

A Dynamic Study of Hepatobiliary System with ^{131}I -BSP and ^{131}I -Rose Bengal in Various Liver Diseases

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The study was undertaken with purpose of elucidating the mechanism of the jaundice and liver function. Thirty five subjects are studied including normal controls, patients with extrahepatic obstructive jaundice, intrahepatic cholestasis and hepatocellular diseases diagnosed by peritoneoscopy, histological examination or laparotomy. After intravenous injection of ^{131}I -BSP and ^{131}I -Rose-Bengal (100—120 μC), the disappearance curve of radioactivity in blood and the external counting over the liver were measured, and urinary excretion was measured simultaneously. A kinetic analysis was performed by assuming a three compartments model and the $Q_1(t)$, $Q_2(t)$ and $Q_3(t)$ were corresponded with dynamic distribution of the blood, liver and the other organs. Dynamic distribution of the radioisotopes in each compartment was calculated by digital computer. The maximum hepatic uptake of ^{131}I -BSP occurred at about 30 min. in normal subjects, 30—60 min. in patients with cirrhosis of the liver, 60—120 min. in intrahepatic cholestasis and 90—250 min. in obstructive jaundice. The liver uptake rate (represented by K_{21}) was calculated at $0.0949 \pm 0.0032/\text{min.}$ in normal subjects and 0.0164 in acute hepatitis, $0.0147/\text{min.}$ in

cirrhosis of the liver, $0.022/\text{min.}$ in intrahepatic cholestasis and 0.0164 in obstructive jaundice.

The values of excretion rate into bile (K_{02}) were calculated at $0.0013/\text{min.}$ in normal subjects, $0.00013/\text{min.}$ in intrahepatic cholestasis and 0.0 in complete obstruction.

The reverse flow rate from liver to blood were calculated at $0.0263 \pm 0.0013/\text{min.}$ in normal subjects, $0.126/\text{min.}$ in obstructive jaundice.

If each pool size is estimated by the following formula $P_i = \int_0^t Q_i(t) dt$, blood pool size (P_1) is estimated at 51.8 ± 12.3 in normal subjects, slightly and moderately decreased in acute hepatitis (90.1) and cirrhosis of the liver (75.8) respectively. Whereas P_1 is moderately increased in intrahepatic cholestasis (203) and complete obstruction (182.8). The liver pool size (P_2) decreased in hepatocellular diseases, increased in complete obstructive jaundice and intrahepatic cholestasis. ^{131}I -BSP excretion into bile was 0.615 ± 0.213 in normal subjects, 0.242 in intrahepatic cholestasis and 0.0 in complete obstruction, in contrast urinary excretion of radioactivity was increased in later two diseases.

Differential Diagnosis of Jaundice by Sequential Liver-Abdominal Scanning

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External monitoring of head, liver and abdomen after injection of radioactive rose bengal has been used as a sensitive indicator

for liver function disturbance. However by this method it was difficult to differentiate surgical from medical jaundice.

In 56 cases whose diagnoses were determined by operation, biopsy or autopsy, sequential liver-abdominal scanning were performed after injection of 600 μCi of ^{131}I RB or 400 μCi of ^{131}I BSP. In normal fasting subjects, radioactivity started to accumulate over the region of the gall-bladder and increased in density by time. Excretion into intestine was observed after fatty meal. In postprandial state, the gall-bladder was not clearly visualized. But intestinal excretion was observed 20 min. after injection.

In medical jaundice, disturbance of hepatic uptake of the dye was observed as delayed clearance of heart blood pool. However in cases with plasma bilirubin below 12 mg/dl, intestinal excretion was visualized within 24 hours, mostly within 7-8 hours. Liver activity decreases diffusely, that is the most important features of medical jaundice including intra-hepatic cholestasis.

In cases of partial obstruction such as choledocholithiasis, abnormal increase of density near the main bile duct system or hilar region was shown. Liver activity decreased from peripheral area of the liver. These signs are thought to indicate bile stasis above the site of passage disturbance of bile. In cases with high degree partial obstruction, these characteristic findings appeared 2-3 days after injection.

In cases with complete obstruction, intestinal excretion was not visualized during observation for 4-5 days.

No excretion was observed in cases with very severe jaundice due to liver cirrhosis superimposed by acute alcoholic hepatitis.

Visualization of kidney did not have a diagnostic value, since in cases with severe jaundice due to either medical or surgical causes kidney was visualized.

Hepatoscintigram of the Biliary Diseases

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Characteristic findings in hepatoscintigram of the biliary diseases are left lobe enlargement, splenic visualization, incomplete central defect and right lower edge defect.

In this study, the diagnostic significance of left lobe enlargement, splenic visualization and incomplete central defect was investigated. One hundred and seventy-three cases of the hepatic diseases and sixty-four cases of the biliary diseases were involved.

The results were as following;

(1) Left lobe enlargement had closely correlated with widened bile duct in the biliary diseases, while with sero-flocculation changes in the hepatic diseases.

(2) Splenic visualization had closely correlated with the diffuse chronic liver diseases such as liver cirrhosis and chronic hepatitis.

(3) Incomplete central defect was characteristic of the biliary diseases, such as carcinoma of the bile duct and the pancreas head, while rare in the hepatic diseases.