1

COMPUTERIZED SINGLE PROBE SYSTEM USING A CADMIUM TELLURIDE(CdTe) DETECTOR.

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Using cadmium telluride as a detector, we assembled a computerized single probe system. The size of the CdTe used is 16mm in diameter and 2mm in thickness. Two types of the straight bore collimators of 16mm in diameter were prepared. One is 16mm in length(long type) and the other is 5mm in length(short type). The response curves of the long and short type collimators to CO-57 in water show that the points at 10% of maximum counts were 4cm and 3cm in depth along the center axis. The data have been accumulated by using a commercialized single cardiac probe system (OMNISCOPE) and processed by itself or transferred to the microcomputer(LSI-11/23) for further analysis. Intervals of data collection can be selected from 0.025sec to several hundred seconds according to the purpose of the study. The study time can be set as long as for 7 hours. High count rate characteristic was studied using Tc-99m pertechnetate. Twenty percent count loss occurred at 100,000cps with an integral discriminator setting at 40KeV. The proposed single probe system has good efficiency in enrgy resolution, sensitivity high countrate capability, stability and characteristics of the collimators specially designed.

2

PRIMARY EVALUATION OF SPECT WITH A PROGRAMABLE BODY COUTOUR TABLE.

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SPECT system composed of Maxi Camera 400 AC/T and PBC table system demonstrates the elliplical orbit which keeps the camera head uniformly close to the body. The detector's circular orbit and synchronizing movement of the table to up and down, right and left (in every direction) permit this orbit.

We took SPECT images through each phantom with both circular rotation (radius of rotation 20cm) and elliptical rotation (long axis 20cm, short axis 15cm). Then we examined the usefulness of elliptical orbit SECT by making comprison of spacial resolution, shadow defect detectability, and uniformity.

As a result, the improvement of spacial resolution by average 14.6% (FWHM) was admitted at the X axis side. The shadow defect detectability also was improved by the enhanced contrast.

3

SPECT RESOLUTION AND DETECTABILITY IMPROVEMENTS BY AUTOMATIC ELLIPTICAL ORBIT.

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An automatic elliptical orbit implemented by a combination of ratational and translational motions in single photon emission computed tomography (SPECT) improves significantly the image resolution and lesion detectability. These are achieved by closer access of the detector to the object on the moving table at each projection angle.

This has been demonstrated by comparing the SPECT images for an elliptical orbit of 40x30 cm with the equivalent circular orbit of 40 cm diameter, performed by SPECT system with a low energy general purpose collimator (GE; MaxiCamera 400 A/T, MaxiStar system). Data were accumulated for 64 pojection angles with 64x64 matrices. Reconstraction of SPECT images was performed by the filtered back projection method, using Ramp-Hanning filter. Resolution FWHM improvements were approximately 10-20 %. In phantom images, the elliptical orbit showed better definition of cold lesion shape, sharper edge response, and clearly increased lesion detectability.

4

EVALUATION OF SPECT IMAGES USING NEW ELLIPTICAL PHANTOM.

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Two kinds of elliptical phantoms were developed to evaluate the performance of SPECT system. Both are 30 x 20 cm in size in the transaxial direction and 20 cm in the axial direction, and are disigned for both hot and cold lesions rods. The one contains 8 hot lesions and 8 cold lesions, having 3 kinds of diameters for both; 1.5, 2.0,and 3.0 cm. The other contains 6 hot lesions and 6 cold lesions consisting of two kinds of diameters, 1.0 and 2.0 cm, which are exchangeable. The SPECT system used in our experiment is a gamma camera (LFOV-E,modified type) interfaced to a computer(Scintipac 1200). Using these phantoms, changes in spatial resolution were evaluated in connection with different orbits, circular and elliptical. Elliptical orbit was obtained manually by producing closer access of the detector to the object at each projection. With the elliptical orbit, an improvement of the resolution in FWHM (10 to 20 %) was obtained as compared with the circular orbit, and the lesion detectability was also increased.When we used an ordinary cylindrical phantom, however, we could not see apparent differences in both resolution and lesion detectability between the elliptical orbit and the circluar obtit