Comparison of the PET/CT image capabilities among PET facilities in the Tohoku region

T. Sasaki[1], H. Akahira[2], M. Narita[3], K. Sato[4], A. Okada[5], A. Komuro[6], H. Tamura[7], M. Hatano[8] and S. Watanuki[9]

[1]Cyclotron Research Center, Iwate Medical University
348-58 Tomegamori, Takizawa, Iwate 020-0603, Japan

[2]Aomori PET Center
313 Shinagawa-cho, Hirosaki, Aomori, 036-8183, Japan

[3]Hirosaki University School of Medicine and Hospital
53 Hon-cho, Hirosaki, Aomori, 036-8203, Japan

[4]Research Institute for Brain and Blood Vessels-Akita
6-10 Senshu Kubota-machi, Akita-city, Akita, 010-0874, Japan

[5]Yamagata University Hospital
2-2-2 Iida Nishi, Yamagata-city, Yamagata, 990-9585, Japan

[6]Shirakawa Kosei General Hosptal
2-1 Toyochiue-Yajiro, Shirakawa, Fukushima, 961-0005, Japan

7 Nagaoka Red Cross Hospital.
297-1 Senshu 2 Chome, Nagaoka, Niigata, 940-2085, Japan

8 Niigata University Medical & Dental Hospital
754 Asahi-machi Ichiban-cho, Chuou-ku, Niigata, Niigata, 951-8520, Japan

9 Cyclotron and Radioisotope Center (CYRIC), Tohoku University
6-3 Aoba, Aramaki, Aoba-ku, Sendai, Miyagi, 980-8578, Japan

Abstract

PET image reconstruction methods vary depending on the devices and/or facilities. The methods are usually designated by the device makers and few facilities search the best method of optimal imaging

for themselves. This study was conducted aiming to improve our skill of image reconstruction through phantom experiments. The phantom we used has a diameter of 20 cm, a thickness of 88 mm and many holes in it. The number of holes is as follows: 3.5 mm Φ, 89; 4.0 mm Φ, 66; 4.5 mm Φ, 55; 5.0 mm Φ, 44; 5.5 mm Φ, 36; 6.0 mm Φ, 28. FDG was poured into the phantom uniformly with a density of 2.65 kBq/ml * 4.0 (equivalent to SUV 4.0) and the phantom was scanned for 60 minutes in the following time sequences; 1min *5, 5min * 3, 10min *1, 30min *1. The experiments were conducted with 17 PET/CT devices in 13 PET facilities in the Tohoku region. Acquired data were processed in the three image reconstruction methods, which were (1) for an image of whole-body, (2) for an image of head & neck part and (3) for a detailed image of maicrotumors. In the third method, reconstruction condition was set as maicrotumors with 1 mmΦ could be visualized. Those image data were evaluated from the aspects of physical depicting ability, image quality, quality of superimposed images obtained by overlapping CT images, and number of the identified spots (the visualized holes of the phantom). Although we had thought we could not identify any spots on the reconstruction condition settled for whole-body imaging, the majority of spots with diameter 6.0 mm and 5.5 mm were visualized. In the images conditioned for head & neck, about 35% of the spots with 3.5 mmΦ were able to be identified. As each facility's PET images are different from one another, standardization or harmonization of PET images is thought to be desirable. In this study some functions of the PET machines have been found to be available though they are not stated in the specifications. Sharing of these results will help to improve our PET image quality.