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The World of Radiology

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Introduction

As any other domain focus IT implementation (E.g. Banking, Finance), Radiological Informatics evolves around its domain of focus - **Radiology** and in order for an IT professional to understand the technology of focus, it is useful to understand the underlying industry in order to apply the knowledge effectively.

As such, the main aim of this article is to get you in gear towards understanding the world of radiology in general. I will only cover in brief the nature of this industry, the various sub-disciplines and the people involved. The reason why I won't go too deep into the topic is simply because as a true RIS/PACS Systems Administrator, you would most probably be working in the Medical Imaging Department itself and it would be only a matter of time before you are familiar with the nitty gritty of this industry.

What is Radiology?

Radiology is the science of ionizing radiation that uses Radioactive substances. Radiology is considered part of **Medical Diagnostic Imaging**.

There are two 'categories of Radiology', **Diagnostic** and **Therapeutic**.

Diagnostic Radiology:
An area of radiology that uses external radiation to produce images of the body, its organs and other internal structures for medical diagnostic purposes
(E.g. diagnose of disease or injuries caused by accidents)

Therapeutic Radiology:
An area of radiology that uses radiation in highly controlled conditions to treat patients with cancer.
(E.g. shrinking a tumor to allow a surgeon to remove it)

What is Medical Diagnostic Imaging?

Medical Diagnostic Imaging is a sub-discipline of **medicine** that uses

- Radioactive substances (Isotope)
- X-ray (Electromagnetic radiation)
- Ultrasound waves

to **create images** of the body, its organs and structures to **prevent**, **diagnose** and **treat** disease. Images can also show if the body and its internal organs and structures are functioning properly.

Modalities

Modalities means the medical imaging equipments used to acquire images of the body. The following are the most common types of modalities for Medical Diagnostic Imaging.

General Radiography

- Also know as "plain X-rays"
- Obtained by exposing the patient to X-ray radiation
- The image or picture is basically a shadow of the parts of the patient that absorb or block the X-rays
- 'Looks through' tissues to examine bones, cavities and foreign objects.

Fluoroscopy

- A technique for obtaining real-time X-ray images of a living patient
- Images are created by passing small, highly controlled amounts of radiation through the body and capturing the resulting shadows and reflections on film.
- Uses X-rays to capture a **moving** image of an organ while it is functioning
- Often the most effective way to view the digestive system (the esophagus, stomach, small bowel, colon and rectum.)

Angiography

- An "invasive" procedure used to investigate blood vessels
- Requires the injection (into the patient) of a substance that is radiopaque (absorbs X-rays)
- This substance is commonly called a "Contrast Agent" or "Dye"
- While the artery or vein contains this radiopaque material, it will block the X-rays, and will cast a shadow of the injected vessels onto the X-ray film or fluoroscope
- This image will reveal the shape of the artery, and can help to diagnose an obstruction,blockage, or narrowing ("stenosis")

Mammography

- An X-ray image of the breasts.
- Mammograms are used to detect calcifications tumors and cysts and help differentiate benign (noncancerous) and malignant (cancerous) disease.

Bone Mineral Density

- Used to determine a patient's risk for osteoporosis and for monitoring ongoing degenerative bone diseases.

CT (Computed Tomography)

- Also known as CT scan
- It may be performed "**plain**" or "**contrast study**" by injecting "Contrast Agent" intravenous
- Images are created by using an array of individual small X-ray sensors and a computer
- By spinning the X-ray source and the sensor/detectors around the patient, data is collected from multiple angles. A computer then processes this information to create an image on the video screen
- These images are called "sections" or "cuts" because they appear to resemble cross-sections of the body
- This technique eliminates the problem of conventional X-rays, where all the shadows overlap, however, because it does use X-rays to form the image, this computerized technique has some limitations that are similar to those for plain film radiographs

Nuclear Medicine

- Involves making the patient temporarily radioactive by injecting (into the veins) a very small amount of an **radioactive isotope** / **radioactive materials** (radiopharmaceuticals).
- The images are obtained by looking for the small amount of radioactivity given off by the patient.
- By choosing the right isotopes and attaching them to physiologic molecules, the radioactivity (and the image) can be isolated to reveal certain organs and tissues (like imaging the thyroid with a radioactive Iodine scan for diagnostic and treatment purposes.

PET (Positron Emission Tomography)

- A type of nuclear medicine that measures metabolic activity of cells.
- A combination of nuclear medicine and biochemical analysis that is used in patients with brain or heart conditions and cancer.
- Helps to visualize the biochemical changes taking place in the body, such as the metabolism of the heart muscle.

MRI (Magnetic Resonance Imaging)

- A diagnostic procedure that does not use X-rays (nor any other type of "ionizing" radiation)
- It uses a combination of a large magnet, radiofrequencies and a computer to produce detailed images (2-D or 3-D map) of the different tissue types, organs and structures within the body.
- First, the magnetic field causes the protons in the atoms of water within the patient to all "line-up". Then, a high-frequency electro-magnetic pulse knocks many of the protons out of alignment. Next, a very sensitive radio antenna "listens" for the "resonance" signal that each proton gives off, as it goes back into alignment. These minute resonance signals occur in a pattern that a computer uses to create 3D information.
- The pictures look like "sections" or "cuts" - just like in CT. Except in the MR, the resulting image primarily reflects the water protons in the patient, as well as their chemical association with proteins, etc.

Ultrasound

- Also known as Ultrasound scanning or Sonography
- It is a noninvasive method of seeing inside the body using high-frequency sound waves
- The sound waves are recorded and displayed as real-time visual images
- Well known for it's use in obstetrics and gynecology, also used to check circulation and examine the heart
- **No radiation** is used in ultrasound imaging

The People Involved

Like any industry, there are different category of professionals with very different skillsets existing to complement each other. The following few some of the most commonly found in a Radiological / Imaging department.

Radiographer

- Also referred to as **Radiologic Technologists** or **Imaging Technologists**
- Utilizes imaging equipment to conduct radiological diagnostic procedures (acquiring images) as needed for evaluating/diagnostic of patient medical conditions.
- If needed, prepares and administers chemical mixtures.

Sonographers

- Similar to the **Radiographer** but performs ultrasound diagnostic procedures only.

Nurses

- Wherever there are doctors, there would be nurses.
- Provides patient care and assist the radiologist in their clinical work.

Radiologist

- Doctors/Physicians who have had special training in interpreting the images produced by the Radiographers

Transcriptionist

- Transcribes medical records, operative reports, discharge summary, letters, examinations, and patient history as dictated by the Radiologists.

Film Librarians

- Files, retrieve medical records as required or requested and locating films that have been misplaced

Imaging Support Technicians

- Also known as Radiographic Assistants or Imaging Assistants.
- Assist radiographers to perform radiographic procedure, process film/images and assist patients.

Contact

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