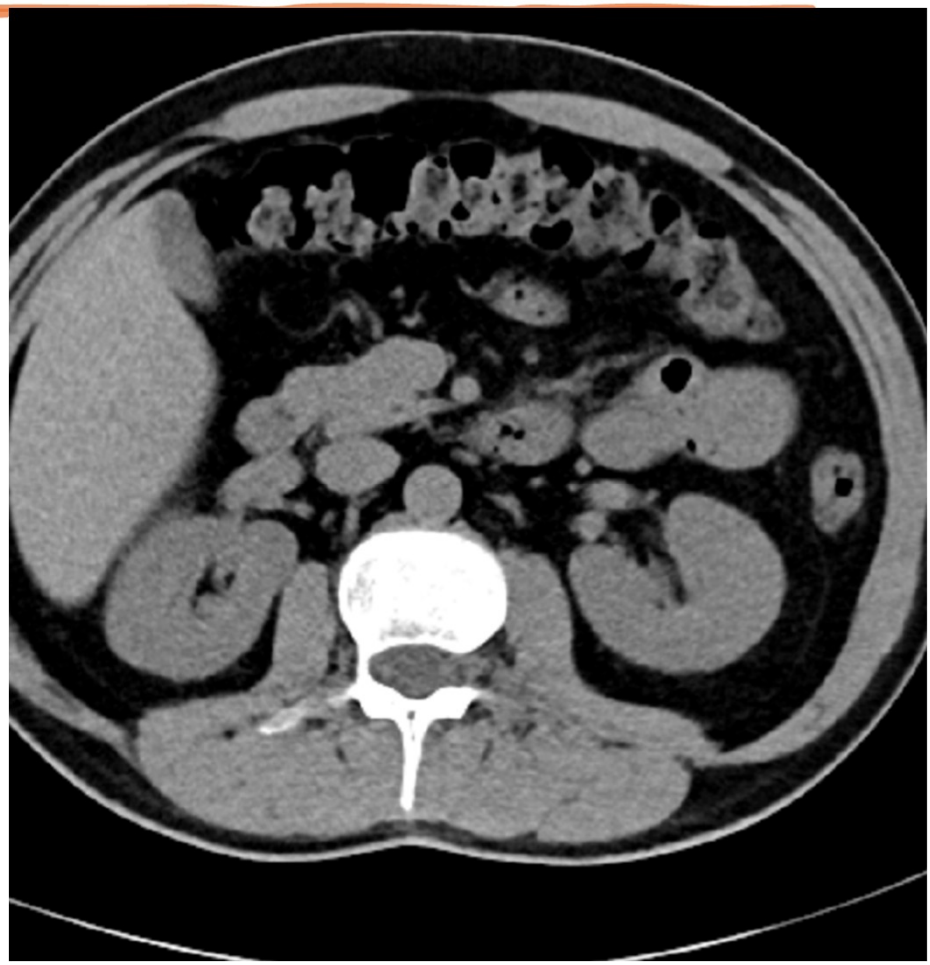
- MRI produces detailed images of the internal structures of the body using strong magnetic fields and radio waves. MRI is widely used in medical diagnostics due to its ability to create high-resolution images of soft tissues, bones, and organs without using ionizing radiation.
- Output is DICOM images and can be stored in PACS.
- MRI scans can take longer than other imaging techniques
- MRI is not suitable for patients with certain implants or devices (e.g., pacemakers, cochlear implants) due to the strong magnetic field





Computed Tomography (CT)

- CT scans use X-rays to create detailed cross-sectional images of structures inside the body, such as organs, bones, and tissues.
- A CT scanner rotates around the patient, taking multiple X-ray images from different angles. A computer processes these images to create cross-sectional slices (tomographic images) of the body.
- Output is a series of detailed cross-sectional images, or slices
- Output can be stored in PACS.



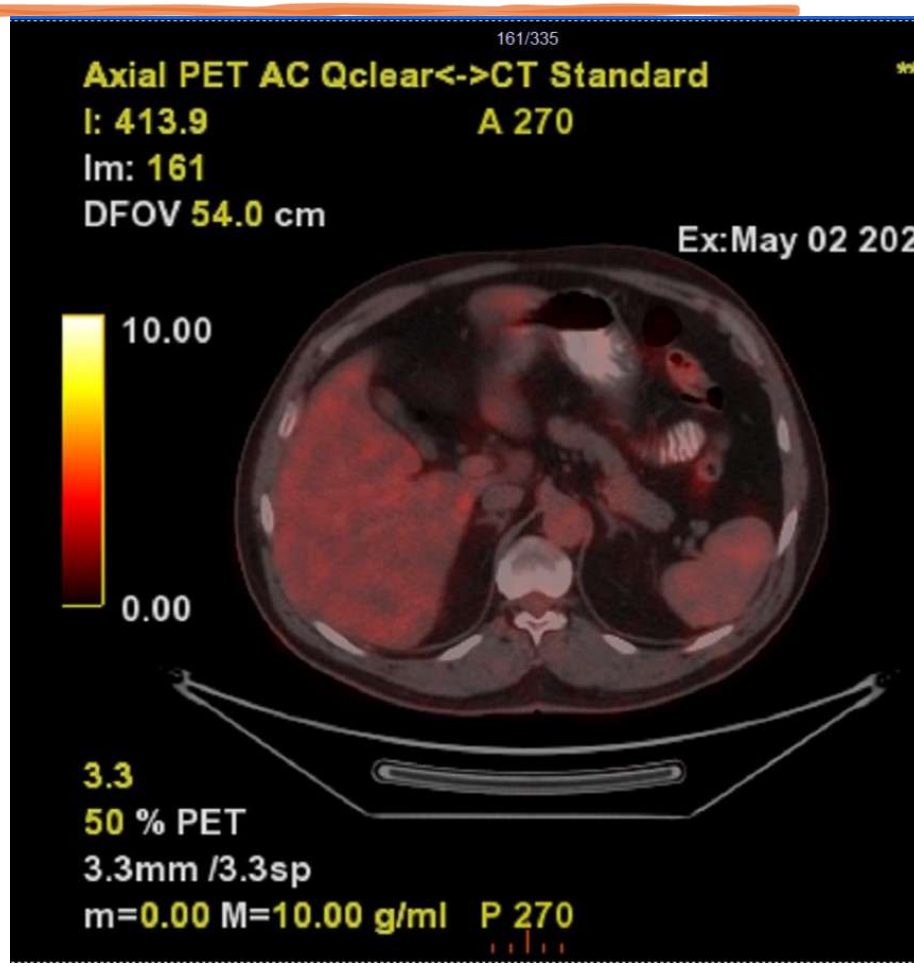
SIEMENS
Healthineers
SOMATOM Drive

PET-CT (Positron Emission Tomography-CT)

- PET scans are used to detect and measure biochemical processes in the body, such as metabolism and blood flow.
- PET scans involve the injection of a small amount of radioactive tracer into the patient's bloodstream. The tracer emits positrons that interact with electrons in the body, this causes gamma rays
- These gamma rays are detected by a PET scanner to create images that reflect metabolic activity.

PET-CT (Positron Emission Tomography-CT)

- PET and CT scans are often combined into a single examination known as PET-CT. This allows for the anatomical information from CT and the functional/metabolic information from PET to be integrated into one image.
- This operation named Axial Fusion
- Output is a series of detailed cross-sectional images, or slices and fusioned images.
- Output can be stored in PACS.



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PET-CT

GAMMA CAMERA

- It is used in Nuclear Medicine
- It detects the gamma radiation emitted by the radiopharmaceutical given to the patient.
- Provide information about the function and structure of organs and tissues
- Output: Series of images
- Output can be stored in PACS.

How a Gamma Camera Works?

1-Radiopharmaceutical injection to patients body. (wait 15 min.)

2-This substance emits gamma rays as it decays

3- Detection of Gamma Rays by detectors

4-Conversion and Processing rays to electrical signals

5- Image Formation, a computer processes the signals to create a two-dimensional image of the radiopharmaceutical distribution in the body.

6- Send dicom images to PACS.

Ultrasound and Doppler

- It uses high-frequency sound (2-15 Mhz) waves to produce images of structures within the body
- Bone or gas-filled structures, such as the lungs or intestines can’t be monitored.
- Doppler USG is used when we want to evaluate and measure blood flow within the body.

Ultrasound and Doppler

- Device send sound waves
- Echoes return to the probe
- Device converts echoes to real time images

- Output: Real time image, operator can make measurement on it.
- Output can be stored in PACS as image or image series.

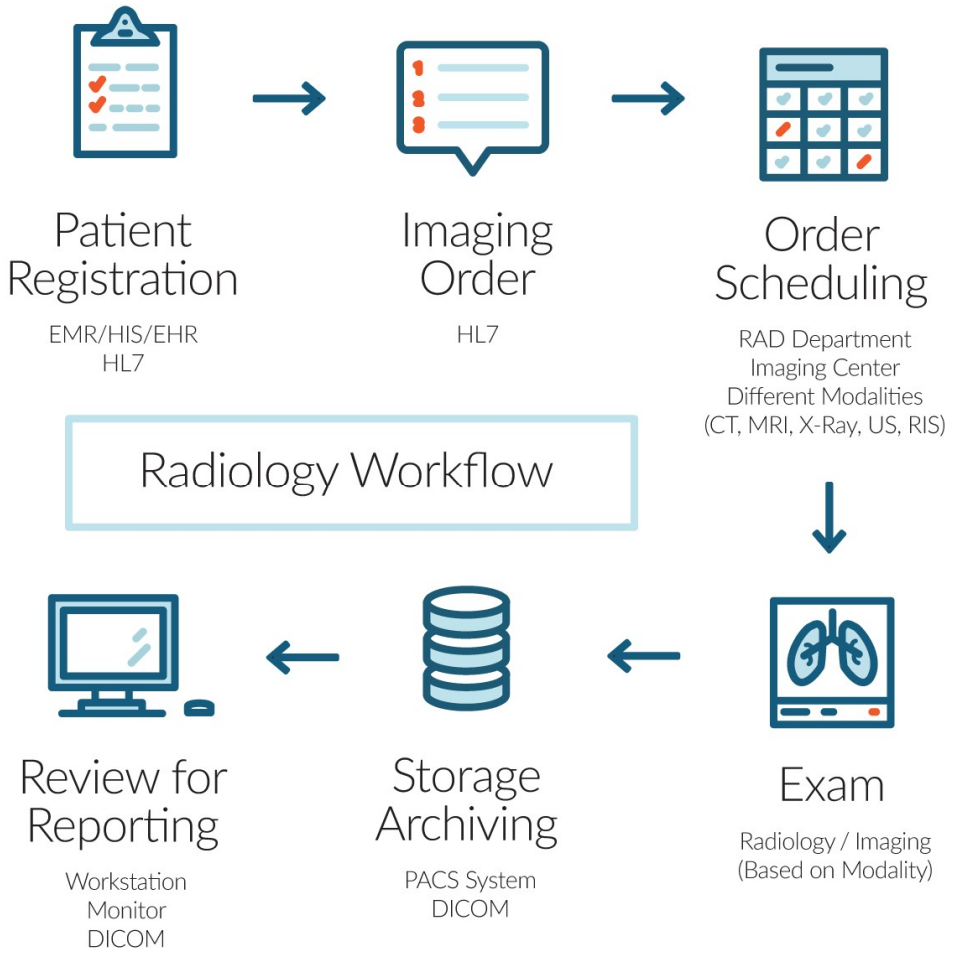
Mammography

- Mammography is a specialized medical imaging technique that uses low-dose X-rays to visualize the internal structures of the breasts.
- It plays a crucial role in the early detection and diagnosis of breast diseases, particularly breast cancer.
- Output is DICOM image and series.
- They can be stored in PACS.

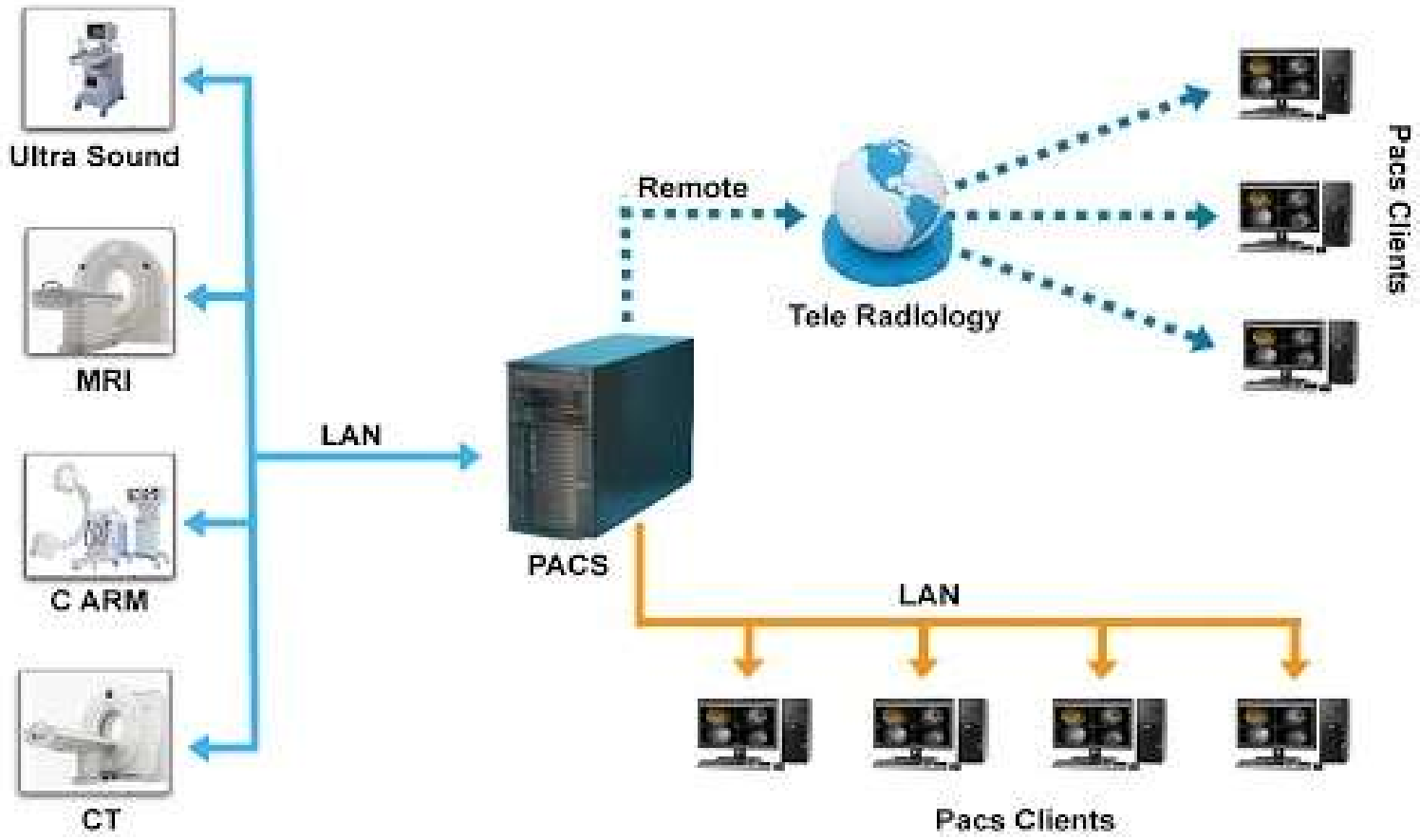
DICOM

- DICOM (Digital Imaging and Communications in Medicine) is an international standard transmit, store, retrieve, print, process, and display medical imaging information and related data (metadata).

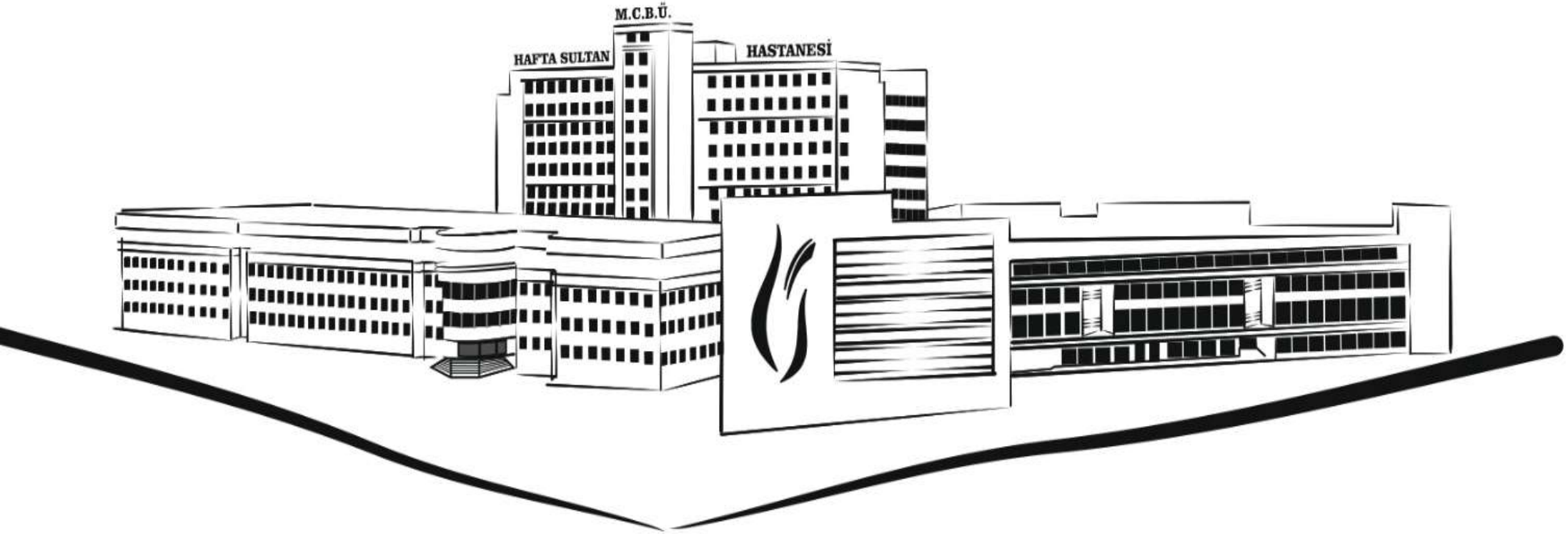
DICOM ensures interoperability between different imaging devices and systems.



PACS


Ultra Sound
MRI
C ARM
CT
LAN
PACS
Remote
Tele Radiology
Pacs Clients
LAN
Pacs Clients

National Personal Health Record System (Türkiye)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