IX. Heart and Circulation

Carbonized Microspheres for the Study of Regional Circulation

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Carbonized microspheres, developed recently in U.S.A., have many advantages for the experimental study of regional circulation. The microspheres are made of plastic, spherical in shape and available in various size from 15 μ to 150 μ in diameter. When injected, they cause no histological reaction and are not metabolized. The microspheres are labeled with 85Sr, 51Cr, 169Yb and 111Ce. Consequently, if the microspheres labeled with an isotope are injected into an animal under a certain condition, and then the microspheres with another isotope are injected under the other condition, the distribution of blood flow under two conditions can be measured in the same animal.

By injecting the microspheres into the left atrium of dogs, we studied the distribution of cardiac output in experimental hemorrhagic shock. The results showed that the blood flow to the heart, liver and brain are maintained well even under shock.

In Vitro Method for the Measurement of the Serum Digoxin Level

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Since the difference between pharmaceutical dose and toxic dose of digitalis is very narrow, the establishment of the method to measure serum digoxin level was expected for long.

Using the specific inhibition of red blood cell ATP-ase by digitalis Lowenstein & Coiner measured the digitalis level by 86Rb uptake into red blood cell.

In this report further simplification of the method was planned using special EKT tube and resin column method (Abbott Lab.) by this eliminating the complicating washing process of red cell.

Following fundamental results were obtained.
(1) The amount of digitoxin & digoxin extracted into the dichloromethane were 72.5 & 59.6% respectively. This extraction rate is independent from the plasma level of digitalis.
(2) Study on the effect of incubation temperature on the RBC uptake of 86Rb does not prove the finding of Coiner, who described the increase of temperature from 37°C to 44°C increase the accuracy. Under such non-physiological condition uptake of 86Rb by RBC was rather suppressed and red cell lose its original shape, color and elasticity.
(3) Linear uptake of 86Rb was observed till 120 min, followed by decreased uptake till 300 min. Therefore incubation time should be determined not more than 120 min.
(4) Effect of Rb concentration on the RBC uptake of 86Rb was studied RBC uptake of this procedure (Rb in the amount of 3×10⁻²
mM) was significantly accelerated when compared with physiological level of 0.24mM. Also four half life decay of $^{85}\text{Rb}$ accompanied by the four times increase of Rb concentration does not affect on the $^{86}\text{Rb}$ uptake of RBC.

(5) Free $^{86}\text{Rb}$ separation by resin column. After incubation of $^{86}\text{Rb}$, RBC and serum with digitalis free $^{85}\text{Rb}$ EKT-test tube with special resin column made this separation with ease.

(6) Effect of RBC aging on $^{86}\text{Rb}$ uptake was measured. Stored RBCs more than 2 weeks old could not be used as standard for this study.

Preliminary fundamental study proved this method is feasible for the assay of plasma digoxin level. Clinical study is now being progressed.

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**Study on peripheral circulation of the muscle clearance with radioactive iodine**

—A study of measuring condition—

H. FURUDATE

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We have made collimators for the study of peripheral circulation by the muscular clearance of radioactive iodine and made a comparative study of Tsuyatscan, isoresponse curve, resolution and sensitivity. As a result of this examination, we demonstrated that long cylindrical collimator with the inside diameter of about 10mm is suitable for the measurement of peripheral circulation.

Next, we examined in respect of some measuring conditions using rabbits. The longer time constant and the more volume of injection, the smaller the muscle clearance. Therefore, we must measure fixed time constant and fixed volume of injection. The muscle clearance showed an extremely high level as compared with the subcutaneous clearance. There is no difference between right and left leg in the muscle clearance.

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**Studies on Cerebral Circulation Applying Intravenous One Shot of RISA**

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We try to find a clinical test for cerebral circulation which gives less distress to the subjects. We would like to say that cerebral circulation must be considered as the problem about both brain and heart.

(Method, Results & Discussion) We use the cardiac function test already reported at the meeting of this society; that is the simultaneous recording of radio-activity from RISA in heart and brain. These records