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PERFORMANCE OF THE EMISSION COMPUTED TOMOGRAPHY USING THE ROTATING SLANT-HOLE COLLIMATOR.

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The purpose of this study is to evaluate in phantom studies the fundamental properties of ECT, using the rotating slant-hole collimator mounted on a mobile gamma camera of Technicare Σ420 with a small field of view (33.6cmø x 0.63cm NaI crystal).

The slant-hole collimator is manually rotated through six positions, and data is acquired at each position, the data from these six views are then reconstructed by the soft-ware into tomographic planes of maximum twelve.

Effective field of view decreases with increasing depth from the collimator face, its size was about 21cmø in diameter at 1cm depth, and 13cmø at 10cm depth. Plannar and axial resolution were evaluated by the FWHM of the Tc-99m line source in scatterer. The plannar resolution was 5.1mm at 1cm depth and 12.8mm at 13cm depth. On the other hand, axial resolution worsened about three times to the plannar resolution.

In a multilayer phantom studies, tomographicimages in shallow plane showed a good resolution, but a poor resolution in deep planes.

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ROTATING SLANT HOLE TOMOGRAPHY AND ITS CLINICAL APPLICATION.

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We evaluated the performance of rotating slant hole collimator, an imaging device for tomography, and compared its images with conventional planar images.

The planar and axial resolutions were evaluated by the FWHM of the line source. The values of FWHM were 14mm, 21mm(line source placed at distacne 4,13cm from the cllimator face)in the X-Y plane and 17mm,24 mm in the Z direction. By simulating the left ventricular myocardium phantom study, penetrating defect of 1cm in diameter could be detected.

In case of myocardial infarction especially inferior wall infarction, rotating slant hole tomography was useful. Still more, by this technique we could separate the hot spot in the sacrum or pubis from underlying urinary activity, and detect small SOL in the spleen.

The advantage of this technique were as follows;

1) RSH tomography could be used at closer distances to the collimator, giving much better resolution and sensitivity.

2) The technique was simple and data acquisition and analysis time were short.

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A NEW POSITRON TOMOGRAPH HEADTOME III.

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A new positron tomograph, HEADTOME III, which is emphasized on a high accuracy in imaging the brain distribution of the positron tracer has been designed. To achieve an accurate measurement, diameter of BGO detector ring is enlarged to 75 cm. The HEADTOME III has 3 rings of BGO detectors. Each ring has 160 BGOs (13.4 circulary wide x 25 axial height x 40 depth mm^3), 480 BGOs for a total. BGOs are directly coupled to 0.5 inch photomultiplier tube (R647) individually. A BGO to BGO interval is 14.7 mm. A paking ratio is 91 %. For high resolution imaging lead shadow masks are used to narrow BGO opening to 8.7 mm. A ring to ring interval is 30 mm, thus, a slice to slice distance is 15 mm for 5 slice measurement. Two openings for patients aperture are designed. A narrow standard collimator has a 30 cm diam opening. A narrow high accuracy collimator has inter ring septa, which allows to assess direct plane only. A wide standard collimator has 50 cm diam opening, thus, allows an option of whole body measurement. A 5.6 mm diam circular wobble and a half BGO interval rotation are used in scanning. The HEADTOME III will be finished by February 1983.

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EVALUATION OF BGO DETECTOR USED IN "HEADTOME III".

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Performance of the BGO detector, which was identical to that to be used in "HEADTOME III", were experimentally examined. The BGO crystal (13.4 x 25 x 40 mm^3) was directly coupled to a 1/2 inch photomultiplier tube (R647;Hamamatsu TV) and was arranged on 75 cm diameter circle.

We first examined effects of different depth of BGO crystal. Then, we measured spatial resolution and detection counts of a pair of opposite BGO detectors by scanning Na-22 point source in air perpendicularly to the detector axis.

We obtained the results as follows; 1) Photopeak counts (energy window; 350-650 KeV) of single BGO were increased 6 % with a 40 mm long BGO crystal as compared to that with a 30 mm long crystal. 2) This increase in depth did not so degrade time resolution. 3) Spatial resolution were 7.4 mm in FWHM and 8.3 mm in FWHM at the center and at 10 cm from the center, respectively. 4) The detection counts decreased 8 % at 10 cm from the center as compared to that at the center. 5) Lead shadow mask, of which shape and position on BGO face were identical to that of "HEADTOME III", decreased detection counts by 50 %, however, improved spatial resolution by about 1.5 mm in FWHM.