B. Measurement A (Information Processing)

Functional Imaging of Brain and Pancreas

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In a dynamic study, two computer methods have been examined.

(1) Subtraction of dynamic images for the diagnosis of brain lesions.

After bolus injection of 15 mCi Tc-99m-pertechnetate, series of scintigraphic images are stored on a magnetic tape within 15 minutes, at interval of 10 seconds. The positive findings in the subtraction from a 15 minutes image a 50 seconds image demonstrate increased activity during dynamic intervals. This procedure was available to detect poor-vascular lesions such as glioma and infarction.

(2) Functional imaging for the diagnosis of pancreas disease.

After injection of 0.3 mCi Se-75-selenomethionine, the data frames (64×64 matrix) of serial scintigraphy are stored on a magnetic tape within 30 minutes, at interval of 10 minutes. Each frames were reduced to a 32×32 matrix after subtraction by Au-198-colloid image. Portions of decreased activity during 30 minutes were eliminated from the 20—30 minutes image. The results of this study including 84 clinical cases give rise to the assumption that this procedure may eliminate abnormal portion in the pancreas image.

The Clinical Evaluation of the Functional Images for the Cerebral Blood Flow

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Color functional images of the cerebral blood flow were generated by using γ-camera and on-line computer system in TMGH.

Successive images were obtained at ten seconds intervals after intracarotid injection of 10 mCi of ^{133}Xe saline solution on the both hemispheres. Functional images were made based on total counts, peak counts and half times of clearance curve on each picture element among 64×64 picture elements. These images were converted into 13 steps of color accordance with the difference of counts of half times.

Thirty-seven studies were performed for 29 patients. Studies for a normal subject, one case with brain tumor, one case with aneurysma and two cases with the CVD were reported as representative cases.

The regional functional images of the cerebral

blood flow can be divided into two types; (1) diffuse perfusion which is found in the normal case and the normal pressure hydrocephalus, (2) type which shows increased or decreased area of the rCBF compared with the surrounding tissues in such cases as the brain tumor or CVD. In the case of CVD, occlusion of major cerebral artery can be visualized as wedgeshaped decreased area of rCBF even at the time when conventional brain scan misses the lesion. This fact suggests that functional images obtained using ^{133}Xe clearance method are very useful to diagnose the CVD such as infarction.

Functional Image Processing Applied Compartmental Analysis

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The construction of the functional image representing the regional cerebral blood flow analyzed by the two terms of compartmental model using ^{133}Xe and scintillation camera was attempted.

The radioxenon washout process can be expressed by multi-exponential equation as

$$y = \sum_i A_i \exp(-\alpha_i t).$$

Each elemental regional washout curve was analyzed according to the weighted least square non-linear regression method, providing initial value Ai, turnover rate ai, and most suitable number of compartment i. Ninety-five percent confidence limits for these parameters were calculated to examine the measurement accuracy.

Scinticamera images were obtained with bolus injection of 5 mCi of ^{133}Xe, and thirty-two of sequencial image data was recorded onto a magnetic tape at the intervals of 6 sec. for initial 24 sec. 9 sec. for subsequent 100 sec. 18 sec. for following 3 min. and 45 sec. for the last 5 min., respectively. These digitized image frames were smoothed to reduce the random fluctuation of images and were arranged in a form of 30×20 matrix. The functional images of αi represent the blood flow rates of the gray and white matter, respectively; and those of Ai represent the fractional distributions of those anatomical components. While the conventional analysis such as the H/A and the initial slope methods can merely provides with the mean values of flow rate, the present method was proved to give additional informations concerning the anatomical informations.

However, by the application of this type of complicated processing, the statistical noise in each element with low counts might become more serious than the conventional processing.