RENAL IMAGING IN ^{99m}Tc-POLYPHOSPHATE BONE SCANNING: FOCAL INCREASED RENAL UPTAKE IN METASTATIC CARCINOMA OF LUNG

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A small group of patients with normal intravenous urograms showed focal increased renal uptake, usually unilateral, of ^{99m}Tc-polyphosphate. All had documented metastatic squamous cell carcinoma of the lung. The combination of focal increased renal ^{99m}Tc-polyphosphate uptake with normal intravenous urogram occurred in no other patients.

A recent report emphasized the diagnostic reliability of renal images obtained incidentally in ^{99m}Tc-polyphosphate bone scanning (*1*). An analysis of the renal images in the first 100 ^{99m}Tc-polyphosphate bone scans performed in our laboratory shows excellent correlation between the renal images and the intravenous urograms in patients with abnormal renal images. However, a small group of patients showing focal areas of increased ^{99m}Tc-polyphosphate renal uptake had normal intravenous urograms. All patients in this group had metastatic squamous cell carcinoma of the lung. This group is described in this paper.

METHODS AND MATERIALS

The 100 patients included were studied for a variety of conditions including suspected or documented soft-tissue malignancies, osteomyelitis, Paget's disease of bone, fibrous dysplasia, renal osteodystrophy, spinal compression fractures of indeterminate age, and unusual radicular extremity pain. Fifteen millicuries of ^{99m}Tc-polyphosphate (New England Nuclear Corp. kit) was administered intravenously in all patients. Imaging started 180 min after injection. A Searle Radiographics Pho/Gamma HP scintillation camera with the low-energy high-resolution collimator was utilized and the skeletal images were recorded on Polaroid or 70-mm film. All patients were imaged in the recumbent position and all patients with abnormal renal images had intravenous urograms within 14 days of the bone scan.

RESULTS

Fifteen of the 100 consecutive patients studied had abnormal renal images. Twelve of 15 patients with a variety of abnormal renal images had abnormal intravenous urograms confirming the image finding. Only the remaining three patients with abnormal renal images showed focal areas of increased renal nuclide uptake. These patients had normal intravenous urograms and all had documented metastatic squamous cell carcinoma of the lung (Figs. 1, 2, and 3). Focal areas of increased renal uptake with normal intravenous urograms occurred in no other patients. The abnormal renal image and intravenous urogram findings are summarized in Table 1.

DISCUSSION

Technetium-99m-polyphosphate is excreted primarily by the kidneys (*2,3*), and renal images are incidentally obtained during bone imaging with this radiopharmaceutical (*4*). A previous report noted nine patients with abnormal renal images in a group of 52 patients who had ^{99m}Tc-polyphosphate bone scans. The renal image abnormality was confirmed by intravenous urography in all nine patients (*1*). None of these nine patients showed focal increased renal uptake. Several other reports mention renal image abnormalities in ^{99m}Tc-polyphosphate bone scanning but focal increased renal uptake is not described (*5,6*). Fluorine-18 is also excreted by the kidneys and, although abnormal renal images during bone scanning with this agent have been reported, focal increased renal uptake of ^{18}F is not mentioned (*7,8*).

The cause of the focal increased renal uptake of ^{99m}Tc-polyphosphate in the three patients in the

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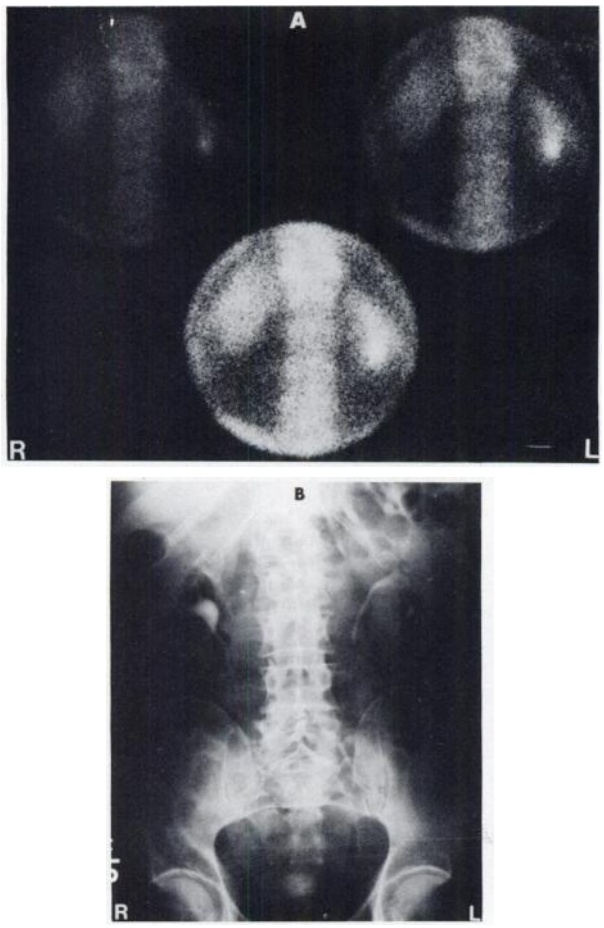

FIG. 1. Case 1. Posterior scan (A) and normal intravenous urogram (B). Focal uptake is demonstrated in left kidney. Vertebral metastases are evident.

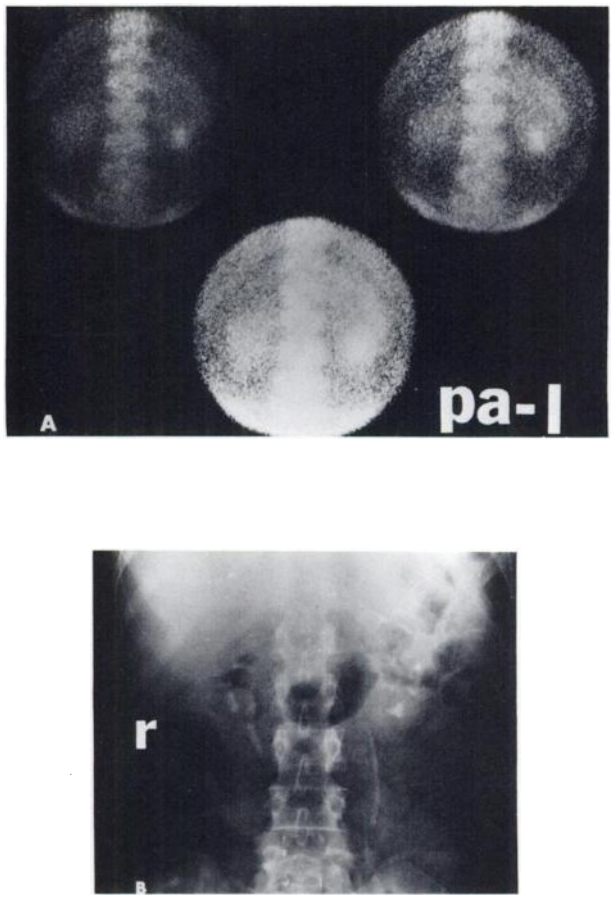

FIG. 2. Case 2. Scan showing unilateral focal uptake in left kidney (A). Intravenous urogram (B) is normal. Note similarity to Case 1.

present study is certainly not clear. An increasing number of reports describe extraosseous soft-tissue concentration of the ^{99m}Tc bone-scanning agents in a wide variety of conditions, including neoplasms (*9–20*). Renal metastases of lung carcinoma occur in up to 17.5% of patients and are often solitary (*21,22*). Perhaps renal metastases were present in these patients and caused focal soft-tissue binding of the polyphosphate complex. Unfortunately, autopsy or renal biopsy confirmation could not be obtained for these patients. No delayed polyphosphate images were obtained beyond the initial images at 3 hr after injection and no patients were scanned with other renal-imaging agents. However, all three patients had normal intravenous urograms including upright films for evaluation of kidney drainage. Localized areas of pooling in obstructed renal collecting systems would therefore seem to be ruled out. All had normal serial BUN and serum creatinine determinations and all had a normal urinalysis. There were no signs or symptoms of urinary tract disease in these patients. Since none of these patients showed uptake of the

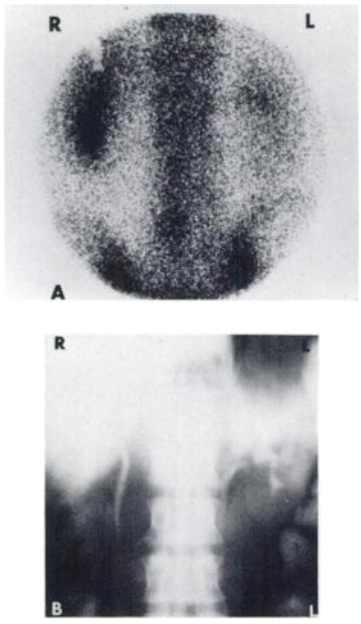

FIG. 3. Case 3. Focal uptake is shown in both kidneys (A). Intravenous urogram (B) is not technically optimal but is grossly normal.

TABLE 1. SUMMARY OF ABNORMAL RENAL SCANS AND INTRAVENOUS UROGRAM FINDINGS

Patients (No.)	Scan	Intravenous urogram
3	Focal increased uptake, normal renal size, documented metastatic squamous cell carcinoma of lung	Normal
4	Unilateral absent renal uptake	Absent or nonfunctioning kidney
3	Generalized unilateral increased uptake, normal renal size	Obstructed kidney
3	Generalized unilateral increased uptake, small renal size	Small obstructed "end stage" kidney
1	Normal uptake, small renal size	Small kidney—? ischemic
1	Focal increased uptake, normal renal size	Dilated upper calyx

nuclide in thyroid or salivary glands, the focal increased renal concentration is apparently not related to free ^{99m}Tc.

Of the 100 patients included in this study, only one other patient, who did not have carcinoma of the lung, showed an area of focal increased uptake at the upper pole of the right kidney. The intravenous urogram, however, was abnormal; there was marked dilatation of the upper calyx and infundibulum (Table 1). There was pooling of the contrast in this dilated calyx on the upright film.

The 15% incidence of abnormal renal images in the present mixed group of patients is in good agreement with the 17% incidence of the previously mentioned report (*1*). The significance of the 3% incidence of focal increased renal uptake of the polyphosphate complex described in this report is not definite. Since this finding was seen only in patients with metastatic carcinoma of lung and normal urograms, it may prove to be of some diagnostic importance.

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