Effects of Colloidal Nature on Distribution of Radioactive Colloids in RES of Liver and Bone Marrow

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The factors that alter the probabilities for colloids to distribute in any major compartment, specifically the bone marrow are (1) blood flow (to liver, spleen, and marrow); (2) reticuloendothelial phagocytic activity; and (3) the nature of the colloidal preparation.

This experiment was designed to elucidate the effect of nature of protective colloids on the distribution of radioactive colloids especially into the marrow and (2) to develope a colloidal preparation to increase marrow uptake.

Protective colloids investigated were Chondroitin sulfuric acid, Gelatin, P.V.P. and Dextran.

Isotopes used were ^{113m}In, ^{99m}Tc and ^{59}Fe.

The method of In-colloidal preparation was basically same as that reported by Wagner.

The degree of distribution of colloids into the liver and marrow was expressed as the ratio of cpm per unit weight of marrow to that of liver in rabbits (M: L ratio).

Bone marrow scanning was also performed in order to confirm the results of radioassay.

The highest M: L ratio with ^{113m}In (1.0–1.4) was obtained using Chondroitin sulfuric acid of protective colloids. This was about four times as much as the ratio of ^{198}Au. Millipore filtration as sterilizing method did not change the ratio greatly. Gelatin, Dextran and P.V.P. were not superior to Chondroitin sulfuric acid.

Technetium sulfide colloid was inferior (0.2).

Antimony colloids which were supplied by Hasting Radiochemical Works, U.S.A. was satisfactory, when labeled with ^{99m}Tc (0.5–0.7). Marrow concentration for stannous oxide colloid labeled with ^{113m}In by Subramanian et al did not offer an advantage over Chondroitin sulfuric acid (0.28). Chondroitin sulfuric acid-^{59}Fe colloids were superior to ^{198}Au (0.4).

Measurement of the Distribution of Blood Flow in Organs by Means of Radioactive Microsphere

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After ^{85}Sr or ^{141}Ce labeled "carbonized microspheres" of $15 \pm 5\,\mu$ in diameter were injected into the left atrium, the dog was killed and the organs were divided into pieces. The distribution of the radioactivity in the organs was compared with the regional blood flow measured by the other methods.

1) Myocardium: Right ventricle was supplied with less blood flow than left, with less in the basal portoion than in the apical. The endocardial side of left ventricle was supplied with more blood flow than the epicardial. These are almost similar to the results obtained by ^{86}Rb clearance method. Isoproterenol decreased the blood flow remarkably at the endocardial side of the apical portion of the

left ventricle, reflecting the increased myocardial contraction there. The ligation of coronary artery decreased the blood flow in its perfusion area with slight increase in the adjacent area, and in myocardial infarction coronary collateral circulation was evidenced with significant arteriovenous shunt.

2) Intestine: At fasting state, the blood flow was distributed uniformly over intestine, but when a part of intestine was perfused with 25% glucose solution the radioactivity of that part increased by 62% more than the other parts. These were almost similar to the results obtained by ^{133}Xe clearance method.

3) Brain: The blood flow in brain stem was less than in the other parts, and the ratio of blood flow of gray matter to that of white matter was 4.9. These were almost similar to the results obtained by ^{133}Xe clearance method.

4) Kidney: The autoradiogram of kidney showed that almost all the microspheres were accumulated in the cortex.

It is concluded that radioactive "carbonized microsphere" injection is a precise, useful and simple method for the measurement of the distribution of blood flow in organs, except in those, the structure of the vessels of which are particular, such as in kidney.