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PROPOSALS OF COLLIMATORS TO IMPROVE NOISE UNIFORMITY IN SPECT IMAGE.

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Images obtained with single photon emission computed tomography (SPECT) have poor statistics in the central region of a body slice to be imaged due to strong attenuation of photons. To improve this, Tanaka and Toyama proposed a new scan method for a SPECT system having a multi-detector array (Jpn. J. Nucl. Med. 20(7), 1057, 1984). In the system, a number of detectors, each equiped with a focusing collimator, are arranged on a circular ring, and each detector scans a field of view with parallel translation. In a SPECT system with a rotating camera head, the camera is usually equiped with a multi-channel parallel hole collimator or a fan beam collimator which is focused in transverse planes and parallel in direction perpendicular to the transverse planes. Proposals are that these collimators are modified so as to increase sampling frequency in the central region. The SPECT system with such collimators has a possibility of improving spatial resolution with the same noise level.

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EXPERIENCE OF BRAIN SPECT USING SLANT HOLE COLLIMATOR

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Fundamental and clinical studies for tomographic brain imaging of I-123 IMP were performed using three different collimators. The collimators used in this study were 180 KeV slant hole, 300 KeV slant hole and 300 KeV parallel hole collimators. Compared with SPECT using 300 KeV parallel hole collimator, 180 KeV slant hole SPECT yieled approximately a 40% increase in resolution, a 100% increase in sensitivity and got good quality images. The performances were shown in the Table.

collimator		Sens.	Reso. FWHM	Reso. FWTM
180 KeV slant hole	*1	115	12.6	25.6
300 KeV slant hole	*1	60	17.9	32.5
300 KeV parallel hole	*2	55	22.7	39.8

Sens.: Sensitivity (cps/μCi/ml/mm)
Reso.: Resolution (mm) at center of rotation in air.
*1 : Radius of rotation 12cm
*2 : Radius of rotation 22cm

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PERFORMANCE OF GAMMA CAMERA COLLIMATORS USED FOR SPECT IMAGING WITH I-123-IMP.

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I-123-IMP, which we can currently be provided in Japan, are contaminated with small amounts of I-124(<5%) and I-126(<0.3%), because it will be produced by Te-124(p,2n)I-123 reaction from the medium size cyclotron.
The purpose of this study is to choose the useful collimator for I-123 SPECT imaging, through the evaluation of the collimator performance with Tc-99m and I-123.
Four collimators of (1)LEAP(for low energy all purpose), (2)LEHR(for low energy high resolution), (3)MESI(for medium energy made by Siemens), and (4)MENU(for medium energy made by Nuclear Technology) mounted on a rotating gamma camera (Siemens, ZLC-7500), were examined for this study.
Relative sensitivity to LEAP with Tc-99m plane source was 0.61, 0.84, and 0.55 with LEHR, MESI and MENU, respectively. But, in the same measurements with I-123, its sensitivity was 0.85, 0.24 and 0.235 with LEHR, MESI and MENU, respectively. Spatial resolutions for SPECT imaging of I-123 in body phantom were 25.2-25.6, 29.9-34.0 and 19.2-20.3 mm in FWHM with LEAP, MESI and MENU, respectively.
In conclusion, both collimators for low energy were not suitable for SPECT imaging with I-123, because of the septal penetration by the higher energy photons. In two medium energy collimators, MENU was more useful. And, it is important to perform the SPECT imaging as short radius as possible of the rotating camera.

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A STUDY FOR IMPROVING THE RESOLUTION OF SPECT IMAGES.

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The clinical use of SPECT was thought to be not valuable some years ago, but, now, it becomes one of the most important method of inspection in the field of nuclear medicine. Traditional devices such as a scanner or a gamma camera could get only low resolution images when these were presented initially, and then these were improved to get high resolution images. In the same manner, SPECT can get only low resolution images now, but we must continue investigation to obtain high resolution as planner images were done. A few methods are thought to get high resolution SPECT's images. Use of non-circular orbit and improvement of collimator system are coincide with this purpose. In this presentation we examine about the latter method.