Control of accuracy of PET system

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Abstract

In order to improve reliability of the quantitative values given by recent 3D-PET, we have started the studies according to the guidance consisting of five items. They are; 1. acquisition of the basic data by means of existing 2D-PET, 2. fundamental development of the method of quantification for 3D-PET, 3. designing of the phantoms for quality and performance of 3D-PET, 4. investigation of the actual statuses of the methods of PET-scan and diagnosis in other facilities, 5. improvement of accuracy and precision of the quantitative values given by 3D-PET.

The number of PET institutes has been increasing recently. Most of all PET cameras are 3D-PET or 3D-PET/CT. 3D-PET camera had increasing not only resolution and sensitivity but also scatter. Then we are afraid that increasing of scatter may cause decrease of PET quantitative.

In this study, we have experimented basis on the guideline for the performance evaluation of PET. But this guideline is not good for the 3D-PET cameras. Then we revised the guideline both sequencing and standard measurement. Usually we experiment performed resolution test at first, scatter fraction is second, and sensitivity is third. But sensitivity test needs about 5hours. It will be completely nothing the FDG by the time we are going to try other kind of PET performance tests. We in turn examined the PET performance test 1.spatial resolution, 2.scatter fraction, 3.partial volume effects, 4.scatter and absorption of accuracy correct, 5.uniformity, 6.sensitivity. Almost PET performance test of guideline are 5% of the scatter coincidence by true coincidence. We changed 10-20-% from 5% of guideline. Because we need to finish all PET performance tests within one or 2 days.

Result spatial resolution was approximately 6.02 mm full with half maximum in plane and 5.96 mm FWHM axially. Scatter fraction was about 51%. Sensitivity was 3914.7cps/(KBq/ml). Accuracy scatter correction, teflon 3.5%, air 27.3%, water 15.4%. Uniformity, -0.869%, round type of recovery coefficient, 38mm=1.0, 27mm=0.79 , 21mm=0.61, 16mm=0.43, 13mm=0.38, 10mm=0.17. Cylinder type of recovery coefficient, 38mm=1.0, 27mm=0.84, 21mm=0.73, 16mm=0.61, 13mm=0.61, 10mm=0.45.

The time for the PET performance test decreased 5hours from about a week after the change of the guideline. If we use this guideline changed method, we could experimented the PET performance more often. Then we will learn how often the PET performance test by year. We will enable to compare quantitative value of the PET between other PET facilities. But also we need to accurate PET performance tests basis on the guideline at once. We applied method is most validate to compare the PET performance. We are going to follow this method about one year.