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PRELIMINARY NOTE

Radioisotope Renogram in Kidney Transplants[1,2]

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Presently the radioactive renogram is being used to follow the clinical course of patients who have received a renal transplant. Collins *et al* (1) have recently reported their experience in a similar group. To date, Iodine-131 Hippuran (Ortho-iodo-hippurate)[1] has been used exclusively in these studies, although consideration is now being given to the use of Mercury-197-Chloromerodrin and Iodine-125-Hippuran. Serial renograms have been performed on 15 patients, who have received a kidney from a close relative or a human cadaver. Varying doses of steroids and other immunosuppressive agents are being used to prevent a rejection reaction. The patient's clinical status and conventional kidney function tests are used together with the renogram to adjust the dosage of drugs used and to indicate the possible need for other treatment.

A dual rate meter system with 2-inch diameter sodium-iodide crystals is being used. Collimation of the crystals provides an 8-inch distance from the crystal face to skin to minimize differences due to depth of the kidney below the skin surface. These kidneys are transplanted into the anterior iliac fossae so that renograms are performed with the patients supine. One probe is placed directly over the kidney. In most cases, the second probe serves as a control and is placed over the abdominal vasculature on the opposite side. The positioning of probes in smaller patients is quite critical because of the close proximity of the kidney transplant to the bladder. The exact position of the kidney is known from surgery so that no localizing dose for the probe placement is necessary. A dose of 20 μc of Iodine-131 Hippuran is administered intravenously as a bolus. Activity is displayed on a strip chart recorder with overlapping pens. The recorder is run at a speed of 3 inches per minute during the first minute and 12 inches per hour for the remainder of the examination. Thirty minute records are usually obtained.

Renograms are obtained when possible on prospective donors. Following transplantation, an initial renogram is obtained while the recipient is in the post-

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[1]Courtesy E. R. Squibb & Company.

operative recovery room and again within the first 24 hours after surgery. Renograms are then obtained on a daily basis for approximately one week and at various times thereafter.

Interpretation of the renogram curves is modified after previously reported series (2,3). The renogram is thus divided into three segments which relate in part to the vascular supply, secretory activity, and excretion from the kidney. Our results show that the renogram is a sensitive indicator of the function of the renal transplant. We have observed a variety of patterns which appear to be related to the acceptance or rejection of a transplant. During a rejection phase the "typical" change in the normal pattern is an elevation of the curve of the excretory segments and a gradual depression of the "functional" peak. Outflow obstruction and in some cases compromise of the vascular supply may complicate the interpretation of a rejection pattern.

The following is a brief case history of one of our patients (T. B.), age 15, who was considered as a candidate for transplantation because of renal failure secondary to chronic glomerulonephritis. On September 28, 1963, she received two cadaver kidneys. Figure 1 shows a typical normal renogram pattern together with selected renograms on these transplanted kidneys. Figure 2 shows results of some of the laboratory tests. The renogram performed on September 30, indicates a gradual increase in the concentration of the isotope in both transplanted kidneys. There is no evidence of an excretory component, although moderate urine

[1]Creatinine clearances are all normalized to 1.73 M^2 body area.

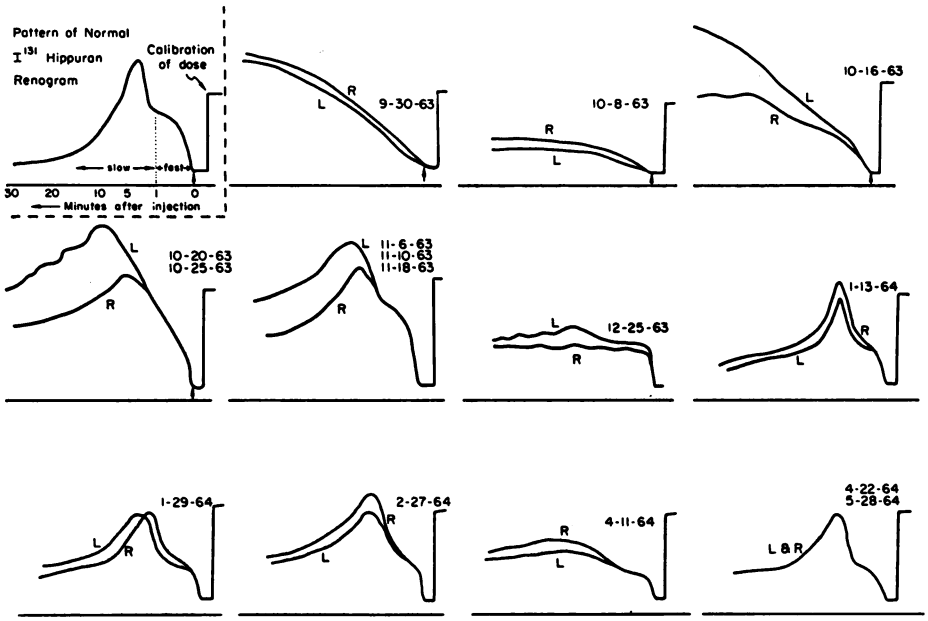

Fig. 1. Upper left demonstrates a normal renogram. Rejection reactions were clinically and chemically present on 10/8/63, 12/25/63 and 4/11/64.

output was measured. The pattern resembles somewhat that seen in early rejection but was thought here to represent tubular damage secondary to the ischemia of the kidneys prior to completion of the transplantation. The BUN was 36 mg % and the creatinine clearance was 60 liters/24 hours at this time.[1] The renogram on October 8 resembles closely a nephrectomy pattern bilaterally, and at this time there was scanty urine output. The BUN had risen to 101 mg % and the creatinine clearance had dropped to less than 10 liters/24 hours. By October 16 the patient's urine output had increased to 1,500 cc per day, the BUN had dropped to 44 mg % and the creatinine clearance had risen to 35 liters/24 hours. At this time an improvement of the renogram may be noted, especially on the right kidney, which appears to show, in addition to some function, a slight excretory component. On October 25 good function is seen bilaterally and good excretion is seen on the renogram of the right kidney. There is some delay of excretion from the left kidney. Two weeks later, on November 6, the renograms have approached normal pattern bilaterally and the patient's clinical status was vastly improved over that of previous weeks. The BUN had fallen to 28 mg % with little change in the creatinine clearance. The patient was discharged about this time.

During the next several weeks there was gradual improvement of the renogram pattern. The BUN dropped to a low of 16 mg % and the creatinine clearance rose to a high of 90 liters/24 hours. There was no change in medications during this time, with the patient on a maintenance dose of Imuran. Beginning about December 6, there was a gradual rise in the BUN and drop in creatinine clearance. The patient was re-admitted to the hospital on December 24 with acute renal failure. The renogram pattern at this time again resembled closely a "nephrectomy pattern." The BUN had risen to 54 mg %, the serum creatinine was 3.8 mg % and the creatinine clearance had dropped below 5 liters/24 hours. The urine

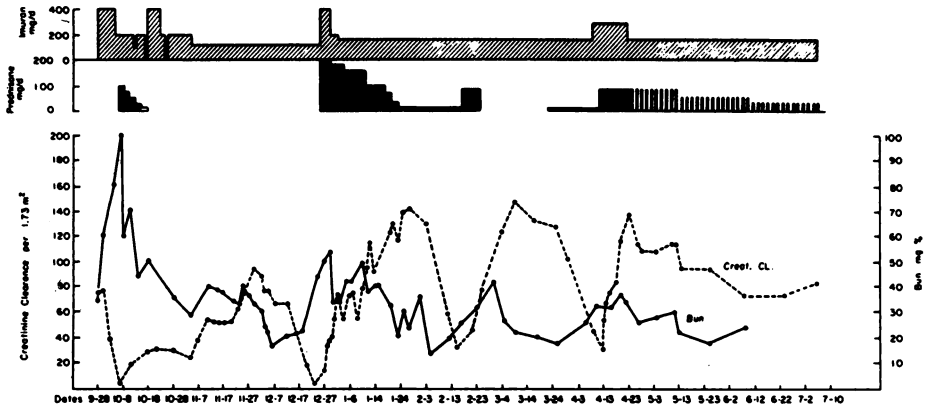

Fig. 2. Chronological presentation of chemical determinations and immunosuppressive drug therapy. Rejection reactions were felt to be present on 10/8/63, 12/25/63 and 4/11/64.

output had been decreasing steadily prior to this admission. Intensive drug therapy was instituted and rapid improvement of the patient's renal status was observed. The renogram pattern obtained on January 13, 1964 reflects this improvement as did, a BUN of 40 mg % and a creatinine clearance of 114 liters/24 hours. It may also be noted that the renal function appears to be slightly better in the right kidney.

Continued improvement of this patient's clinical status was observed during the ensuing weeks. The pattern of the renogram likewise improved as may be evidenced by that obtained on January 29. Since that time, there have been two more episodes of rejection reaction noted, both of which were less severe than that observed in December, 1963. At present, this patient continues to do well.

SUMMARY

Abnormal patterns have been obtained at various times following the transplants. Delayed excretory phase with a gradual depression of the functional peak has been the most consistent pattern seen during a rejection reaction. Our interpretation of the renogram pattern does not always correlate with the clinical status. In some cases an abnormal pattern persists despite an improvement in urine output and blood chemistries. Continued investigation in man and animals as to the value of the renogram in kidney transplants is being carried out.

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