Simultaneous Measurement of the Red Cell Life Span in Various Diseases Using $DF^{32}P$ and ^{51}Cr

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The red cell life span was measured with $DF^{32}P$ and ^{51}Cr simultaneously in 40 patients chiefly with hematologic disorders. Red cell life span was obtained following the intravenous administration of 0.3 to 1.0 mg. (30 to 150 microcuries) of $DF^{32}P$ and the radioactivity was measured in gasflow counter, and 100 to 150 microcuries of ^{51}Cr was labelled in vitro and the radioactivity was measured in a well type scintillation counter.

There was fairly good correlation between the life span obtained by $DF^{32}P$ and the ^{51}Cr half survival, but in some diseases some dissociation was observed between the red cell survival with $DF^{32}P$ and the half survival with ^{51}Cr. In iron deficiency anemia, normal or the slightly shortening of the red cell life span with ^{51}Cr was observed; on the other hand, with $DF^{32}P$ it was observed a clearly shortened life span. In 9 cases of iron deficiency anemia, their half survival time by ^{51}Cr was from 21.5 to 28.0 days (normal range: 25 to 34 days) but the life span measured with $DF^{32}P$ was from 49 to 86 days (normal range: 103 to 126 days).

From these facts, it is reasonable to presume that this discrepancy may show the result of the differences of the elusion rate of chromium from the red cell in various diseases. In this respect the elusion rate of chromium can be calculated from these survival curves which are obtained from simultaneous measurement with $DF^{32}P$ and ^{51}Cr. In contrast with normal range 1.3 to 1.6%, in iron deficiency anemia the elusion rate of chromium was calculated to be fairly low, and it was higher in some cases of hypoplastic anemia.

In cases of suspected abnormal hemolysis, simultaneous determination of the life span of the patients' own red cell and of normal red cell transfused to the patient may be very valuable to elucidate the mechanism of the red cell destruction. For this purpose, the patient's red cell was labelled with $DF^{32}P$ in vivo, while at the same time the normal compatible red cell labelled with ^{51}Cr in vitro was transfused and the red cell survival of both were compared. In cases of iron deficiency anemia the patients' own red cell life span measured with $DF^{32}P$ was shortened; on the other hand the donor red cell labelled with ^{51}Cr survived for the normal period. The results indicate that the shortening of the red cell life span of iron deficiency anemia is of intracorpuscular origin. In some cases of hypolastic anemia, both the life span of the patients' own red cell labelled with $DF^{32}P$ and the normal donor red cell labelled with ^{51}Cr were reduced. In these cases hemolytic process proved to be of extracorpuscular origin.

was thought that abscence of kidney function in progress may be a cause for cure.

2) Renogram in recurred cases

In Renogram, cases in which the recurrence was found in the pelvic cavity showed an abnormal form as compared with previous Renogram in agreement with the involved position, but cases in which distant metastasis was noted did not show an evident change.

This finding acquires much intrest about diagnosis o frecurred lesion in the pelvic cavity.

VII. Kidney

Rate of Renal Blood Flow Obtained with ^{131}I-Hippuran External Counting Method

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In order to investigate a physiopathological value of renal blood flow (RBF), which varies relatively according to the shift of cardiac output, we calculated a rate of RBF by ^{131}I-Hippuran external counting method.

Methods

^{131}I-Hippuran (IH) Radiocardiogram was recorded for the calculation of cardiac output, using a gradient of it's disappearance curve which could be analyzed as a single exponential equation putting on the detector head on the region of left ventricle.

When C represent a concentration of IH at anytime t, and K a proportionality factor, the following equation is lead.

$$\frac{dc}{dt} = KC \quad \cdots\cdots (1)$$

and then

$$C = C_0 e^{-kt} \quad \cdots\cdots (2)$$

where, C_0 is a value for concentration at zero time, $K = k$ as Fozzard mentioned.

On the other hand, $k = \frac{F}{V}$ ..... (3)

where, F indicates flow and V is volume hence,

$$F = V \cdot k = \frac{\text{total counts/min in jected}}{C_0} \times \frac{(\log e\ C_0 - \log e\ C)}{t} \quad \cdots\cdots (4)$$

The equation of disappearance curve obtained by external IH counting method is lead as follows under the same physiological conditions.

If represents C' a external count at any time t,

$$C' = C_0' e^{-kt} \quad \cdots\cdots (2)'$$

from (2) and (2)'

$$\frac{C'}{C} = \frac{C_0' e^{-kt}}{C_0 e^{-kt}} = \frac{C_0'}{C_0} \quad \cdots\cdots (5)$$

Consequently, we can calculate V and K with above equations. And our data obtained from this index of RBF by external IH counting method is closely corelated with RBF calculated from PAH clearance.

Moreover, we can calculate the cardiac output (CO) using the following equation on above IH cardiogram

$$Q' = \frac{I \times E_0'}{S' \times B_0'} \quad \cdots\cdots (6)$$

where, Q' is cardiac output, I, S', Eo' and Bo' indicate the total amaunts of IH, the surface of IH cardiogram, the external counts on the left ventricle and the count of Well-type scintillation countor 1 ml of blood.

Here, S' recieves no influence from renal IH excretion, although we calculated the more value of Q' than that of the calculation using radioiodinated human serum albumin, but we found that those greater values are attributable to V calculation ($V = \frac{I}{B_0'}$), and we pointed out in this report that the practical index of cardiac output (Q) can be calculated as follows,

$$Q = Q' \times \alpha \quad \cdots\cdots (7)$$

where, α is propotionality constant being lead from some investigated statistical bases of physical examinations.