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


*Department of Radiology and Nuclear Medicine, Osaka University Medical School
**First Department of Medicine, Osaka University Medical School

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 $64 \times 64$ 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 $\kappa$ was the calculated mean slope, $\lambda$ the hepatic tissue to blood partition coefficient assumed to be 0.74, and $\rho$ 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 $^{13}$NH$_3$ I. Methods


Division of Clinical Research, National Institute of Radiological Sciences (NIRS) Chiba, Division of Physics, NIRS, Hospital, NIRS
Division of Technical Services, NIRS, First Department of Internal Medicine, Chiba University School of Medicine, Chiba

Sequential coincidence positron imaging of the liver and heart was carried out immediately after rectal administration of $^{13}$N-ammonia for the evaluation of portal-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
of porta-systemic circulation in liver cirrhosis.

In a patient with essential tremor, a patient with essential hypertension and 3 patients with chronic hepatitis, as well as in 5 patients with liver cirrhosis and a patient with portal hypertension, $^{13}$N-activities were measured for 50 min over the head and leg. In all subjects, $^{13}$N-activity appeared in the head and leg in about 1 min after rectal administration, and increased linearly up to 30 min.

$^{13}$N-head activity seems to serve in differentiating between the control and the cirrhosis or portal hypertension group.

### Studies on Portal Hemodynamics by Per-Rectal Portal Scintigraphy


*The Third Department of Internal Medicine, **Department of Radiology, Osaka City University Medical School, Osaka

The per-rectal portal scintigraphy was reported at this conference previously (1975, 1976).

This time, portal shunt index was measured in animal study and compared with that by other procedures such as trans-splenic injection and portal vein catheterization.

Materials: Sixteen rats with hepatic damages induced by carbon tetrachloride and 5 healthy control rats were used

Portal shunt indexes by the per-rectal portal scintigraphy were calculated from the radio-activities in the ROI on the liver and head after the instillation of $^{99mTc}$O$_4^{-}$ into the rectum. On the same subjects within one week, portal shunt indexes by trans-splenic injection and portal vein catheterization were calculated from the activities of $^{131}$I-MAA or $^{99mTc}$-MAA in the removed liver and lung.

Results: In cases with hepatic cirrhosis or portal hypertension over 150mmH$_2$O, portal-shunts by these three techniques were detected frequently and portal shunt indexes correlated well with the extent of hepatic fibrosis and value of the portal blood pressure.

Even in cases without hepatic cirrhosis or cases with slight elevation of portal blood pressure, portal shunt indexes by perrectal portal scintigraphy correlated well with the extent of hepatic fibrosis and value of portal blood pressure.

On the other hand, other 2 methods were almost unable to detect the portal shunts in these cases and portal shunt indexes not always correlated with the extent of hepatic fibrosis and value of portal blood pressure.

In conclusion, our per-rectal portal scintigraphy is possible to detect the portal shunt more sensitively even in the cases with the early stage of hepatic fibrosis and slight elevation of portal blood pressure.

### Comparative Study of RI Tomoscan (PHO/CON) and CT (ACTA Scan) in Intrathoracic Diseases

Makoto Takayama, Izumi Anno, Junta Harada, Naofumi Katsuyama, Masao Kino, Kenji Kawakami, Shinpei Tada, Sachio Mochizuki

Department of Radiology, Jikei University School of Medicine, Minato-ku, Tokyo

Abnormal accumulation of $^{67}$Ga citrate detected by PHO/CON was compared with the findings of CT image in the intrathoracic diseases.

Diagnostic value of the RI tomoscan and CT on anatomical localization of the lesion detected by both methods were discussed.

Comparison was performed in 28 cases with malignant tumor in the lung and the mediasti-