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-
ings include displacement of the kidney (2), unilater-
ally poor functioning kidney (2), nonfunctioning
kidney (1), hydronephrosis, 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 po-

tion.

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 car-
cinoma of the urinary bladder. The scan showed a

FIG. 2. Poorly functioning kidney. Anterior scan reveals radio-
activity 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 re-
veals no bone metastasis but hydronephrosis and hydroureter on
left with poor renal function on right is apparent. Subsequent in-
travenous pyelogram documents hydronephrosis and hydroureter
secondary to two stones obstructing ureteroceles (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.

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).

Hydronephrosis and hydroureter. GK is a 60-
year-old woman who had a past history of an en-
dometrial 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 follow-
ing week showed the same finding secondary to two
stones obstructing an ureteroceles.

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 phos-
phate 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 mrad 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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REFERENCES

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