SCINTIPHOTOGRAPHY IN DIAGNOSIS OF URINARY FISTULA AFTER RENAL TRANSPLANTATION

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Scintiphotographic studies in six patients with ureteral fistula following renal transplantation are presented. Images were obtained using ^{99m}Tc-Sn-DTPA or ^{131}I-orthoiodohippurate. Urinary leakage was accurately detected in each case but the pattern of extravasation is highly variable. When carefully performed, radionuclide scintiphotography is a safe and effective method for detecting urinary leakage after renal transplantation.

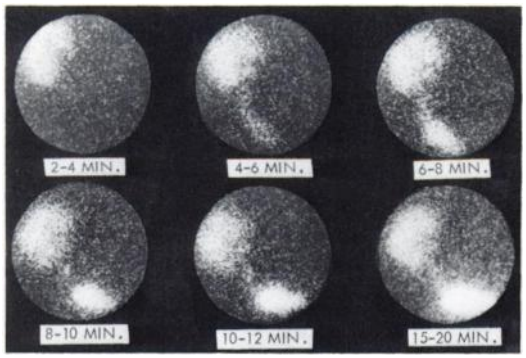

FIG. 1. Normal renal transplant scintigraphic study using ^{131}I-Hippuran. Time after tracer injection is given below each scintiphoto. Kidney in right iliac fossa, ureter, and bladder are seen.

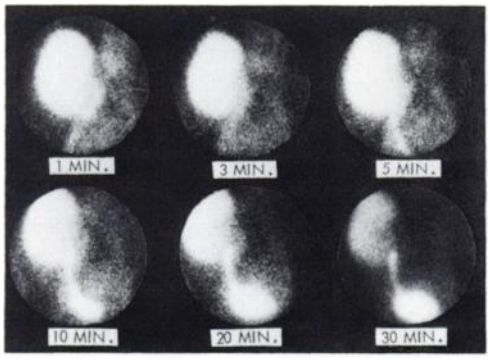

FIG. 2. Normal renal transplant scintigraphic study using ^{99m}Tc-Sn-DTPA.

Extravasation of urine from the ureter or from the ureterovesical junction is now recognized as a common complication of renal transplantation. The incidence of this complication is reported to be approximately 8–30% with a mortality rate of 25–50% (*1,2*). Radionuclide scintiphotography has proven to be a valuable method for evaluating renal transplant function and in differential diagnosis of oliguria following transplantation (*3,4*). This procedure is particularly useful for detecting urinary leakage. We have performed ten scintigraphic studies on six patients with this complication and have found the study abnormal in each case. The appearance of urinary extravasation on radionuclide scintigrams, however, is quite variable and at times is difficult to detect. Presented here are examples of scintigraphic studies showing the varying appearance of urinary extravasation in these patients.

METHOD OF STUDY

The results presented were obtained in adult male patients receiving cadaver or living donor renal transplants. Scintiphotos were made by a Searle Radiographics scintillation camera after intravenous injection of either 150 μCi of radiohippuran (^{131}I-orthoiodohippurate) or 10 mCi of ^{99m}Tc-Sn-DTPA. Patients were all supine with the detector positioned to view the kidney and bladder. When using ^{131}I-Hippuran, 2–5 min scintiphotos were routinely obtained periodically for 20 min. When using ^{99m}Tc-Sn-DTPA, scintiphotos were obtained at approximately 1, 3, 5, 10, 15, and 20 min after injection using a high-resolution, low-energy, parallel-hole collimator. Postvoiding pictures were also obtained in some cases and additional pictures when indicated. Examples of normal studies are shown in Figs. 1 and 2.

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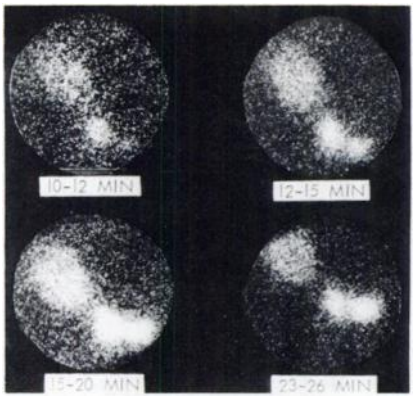

FIG. 3. Renal transplant scintigraphic study of kidney, ureter, and bladder using ^{131}I-Hippuran. Persistent concentration is seen over distal ureter.

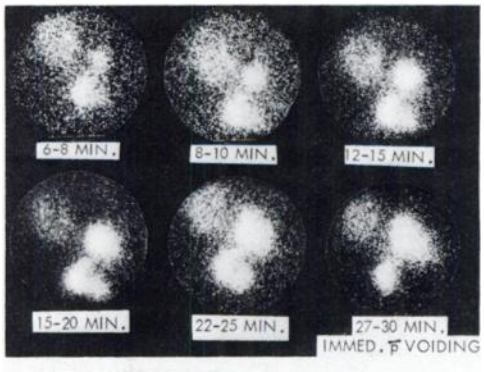

FIG. 4. Same case as in Fig. 3. Large abnormal collection of radioactivity is seen superior to bladder extending from abnormal concentration over distal ureter.

RESULTS

The most common site of leakage by far is the distal ureter or the ureterovesical junction. Initially a small persistent collection of radioactivity appears over the distal ureter adjacent to the bladder, as seen in Fig. 3 obtained 6 days after transplantation. Urine flow is still primarily into the bladder, and at this stage of beginning extravasation the patient may have no symptoms related to urinary extravasation. With increasing leakage, the scintigraphic study will usually develop an obvious abnormal collection of radioactivity as in the repeat study on this patient 2 days later (Fig. 4) when he developed suprapubic pain and decreasing urine output. Cystogram at this time was normal. Some urine is still entering the bladder at this stage as shown by the bladder activity which disappears with voiding. At laparotomy, a small hole was found in the ureter just proximal to the ureterovesical junction, with extensive urinary extravasation.

Figure 5 shows a routine study obtained 4 days after transplantation. At this time, transplant function was good and there were no symptoms of extravasation. A persistent collection is seen over the distal ureter adjacent to the bladder and this suggests early leakage. Six days later the patient developed fever and suprapubic tenderness, and a repeat study was obtained as shown in Fig. 6. The kidney is functioning quite well as evidenced by good concentration and rapid excretion into the bladder. The abnormal collection is no longer seen on the routine pictures and the study would have been considered normal if a postvoiding picture had not been obtained. The postvoiding picture again shows the abnormal collection adjacent to the bladder. Cystogram at that time was normal. Symptoms continued for two more weeks at which time a cystogram showed urinary leakage. At surgical exploration the distal ureter was found to be necrotic with urine extravasation and infection.

Figure 7 shows a study obtained 5 weeks after cadaver transplant because the patient had developed pain in the right lower abdomen and decreasing urine volume. He had also developed swelling and tenderness in the right scrotum attributed to epididymitis. The scintiphotos show good concentration by the kidney with rapid accumulation of radioactivity below the kidney in an area that could be bladder. Later pictures, however, show increasing accumu-

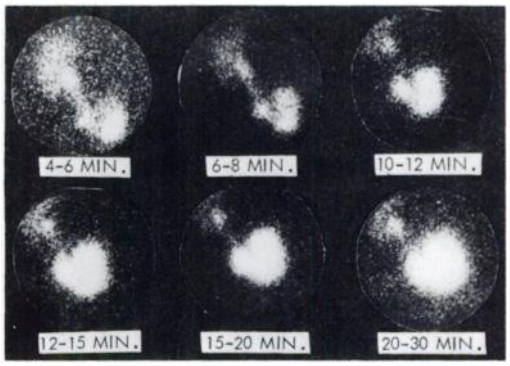

FIG. 5. Renal transplant scintigraphic study of kidney, ureter, and bladder visualized with Hippuran shows persistent collection over distal ureter.

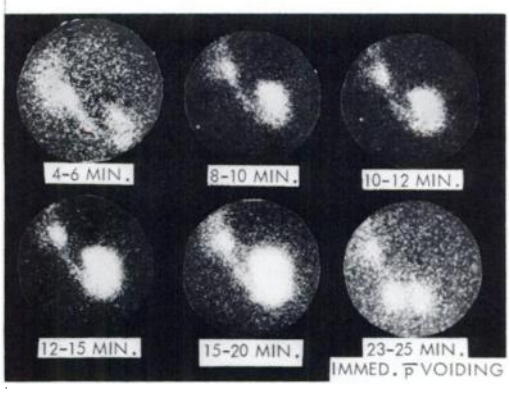

FIG. 6. Same case as in Fig. 5. Abnormal collection over distal ureter seen only after voiding.

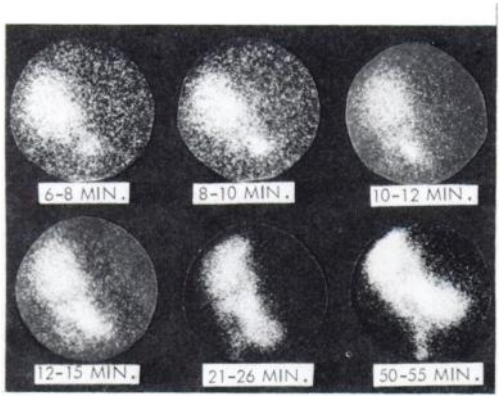

FIG. 7. Early renal transplant scintiphotos show concentration in kidney and ureter. In later pictures radioactivity is seen to extend laterally from ureter and then inferiorly along spermatic cord into right scrotum.

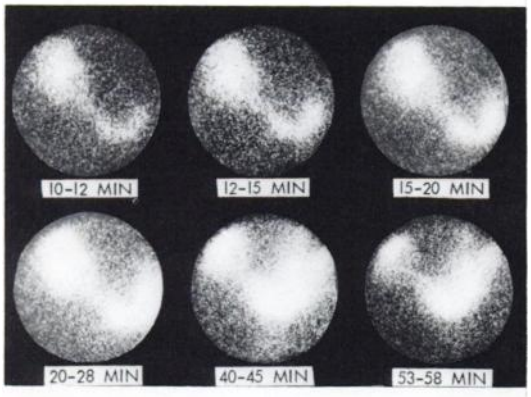

FIG. 8. Same case as in Fig. 7. Tracer is seen to escape from distal ureter with spreading collection in pelvis.

lation along the course of the ureter with extension of radioactivity laterally below the kidney and then inferiorly along the spermatic cord into the scrotum. An intravenous pyelogram at that time was of poor quality but failed to reveal a leak. Cystogram was normal. Repeat study on this patient 3 days later (Fig. 8) shows an entirely different pattern of extravasation. Again there is rapid accumulation in an area which could be bladder. The shape is unusual for bladder, however, and later pictures show this to be extravasated radioactivity in the pelvis that spreads far beyond the bladder area. At operation the next day, the distal ureter was necrotic with massive urinary extravasation.

Figure 9 shows scintiphotos of a transplant using technetium-labeled tin-DTPA. This tracer is excreted exclusively by glomerular filtration. This study was obtained 1 month after transplantation when the patient developed vague lower abdominal pain. Rapid excretion into the ureter is seen and into the area of the bladder. The shape of this collection is distorted, however, and is eventually shown to be outside of the bladder by its persistence after voiding. Cystogram and retrograde pyelogram the same day confirmed the ureteral leak. At exploration a necrotic area was found in the ureter 2 cm proximal to the bladder with a large amount of extravasated urine.

Figure 10 shows scintiphotos obtained 14 days after transplantation using ^{131}I-Hippuran. The transplant had functioned poorly and was thought to have acute rejection. After initial visualization of the kidney, the detector was positioned so that the kidney was at the upper margin of the field of view in order to include the bladder. There is good concentration by the kidney and radioactivity promptly appears in the ureter. There is persistent and increasing concentration in the ureter area but no excretion into the bladder. The initial 30-min study on this patient suggested ureteral obstruction. Later pictures were thought to show some radioactivity extending outside of the renal pelvis. When the detector was repositioned to image the surrounding area, it was evident that there was leakage of urine extending superiorly. At surgical exploration there was a dilated necrotic ureter with massive extravasation.

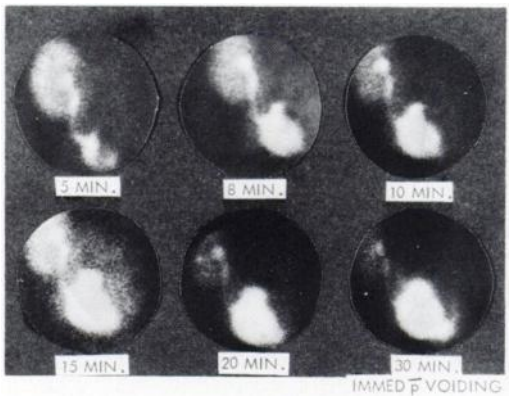

FIG. 9. Renal transplant scintigraphic study of kidney, ureter, and bladder using ^{99m}Tc-Sn-DTPA shows progressive leakage around distal ureter.

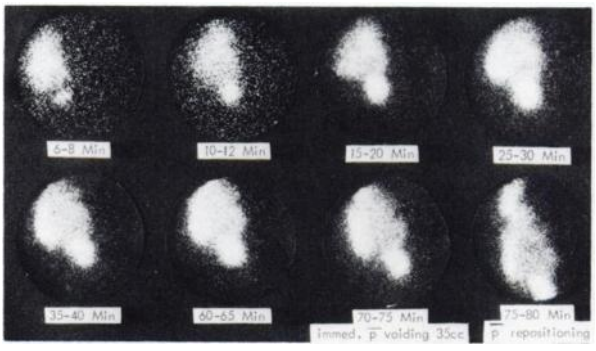

FIG. 10. Concentration of Hippuran is seen in the kidney and just inferior to kidney. After change of position, tracer extravasation is recognized around and superior to kidney.

DISCUSSION AND CONCLUSIONS

Radionuclide scintiphotography is a safe and effective method of detecting urinary leakage following renal transplantation. Intravenous pyelogram in our experience has not been as dependable because of the poor contrast excretion frequently present in these patients. Cystogram is diagnostic only if the leak is from the bladder or if ureteral reflux is obtained. Successful scintigraphic studies may be obtained with either ^{131}I-Hippuran or ^{99m}Tc-Sn-DTPA. The technetium tracer allows better definition when the transplanted kidney is functioning well but may be unsatisfactory if kidney function is poor. Hippurate may provide satisfactory images despite poor renal function. If the study is normal, it may be completed in 20–30 min. However, each case must be considered individually and additional pictures must be obtained to evaluate fully any abnormality. A postvoiding picture should be obtained routinely since this may be necessary to show early extravasation or to confirm bladder activity. Late pictures at 1–2 hr and lateral views may be helpful in some cases. When carefully performed, radionuclide scintiphotography appears to be the method of choice in detection of post-transplant urinary extravasation.

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