Pitfalls and Limitations of PET/CT in Brain Imaging.

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Abstract

Neurologic applications were at the forefront of PET imaging when the technique was developed in the mid-1970s. Although oncologic indications have become prominent in terms of number of studies performed worldwide, neurology remains a major field in which functional imaging provides unique information, both for clinical and research purposes. The evaluation of glucose metabolism using FDG remains the most frequent exploration, but in recent years, alternative radiotracers have been developed, including fluorinated amino acid analogues for primary brain tumor imaging and fluorinated compounds for assessing the amyloid deposits in patients with suspected Alzheimer disease. As the brain is enclosed in the skull, which presents fixed landmarks, it is relatively easy to coregister images obtained with various cross-sectional imaging methods, either functional or anatomical, with a relatively high accuracy and robustness. Nevertheless, PET in neurology has fully benefited from the advent of hybrid imaging. Attenuation and scatter correction is now much faster and equally accurate, using CT as compared with the traditional transmission scan using an external radioactive source. The perfect coregistration with the CT data, which is now systematically performed, also provides its own set of valuable information, for instance regarding cerebral atrophy. However, hybrid imaging in neurology comes with pitfalls and limitations, in addition to those that are well known, for example, blood glucose levels or psychotropic drugs that greatly affect the physiological FDG uptake. Movements of the patient's head, either during the PET acquisition or between the PET and the CT acquisitions will generate artifacts that may be very subtle yet lead to erroneous interpretation of the study. Similarly, quantitative analysis, such as voxel-based analyses, may prove very helpful in improving the diagnostic accuracy and the reproducibility of the reading, but a wide variety of artifacts may also be introduced, and should therefore be identified and corrected.

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PMID: 26522395 [PubMed - in process]