Term Paper update-5

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1 Nuclear Medicine Techniques

Diagnostic techniques in nuclear medicine use radioactive tracers that emit gamma radiation from within the body. The camera constructs an image from the points where the radiation is emitted. This image is magnified on a computer and it can be observed on a monitor that indicates the anomalies.

The nuclear medicine techniques include Single Photon Emission Computerized Tomography (SPECT), Positron Emission Tomography (PET), and computed tomography-PET (PET-CT) (for better anatomical visualization), micro-PET (with ultra-high resolution) and microcomputerized axial tomography micro-CAT. These techniques are used to analyze biochemical dysfunctions as early signs of the disease, its mechanisms and association with disease states from cancer to cardiovascular diseases and mental disorders.

A SPECT exam is used primarily to visualize the blood flow through veins and arteries, and to perform pre-surgical evaluation of seizures. SPECT is also useful in the diagnosis of blood deprived areas of brain (ischemic), spinal stress fractures (spondylolysis) and tumors.

The PET imaging detects the pair of gamma rays produced by the interaction between a positron and an electron in the tissues of the body. The electron and the positron neutralize each other producing two gamma rays in opposite directions. PET detects the electronic signal converting with scintillation crystals the energy released by gamma rays.

99mTechnetium is the radionuclide that has the best characteristics to combine with gamma cameras and 18fluorine has the most desirable characteristics for PET.

Although the SPECT and PET techniques capture images with high intensity, they have low spatial resolution because they are directed to the surface of the body they are accurately visualized. On the other hand, computerized tomography (CT) and magnetic resonance have greater spatial resolution, but with less sensitivity. To obtain such restrictions, the techniques are merged for images with excellent spatial resolution combined with high sensitivity.

X-ray CT has a computational process that makes a three-dimensional image, resulting in images with much greater resolution and quantity of details of internal structures and organs of the body6. There are other non-nuclear

techniques, which are not described in this review, but could be accessed in this reference.