UROLOGY

DIAGNOSTIC VALUE OF ROUTINE BONE SCINTIGRAPHY RENAL IMAGING IN RENAL CELL CARCINOMA

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ABSTRACT—Technetium-99m-phosphate compounds used in bone scanning are excreted by the kidney, and excellent renal images can be obtained on routine bone scintigrams. The preoperative bone scans of 49 patients who underwent radical nephrectomy for renal cell carcinoma between 1981 and 1985 were reviewed for renal imaging. Ninety-four percent of the patients had abnormal bone scan renal images (82% had focal decreased uptake, and 12% had focal increased uptake). Six percent of the renal images were symmetrical bilaterally. When bone scans are employed in the postoperative follow-up of patients with renal cancer, they can be used to assess the status of the remaining kidney.

Bone scans have proved to be more sensitive in the detection of bone metastases than conventional x-ray studies.[1] For this reason bone scans are used routinely in the diagnostic workup of renal cell carcinoma. The technetium-99m-phosphate compounds used for bone scanning are excreted by the kidneys and often yield excellent renal images. Unsuspected renal abnormalities can be detected on renal images obtained during a routine bone scan.[2] Several authors have reported results of renal images obtained incidentally during routine bone scanning.[3-7] These studies were nonselective retrospective reviews of bone scans over a period of time, and only a few cases of renal cell carcinomas, presenting as a focal decreased uptake on the renal images, were reported in each study. We reviewed preoperative bone scans in 49 patients with known renal cell carcinomas. The review findings are reported.

Material and Methods

From 1981 to 1985, 49 patients at the University of Michigan Medical Center had radical nephrectomy for renal cell carcinomas. All patients had preoperative routine bone scans which were reviewed. The bone scans were obtained three to four hours after intravenous administration of 10–15 mCi of ^{99m}Tc-stannous-phosphate compounds (polyphosphate, pyophosphate, and diphosphate). The images were obtained with a rectilinear scanner.

The bones scans were reviewed independently of the radiographs and correlated retrospectively. Renal uptake of ^{99m}-Tc-phosphate compounds were considered to be normal when it was symmetrical, homogenous, and sufficient to allow adequate visualization of both kidneys. Abnormal images were categorized as focal decreased uptake or focal increased uptake, then correlated with radiographs and surgical specimens. The size of the tumor images on the bone scans were also measured and compared with the actual tumor size obtained from the surgical specimens.

Results

The mean age of the 49 patients was sixty-one years, with a range from thirty-five to eighty-one. There were 32 men and 17 women.

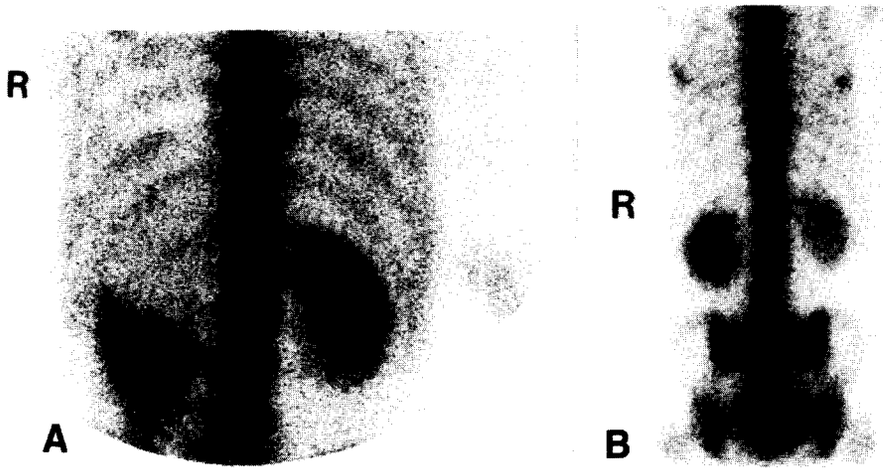

FIGURE 1. *(A) ^{99m}Tc bone scan of thirty-five-year-old woman with right upper pole hypernephroma showing decreased uptake and caliceal distortion. (B) Sixty-one-year-old woman with large hypernephroma involving upper two thirds of right kidney with perinephric and renal vein extension of tumor. No hydronephrosis noted on IVP or ultrasound. Bone scan showed increased uptake of right kidney, especially the upper two thirds of kidney.*

Staging of the 49 patients according to the Robson system are as follows: 21 (43%) patients had Stage 1 tumors without capsular invasion, 9 (18%) patients had Stage 2 with perinephric extension, 13 (27%) had Stage 3 with venous or lymphatic extension, and 6 (12%) had Stage 4 with distant metastases.

Abnormal bone scan renal images were found in 46 of 49 patients (94%). Focal decreased uptake was seen in 40 (82%), and focal increased uptake was observed in 6 (12%). Three of the 49 patients (6%) had normal and symmetrical scans.

Figure 1A and B are examples of decreased uptake of radionuclide and increased uptake of radionuclide on bone scan, respectively. The mean size of the tumors in the focal decreased uptake group and focal increased uptake group were 7 cm and 8 cm, respectively (Table I). The smallest tumor visualized was 2 cm in the decreased uptake group. In the symmetrical group, the mean actual tumor size was only 4 cm (3.5–4.5 cm).

Of the 49 patients 6 (12%) had evidence of metastatic disease preoperatively; 2 patients had evidence of bone metastases only. Fifteen (30%) of the patients had postoperative follow-up bone scans. Two new cases of bone metastases were discovered. No renal cell carcinomas in the remaining kidneys were discovered with bone scans or other radiologic modalities.

TABLE 1. *Tumor size*

Renal Image Findings	No. of Patients	Mean Size	Range (cm)
Focal decreased uptake	40 of 49	7 cm	2–15
Focal increased uptake	6 of 49	8 cm	3–15
Symmetrical	3 of 49	4 cm	3.5–4.5

Comment

The incidental discovery of renal abnormalities on routine bone scans has been described in the literature.[1-8] Demonstration of absent renal activity, small kidneys, displaced kidneys, focal decrease in renal activity (mass lesions), and hydronephrosis are reliably detected on bone scans.[6] When renal images are considered to be normal on routine bone scan, the level of confidence is 98 percent that the kidneys are normal. When the renal images show some abnormalities, the level of confidence is 84 percent that the kidneys are abnormal.[5]

In our patients with renal cell carcinomas we noted 94 percent abnormal renal images on preoperative bone scans. The mean actual tumor size was 7 cm and 8 cm in the decreased uptake and increased uptake group, respectively, as compared with only 4 cm in the symmetrical group. Because bone scan images are usually 1/6–1/10 of the actual body size, the evaluation of small changes in parenchymal density are more difficult. The finding of three symmetrical normal scans in our study may be due to the small size of these tumors.

It is unclear why 12 percent of the patients with abnormal scans had increased intensity instead of the decreased activity seen in the majority of the scans. The two groups were similar in mean tumor size, pathologic histology, staging, and vascularity and the absence of obstruction by the tumor. It is important for clinicians to be aware that renal tumors can present either as increased or decreased activity on bone scan renal imaging.

While we do not advocate the use of bone scans in the workup of renal masses, our data indicate that renal tumors can be detected on routine bone scans in 94 percent of cases, a

number comparable with excretory urography or renal ultrasound.[9] Renal abnormalities should be looked for when bone scans are employed for other reasons and appropriate studies instituted if they are found. Another use may be in the follow-up of the remaining kidney in patients with renal cell carcinoma treated surgically. If bone scanning is employed in the follow-up of these patients in an effort to detect bony metastases, the renal images obtained may provide adequate follow-up of the remaining kidney, eliminating the need for excretory urography or other methods of renal imaging. Comparison with preoperative bone scan renal images should provide sensitivity similar to that seen in this study.

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