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Nuclear Medicine: An Overview

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Editorial

Nuclear medicine is a branch of medicine that deals with the use of radioactive substances in disease diagnosis and therapy. Nuclear medicine imaging is "radiology done inside out" or "endoradiology" in that it records radiation emitted from within the body rather than radiation emitted from outside sources such as X-rays. Furthermore, nuclear medicine scans differ from radiology in that the focus is on the function rather than the anatomy. As a result, it is referred to as a physiological imaging modality. The most popular imaging modalities in nuclear medicine are Single Photon Emission computed Tomography (SPECT) and Positron Emission Tomography (PET) scans. Radiopharmaceuticals are taken internally in nuclear medicine imaging, for example, by inhalation, intravenously, or orally. The radiation emitted by the radiopharmaceuticals is then captured and formed into images by external detectors (gamma cameras). This differs from a diagnostic X-ray, which involves passing external radiation through the body to create an image. Nuclear medicine diagnostic procedures come in a variety of forms. Nuclear medicine tests differ from most other imaging modalities in that, as opposed to standard anatomical imaging such as CT or MRI, they focus on the physiological function of the system under investigation.

Nuclear medicine imaging studies are more organ-, tissue-, or disease-specific (e.g., lungs scan, heart scan, bone scan, brain scan, tumour, infection, Parkinson, etc.) than traditional radiology imaging studies, which focus on a specific body section (e.g., chest X-ray, abdomen/pelvis CT scan, head CT scan, etc.). Furthermore, nuclear medicine studies allow for whole-body imaging depending on specific cellular receptors or functions. Whole-body PET or PET/CT scans, gallium scans, indium white blood cell scans, MIBG, and octreotide scans are among examples. Nuclear metabolism's ability to image disease processes from metabolic variations is unrivalled, yet it is not unique. Certain approaches, such as fMRI, use blood flow to visualise tissues (especially cerebral tissues) and hence reveal metabolism. In addition, due to an inflammatory response, contrast-enhanced CT and MRI scans reveal sections of tissue that handle medications differently. Nuclear medicine diagnostic techniques take use of the way the body treats chemicals differently when disease or pathology is present [1-5].

The radionuclide that is injected into the body is frequently chemically attached to a compound that has a specific function within the body; this is referred to as a tracer. A tracer will frequently be transported throughout the body and/or metabolised differently in the presence of illness. The ligand methylene-diphosphonate (MDP), for example, can be taken up preferentially by bone. Radioactivity can be transferred and attached to bone *via* the hydroxyapatite by chemically binding technetium-99m to MDP. Any increase in physiological function, such as owing to a bone fracture, will usually result in an increase in tracer concentration. A "hot spot," which is a focused increase in radio accumulation or a widespread rise in radio accumulation throughout the physiological system, is frequently the result of this. Some diseases cause a tracer to be excluded, resulting in the appearance of a "cold spot." Many different tracer complexes have been created to image or treat a variety of organs, glands, and physiological processes. Nuclear medicine scans can be placed on pictures from modalities such as CT or MRI in some facilities, utilising software or hybrid cameras, to emphasise the portion of the body where the radiopharmaceutical is concentrated. For example, SPECT/CT and PET/CT, this procedure is known as image fusion or co-registration. Nuclear medicine's fusion imaging technology gives information about anatomy and function that might otherwise be unavailable or need a more intrusive procedure or surgery.

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