

A basic study on lesion detectability for hot spot imaging of positron emitters with dedicated PET and positron coincidence gamma camera

Hong ZHANG,* Tomio INOUE,* Mei TIAN,*** Saleh ALYAFEI,* Noboru ORIUCHI,*
Nasim KHAN,* Sijin LI** and Keigo ENDO*

**Department of Diagnostic Radiology and Nuclear Medicine, Gunma University School of Medicine, Gunma, Japan*

***Department of Nuclear Medicine, First Hospital of Shanxi Medical University, Shanxi, People's Republic of China*

The aim of this study was to explore the correlations of detectability and the semi-quantification for hot spot imaging with positron emitters in positron emission tomography (PET) and with a positron coincidence detection system (PCD). Phantom study results for the measurement of the lesion-to-background (L/B) ratio ranged from 2.0 to 30.3, and detectability for hot spot lesion of PET and PCD were performed to correspond to clinical conditions. The detectability and semi-quantitative evaluation of hot spots from 4.4 mm to 36.9 mm in diameter were performed from the PET and PCD images. There were strong correlations between the L/B ratios derived from PET and PCD hot spot images and actual L/B ratios; but the L/B ratio derived from PET was higher than that from PCD with a significant difference of 10% to 54.8%. The detectability of hot spot imaging of PCD was lower than that of PET at 64.8% (PCD) versus 77.8% (PET). Even the actual L/B ratio was 8.0, hot spots more than 10.6 mm in diameter could be clearly identified with PCD imaging. The same identification could be achieved with PET imaging even when the actual L/B ratio was 4.0. This detailed investigation indicated that FDG PCD yielded results comparable to FDG PET on visual analysis and semi-quantitative analysis in detecting hot spots in phantoms, but semi-quantitative analysis of the L/B ratio with FDG PCD was inferior to that with FDG PET and the detectability of PCD in smaller hot spots was significantly poor.

Key words: dedicated PET, positron coincidence gamma camera, detectability, semi-quantification, lesion-to-background ratio