Analysis of Plasma $^{131}$I-Insulin and Human Growth $^{125}$I-Hormone ($^{125}$I-HGH) Disappearance Curve in Diabetic Patients

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Studies on kinetics of insulin and HGH metabolism were performed in 5 normal subjects, 6 patients with juvenile diabetes mellitus, and 7 patients with maturity onset diabetes mellitus. Patients who had abnormal renal and hepatic functions, and who had ever received insulin were excluded from the studies.

$^{131}$I-insulin and $^{125}$I-HGH were rapidly injected into antecubital vein simultaneously, and serial blood samples were obtained for 4 hours after injection. Plasma $^{131}$I-insulin and $^{125}$I-HGH concentration were estimated by double antibody immunoprecipitation method.

Plasma disappearance curve of both $^{131}$I-insulin and $^{125}$I-HGH was curvilinear when graphed on semilog paper. These curves could be resolved into sums of three exponentials by the methods of “peeling”. A three pool model was then formulated to describe the kinetics of plasma insulin or HGH disappearance, representing plasma (POOL 1), interstitial fluid (POOL 2), and all tissues in which insulin or HGH is utilized and degraded (POOL 3).

The appropriateness of this model was tested by computer analysis. The computer predicted values provided an excellent fit for experimental values. This indicates the postulated model is reasonable to describe the kinetics of insulin and HGH distribution and degradation.

The fractional turnover rates ($\lambda_{ij}$) were computed using the methodology described by Skinner, and compared to identify which parameter might most distinguish differences between the control group and the diabetic group.

In the diabetic group, especially in the patients with juvenile diabetes mellitus, increased fractional rate of insulin leaving interstitial fluid and entering pool 3 ($\lambda_{32}$) was noted (0.045 ± 0.006 vs. 0.034 ± 0.004 in the controls, 0.01 < p < 0.025). As for HGH, increased fractional rate of HGH returning to plasma from pool 2 was characteristic in the diabetic group.

The formulation of the three pool model is reasonable and capable of yielding detailed informations relevant to insulin and HGH kinetics.

Fundamental Studies on Insulin Radioimmunoassay (2)

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Our first report at Kinki Kakuigaku Kenkyukai, June, 1970, was concerned in the method including standard curves and its clinical usefulness of insulin radioimmunoassay.

The present studies are on precission of the measurement and simplification of the technique.

1) Leo, Stimmmer reported in the Lancet 23, 1963; when the reciprocal of percentage of precipitation was plotted against the concentration of standard insulin, a straight line was obtained.

However the result of our data analysis, it was expressed by a curve of the second degree ($y = a + bx - cx^2$) rather than by a straight line ($y = a + bx$).