Where ρ=specific gravity of the liver tissue, 1.05

λ=the partition coefficient of ^{133}Xe between liver and blood, 0.74

$$\left(\frac{\text{tissue-concentration of } ^{133}Xe}{\text{blood-concentration of } ^{133}Xe}\right)$$

The disappearance rate (constant) is determined from the half-time ($t^1/_2$): $K=\frac{\log_e 2}{t^1/_2}$

Eighteen cases experiments were performed with the results that in every case the hepatic blood flow was higher by the portal route than by the intrahepatic injection route. Mean flow was 125 ml. per min. via the portal route and 59 ml. per 100 gr. per min. via the intrahepatic route.

Clinical studies:

Studies were carried out on 10 patients at the time of the upper abdominal surgery, e.g. gastrectomy, cholecystectomy. The patients were anesthetized with CI[581], nitrous oxide and oxygen under the controlled respiration using respirator. To measure liver blood flow, ^{131}Xe (300 μCi) dissolved in saline were injected serially into portal vein and into the substance of the liver. The similar results were obtained.

The significance of these studies are not completely understood yet. However, if there is functional mixing of the two routes, then the hepatic blood flow should be equal, regardless of the route of administration. It seems reasonable to assume that during portal route injection the liver tissues tagged with ^{133}Xe are immediately surrounding functioning capillaries and sinusoids. After intrahepatic injection on the other hand, the mean diffusion distance from functioning capillaries and sinusoids must be longer in this situation. Our findings suggest that the portal venous stream and arterial stream remain functionally separate as they perfuse the liver tissue.

Summary;

Hepatic blood flow was measured in man and dogs by determining the washout curve of ^{133}Xe from the liver. It was shown that hepatic blood flow was greater when the ^{133}Xe was given by the portal vein than when it was given by the intrahepatic injection. Thus, ^{133}Xe method can be considered as a powerful tool in the regional hepatic hemodynamics study.

An Analysis of Hepatic Circulation and Examination of Extrahepatic Shunt by Intrasplenic Injection of ^{198}Au Colloid

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As organs have numerous blood pathways and each pathway has its own transit time, a distribution of transit times should be considered in studying circulation system of organs. Surface counting curve obtained by sudden injection of radioisotopic substance include this distribution function of transit times. As we reported earlier the characteristic distribution function of transit times can be determined by application of Z transform to sudden injection process and use of digital computer. We applied this analytical method to the surface counting curve on the liver obtained by sudden injection of ^{198}Au colloid into the spleen and reported the results of analysis of hepatic circulation as follows.

In a normal case, colloidal particles, passing through the liver, were extracted 4.47 percent per sec. (extraction factor). And extraction ratio by one passage was 44.4 per cent. The distribution of transit times was similiar to Poisson distribution and indicated that there is negligble fracton having transit time less than 5 sec. The mean transit time was 13.67 sec. The results of the analysis in three cases with cirrhosis of the liver were reported.

In the first case, transit time ranged widely from below 2 sec. to over 30 sec. The distribution had two peaks, which suggested distributions of shunt and sinusoidal pathways. The fraction of transit time less than 5 sec. was about 40 per cent. The extraction factor was 1.55 per cent per sec. and extraction ratio was 16.3 per cent supporting that the distribution of transit times was affected by shunt pathways.

In the second case with cirrhosis of the liver, the transit times distributed from less than 2.5 sec. to more than 40 sec. and the maximum fraction was between 5.0 and 7.5 sec. The mean transit times was 11.9 sec. The extraction factor and the extraoction ratio were reduced markedly.

The third case with cirrhosis of the liver was severe, having ascites in much degree. The transit times distributed for the most part less than 10 sec. and fraction of less than 5 sec. was more than 50 per cent. The mean transit time was 6.44 sec. in this case.

We reported also that the intrasplenic sudden injection of ^{198}Au colloid was helpful for detecting extrahepatic shunt pathways. In nromal case final level of hepatic uptake is slightly lower than the height of initial peak. But in cases having extrahepatic shunt, the final level was much higher than the height of initial peak. The simultaneous counting on the lung and the head serve this purpose by comparing with appearance of peak on the liver.

Comparative Study in External Counting Method of Hepatic Blood Flow Index and Circulated Blood Flow Disappearance Index Using Colloidal Radiogold

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The investigation of blood flow of the liver by using colloidal radiogold is one of the most useful examination for diseases of the liver. When we calculate the hepatic blood flow index (Kl) from the liver accumulation curve of radioisotope, the influence of the location of the disease and method of physical and physiological detection are problems. To avoid these miscalculation and influence we checked the external head curve and calculated the circulated blood flow disappearance index (Kb) by plotting it on the semilogarithmic graph. We calculated $T\frac{1}{2}$ from the slopes and intercepts of the components of the corrected curve, then got the circulated blood flow disappearance index (Kb) and the hepatic blood flow index (Kl). In 62 cases, Kb was 0.347~0.122 (average 0.204 min.) and Kl was 0.347~0.079 (average 0.150). The comparison of these data with liver scintigram was performed.

1. Nothing particular in liver scintigram and little difference in Kb and Kl: 22 cases (35.5%).
2. Nothing particular in liver scintigram and large difference in Kb and Kl: 4 cases (6.4%).
3. Abnormal liver scintigram and little difference Kb and Kl: 17 cases (27.5%).
4. Abnormal liver scintigram and large difference Kb and Kl: 19 cases (30.6%).

In Group (2) the liver function tests were almost all abnormal.

In Group (3) we found enlarged liver scin-