

Studies on the Functional Image of the Liver: Intrahepatic Distribution of Blood Flow

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We have developed the functional image of the liver which represents the intrahepatic distribution of regional hepatic blood flow (r-HBF) topographically. Following percutaneous intrasplenic injection of ^{133}Xe , radioisotopic images obtained by means of scintillation camera were recorded on the magnetic tape in a digital image of 64×64 matrices (time increment: 5 sec, total time: 120 sec) for further analysis using an on-line mini-computer system. The following series of operations were carried out to obtain the functional image of r-HBF.

(1) The processing area composed of 8 mm \times 8 mm element was set over the 10–15 sec digital image after injection.

(2) The washout curves in every element were extracted from the serial digital images.

(3) The slope of the logarithmic washout curves in every element was calculated by least squares regression analysis.

(4) R-HBF in ml/100 gm/min was calculated using the following equation:

$$\text{Hepatic blood flow} = \frac{\kappa \cdot \lambda \cdot 100}{\rho}$$

where κ was the calculated mean slope, λ the hepatic tissue to blood partition coefficient assumed to be 0.74, and ρ the specific gravity of the liver assumed to be 1.02.

After above processing the calculated r-HBF values were retrieved as a CRT display or teletype printout representing intrahepatic distribution of blood flow in ml/100 gm/min. Using this functional image, heterogeneity of r-HBF was clearly demonstrated in man.

Liver Function Studies by Rectal Administration of ^{13}N . I. Methods

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Sequential coincidence positron imaging of the liver and heart was carried out immediately after rectal administration of ^{13}N -ammonia for the evaluation of porta-systemic collateral circulation in liver cirrhosis. The device used was a new positron camera consisting of a focal detector of hexagonal multi-crystal array and a conventional Anger type scintillation camera.

In a patient with essential tremor, a patient with essential hypertension two patients in the convalescent stage of acute hepatitis, three patient with chronic hepatitis, eight patients with liver cirrhosis and three patients with idiopathic portal

hypertension, ^{13}N -activities were measured for 50 min over the liver and heart.)

In all subjects, the liver was visualized within 1 min, but the image was obscure in the patients with liver cirrhosis or idiopathic portal hypertension.

^{13}N -heart/liver ratio seems to serve in differentiating between the control (patients without varices and ascites) and the cirrhosis or portal hypertension group.

Continuous recording of the head and leg radioactivity was carried out immediately after rectal administration of ^{13}N -ammonia for the evaluation