التصوير الطبي

Medical Imaging

LECTURE TEN

The Physics of Nuclear Medicine

Dr. Forat Hamzah

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Introduction

Nuclear medicine is the study and utilization of radioactive compounds in medicine to image and treat human disease. it relies on the 'tracer principle' first espoused by Georg karl von hevesy in the early 1920s. The tracer principle is the study of the fate of compounds in vivo using minute amounts of radioactive tracers which do not elicit any pharmacological response by the body to the tracer. Today, the same principle is used to study many aspects of physiology, such as cellular metabolism, dNa (deoxyribonucleic acid) proliferation, blood flow in organs, organ function, receptor expression and abnormal physiology, externally using sensitive imaging devices. larger amounts of radionuclides are also applied to treat patients with radionuclide therapy, especially in disseminated diseases such as advanced metastatic cancer, as this form of therapy has the ability to target abnormal cells to treat the disease anywhere in the body. Nuclear medicine relies on function. for this reason, it is referred to as 'functional imaging'. rather than just imaging a portion of the body believed to have some abnormality, as is done with X ray imaging in radiology, nuclear medicine scans often depict the whole body distribution of the radioactive compound often acquired as a sequence of images over time showing the temporal course of the radiotracer in the body. There are two main types of radiation of interest for imaging in nuclear medicine: γ ray emission from excited nuclei, and annihilation (or coincidence) radiation (γ±) arising after positron emission from proton-rich nuclei. Gamma photons are detected with a gamma camera as either planar (2-d) images or tomographically in 3-d using single photon emission computed tomography. The annihilation photons from positron emission are detected using a positron emission tomography (PeT) camera. The most recent major development in this field is the combination of gamma cameras or PeT cameras with high resolution structural imaging devices, either X ray computed tomography (cT) scanners or, increasingly, magnetic resonance imaging (Mri) scanners, in a single image device. The combined PeT/cT (or PeT/Mri) scanner represents one of the most sophisticated and powerful ways to visualize normal and altered physiology in the body. it is in this complex environment that the medical