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Role of Nuclear Medicine in Combination with Computed Tomography

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Feasibility of PET/CT in children: Initial publications concerning PET/CT in young patients demonstrate that the combined imaging technique is feasible in all paediatric age groups with minor modifications of the adults' examination protocols. The incidence of PET/CT artifacts due to movement, different respiration positions between PET and CT, or non-compliance is no higher in the paediatric group as compared to adult patients.

Specific demands for PET/CT acquisition in paediatric patients: Especially for paediatric patients, radiation doses need to be kept as low as reasonably achievable. Therefore, it is essential and it is the responsibility of the nuclear medicine physician and the radiologist to adjust the imaging protocols to special standards in those young patients.

Advantages of combined PET/CT in comparison to separately acquired PET and CT or single PET: Using PET/CT, neither the radiotracer is only a simple contrast agent nor is CT a simple localization device that can additionally function as a method of performing attenuation correction. Correlation information from two different imaging modalities will improve the diagnostic results of both tests: Improvement of lesion localization, optimization of therapy planning, increase in sensitivity, increase in specificity, time saving and interdisciplinary collaboration.

Potential applications of PET/CT in paediatric oncology: Despite the absence of studies defining the clinical benefit of PET/CT for paediatric patients, the following recommendation can be given.

PET/CT with diagnostic CT scan: PET/CT including diagnostic CT should always be preferred to performing PET and CT in two single sessions when there is an indication for both modalities. This prevalently applies for PET/CT with diagnostic chest CT in sarcoma patients (Ewing tumours, soft-tissue sarcomas, and osteosarcomas). In paediatric lymphoma patients, morphological imaging is usually performed using a combination of ultrasound, MRI and/or CT of various parts of the body. Most patients receive at least a diagnostic chest CT for staging and assessing therapy response. FDG-PET has been demonstrated to change staging and therapeutic management in a relevant number of paediatric lymphoma patients. Therefore, PET/CT with diagnostic chest CT can be recommended in these patients.

PET/CT for planning local therapy: PET/CT with diagnostic CT may be integrated in the exact planning of local therapy such as surgery or radiotherapy. In case of radiotherapy, the CT component is a sine qua non for planning the conformal three-dimensional treatment.

PET/CT with low-dose CT scan: PET/CT including diagnostic CT is obsolete, if there is no indication for diagnostic CT and the clinical question can also be answered by another morphologic imaging technique without radiation exposure (e.g. ultrasound or MRI). In these cases, the indicated PET should be performed using PET/CT with low-dose CT providing anatomical information with a slightly higher radiation exposure than single PET with transmissions scans.

References

1. Hahn K, Pfluger T.2006; EJNMMI 33: 966-968.
2. Franzius C, Juergens KU, Schober O. 2006; EJNMMI 33: 960-965.