

Fundamental study of hot spot detectability in 3-dimensional positron emission tomography

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The purpose of this study was to investigate the detectability of small hot lesions with the 3-dimensional transmission/emission (3D T/E) acquisition mode in FDG-PET scan. The correlation of target detectability, target size, target to non-target uptake ratio (T/N ratio) and standardized uptake value (SUV) were studied. Small hot lesions ranged from 4.4 mm to 36.9 mm in diameter were located in cylindrical phantom. The images of phantoms with a T/N ratio of 2.0, 4.0, 6.0, 8.0, 9.6, 13.2, 17.5, 23.8 and 30.3 were obtained with 2-dimensional transmission/emission (2D T/E) scan and 3D T/E scans. Targets in diameter more than 10.6 mm in diameter with an actual T/N ratio ranged from 6.0 to 30.3 could be identified on the images obtained with all the 2D T/E and 3D T/E acquisition modes. The detectability efficiency of small hot target in 2D T/E and 3D T/E scans was as same (77.8%). The T/N ratio of targets from 2D T/E images was 30% to 48.4% different to that from 3D T/E image, and the SUV of the target from the 2D T/E images was almost the same as that from 3D T/E images. This study revealed that 3D T/E scanning had similar hot spot detectability to 2D T/E scanning; 3D T/E and 2D T/E scanning had the same faculty for semi-quantitative analysis using SUV. These findings may be helpful for the diagnosis and understanding of 3D T/E FDG-PET in hot lesion detection.

Key words: 2-dimensional and 3-dimensional PET; T/N ratio; SUV; hot spot detectability