Radiology

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Radiology

Humanity, constantly learning, growing, and facing more challenges each second of the day. Whether the challenges are mental or purely physical. We have found more efficient, safer, and easier ways of doing the tasks we may face. From moving cargo, to sending information via the Internet.

Probably the greatest accomplishments we have made, are in the studies of medicine/treatment.

And to be specific, the study of radiology.

Radiology, the process of working and viewing inside the human body without breaking the skin. By using radiant energy, which may take the form of x rays or other types of radiation, we are able to diagnose and treat many diseases and injuries. Both diagnostic and therapeutic radiology involve the use of ionizing radiation (Beta, Alpha, Gamma, and x rays), with the exception of the MRI, which uses a magnetic field rather then radiation.

Radiology is classified as being either diagnostic or therapeutic. Diagnostic radiology is an evaluation of the body, by means of static or dynamic images or anatomy, physiology, and alterations caused by injury or disease. A majority of these pictures are formed by passing a low or high level of x rays through the part of the body being examined, producing the static image on film.

This image is called a radiograph or x ray picture. The image it's self may have many forms. It could be a common radiograph, such as a chest x ray; a tomograph (Greek for " section"), which is a radiograph obtained by timing the x ray exposure to correspond with the movement of the x ray tube and film in opposite directions around the plane of the body; or, finally, a computerized axial tomography (CAT or CT) scan.

Which is a computer analysis of a sharply limited, thin x ray beam passed circumferentially through an area of the body, giving the doctor of Technician
a cross-sectional image. Much like that of slicing a loaf of bread into sections.

Other images may be obtained by using ultrasound
or MRI, or by recording the activity of isotopes internally administered and deposited in certain parts of our body. This practice is called nuclear radiology or nuclear medicine. This include such techniques as a PET scan, or positron emission tomography, which uses patterns of the positron decaying to study metabolism reactions in the body. PET

requires
a cyclotron as an on-site source of short-lived, positron-emitting isotopes.

The isotopes are injected into the patient along with a glucose related compound, and the positrons collide with the electrons in the body to produce photons. The photons are then tracked by a tomographic scintillation counter, and the information is processed by a computer to provide both image and data on blood flow and metabolic processes within bodily tissues. PET scans are particularly useful for diagnosing brain tumor and the effects of strokes on the brain, along with various mental illnesses. They are also used in brain research and in mapping of brain functions.

Another form of imaging is ultrasound.

Ultrasound, which uses very high frequency sound, is directed into the body. And because the tissue interference's reflect sound, doctors are able to produce, by use of a computer, a photograph or moving image on a television. Ultrasound has many application uses on the body, but is more commonly used in examinations of the fetus during pregnancy, because use of radiation may affect the outcome of the baby. Some other practices for ultrasound include examination of the arteries, heart, pancreas, urinary system, ovaries, brain, and spinal cord. And because sound travels well through fluids it is a very useful technique for diagnosing cysts(which are filled with fluid), and fluid filled structures such as the bladder. And since sound is absorbed by air and bone it is impossible to use a ultrasound on bones or lungs.

The sound waves are produced by a random oscillating crystal, and are inaudible to humans. A instrument called a transducer is used to transmit the sound waves and receive the echoes.

The transducer must be in close contact with the skin, and a jelly like substance is used to improve the quality of the transmission.

And last of the diagnostic imaging tools is the MRI. MRI, which stands for Magnetic Resonance Imaging.

Was a technique developed in the 1950's by Felix Bloch, and is the most versatile, powerful, and sensitive tool in use. The process of MRI was originally called NRI (Nuclear Resonance Imaging), but was found to be to confusing due to the fact that MRI's don't use radioactivity and ionizing radiation. The MRI generates a very powerful electromagnetic field, which allows the radiologist to generate thin-section images of any part of the body. Also it can take these images from any direction or angle, and is done without and surgical invasion. Another plus side to the MRI is The time it take to perform, where as a CAT scan may take 30-60 min. A MRI may only take 15 minutes max. The

MRI also creates 'maps' of biochemical compounds within a cross-section of the body. These maps give basic biomedical and anatomical information that provides new knowledge and may allow early diagnosis of many diseases.

The MRI is possible in the human body because our bodies are filled with small biological 'magnets', the most abundant and responsive of these are the protons (in the nucleus of the hydrogen atom). The principal of the MRI, utilizes the random distribution of protons, which have basic magnetic properties. Once the patient is placed in the cylindrical magnet, the diagnosis process follows 3 steps.

First, MRI creates a steady state of magnetism in the body, that is 30, 000 time greater then that of the earth's own magnetic field. The rate of absorption in the body is measure in megahertz and gigahertz ranges.

Then MRI stimulates the body with radio waves to change the steady-state orientation of the hydrogen protons. It then Stops the radio waves and 'listens' to the bodies electromagnetic transmissions at the selected frequency. The transmitted signal is used to create images much like those of the CAT scans, but are far more accurate and much easier to interpret.

In current practice, the MRI is preferred
for diagnosing most diseases of the brain and central nervous system.

And is the best diagnostic technique we know. It's images, information, and other vital information surpass that of its relatives the CAT scans, x rays, PET scans, etc. The MRI has yet another distinguishing feature it can determine between soft tissue in both normal and diseased states.

The only drawback to the MRI is that is relatively expensive ($2, 000 dollars session), but that may not be so bad when you account for all the money and time you save by getting treatment and diagnosis sooner. Because the MRI uses no radiation what-so-ever the only risk it presents is to people who have one or more of the following: A pacemaker, neurostimulator,
implanted electrodes, pumps, or electrical devices, diabetic insulin pumps, aneurysm clips, shunt, seizures, heart bypass surgery, abdominal injuries, eye prosthesis, hearing aid, dentures, middle ear prosthesis, metal mesh, wire sutures, war injuries or gunshot wounds, other known metal fragments in head, eye, or body, known possible pregnancy, IUD's, penile prosthesis, joint or limb replacement, fractured bones treated with metal rods, plates, pins, screws, nails, or clips, any other for of prosthesis, permanent eye liner, wig, or make-up with metallic fragments.

Many organs that may not be visible by routine radiographic methods may become visible by ingesting, installing, injecting, or inhalation of substances. These substances are called contrast media, which are impenetrable by radiation. Exams involving a contrast include the upper intestine, the colon, a arthrogram (a injection into a joint), myelogram (an injection into the spinal canal), and an angiogram (a injection of the contrast into an artery, vein, or lymph vessel). These procedures may be observed while the they are taking place, by fluoroscopy. Which is a movable, radiation sensitive screen.

Now That I have described static images and the processes used to create them let me explain dynamic images and how they are manufactured. Dynamic images, which record movement of organs or the flow of contrast material through blood vessels or spinal canal, may be obtained be recording the image by fluoroscopy, or by recording on to video tape or movie film (cineradiography). Both film and the video tape are permanent recording media. The fluoroscopic image on the other hand isn't. However, these images can be made permanent (film spots), and can be made at any time during the examination.

The use of ionizing radiation in the assessment of a disease is similar to the use of drugs and medication in treatment of the disease. For the simple reason that radiographic exams should only be performed for specific medical indications and only on the direct request of a physician or another skilled professional.

And although diagnostic radiation dose levels do have a small risk potential, no current evidence shows that properly conducted diagnostic exams have no detectable adverse effects on our bodies. Dynamic images are used quite frequently, but not as often as static images.

As I mentioned at the beginning of my report,
there are 2 sections of radiology. And since I just discussed diagnostic radiology, it is time to explain a little about therapeutic radiology.

Therapeutic Radiology is used in the treatment of malignant diseases with ionizing radiation, either alone or with drugs. This practice branches off from the discovery of elements that occur naturally in the late 19th century. Such treatment is often described in terms of energy of the beam being used: superficial(less then 120 Kilovolts, orthovoltage (l20 to 1000 kV), megavoltage (Greater then 1000 kV) Superficial radiation is used in treatment of diseased skin, eye, or other parts of the bodies surface. Orthovoltage therapy has almost been completely replaced megavoltage(cobalt, linear accelerator, and betatron). Because it provides more efficient delivery of the intended dose to tumors deep within the body, sparing the skin and surrounding tissues as much as possible.

Radiation therapy may be used alone as
the treatment of choice in most cases of cancer of the skin; in certain stages of cancers involving the cervix, uterus, breast, and prostate; and in some types of leukemia and lymphoma, particularly Hodgkin's Disease.

In such instances, radiation therapy is intended to effect a cure.

But when is use with cancer-treatment drugs it may only pose as a relief of symptoms. Radiation therapy is commonly used before and after surgical removal of certain tumors, in order to provide a better chance of cure.

The idea of radiation therapy is that normal
tissues have a greater ability to recover from the effects of the radiation more so then tumor and tumor cells. Thus, a radiation dose sufficient to destroy tumor cells will only temporally injure adjacent normal cell.

And if the ability of normal tissue to recover from a given amount of radiation
is known to be the same as or less then that of the cancer tissues, the tumor is described as being radio-resistant. Such forms of therapy are not considered an appropriate form of treatment.

Well, as you can see radiology is a field

of study that deserves our uttermost attention. For the future of

humanity may one day totally rely on these processes.