

in the abdominal cavity, has been devised by Akita et al, in 1964.

Following the splenopneumopexy, the numerous collateral communications were formed between splenic and pulmonary vascular beds and O<sub>2</sub>-saturation of the blood in the pulmonary vein of the fixed lobe was lowered. Hemodynamic studies revealed that when the supradiaphragmatic inferior vena cava was constricted, the portal pressure of dogs with splenopneumopexy, increased only to 166.7 mmH<sub>2</sub>O, while that of the other group without splenopneumopexy, rised as high as 204.7 mmH<sub>2</sub>O.

Clinically as observed experimentally, the collateral communications were well demonstrated on roentgenograms in three patients with Budd-Chiari syndrome. Intrasplenic pulp pressures were significantly decreased in

these patients from preoperative mean value of 332 mmH<sub>2</sub>O to postoperative mean value of 200 mmH<sub>2</sub>O.

Blood flow through the portopulmonary anastomosis was estimated using the radioactive Krypton (<sup>85</sup>Kr). The mean value of blood flow through the portopulmonary anastomosis was 19.2% of the whole portal blood in the dogs with the constriction of supradiaphragmatic inferior vena cava in which the splenopneumopexy was performed one month previously, while the mean value of that were nearly 0% in normal dogs and in the dogs with the construction of supradiaphragmatic inferior vena cava.

In three patients with Budd-Chiari syndrome the mean value of blood flow through the portopulmonary anastomosis was 29.1% of the whole portal blood.

### The Estimation of the Blood flow in Intra- and Extrahepatic Shunt Following the Intra- Splenic Injection of Colloidal Radiogold

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Using radiogold, an attempt was made to newly devise a method for estimating the blood flow in intra- and extrahepatic shunts which are not infrequently encountered in clinical medicine. That is, approximately 50-100  $\mu$ Ci of <sup>198</sup>Au colloid was quickly injected into the spleen, and thereafter the radioactivity over the liver was automatically recorded continuously for a certain period of time. Arithmetical analysis of the radioactivity curve recorded made it possible to differentiate intrahepatic shunt from extrahepatic shunt, and vice versa. In other word, the detection of intra- and extrahepatic shunts in diseased states become possible by this analysis. Representative radioactivity curves are shown in the figure, where  $a_1$ ,  $a_2$  and  $a_3$  are the radioactivities passing through the liver following the injection, and  $b_1$ ,  $b_2$  and  $b_3$  denote the radioactivities initially taken up by the liver which increase again gradually and

reach a plateau that referred to as  $c_1$ ,  $c_2$  and  $c_3$ .

For the arithemetical analysis,  $b/a$  and  $c/a$  were calculated. In normals, each ratio can be regarded as hepatic removal efficiency and hepatic uptake of radiogold, respectively, can be regarded as hepatic removal efficiency and hepatic uptake of radiogold, respectively, but not in the presence of intrahepatic shunts.

In extrahepatic shunt case,  $m_2/a_2$  was same as normal but  $c_2/a_2$  was increased, probably due to the accumulation in the liver of radiogold which once passed through the extrahepatic shunt. Suppose the radioactivity passing through the liver in the absence of the extrahepatic shunt following the injection is  $a_2'$ ,  $a_2'$  could be calculated by the formula,

$$a'_2 = c_2 \times \frac{a_1}{c_1}$$

Therefore the ratio of the blood flow in the

extrahepatic shunt to that in the portal vein ( $R_1$ ) would be estimated as follows:

$$\frac{a'_2 a_2}{a'_2} = 1 - \frac{a_2 c_1}{a_1 c_2}$$

Meanwhile, when the intra- and extrahepatic shunts coexist in a single individual like those with hepatic cirrhosis,  $\frac{b_3}{a_3} < \frac{b_1}{a_1}$  and  $c_3 a_3$  and the above mentioned ratio  $R_1$  is calculated from the formula,  $1 - \frac{a_3 c_1}{a_1 c_3}$ .

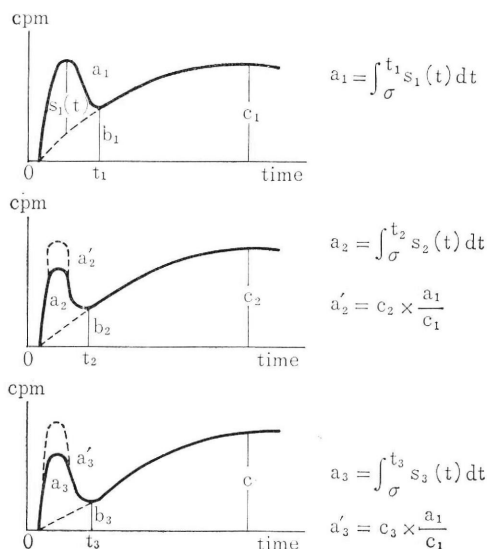
$R_2$ , the ratio of the blood flow in the intrahepatic shunt to that in the portal vein, can similarly be estimated by the followings formula:

$$\frac{a_3 \times \frac{b_1}{a_1} - b_3}{a_3 \frac{b_1}{a_1}} = 1 - \frac{a_1 b_3}{a_3 b_1}$$

From this mathematical analysis, the following results were obtained: (1) the efficiency of radiogold removal by the liver, was 54.4—63.2% and hepatic uptake of radiogold was 92.5%. (2) In a splenomegaly case, intrahepatic shunt was not found by this analysis and  $R_1$  was 62.7%. In this case, although hepatic blood flow and liver biopsy findings were both normal, portal angiography demonstrated the presence of extrahepatic

shunt. (3) In two cases of hepatic cirrhosis,  $R_2$  was found 27.9% and 13.6%, and  $R_1$  was 25.4% and 18.4%.

Our analysis was made on the assumption that the hepatic removal and extrahepatic uptake of the radiogold are constant, but would be a useful tool for the study of intra- and extrahepatic shunts in various diseases, although further investigation are required.



## Skeletal Muscle Blood Flow in Diabetic Patients Measured by $^{133}\text{Xe}$ Clearance

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Recent studies with intramuscular injection of small amount of  $^{133}\text{Xe}$  solution have tended to support that radioactive inert gas such as  $^{133}\text{Xenon}$  is probably a better indicator of blood flow than  $^{24}\text{Na}$ . The test is easy to perform, and is sensitive for discriminating between healthy legs and legs with arterial disease; it demands no standardization, the result is available immediately after the test, and it compares favorably with plethysmographic method. The purpose of this paper is to study some features of the peripheral circulation in diabetic patients.

**Materials and Methods:** We investigated ten normal subjects, fifty-four diabetics, ten hypertensives, three of aortitis syndrome and other miscellaneous diseases such as two of collagen disease, two of uremia with edema and one of dystrophic myotonia. The average age of the healthy subjects was 29 yrs. (15 to 49 yrs.). Twelve of the diabetics were younger than 35 yrs. (young group); forty-two of the diabetics were older than 36 yrs. (aged group). With the materials in supine position the disappearance rate of the radioactivity of  $^{133}\text{Xe}$  was measured according to