URETERAL KINKING AND HYDRONEPHROSIS IN A TRANSPLANTED KIDNEY MIMICKING THE REJECTION PHENOMENON

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Because renal homotransplantation has been used increasingly in recent years, there is a great need for simple, reliable techniques that can evaluate accurately renal function during the post-transplant period. Conventional urologic and radiologic techniques cannot be repeated frequently, may be difficult to interpret, often provide information too late to be clinically helpful and are not without significant side effects (*1–5*).

With the development of the scintillation camera, radioisotope techniques have become available which permit dynamic visualization of transplant vascularity, function and morphology. These techniques may be repeated daily if necessary, and they are accurate, reproducible and atraumatic.

The case to be presented illustrates their importance and usefulness in the evaluation of a renal transplant problem.

METHODS

The instrument used for these studies was the Nuclear-Chicago Pho/Gamma scintillation camera with a 3-in. multichannel collimator. A 1,000-hole collimator was used. The patient was studied in the supine position, with the scintillation camera detector placed so that both the renal transplant and the urinary bladder were included in the field of view. Fifteen millicuries of ^{99m}Tc-pertechnetate was injected intravenously by rapid bolus injection, and serial 4-sec exposure scintiphotos were obtained for a total of 32 sec. Without moving the patient, 300 μCi of ^{131}I-Hippuran was then injected and serial 2-min exposure scintiphotos were obtained. During the ^{131}I-Hippuran study, serial precordial counts were obtained at 2-min intervals for a total of 30 min with a collimated scintillation detector centered over the manubrium at the level of the second rib. Precordial radioactivity was subsequently plotted on semilog paper as a function of time, and the ^{131}I-Hippuran disappearance half-time was calculated from the 10–20-min segment of the slope.

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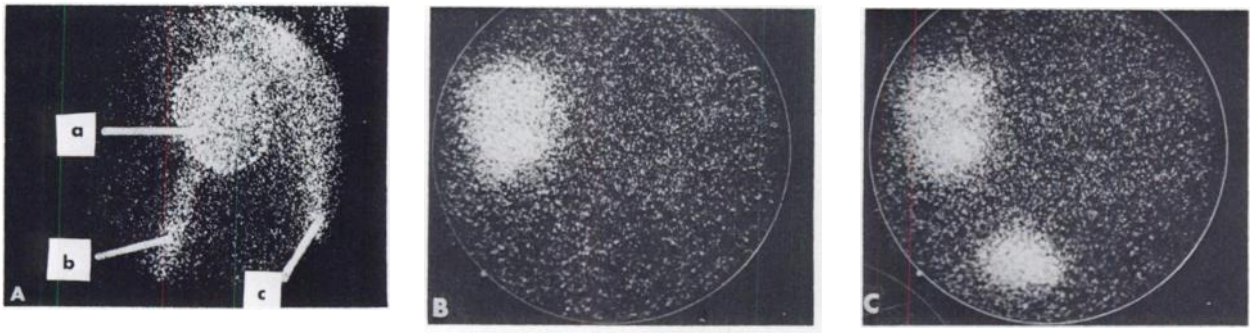


FIG. 1. A shows normal ^{99m}Tc-pertechnetate perfusion study at 16 sec. Both common iliac arteries are clearly seen (b and c). Transplant size and shape is normal (a). B shows ^{131}I-Hippuran concentration at 2 min. Transplant size and shape is normal. C shows ^{131}I-Hippuran concentration at 6 min. Definite bladder radioactivity can be seen.

The ^{99m}Tc-pertechnetate studies were visually analyzed for abnormalities of transplant vascular perfusion. The ^{131}I-Hippuran studies were used to evaluate transplant function and morphology as well as the excretory progression of the tracer from the renal cortex to the renal pelvis and ultimately to the urinary bladder.

In patients with functioning transplants, vascular perfusion was well outlined within 20 sec with ^{99m}Tc-pertechnetate. The ^{131}I-Hippuran was concentrated in the renal parenchyma within 2 min, and bladder radioactivity was usually noted within 10 min. The ^{131}I-Hippuran disappearance half-time ranged from 26 to 44 min. Normal ranges for these studies have been determined (*6–7*). Figure 1 shows a normal ^{99m}Tc-pertechnetate and ^{131}I-Hippuran study.

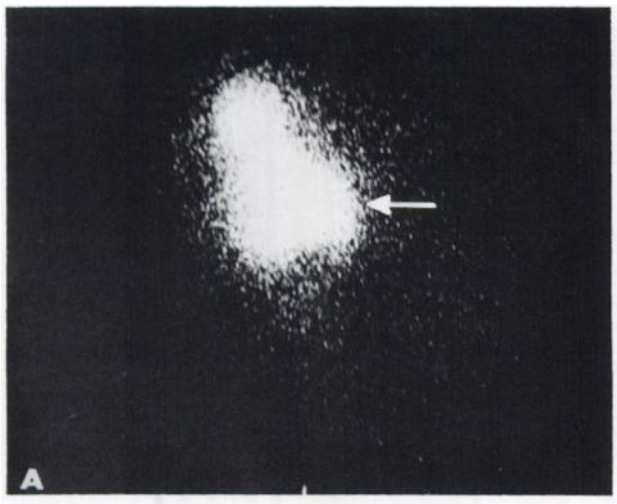
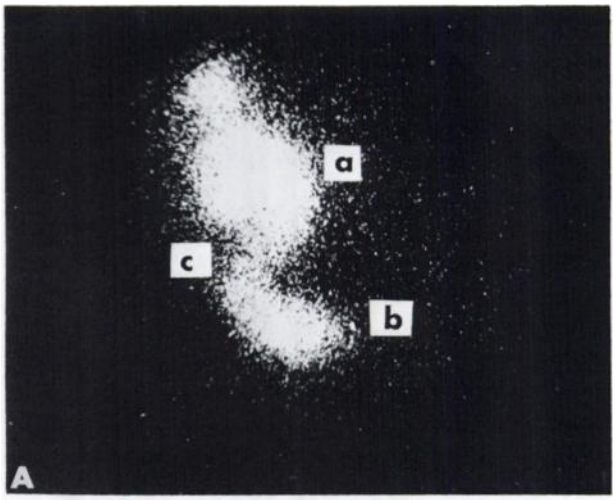


FIG. 2. A is ^{131}I-Hippuran study at 24 sec. Marked accumulation of isotope in region of renal pelvis is noted (arrow). No bladder radioactivity is noted. B is ^{131}I-Hippuran study immediately after voiding. Passage of most of tracer into urinary bladder has suddenly occurred (arrow).



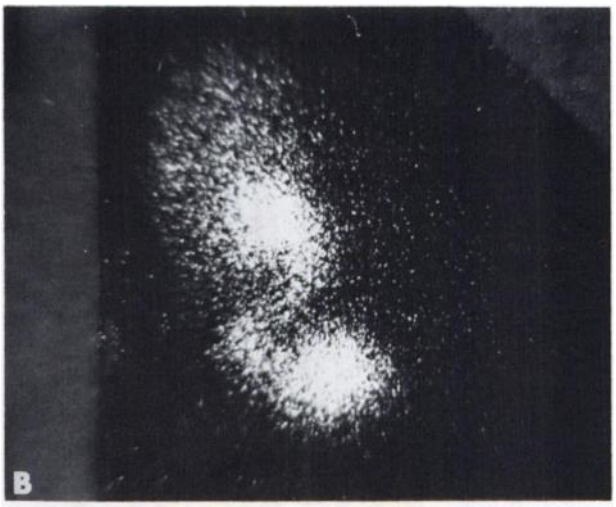


FIG. 3. A is ^{131}I-Hippuran study at 18 min. Marked accumulation in region of pelvis is noted (a) but some progression to urinary bladder has occurred (b). Dilated, kinked, S-shaped ureter is easily seen (c). B is ^{131}I-Hippuran study immediately after voiding.

CASE REPORT

HW, a 35-year-old Negro male, received a cadaver transplant on March 23, 1969. Azothioprine and prednisone were begun. Following an episode of acute tubular necrosis the homograft functioned well, and 2 weeks post-transplantation the creatinine was 1.5 mg% with a urinary output of 3,000 ml/24 hr. The patient did quite well until 2 months post-transplantation when the creatinine suddenly rose to 2.5 mg%, associated with a fever of 101°F. Rejection was considered the most likely reason, and azothioprine and prednisone were increased.

However, scintillation camera studies were not consistent with rejection; instead they showed that the ^{131}I-Hippuran had not progressed to the urinary bladder by 24 min and that there was marked accumulation of the tracer in the region of the renal pelvis (Fig. 2A). At the end of the study the patient asked to stand and void and was allowed to

do so. A repeat scintiphoto immediately after surprisingly revealed progression of the ^{131}I-Hippuran into the urinary bladder and excellent renal parenchymal clearance of the tracer (Fig. 2B). The ^{131}I-Hippuran disappearance half-time and the ^{99m}Tc perfusion studies were normal.

A repeat ^{131}I-Hippuran study was done the following day and revealed a dilated, kinked, S-shaped ureter (Fig. 3A). The patient voided, and again rapid progression of ^{131}I-Hippuran into the urinary bladder was noted, associated with parenchymal clearing of the tracer (Fig. 3B). The dilated, tortuous ureter could still be seen.

It seemed apparent that the kinked, tortuous ureter was compressed or "pinched" between the transplant and the bladder when the bladder was full, producing obstruction to urinary flow. When the patient voided, the decrease in urinary bladder size decompressed the ureter enough to effectively remove the "obstruction".

An infusion intravenous pyelogram confirmed ureteral kinking and dilatation and also revealed marked hydronephrosis (Fig. 4). Surgical repair was accomplished in July 1969, 4 months after transplantation.

DISCUSSION

Vascular thrombosis, acute tubular necrosis, extravasation, ureteral obstruction and rejection are the major threats to the viability of the transplanted kidney in the postoperative period. With the aid of the scintillation camera, radioisotope techniques have been developed that permit accurate evaluation of the renal transplant and successful differentiation between these lesions (*6,8–11*).

These techniques permit dynamic visualization of radioactive compounds as they pass through the renal arteries and the renal parenchyma following intravenous injection. The ^{99m}Tc-pertechnetate is used to assess renal vascular perfusion. It has been used previously in dynamic vascular studies of the brain (*12,13*), heart (*14,15*) and major vessels (*16*), and recently in the functional evaluation of renal transplants (*6,8*). With its short half-life and low body radiation dose, large doses can be used, resulting in extremely good resolution.

Iodine-131-Hippuran measures renal concentrative and excretory function and can be visually monitored with the aid of serial scintiphotos as it passes through the kidney parenchyma into the renal pelvis. It is of great value in differentiating ureteral obstruction and vascular ischemic lesions (*17*). Disappearance half-time reflects renal blood flow and is of great importance in the early detection of transplant rejection (*2,6–8*).

In the present case, fever and a rising serum creatinine appeared to indicate transplant rejection, and increasing doses of azothioprine and prednisone were begun. The ^{131}I-Hippuran study, however, dramatically clarified the situation. Intense accumulation of ^{131}I-Hippuran in the region of the renal pelvis without progression to the urinary bladder was consistent with ureteral obstruction. Tracer appeared in the bladder only after voiding since the full bladder apparently compressed the kinked ureter between the bladder and the transplanted kidney, preventing the free flow of ^{131}I-Hippuran through the ureter. A repeat ^{131}I-Hippuran study outlined the dilated, kinked ureter, which was confirmed by an IVP. Surgical repair was subsequently accomplished.

These studies were done repetitively before the diagnosis was made and after the surgical repair, and proved to be of great value in the management of this patient. It would appear from our experience in this case that the scintillation camera has an important role in the evaluation and clinical management of renal homotransplants.

SUMMARY

A patient who had received a renal homotransplant suddenly appeared to manifest the rejection

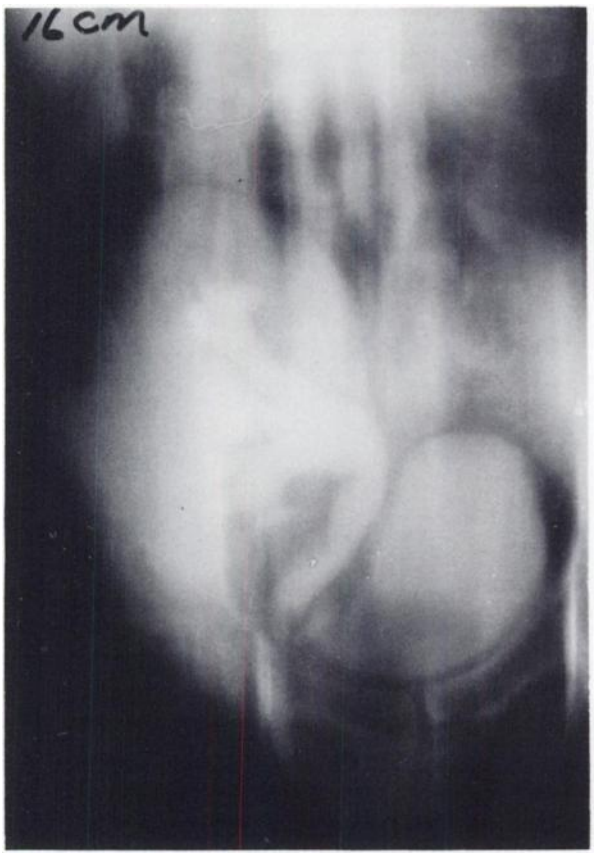


FIG. 4. Intravenous pyelogram showing marked hydroureter and hydronephrosis.

phenomenon, with fever and a rising serum creatinine. Increased doses of azothioprine and prednisone were administered. Dynamic radioisotope studies with the scintillation camera revealed a tortuous, kinked ureter compressed between the bladder and the transplant causing obstruction to urinary flow and severe hydronephrosis.

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