diseases from parenchymal renal disorders. ^{99m}Tc-(Sn) DTPA also showed higher sensitivity than ^{131}I-Hippuran renogram, providing useful aid in the follow up studies of operated cases or chronic patients.

Simultaneous Measurement of Effective Renal Plasma Flow (RPF) and Glomerular Filtration rate (GFR) by external monitoring of ^{125}I Hippuran and Plasma Disappearance of ^{125}I Iothalamate

M. KINOSHITA, Y. SHIMONO, I. MASHIRO, G. TOMONAGA, T. HOSHINO and R. KUSUKAWA

Division of Cardiology, Tenri Hospital, Tenri

A. ISHIHARA and M. INADA

Division of Nuclear Medicine, Tenri Hospital, Tenri

Our investigation was designed to obtain data which could provide information regarding the cause of the difference between the renal clearance of PAH and Hippuran in man. This investigation was also established to demonstrate the feasibility of measuring the simultaneous GFR and RPF by the use of ^{131}I Hippuran and ^{125}I Iothalamate.

Materials and Methods: The present study was performed in 82 patients suffering from different disease entities. Following the intravenous injection of 50 microcuries of ^{131}I Hippuran and 100 microcuries of ^{125}I Iothalamate in 5 ml saline, serial blood samples were obtained at 60, 120, and 180 min after injection, in order to determine ^{125}I Iothalamate in blood. At the same time by external counting ^{131}I Hippuran disappearance from the blood was measured by a collimated scintillation detector centered over the manubrium sterni at the level of the second ribs. One compartment analysis was adopted to calculate RBF and GFR. The disappearance half-time (T1/2) as well as the disappearance rate constant(k) could be calculated from the exponential curve. The space or volume of distribution of radiohippuran or iothalamate was calculated from the injected dose and the concentration of the isotope in the blood at zero time derived from back extrapolation of the exponential curve. From these data the RBF or GFR was calculated according to the equation: RBF or GFR$=k\times$ DV. A cournand catheter was introduced into renal vein to measure the renal extraction ratio of Hippuran.

Results: Renal extraction ratio of Hippuran was found to range from 40 to 50%, in contrast to that of p-amino hippurate having 80 to 90%. In addition the extraction ratio decreased as time goes on. One of the reasons for the low extraction ratio was red blood cell uptake of ^{131}I Hippuran in one ml of whole blood, which ranged from 15 to 20%, and showed a slight increase with time. The low extraction of hippuran leads to underestimation of RBF. In contrast, one compartment analysis of the disappearance curve tends to overestimate RBF. The understimation and overestimation cancel out each other to give the good agreement between p-amino hippurate

clearance and hippuran clearance (r:0.80, $p<0.01$, $N=55$). The relationship between thiosulfate clearance and iothamalate clearance was excellent, if blood disappearance curve was recorded up to 180 min post dose. (r:0.83, $p<0.01$, $N=48$) Filtration fraction showed a reasonable value, ranging from 0.18 to 0.23 in normal subjects, with a mean $\pm$SD of 0.10 ± 0.20 in patients with chronic nephritis, and 0.17 ± 0.20 in those with diabetic glomerulosclerosis. It was concluded that simultaneous measurement of GFR and RPF from disappearance curve has a very useful way of assessing renal function in outpatient clinic.

Measurement of GFR and RPF using a Single Injection of ^{51}Cr-EDTA and ^{125}I-Hippuran, II. Estimation from Theoretical Volumes of Distribution

M. Takasugi, K. Kimura and H. Ibayashi

Third Department of Internal Medicine, Faculty of Medicine, Kyushu University, Fukuoka

H. Uematsu

Department of Computer Science, Kyushu Institute of Technology, Fukuoka

K. Nomo

Department of Electric Engineering, Kitakyushu College of Technology, Fukuoka

A single-shot urineless technique for the estimation of GFR and RPF is evaluated using ^{51}Cr-EDTA (1 μCi/kg) and ^{125}I-Hippuran (0.4 μCi/kg). The blood clearance curves are observed by serial blood sampling.

Assuming that the plasma disappearance curve of these substances can be described by artitrary number of exponential functions: $Ct=\sum_i Ai\cdot e^{-kit}$, parameter values of the equation are obtained by digital computer with the peeling method. Then blood clearances are expressed as $G=I(\text{Injected RI Dose})/\int_0^\infty Ctdt$.

Clearances obtained by these computer programs agree closely with those obtained by the manual compartmental analysis. Theoretical volumes of distributions of these substances are calculated from the reciprocal of the plasma concentration. A good correlation is observed between clearances derived from plasma disappearance curve and the total theoretical volume of distribution. The correlation coefficient of ^{51}Cr-EDTA increases gradually to a maximum of 0.92 between 120 and 140 minutes after injection, while the correlation coefficient of ^{125}I-Hippuran increases rapidly to a maximum of 0.84 between 30 and 40 minutes after injection, then decreases rapidly. Thus, to estimate GFR and RPF, 30–40 and 120–140 minutes after injection seem to be adeuate. For this purpose regression equations between the clearances and the total volume of distribution are established with standard deviation.