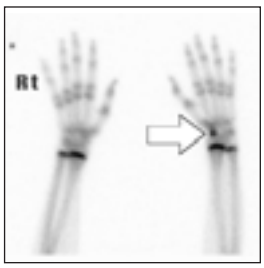
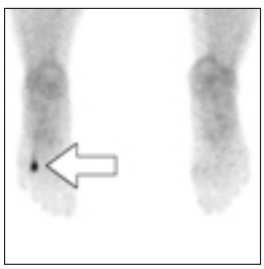
Southernex
Imaging Group Ltd

May 2004

Nuclear Medicine Information Series

This is the first part of a series to familiarise the referrer to the practice of Nuclear Medicine.





How is Nuclear Medicine different from Radiology?

Both Nuclear Medicine and Radiology uses low level radiation to produce diagnostic images. Radiology uses radiation generated by the scanner whereas the radiation in nuclear medicine comes from radioactive pharmaceuticals, known as radiopharmaceuticals, administered to the patient. The scanning camera collects the emitted radiation photons to create an image. Positron Emission Tomography (PET) is a specialised form of nuclear scanning used predominantly for cancer imaging.

What is a radiopharmaceutical?

The radiopharmaceutical consists of a radioactive atom, also called a radioisotope or radionuclide, attached to a pharmaceutical molecule. Although called a pharmaceutical, only minute quantities are injected and there is no pharmacological effect in the body. The commonest radionuclide used is technetium-99m, abbreviated as Tc-99m. The purpose of the radionuclide is to allow camera localisation of the tagged pharmaceutical. The radiation comes from the nucleus of the radionuclide, hence the term "nuclear medicine" with its application in medicine. The nuclear radiation is also known as gamma rays and the scanning camera is therefore often referred to as a gamma camera.

How does Nuclear Medicine scanning work?

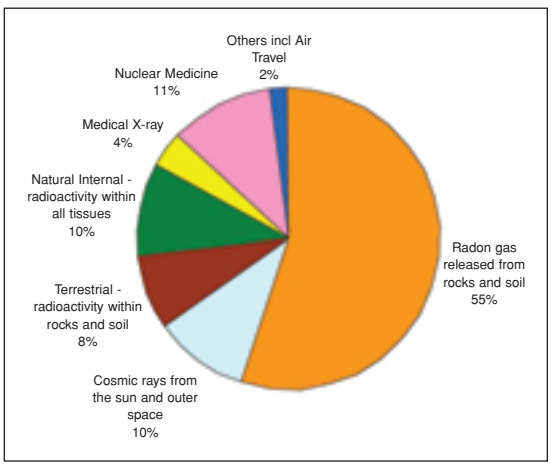
Depending on the organ to be imaged, an appropriate pharmaceutical is tagged with the radionuclide. For example, in bone scanning, a phosphonate compound is used which binds to calcium within newly forming bone. The phosphonate compound is tagged or radiolabelled with Tc-99m. The intensity of localised radiation depends on the metabolic activity. With most disease states, there is increased metabolic activity. With bone scanning, for example, there is increased bone deposition of radiolabelled phosphonate due to the reparative mechanisms at sites of fractures or osteoblastic metastatic skeletal deposits. These are seen as "hot" spots in the bone scan. As the radiopharmaceutical traces metabolic function, it is also often called a radiotracer. The images show examples of a scaphoid fracture and a 4th metatarsal neck fracture.

Why is functional or metabolic imaging valuable?

The functional nature of nuclear medicine is valuable because with disease processes, functional change precedes structural or anatomical change. For example, delineation of sclerosis on x-ray requires an increase in bone mineral content of at least 30%. Bone scanning using a radiolabelled phosphonate is very sensitive and is able to identify a 5-15% alteration in local bone turnover.

What is the radiation exposure with Nuclear Medicine?

The low-level radiation used in nuclear medicine or radiology is safe. The term "nuclear" in nuclear medicine can give rise to concerns about radiation. However, we are constantly exposed to low levels of radiation every moment of every day from naturally occurring radioactive elements present all around us in the ground, air and water. We receive a small dose of radiation every time we breathe or fly in aeroplanes. Radiation is a natural part of our lives. The pie chart shows the sources of radiation exposure for an average person. The dose from common nuclear medicine scans such as bone scans is comparable to that of CT scans.



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