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RELIABILITY OF RENAL IMAGING OBTAINED INCIDENTALLY IN ^{99m}Tc-POLYPHOSPHATE BONE SCANNING

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Technetium-99m-polyphosphate is probably the current agent of choice for bone imaging, and satisfactory renal imaging can be obtained during whole-body bone scanning because the kidneys excrete ^{99m}Tc-polyphosphate. In our experience, renal images noted during bone scanning with ^{99m}Tc-polyphosphate are of diagnostic quality.

Technetium-99m-polyphosphate has recently been introduced as a bone scanning agent (*1–3*), and it is probably the current agent of choice for bone imaging. The localization of ^{99m}Tc-polyphosphate in the skeletal system is similar to other bone-seeking radionuclides, and 43–53% of the administered dose was localized in the skeleton of normal rabbits (*2*). The mode of excretion is through the urinary tract, thus affording excellent images of the kidneys at the time of bone scanning.

Recently patients undergoing ^{99m}Tc-polyphosphate bone scanning at our institution were noted to have abnormal renal images. These abnormalities were confirmed, thus suggesting that renal lesions may be accurately imaged during bone scanning with this agent.

METHODS

Technetium-99m-polyphosphate is prepared from a sterile, pyrogen-free kit manufactured by Diagnostic Isotopes Inc. and New England Nuclear Co. The procedure involves adding ^{99m}Tc-pertechnetate solution to a premixed vial of polyphosphate and stannous chloride and then mixing for 1–2 min. Scanning is started 3 hr after the intravenous injection of 10 mCi of ^{99m}Tc-polyphosphate on an Ohio-Nuclear Model 84 dual 5-in. scanner with 5:1 minification using maximum speed of 750 cm/min. Whole-trunk or total-body scanning including kidneys and bladder in both anterior and posterior projections is completed in approximately 30–45 min.

RESULTS

Nine out of 52 patients who underwent ^{99m}Tc-polyphosphate bone scanning showed abnormal renal findings that were proven to be accurate on subsequent intravenous pyelograms. Abnormal renal find-

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FIG. 1. Normal renal image. Posterior scan shows normal kidneys in size, shape, position, and contour. Arrow points to radioactivity in Texas urosheath.

ings include displacement of the kidney (2), unilaterally poor functioning kidney (2), nonfunctioning kidney (1), hydronephorosis, hydroureter (2), renal cyst (1), and hypernephroma (1).

The following cases are representative examples.

Normal renal image. Figure 1 is a posterior scan on an 18-year-old boy who was having pain in his back and urinary incontinence. Bone scan is normal and both kidneys are normal in size, shape, and position.

Poor functioning kidney. JB is a 44-year-old man who had a bone scan because of pain in his back and right hip. In September 1969, he had a cystectomy and bilateral ureteroileostomy for carcinoma of the urinary bladder. The scan showed a poorly functioning left kidney and metastatic lesions in the pedicle of the L5 on the right side, right sacral wing, and the right proximal femur (Fig. 2).

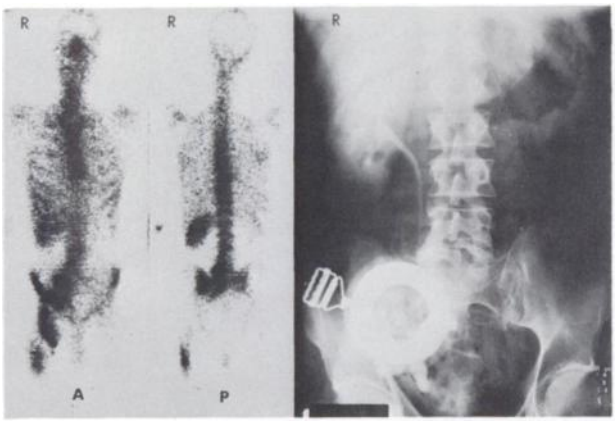

FIG. 2. Poorly functioning kidney. Anterior scan reveals radioactivity in ileal conduit in right pelvis and in collecting bag in region of right hip. Posterior scan shows poor visualization of left kidney and intravenous pyelogram confirms poorly functioning left kidney.

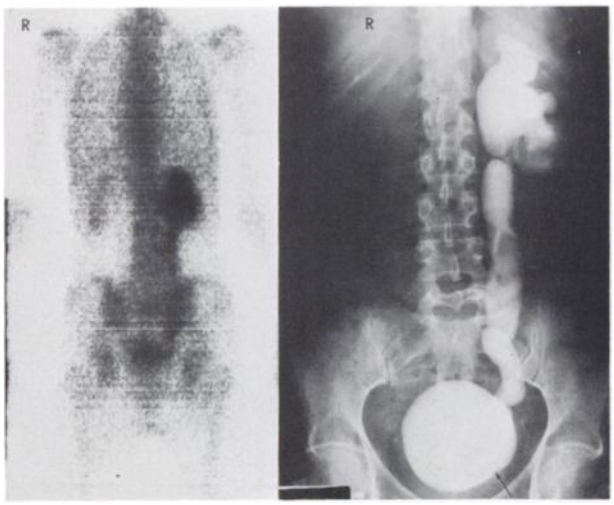

FIG. 3. Hydronephrosis and hydroureter. Posterior scan reveals no bone metastasis but hydronephrosis and hydroureter on left with poor renal function on right is apparent. Subsequent intravenous pyelogram documents hydronephrosis and hydroureter secondary to two stones obstructing ureterocele (arrow) and poor visualization of right kidney.

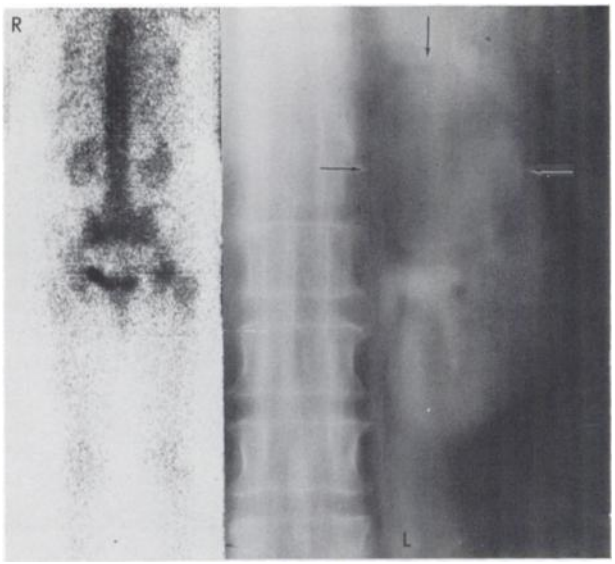

FIG. 4. Surgically proven benign renal cyst. Posterior scan shows discrete defect in upper pole of left kidney and increased uptake in region of left hip secondary to arthritis. Nephrotomogram of left kidney confirms cyst (arrows) in upper pole.

Hydronephrosis and hydroureter. GK is a 60-year-old woman who had a past history of an endometrial sarcoma and a bone scan was done because of pain in the upper thoracic region. She did not have any genitourinary complaints and the blood urea nitrogen was normal at the time of bone scanning. The scan failed to reveal bony metastasis but left hydronephrosis and hydroureter were found (Fig. 3). A subsequent intravenous pyelogram the following week showed the same finding secondary to two stones obstructing an ureterocele.

Space-taking lesions. TS is a 74-year-old woman who had a bone scan because of pain in the left hip and thigh. A mass lesion was noted in the upper pole of the left kidney (Fig. 4) and a renal cyst was found at surgery. Increased uptake in the region of the left hip is due to arthritis. A similar mass lesion in the upper pole of the right kidney on a 36-year-old man was subsequently proven to be a hypernephroma at surgery.

DISCUSSION

Renal excretion occurs probably as a simple phosphate and the cumulative renal excretion up to 3 hr on rabbits ranged between 45–50% (*1*). Usually, renal radioactivity would not interfere with the skeletal imaging of the lumbar spine. However, it is very difficult to interpret the pelvic areas when the urinary bladder is filled with urine containing large amounts of radioactivity. To avoid this problem, the

patient voids just before the scan and the scanning is started from bottom to top.

Radiation dose to the kidneys is 890 mrads per 10 mCi ^{99m}Tc-polyphosphate assuming 50% of an injected dose in the kidneys and renal disappearance by physical decay alone (*4*). To decrease radiation dose to the kidneys and bladder, hydration, and frequent voiding are recommended to the patient.

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