Circulating Blood Volume and Extracellular Fluid Volume of Healthy Japanese Adults

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Circulating blood volume (CBV) and extracellular fluid valume (ECFV) of 92 healthy japanese adults are measured by dilution technique using $R^{125}ISA$ and $Na_2{}^{35}SO_4$. Radioactivity of ^{125}I is counted by well type schintilation counter and energy of weak beta ray of ^{35}S is estimated by Antracene free flow disc attached to photomultphlier.

CBV is calculated on plusma volume by corrected heamatui and F-cell ratio 0.915, and ECFV is also calculuted by Hcmuny's correction formula. The results is that mean CBV per kilogram body weight is 73.5 ml (male), 67.6 ml (female) and ECFV is 181.5 ml (male), 17.1 ml (female) CBV has not linear relations to body weight and body surface area. The comparison of previously reported prediction formula of CBV with measured blood volume show that Nadler's heightcuhed-body mass formula is most proportional to measured blood volume, then, computer analysis of norms of CBV is made according to Allen-Nadler's height cubed-body mass method.

The busic height cubed-body mass formula is of the form:

$$P.B.V. = \beta H^3 + \beta W + \gamma$$

where P.B.V. is predicted blood volume, α, β, γ are conotants, His height(M), and W is body mass (Kg).

(male) $P.B.V. = 0.309H^3 + 0.048W - 0.019$

(female) $P.B.V. = 0.255H^3 + 0.046W + 0.105$

Regression analysis gave the following formulas:

ECFV and plasma volume has a good correction as Etatland reported. The ratio of ECFC and plasma volume is 420 formule and 4.18 for female. The fact leads to the prediction of ECFC secondary to plasma volume.

(male) $P.ECFV = CBV \times 0.614$ (plasmacut) $\times 4.20 = 0.799H^3 + 0.124W - 0.049$

(female) $P.ECFV = CBV \times 0.622$ (plasmacut) $\times 4.12 = 0.665H^3 + 0.120W + 0.274$

H is height(M) and W is body mass (Kg), p. ECFV is predicted extracellular fluiv volume (L).

Total Exchangeable Sodium in Relation to Extracellular Water in Hypertension

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We have reported that it seems appropriate to observe body sodium in relation to extracellular water (ECW) in studying the diseases related to sodium disturbance. The paper presented a study of hypertensive patients from this aspect.

Materials and methods: Determinations of TENa (total exchangeable sodium), TBW (total body water), ECW and plasma volume were carried out by the isotope dilution method reported previously, except ^{24}Na instead of ^{22}Na. The materials included eight normal subjects, 27 patients with hypertension (10 the non-treated, 17 the treated with thiazide), three Conn's syndrome and seven renal insufficiency.

Results: (1) Plasma sodium levels were in the neibrohood of the normal in all, but slightly lower in renal insufficiency. (2) Mean value of TENa per body weight was 42.5 mEq/kg in the normal, which showed little distinction from the patients. (3) In 60 per cent of the

hypertensive, TENa per lean body mass was above the normal range, and this percentage reduced to 28.5 per cent by thiazide therapy. (4) This feature was more clearly observed in relation with TENa to ECW: 80 per cent of the non-treated hypertensive was above the normal range, while this figure reduced to 28.0 per cent by thiazide therapy. (5) It was, however, difficult to find out a dirct relationship between the value of TENa per ECW and the degree of high blood pressure. (6) Ratio between plasma volume to ECW and/or between ECW to TBW did not illustrate any significant difference among the materials.

Conclusions: It is reasonable to observe sodium disturbance in the hypertensive in relation with TENa to extracellular water.

Studies on Changes of Body Fluids Distribution during Peritoneal Dialysis (I)

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In recent years peritoneal dialysis and hemodialysis by artificeial kidney are effective for treatment of renal insufficiency. We have studied changes of body fluid compartments and chemical findings during dialysis.

0.3 mc HTO, 30 μc ^{22}Na and 1.5 g PAH were injected intravenously, and appearance rate in dialysate by peritoneal dialysis and ascites by carcinomatous peritonitis were examined. The determination of HTO concentration was made with liquid scintillation counter, and ^{22}Na with Well type scintillation counter. The concentration ratio 1 hour after intravenous injection between dialysate and ascites and plasma were HTO ca 50%, ^{22}Na ca 20% and PAH ca 30%. These ratio were lower in ascites than in dialysate.

The concentration ratio of HTO, ^{22}Na and PAH in plasma 1 hour after intraperitoneal injection were HTO ca 40%, ^{22}Na 20% and PAH under 5%.

The appearance rate of HTO, ^{22}Na and PAH in dialysate were compeared with other chemical materials. HTO was almost equal with urea N, creatimine, uric acid and K. PAH and ^{22}Na were lower than these chemical materials.

Changes of body fluid compartments before and after peritoneal dialysis were studied with HTO, ^{22}Na and ^{51}Cr. HTO and ^{22}Na were injected intravenously 12 hours before dialysis, and ^{51}Cr was injected direct before and after dialysis. Total body fluid, extracellular fluid and circulating plasma volume were reduced after peritoneal idalysis. In edematous cases the reduction of extracellular fluid was prominent.

Studies on Changes of Body Fluids Distribution Produced by Surgical Operation (I)

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Changes in water-electrolyte balance brought about by surgical operation have been the object of many investigators. Isotopic methods are newer addition to the armamentarium in the study in this area and assure greater accuracy and convenience.