Gamma camera based Positron Emission Tomography: A study of the viability on quantification.

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Positron Emission Tomography (PET) is a Nuclear Medicine imaging modality for diagnostic purposes. Pharmaceuticals labeled with positron emitters are used and images which represent the *in vivo* biochemical process within tissues can be obtained. The positron/electron annihilation photons are detected in coincidence and this information is used for object reconstruction.

Presently, there are two types of systems available for this imaging modality: the dedicated systems and those based on gamma camera technology. In this work, we utilized PET/SPECT systems, which also allows for the traditional Nuclear Medicine studies based on single photon emitters.

There are inherent difficulties which affect quantification of activity and other indices. They are related to the Poisson nature of radioactivity, to radiation interactions with patient body and detector, noise due to statistical nature of these interactions and to all the detection processes, as well as the patient acquisition protocols. Corrections are described in the literature and not all of them are implemented by the manufacturers: scatter, attenuation, randoms, decay, dead time, spatial resolution, and others related to the properties of each equipment.

The goal of this work was to assess these methods adopted by two manufacturers, as well as the influence of some technical characteristics of PET/SPECT systems on the estimation of SUV. Data from a set of phantoms were collected in 3D mode by one camera and 2D, by the other.

We concluded that quantification is viable in PET/SPECT systems, including the estimation of SUVs. This is only possible if, apart from the above mentioned corrections, the camera is well tuned and coefficients for sensitivity normalization and partial volume corrections are applied.

We also verified that the shapes of the sources used for obtaining these factors play a role on the final results and should be delt with carefully in clinical quantification. Finally, the choice of the region of interest is critical and it should be the same used to calculate the correction factors.

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