What is Radiology?

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Radiology represents a branch of medicine that deals with radiant energy in the diagnosis and treatment of diseases. This field can be divided into two broad areas – diagnostic radiology and interventional radiology. A physician who specializes in radiology is called radiologist.

The outcome of an imaging study does not rely merely on the indication or the quality of its technical execution. Diagnostic radiology specialist represents the last link in the diagnostic chain, as they search for relevant image information to evaluate and finally support a sound diagnosis.

History of radiology

Working in a darkened laboratory in Würzburg in Germany in 1895, Wilhelm Conrad Röntgen noticed that a screen painted with a fluorescent material in the same room, but a couple of feet away from a cathode ray tube he had energized and made lightproof, started to fluoresce.

Röntgen recognized that the screen was responding to the nearby production of unknown rays transmitted invisibly through the room which he called “X-rays”. Radiographic images began to be created, starting as a burst of ionizing radiation and causing a contrast image on a piece of film.

For his discovery, Röntgen was honored with the first Nobel Prize in Physics in 1901, and the public was fascinated with the ensuing developments and implications. Nevertheless, early radiologists were not concerned about the potential negative effects of X-rays, thus protective measures were not introduced until 1904 after the death of Clarence Dally (the long-time assistant of Thomas Edison in X-ray manufacture and testing).

Radiology techniques

Similar to the images produced in 1895, conventional radiographic images (usually shortened to X-rays) are produced by a combination of ionizing radiation (without added contrast materials such as barium or iodine) and light striking a photosensitive surface, which in turn produces a latent image that is subsequently processed.

The major advantages of conventional radiography are relative inexpensiveness of the images and the possibility to obtain them virtually anywhere by using mobile or portable machines (for example, mammography). Disadvantages are the limited range of densities it can demonstrate and the use of ionizing radiation.

Computed tomography (CT) currently represents the workhorse of radiology. Recent developments permit extremely fast volume scans that can generate two-dimensional slices in all possible orientations, as well as sophisticated three-dimensional reconstructions. Nevertheless, the radiation dose remains high, thus a very strict indication for every intended CT is needed.

Ultrasonography is still the cheapest and most harmless technology in radiology, which is the reason why many physicians outside radiology use this technique. Ultrasound probes utilize acoustic energy above the audible frequency of humans in order to produce images. As there is no ionizing radiation with this modality, it is particularly useful in imaging of children and pregnant women.

Magnetic resonance imaging (MRI) makes use of the potential energy stored in the body’s hydrogen atoms. Those atoms are manipulated by very strong magnetic fields and radiofrequency pulses to produce adequate amount of localizing and tissue-specific energy that will be used by highly sophisticated computer programs in order to generate two-dimensional and three-dimensional images. The major advantage is that no ionizing radiation is used.

Fluoroscopy represents a modality where X-rays are used in performing real-time visualization of the body, allowing for evaluation of body parts, administered contrast flow and positioning changes of bones and joints. Radiation doses in fluoroscopy are substantially higher when compared to conventional radiography, as many images are acquired for every minute of the procedure.

Nuclear medicine images are made by giving the patient a short-lived radioactive material, and then using gamma camera or positron emission scanner that records radiation emanating from the patient. Most common nuclear medicine modalities used in clinical practice are single-photon emission computed tomography (SPECT) and positron emission tomography (PET).

Finally, advances in equipment and increases in computer power have allowed combining data imaging sets from various modalities in radiology; the most popular use of this has been integration of PET functional nuclear medicine data with CT anatomic data (PET/CT), which currently has widespread use in the imaging of cancer.

Sources

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Further Reading

- All Radiology Content
- Radiologist Training
- Teleradiology
- Propagation-Based Phase-Contrast X-Ray Imaging
- Digital Radiology Advantages

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