VI. Endocrine Organs and Metabolism

Kinetic Analysis of Metabolism of Thyroid Hormones with $^{131}$I-Trijodothyronine and $^{131}$I-Thyroxine by Aid of Computer in Various Liver Diseases

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As reported previously, the liver plays an important role in the peripheral metabolism of thyroid hormones in man. Concentration of serum thyroxine (T₄) using tetrasorb kit was $9.93\pm1.87\,\mu g/dl$ serum, and concentration of serum T₃ by means of Sterling's method was $210\pm31\,\mu g/dl$ in normal controls. The values obtained in liver diseases were within normal range.

A three compartments model was set up, using plasma disappearance curves, time dependent counting over the liver and the tracer excretion into the urine, to analyze the metabolism of T₃ and T₄.

Plasma disappearance curve $Q_1(t)$ which was given as three exponential function was correspond to compartment one. Supposing $Q_2(t)$ was to be the concentration of tracer in the extravascular space of the liver at time t. So $Q_1(t)$ and $Q_2(t)$ were approximated to three exponential function respectively with the same coefficient of exponent by aid of digital computer FACOM 270-20.

The individual values for the fractional rate constant and pool size for distribution of tracer and metabolism and excretion values of tracer into bile and urine were calculated. The calculated rate constant of $k_{21}$, expressing the uptake from the plasma to liver was $0.0135\,min^{-1}$, $k_{12}$, for reverse flow rate from liver to plasma, $0.00675\,min^{-1}$ and $k_{02}$, expressing the excretion from liver to bile duct, $0.000315\,min^{-1}$ in average. The cases of chronic hepatitis and liver cirrhosis showed a more remarkable decrease in the values of $k_{02}$ and $k_{21}$ than normal controls, which showed a slight increase in the value of $k_{01}$. The cumulative biliary excretion during the initial 24 hours averaged $65.2\,\mu g(T_4)$ and $0.8\,\mu g(T_3)$, but the cases of liver diseases with diminished hepatic pool size and biliary excretion showed remarkably decreased values of T₃ and T₄, while they gave increased values of T₃ and T₄ excreted into the urine. As half life of plasma disappearance curve of T₃ was 1.2 days, metabolic rate of T₃ was about three times faster than that of T₄ and rate constant of $k_{21}$ of T₃ were about 20 times faster than that of T₄. It was recognized that reduction in the values of the liver pool size and excretion into the bile of thyroid hormones were remarkable in the cases of liver diseases.