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Image Analysis and Quantification for PET Imaging

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Introduction: Positron emission tomography (PET) is a highly sensitive, quantitative and non-invasive detection method that provides 3D information on biological functions inside the body. There are several factors affecting the image data, including normalization, scattering, and attenuation. In this study we have quantified the effect of scattering and attenuation corrections on the PET data. Methods: The image quality phantom (approximating the size of a mouse) was modified to match the diameters of the rat and monkey count rate phantoms by creating high density polyethylene (HDPE) sleeves that fit over the standard phantom. The emission and transmission data from the phantom, filled with 18F, were acquired with a microPET P4 scanner. The data were histogrammed, reconstructed, using various algorithms, with required corrections applied, including normalization and physical decay of 18F. The data were analyzed using volume of interest (VOI) analysis with and without attenuation or scattering corrections. Signal–to-noise ratio values were calculated and the results were correlated with the phantom size, correction methods and reconstruction algorithm. Results: The signal to noise using OSEM3D/MAP algorithm provided the highest signal-to-noise ratio values for all three phantoms, followed by OSEM2D. Since both are iterative algorithms and reduce the noise in the images. Attenuation correction, along with scattering correction had a significant impact on the quantitative results. Conclusion: Both attenuation and scattering corrections need to be included in image quantification for PET imaging. OSEM3D/MAP provides the images with highest signal-to-noise ratio values.

Primary author: Dr ELHAMI, Esmat (University of Winnipeg)

Co-authors: Ms PHAM, Chantale (University of Winnipeg); Ms O'BRIEN-MORAN, Zoe (University of Winnipeg)

Presenter: Dr ELHAMI, Esmat (University of Winnipeg)

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