Dose Reduction in Hybrid Imaging Techniques in Nuclear Medicine

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In these last few years, nuclear medicine equipments were subject of many developments, in order to improve the image quality for a better and more reliable diagnose as well as shorter exam times and therefore more comfort for the patients. These innovations led to fusion imaging with SPECT (Single Photon Emission Computed Tomography) and PET (Positron Emission Tomography) with the CT (Computed Tomography) and more recently with MIR (Magnetic Resonance Imaging), giving way to the era of hybrid imaging techniques in nuclear medicine. These hybrid modalities allow in a single diagnostic procedure a combined evaluation of function and structure, while obtaining the most from each modality. However, hybrid equipments are one of the most challenging and interesting areas of radiation safety as a result of its combination of two techniques that employ radiation and whose handling involves radiation doses for both the professional and the patient.

The frequency of hybrid imaging modalities, like PET/CT and SPECT/CT, has been increasing because the use of CT in nuclear medicine imaging is improving diagnostic accuracy, but it is also increasing patient doses significantly, Huang et al. (Radiology 2009) points that CT may contribute up to 76% of the total effective dose of a PET/CT exam, which raises special concerns on radiation dose reduction.

The first and perhaps the most important way to dose reduction is to know as much as possible about the equipment, in order to make the best of it. Protocols optimization may enable a decrease on dose administration for the emission image. Since the CT dose to the patient can vary widely depending on the system and protocol, it is important to use the appropriate protocol for the purpose of the scan. Technological improvements in nuclear medicine imaging can influence patient radiation doses significantly: available data on SPECT/PET and PET/CT innovations are mostly linked to improved image quality and/or reduced scanning times, however dose reductions are possible. Available data in CT innovations are often linked to patient dose reduction while maintaining image quality. Nevertheless, a trade-off should be made with respect to image quality improvement, scan time reduction and patient dose reduction. Recent introduction of PET/MRI, offers anatomical information without the disadvantage of ionizing radiation and in contrast to CT, MRI has a high capability for differentiating soft tissues.

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