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DEVELOPMENT OF NEW COLLIMATOR FOR I-123 SPECT IMAGING - BASIC CHARACTERISTICS.

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We developed a new collimator to obtain I-123 IMP SPECT images with high resolution, keeping the loss of sensitivity minimum. There are 4 units of slat type collimators, and they are called "ultra-high resolution(UHR)","high resolution(HR)","high sensitivity(HS)" and "ultra-high sensitivity(UHS)". The slit width is 0.9mm, 1.5mm, 3.2mm and 5.2mm, respectively. When SPECT is performed, either one of UHR or HR is set to detector together with either one of HS or UHS at a right angle to each other. The former is always set to the detector side and the direction of the slits is always parallel to the rotation axis. From our basic experiments, it was found that the combination of UHR and HS was best suited for I-123 IMP imaging, and its sensitivity was calculated 123 cps/ Ci/ml /slice whereas medium energy collimator gave us 243. The spatial resolution was 15.9 mm in FWHM at the center of rototion. According to our calculation, if the medium energy collimator is designed to increase its resolution to the level of that of our collimator the sensitivity will drop to 1/6. We found that our new collimator was very usefull for SPECT imaging of the brain with I-123 IMP.

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QUANTITATIVE MEASUREMENT OF RADIONUCLIDE WITHIN EACH ORGAN OF THE WHOLE BODY. - ESTIMATION OF THE COMPTON-SCATTER QUANTITY -.

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We are investigating a method to measure the whole body radionuclide distribution by using a gamma camera system which has ability of conventional localized imaging, whole body imaging and SPECT. The correction of Compton-scatter is one of the most important problem for reconstruction of quantity of SPECT. But, the quantity of Compton-scatter is not found correctly yet. We estimate the quantity by using several method. Using these data, we will establish the method to eliminate the Compton-scatter factor in the near future.

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COMPARATIVE STUDY BETWEEN PLANAR IMAGES AND SPECT ON LIVER SCINTIGRAPHY.

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It is important to understand normal variants of liver images in interpreting the information of SPECT images accurately. Because the specific structures of the liver such as falciform ligament,porta hepatis and gallbladder fossa frequently produce the patterns of regional decreases of activity,simulating various defects of normal tissues on images. These are sometime mistaken for space occupied lesions(SOLs).
The purpose of the study is at first to analyse patterns of normal variants of the liver on images. SPECT was taken on 32 cases of normal liver and 16 cases of liver cirrhosis with three different transverse planes which contained above mentioned specific structures.
Planar and SPECT images were compared. The results showed image patterns of normal variant were classified into three categolies. Next,the detectability of SOLs was compared on 72 cases of various condition by using planar images with those of SPECT ones. The result showed that false positive cases brought by planar images alone was effectively corrected by adding SPECT. It was frequently possible to distinguish SOLs from normal hepatic structures by adding SPECT image to planar image.

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PROBLEMS FOR SINGLE-PHOTON EMISSION COMPUTED TOMOGRAPHIC IMAGING WITH N-ISOPROPYL-P-[^{123}I] IODEAMPHETAMINE (IMP).

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The feature of single-photon emission computed tomography (SPECT) is the ability to detect sensitively and quantitatively the physiological change of an organ. Recently, a newly developed radiopharmaceutical, N-isopropyl-^{123}I-p-Iodeamphetamine, is taken notice in the point that it makes possible to map the status of regional brain perfusion. However, there are two major problems to reconstruct SPECT images by this agent. That is, there is no suitable collimator to detect the photo peak of the radionuclide. And the other problem is that the radionuclide containing ^{124}I and ^{126}I, which are generated inevitably in the process of production of ^{123}I, emits high energy gamma rays. So the reconstructed image with SPECT is distorted by scattered gamma rays and high energy gamma rays. We made some fundamental experiments and clinical study to evaluate imges according to the following items; (1) type of the collimator, (2) reconstruction filter, (3) distance between an object and a gamma camera, and (4) attenuation correction method. Phantom studies and clinical trial show us that the problem of a removal of scattered rays and attenuation correction method have important effects upon the reconstructed image.