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EFFECT OF CORRECTION FUNCTION, ANGULAR SAMPLING NUMBER AND FILTER LENGTH ON IMAGE QUALITIES OF ECT.

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The effects of correction function, angular sampling number and filter length on image qualities of a single photon emission computed tomography were studied using a computer-simulated phantom and experimentally.

Correction functions were obtained using the Chebyshev-type min-max method and the Remez exchange algorithm for alleviation of the truncation error.

The relationship of the percent-root mean square(r.m.s.) noise in the reconstructed image against the filter energy and count density was investigated together with the relationship between the spatial resolution and the filter energy. The relationship between the percent-r.m.s. noise and the spatial resolution of the reconstructed images was also obtained. Using this relationship, a method for dtermining the optimal correction function was proposed, which was obtained from a minimum detectable image contrast for the human visual system.

Finally, the aliasing artifact due to a finite angular sampling number was also studied together with the effect of the filter length on image qualities.

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EFFECTS OF PROJECTION IMAGE FILTERING ON THE MULTI PLAINARY IMAGES RECONSTRUCTED BY SPECT.

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We have developed the fourier domain filters to improve quality of the multi plainary images of SPECT (ex. frontal, sagittal and obligue slices) by applying them to original projection images obtained from rotated camera. Filters investigated are simple 9 points smoothing, Butterworth filters to improve the signal to noise ratio and Wiener type filters to restore blurred images. Wiener filters are generated by defining FWHM of the point spread function(PSF) of the imaging system. All the filters except 9 points smoothing are operated in fourier domain using two dimensional FFT and it takes 15 seconds to process a 64 x 64 matarix size image.

Wiener filter combined with Butterworth filter were seemed to have produced desirable results from the point of supressing noise and enhancing signals. Filtering effects were outstanding in multi plainary slices, although original images were filtered slightly. In the case of the images with poor statistics, filtered images were greatly improved than 9 points smoothing images.

Such filtering would be performed as easily and instantly as window operation of image display device if the Array processor were introduced.

To find the optimal filters for specific organ, ROC analysis will be desirable.

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DETERMINATION OF ORGAN VOLUME BY SINGLE PHOTON EMISSION CT.

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We have developed an automatic-calculation program for the estimation of organ volume by single photon emission computed tomography. Using a gamma camera(Searle, LFOV) connected on line to a minicomputer (Scintipac 1200, 32 KW), we imaged 10 phantoms made of modeling compound mixed with Tc-99m O4, from 120 ml to 1470 ml in size, and evaluated the accuracy of volume measurement.

ECT images were reconstructed using a filtered back projection method and attenuation correction was performed by Sorenson's method. Each organ volume was estimated by totaling all of the volume elements(voxels) lying within the organ. A voxel was considered part of the organ if it was within the outer edge of the organ determined by thresholding as a function of maximum activity within a volume of interest(cut-off level). The effects of respiratory motion, sampling count, background and filter function used in image reconstruction on the optimum cut-off level were studied using a moving phantom.

Finally, the kidney volumes calculated by ECT were compared with those determined by XCT, and a good correlation coeffcient (r=0.82) with a regression equation y=0.99x +10.9(c.c.) was obtained.

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CLINICAL USEFULNESS OF COMPLEMENTAL DIAGNOSIS OF SPECT AND XCT USING COMPOSITE DISPLAY.

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Complemental imaging diagnosis of single photon ECT and X-ray CT by means of superimposition of both images was applied on 55 cases (62 scintigraphies) and clinical usefulness of the technique was evaluated. The equipments we used are Universal Gamma Camera (Toshiba), micro-computer Mark IV (SORD) for data aquisition and computer system attached to CT/T 8800 (G.E.) for image processing and display. In order to correlate slice level of SPECT with that of XCT, the distance from a reference point was clearlydetermined using positioning light. A contour image derived from the original XCT image was used for image composition with the corresponding SPECT image. Of the 62 studies 11 studies were evaluated to be very useful as the composite images provided new information that SPECT or XCT alone did not provide and contributed to clinical decision making, 31 studies to be useful as the composite images provided some additional information to each other that supported clinical decision. There were no studies that caused confusion or erroneous clinical decision.
This method led us to more accurate interpretation of images by informing clearer structure-function relationship with precise anatomical localization.