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Commentary

Positron Emission Tomography (PET): A Functional and Chemical Imaging Technique

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DESCRIPTION

PET (Positron Emission Tomography) depicts and measures changes in metabolic processes and other physiological activities such as blood flow, regional chemical composition, and absorption using radioactive chemicals known as radiotracers. PET/CT is a newer technology that combines PET and CT into one scanner. PET is applied in pre-clinical and medical applications as a research and clinical tool. Depending on the objective of the scan, other chemicals may be employed for PET scanning. The radionuclide used to study blood flow and perfusion in an organ or tissue could be a form of radioactive oxygen, carbon, nitrogen, or gallium. An Intravenous (IV) line is used to inject the radionuclide into a vein.

PET is a type of screening that combines nuclear medicine and biochemistry. Depending on the target process within the body, different tracers are utilized in various imaging reasons. PET is most commonly used in patients with brain or heart disorders, as well as cancer, to observe biochemical changes in the body, such as the heart muscle's metabolism (the process by which cells convert food into energy after it is digested and absorbed into the circulation). PET stands for positron emission tomography, which is a nuclear medicine process that evaluates the metabolic activity of cells in tissue cells. It is a form of nuclear medicine treatment, which implies that during the procedure, some little amount of a radioactive material called a radiopharmaceutical (radionuclide or radioactive tracer), is utilized to aid in the inspection of the tissue under study. PET investigations examine the metabolism of a specific organ or tissue, as well as its physiology (functionality) and anatomy (structure), as well as its biochemical characteristics. Oncologists (doctors who specializing in cancer treatment), neurologists and neurosurgeons (doctors who specializing in the treatment and surgery of the brain and neurological system), and cardiologists are the most frequent types of user of cardiologists (doctors specializing in the treatment of the heart). PET can also be used with other diagnostic tests like computed tomography (CT) or magnetic resonance imaging (MRI) to provide a better picture of malignant (cancerous) tumors and other lesions. Nowadays, radiopharmaceuticals are made in a variety of locations and delivered to PET institutes, requiring only the scanner to perform a PET scan. A product known as gamma camera systems is helping to improve the availability of PET imaging (devices used to scan patients who have been injected with small amounts of radionuclides and currently in use with other nuclear medicine procedures). These systems have been updated to work with PET scans. A scan using the gamma camera system can be completed faster and for less money than a typical PET scan. PET detects photons (subatomic particles) generated by a radionuclide in the organ or tissue being investigated using a scanning device (a machine having a massive hole in the middle).PET scan radioisotopes are created by binding a radioactive atom to chemical compositions that the organ or tissue uses naturally throughout its metabolic activity. As the brain utilizes glucose for its metabolism, a radioactive atom is applied to glucose (blood sugar) to form a radioisotope termed Fluoro Deoxy Glucose (FDG) in PET scans of the brain. In PET scanning, FDG is generally utilized. The PET scanner then glides slowly over the body portion being investigated. Positrons are emitted when a radionuclide breaks down. When positrons meet with electrons near the decay event, annihilation photons are produced. The annihilation photons, which arrive at the detectors 180 degrees apart in time, are then detected by the scanner. The gamma rays are analyzed by a computer, which then creates an image map of the organ or tissue being investigated. The amount of radionuclide gathered in the tissue determines how bright the tissue appears on the imaging and signals the organ or tissue's level of function. In general, PET scans can be performed to check for disease or other problems in organs and/or tissues. PET can also be used to assess organ function, such as the heart or the brain. The most prevalent applications of PET are cancer detection and treatments evaluation. PET is a useful research method for learning about and improving our understanding of the normal human brain, heart function, and drug development. PET is also applied in animal pre-clinical research. It enables for repeated studies of the same people over time, with subjects acting as their own controls, and it considerably reduces the number of animals needed for a given study. This procedure gives research works to

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minimize the amount of samples required while improving the scientific quality of their discoveries. PET scans are increasingly being scanned in conjunction with CT or MRI images, with the combination (referred to as "co-registration") providing both anatomic and metabolic information (i.e. what the structure is, and what it is doing biochemically). Modern PET scanners are now available with advanced high multi-detector-row CT scanners, because PET imaging is most generally compatible with anatomical imaging, such as CT (so-called "PET-CT").

CONCLUSION

PET differs from other nuclear medicine exams in that it detects metabolism within biological tissues, whereas other nuclear medicine tests determines the amount of a radioactive chemical gathered in a specific region to assess the tissue's function. It may detect metabolic changes in an organ or tissue that can indicate the onset of a disease process before other imaging methods such as Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) can detect anatomical changes that occur due to the disease (MRI). It is extensively employed in the field of clinical oncology for cancer diagnostics and the search for metastases, as well as for the medical assessment of some diffuse brain illnesses, such as those that cause various types of dementias. PET/CT has a lot of potential for identifying and managing lung cancer, as well as examining epilepsy, Alzheimer's disease, and coronary artery disease.