N. Kidney, Urinary Tracts and Reproductive Organs

Evaluation of ^{99m}Tc-(Sn) DTPA Renal Studies Compared with ^{131}I-Hippuran

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Diethylene triamine pentaacetic acid (DTPA) is a chelate and is excreted probably solely by glomerular filtration. ^{99m}Tc-labeled compounds containing DTPA are ^{99m}Tc-(Sn) DTPA, ^{99m}Tc-(Fe) DTPA and ^{99m}Tc-(iron ascorbic acid) DTPA. They are used for both brain and renal scannings.

Recent introduction of ^{99m}Tc-(Sn) DTPA found its usefulness in dynamic renal studies because of its faster metabolism than the other DTPA-^{99m}Tc labels.

In 72 cases (17 y.o.–97 y.o. (mean 59 y.o.)) comparison study of ^{99m}Tc-(Sn) DTPA with ^{131}I-Hippuran for γ-camera renogram & renal imaging are performed.

Pho/Gamma HP γ-camera with data store playback system was used.

Studies are perfoemed with the patient upright and the gamma camera detector, with diverging collimeter, positioned over the kidneys posteriorly.

γ-camera renograms were obtained by setting ROI on the each Kidney. Two mCi of ^{99m}Tc-(Sn) DTPA and 300 uCi of ^{131}I Hippuran were administered in this order to the same patient, and entire study was through within an hour. One hundred and fifty studies were performed.

In the obstructive kidney diseases such as congenital hydronephrosis due to ureteropelvic junction stenosis higher sensitivity of DTPA renogram were found in two cases. During the follow up studies after operation, ^{131}I Hippuran renogram showed improvement or normalized, however, ^{99m}Tc-(Sn) DTPA renogram still showed impairment of renal function at this stage.

In the advanced parenchymal renal diseases, when ^{131}I-Hippuran renogram show occassionary obstructive-type renogram, ^{99m}Tc-(Sn) DTPA renogram revealed not obstructive pattern but characteristic type without 2nd phase of normal renogram.

These findings served to differentiate obstructive kidney diseases from parenchymal renal disorders. Also it is useful to follow up renal discases by ^{99m}Tc-(Sn) DTPA with its higher sensitivity than ^{131}I-Hippuran. Simaltaneous γ-camera images also served to make accurate diagnosis of obstructive renal diseases when renogram showed intermediate pattern or obstructive pattern as in advanced parenchymal disorders or as the effect of dehydration.

In summary, ^{99m}Tc-(Sn) DTPA renogram and γ-camera images showed its unique usefulness in the differential diagnosis of obstructive kidney

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

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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