5) When 20% was used as the upper limit of normal for 3hr. uptake value, the diagnostic error was 2.8%. When 35 or 40% and 45% were used as the upper limits for 6 and 24 hrs. uptake respectively, the respective diagnostic errors were 1.8 and 2.4%.

6) The effective half life in 155 hyperthyroid cases was 5.7 days in average.

7) In 150 cases of hyperthyroidism successfully treated with ^{131}I, 24 hrs. ^{131}I thyroid uptake after treatment was 1.4~70.9 (average 29.2%) and 39% and 15.3% of the cases showed ^{131}I thyroid uptake rate higher than 40% respectively.

Studies on the Initial Metabolic Phase of the Inorganic Iodide

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The metabolism of inorganic iodine in relation to thyroidal function is not completely clear. Time course of the distribution of radioactivity in forearm of various thyroidal functions was measured by use of arm counter (Packakrd) after intravenous injection of 10-40μC of ^{131}I Na solution. The curve obtained was composed of three phases; namely the first phase of rapid increase followed by second slow uphill movement and the third gradual downstroke.

The time after injection required for maximum radioactivity and the half-life of the downstroke were found to well indicate the thyroidal function.

The average value of the former was 12.3 minutes in normal thyroidal function, 3.4 minutes in hyperthyroidism and 37.6 minutes in hypofuction.

The mean value of the latter was 5 hours in normal, one hour in hyperthyroidism and 13,5 hours in hypofunction.

Although the above difference may well be resulted from the different rate of iodine uptake by thyroid, the other possibility still remains that the diffusion volume and the rate constant could affect the type of the arm counter curve.

To clarify the latter possibility, inorganic iodide metabolism was mathematically analysed by compartment model.

Radioactivity of forearm was thus expressed as the following equation.

$$f(t)=(1+\lambda u)\exp[\alpha t]-(1-\lambda v)\exp[\beta t]$$

In the equation, λ means the ratio, (first diffusion volue: V_0)/(second diffusion volume: V_1) in forearm which was found smaller than that in whole body.

The terms (u, v, α, β, λ) or (k_T, k_D, V_0, V_1, λ) are parameters of compartment model.

Here k_T and k_D means the rate constants between V_0 and thyroid and between V_0 and V_1, respectively.

Experimentally, we figured out k_T, k_D, V_0 and V_1 from plasma disappearance curve and checked the change of $f(t)$ with ten cases of normal subjects, six patients of hyperthyroidism and four patients of hypothyroidism.

When k_D of the normal curve was substituted by that of hyperthyroidism, the time required for the maximum radioactivity was shortened with the same reasonable decrease by substitution of k_T. In contrast, the prolongation was obtained by the substitution of k_T and k_D respectively in case of hypothyroidism.

Our results indicate that the thyroidal function controls the parameters k_D, V_0, V_1, λ as well as k_T, which had been considered the only parameter controlled by thyroidal function.

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