PHILIPS

Advanced molecular imaging

Significantly reduce scan times with Digital Photon Counting technology

PURPOSE OF STUDY

PET using 18F-FDG has become a routine and highly sensitive method to provide comprehensive and reliable information, particularly in oncology, cardiology, and neurology. However, PET/CT is still a time-consuming examination, and obtaining images of sufficient diagnostic quality requires patients to endure significant discomfort. This limitation is particularly challenging in elderly, orthopedic, and pediatric patient populations. Reducing the PET acquisition time will help improve the aforementioned shortcomings and resulting diagnostic image quality and confidence. This study demonstrates the capability of a solid-state Digital Photon Counting Technology PET/CT system in generating fast and ultrafast whole-body PET scans, a reduction of 90% in scan time. The following is a summary of the study presented by Zhang J. et al, at the Society of Nuclear Medicine and Molecular Imaging Annual Meeting 2017.

Overview

Reducing patient PET scan times can have a positive impact on image quality, patient comfort and clinic throughput. This study included FDG-PET scans of a phantom, preclinical canine (~2mCi) and 20 clinical patients (13±1mCi), all performed on a 325ps timing resolution dPET system (Digital PET, Philips) with default 90s/bed. Simulated fast (60 and 30 s/bed) and ultrafast (9s/bed) PET data sets were generated using list mode-based established approach. Validation PET acquisitions were performed at varying bed speeds for all subjects. PET data were reconstructed using default 3D Ordered Subset Expectation Maximization (OSEM) Time of Flight (TOF, 3 iterations, 15 subsets) as well as optimized number of subsets for fast PET imaging data. SUV quantification and blinded image reviews were performed.

Results

Among phantoms, canine and oncology patients, equivalent diagnostic IQ and SUV quantification ($p>0.05$) were obtained between true PET data and simulated PET data, validating feasibility of the data simulation approach. In the 20 oncology patients, 70 lesions were identified. Compared to standard scan times, consistent and good agreement of SUV quantification for both lesions and normal tissues, was found on fast PET and ultrafast PET imaging. Although, nosier and blobby in characteristic, all 70 lesions were identified

on fast and ultrafast PET scans. Reconstruction optimization of dPET by adjusting OSEM subsets demonstrated major benefits to suppress noise and improve IQ of fast PET acquisitions. BMI influences the visual image quality and was a confounding factor.

Conclusion

This study demonstrates that Digital PET/CT is capable of fast and ultrafast PET imaging, allowing for the identification of lesions in 1/10th of the time.

CLINICAL RELEVANCE

Digital PET/CT can reduce the time for scans by 90%. The dynamic range of scanner speeds, enabled by the Digital PET/CT, allows for personalization of scanning protocols for the most challenging patient populations, the elderly, orthopedic, and pediatric.

Whole Body PET	BMI <28	BMI 28-33
Bed Speed	30s/bed	60s/bed
Acceleration	67%	33%
Table Time	<7 min	<10 min
Lesion Detection	100%	100%

Zhang J., Evaluation of speed of PET acquisition: How fast can we go? - A validation of list mode PET simulation approach with true acquisitions, SNMMI 2017

Results from case studies are not predictive of results in other cases. Results in other cases may vary.

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