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Unifocal Bone Findings by Scintigraphy

Clinical Significance in Patients With Known Primary Cancer

ALLAN H. RAPPAPORT, MD, *San Francisco*, PAUL B. HOFFER, MD, *New Haven, Connecticut*, and HARRY K. GENANT, MD, *San Francisco*

Preliminary findings suggest that in patients with known primary cancer, a large percentage of unifocal lesions seen on radionuclide bone scans are not metastatic. In a survey of radionuclide bone studies done on 861 consecutive patients, 30 patients with known primary cancer had solitary lesions. Adequate follow-up information was available on 21 of these 30 patients. In only four did the lesions prove to be caused by metastatic malignancy.

ONCOLOGISTS increasingly rely on radionuclide bone scans to determine the presence of osseous metastases in patients with malignant disease. It is of utmost importance, therefore, to know whether lesions seen on the scans of such patients are due to metastatic disease. The purpose of our study was to review *solitary* abnormalities seen on bone scan to determine how often these findings were caused by metastatic versus benign lesions.

Patients and Methods

At our institution between July 1, 1974, and June 30, 1975, 861 bone scans were done. All studies were carried out using approximately 15 millicuries of pyrophosphate Tc 99m injected intravenously about three hours before scan. Anterior and posterior whole body images were obtained using either a dual probe 5 inch sodium-iodine crystal rectilinear scanner (Ohio Nuclear 84D) or an Anger camera with scanning table

(Searle Radiographics Pho Gamma IV). All scans were interpreted by an experienced physician in nuclear medicine. The clinical report recorded at the time of the study served as the basis for determining if a solitary lesion was present. All bone scan reports for this period were reviewed. All positive reports describing a solitary lesion were selected for further evaluation.

Of all scans, 63 (7.3 percent) showed a solitary lesion. Of these solitary lesions, 30 occurred in patients being evaluated for osseous metastases and serve as the primary study group for this report.

Eighteen of the 30 patients were male and 12 were female. The median age was 60 years with a range of 14 to 82. In 21 of these patients a probable cause of the scan finding was determined by radiograph, laboratory data, biopsy, clinical observation for at least 18 months or a combination of these methods.

In the remaining nine patients follow-up information was inadequate to establish the cause of the positive scan finding. This group included two patients who had undergone radiation or chemotherapy for presumed metastatic disease based on the scan finding and clinical symptoms.

From the Department of Radiology, Section of Nuclear Medicine, and Division of Radiation Oncology, University of California, San Francisco. Dr. Hoffer is now with Yale University School of Medicine.

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Reprint requests to: Paul B. Hoffer, MD, Department of Diagnostic Radiology, Yale University School of Medicine, 333 Cedar Street, New Haven, CT 06510.

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Three patients died within one month of scan and no histologic confirmation of the suspected osseous lesion was obtained. In the remaining four patients clinical follow-up was inadequate although in one of these patients with a solitary area of uptake in the humeral head region a diagnosis of "bursitis" was recorded in the clinical record.

Results

The solitary bone scan lesion was proven to definitely represent metastatic disease in only four patients. In 17 patients the lesion proved to be due to an incidental benign disorder (8 patients) or no further evidence was found to confirm a metastatic lesion after a follow-up period of at least 18 months. These results are summarized in Table 1. The bone scans of five of this group of 17 patients are shown in Figures 1 through 5.

Discussion

Radionuclide, skeletal imaging is particularly useful in evaluating the cases of patients with known primary cancer before they undergo definitive therapy. Its popularity has increased as a result of the introduction of effective, low-cost, bone-seeking radiopharmaceuticals, such as pyrophosphate TC 99m and concurrent improvements in imaging equipment.¹

The greater sensitivity of scintiscans compared with conventional radiographs in the detection of metastatic disease is well documented.²⁻⁶ The percentage of false negative scans in large series was found to be invariably less than 5 percent; for radiographs, the percentage of false negative studies typically exceeded 10 percent. However, despite its greater sensitivity, the bone scan when used alone as an indicator of osseous metastasis lacks specificity.⁷⁻¹³ It is important to be aware of the lack of specificity of the bone scan because confirmation of metastatic disease frequently alters therapy.

It has been our clinical impression that solitary scan lesions in patients with known malignancy must be carefully evaluated to avoid potentially harmful overstaging. This impression is confirmed by the results of this study. It is often difficult to confirm a specific metastatic lesion in a patient with known malignancy once a presumed diagnosis of metastasis has been made. In our series, however, only four of 21 confirmed solitary lesions were due to metastatic disease. Even if the remaining 9 patients with inadequate follow-up were presumed to have lesions due to metastasis, the overall incidence of positive solitary lesions due to metastatic disease would be 13 of 30 patients, less than 50 percent.

These results confirm the previously reported

TABLE 1.—Twenty-one Patients With Diagnosis of Malignancy and Solitary Bone Lesion on Scan

<i>Site of Primary Lesion</i>	<i>Histologic Diagnosis</i>	<i>Site of Positive Scan Finding</i>	<i>Cause</i>
Skin	Malignant melanoma	Right rib	Metastasis
Skin	Malignant melanoma	Left rib	Unknown, no clinical evidence of metastasis 18 months after scan
Skin	Malignant melanoma	L3 vertebra	Paget disease
Skin	Malignant melanoma	Right femur	Enchondroma
Skin	Malignant melanoma	Right foot	Unknown, no clinical evidence of metastasis 18 months after scan
Skin	Malignant melanoma	Left femur	Bone island
Breast	Adenocarcinoma	L3 vertebra	Metastasis
Breast	Adenocarcinoma	Left femur	Bone infarct
Breast	Adenocarcinoma	Right knee	Degenerative disease
Breast	Adenocarcinoma	Costicervical junction	Degenerative disease
Breast	Adenocarcinoma	T9-10 vertebra	Degenerative disease
Lung	Poorly differentiated carcinoma	Left rib	Metastasis
Bone	Osteosarcoma	Left humerus	Metastasis
Hypopharynx	Squamous cell carcinoma	Right rib	Unknown, clinically normal 18 months after scan
Hypopharynx	Squamous cell carcinoma	Left clavicle	Postsurgical, clinically normal 18 months after scan
Oropharynx	Squamous cell carcinoma	Right calvarium	Unknown, clinically normal 18 months after scan
Rectum	Adenocarcinoma	Left rib	Unknown, clinically normal 18 months after scan
Stomach	Adenocarcinoma	Left rib	Unknown, clinically normal 18 months after scan
Brain	Malignant melanoma	Left clavicle	Paget disease
Endometrium	Adenocarcinoma	Left sacroiliac joint	Unknown, clinically normal 18 months after scan
Lymphatic	Well differentiated lymphoma	Right mandible	Unknown, clinically normal 18 months after scan

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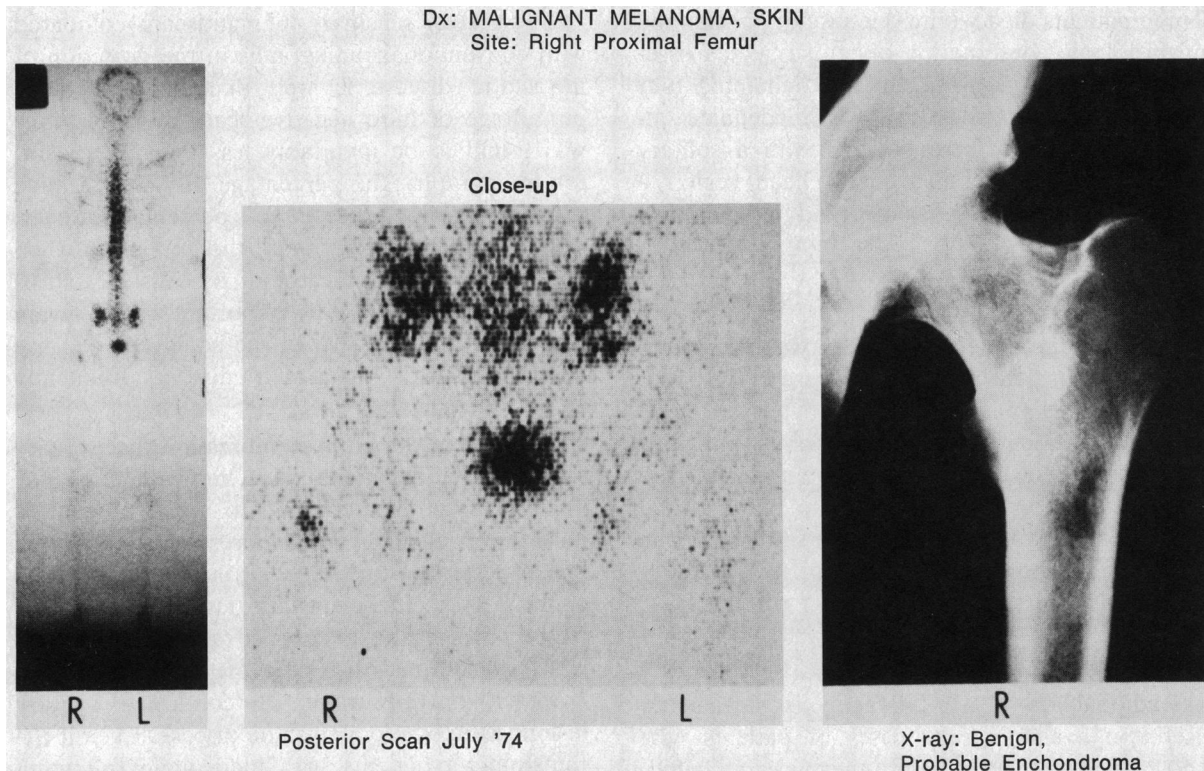


Figure 1.—Bone scan of a 43-year-old man with malignant melanoma of the skin. A single focus of increased radioactivity is seen in the right proximal femur. The radiograph's appearance typified that of a benign lesion, probably an enchondroma.

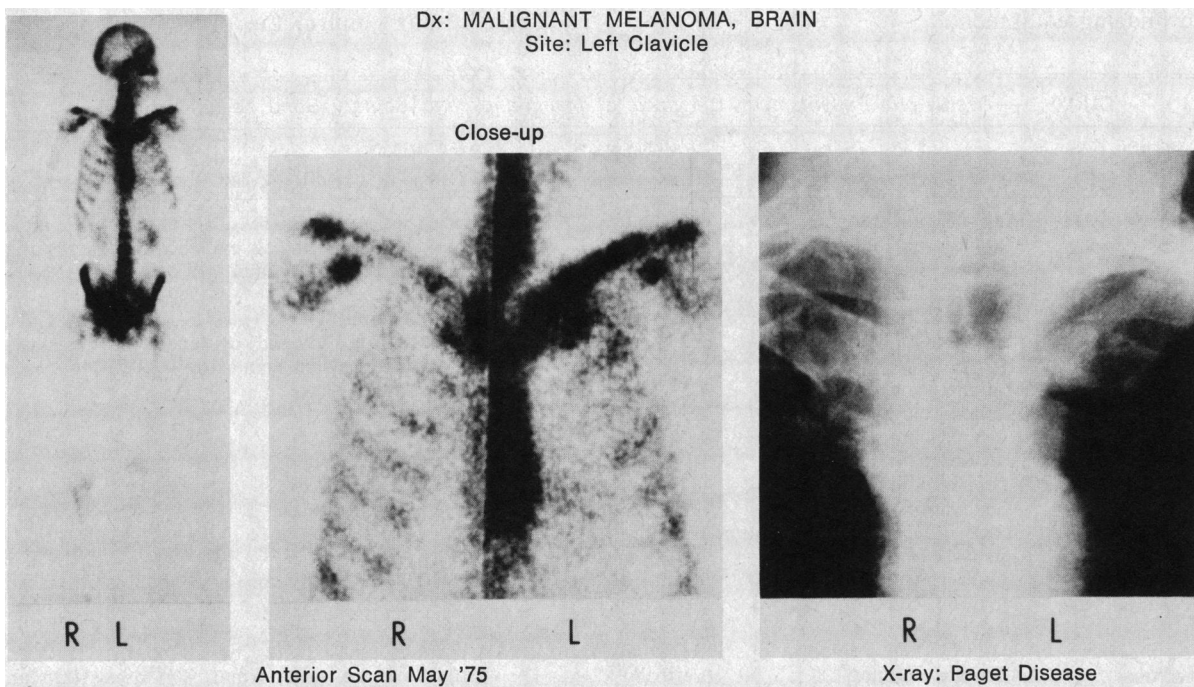


Figure 2.—Bone scan of a 74-year-old man with malignant melanoma of the brain. There is increased activity involving the left clavicle. The radiograph showed cortical thickening, classic of Paget disease.

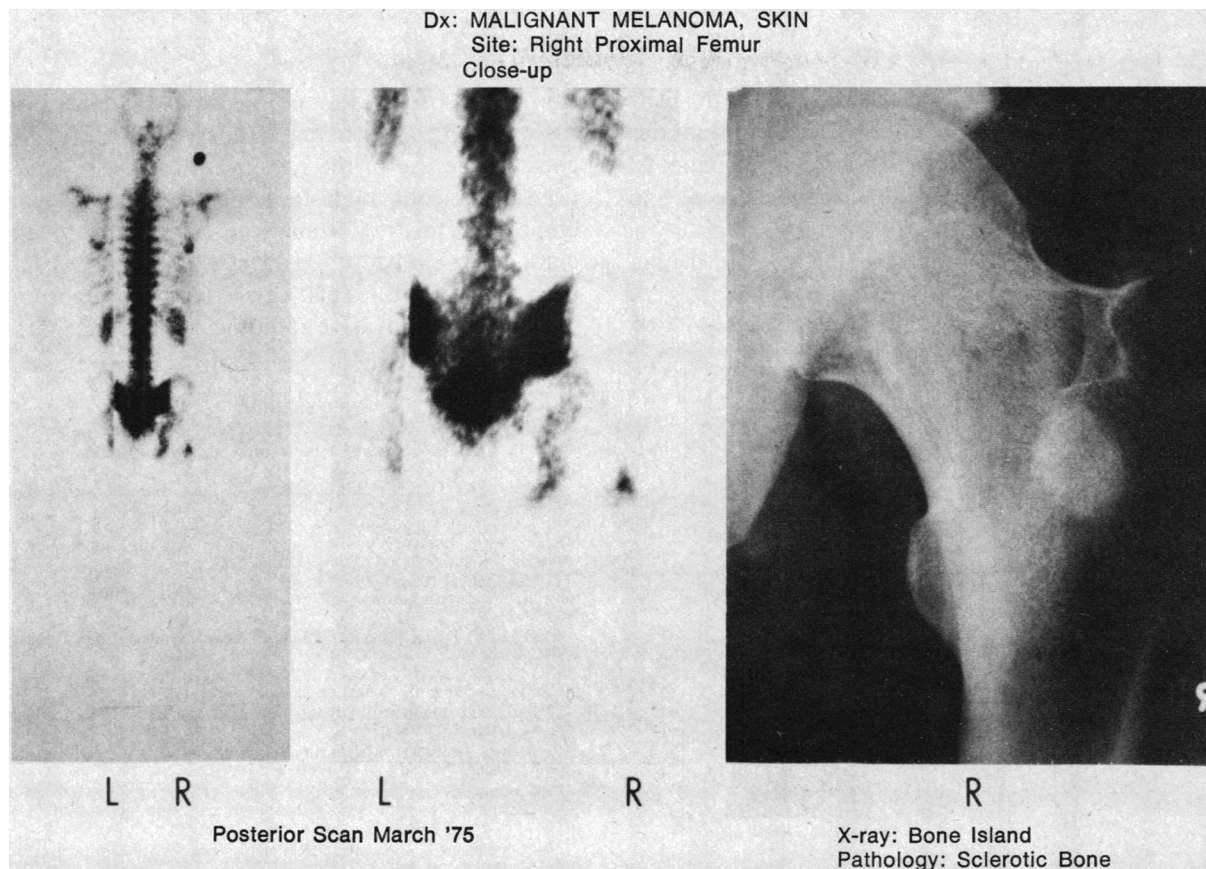


Figure 3.—Bone scan of a 32-year-old man with malignant melanoma of the skin. A single focus of increased radioactivity is seen in the right proximal femur. The radiograph showed a lesion indicative of a bone island. Biopsy of the area showed sclerotic bone. Because bone islands are not thought to be positive on scan, this unusual case has been separately reported.¹⁴

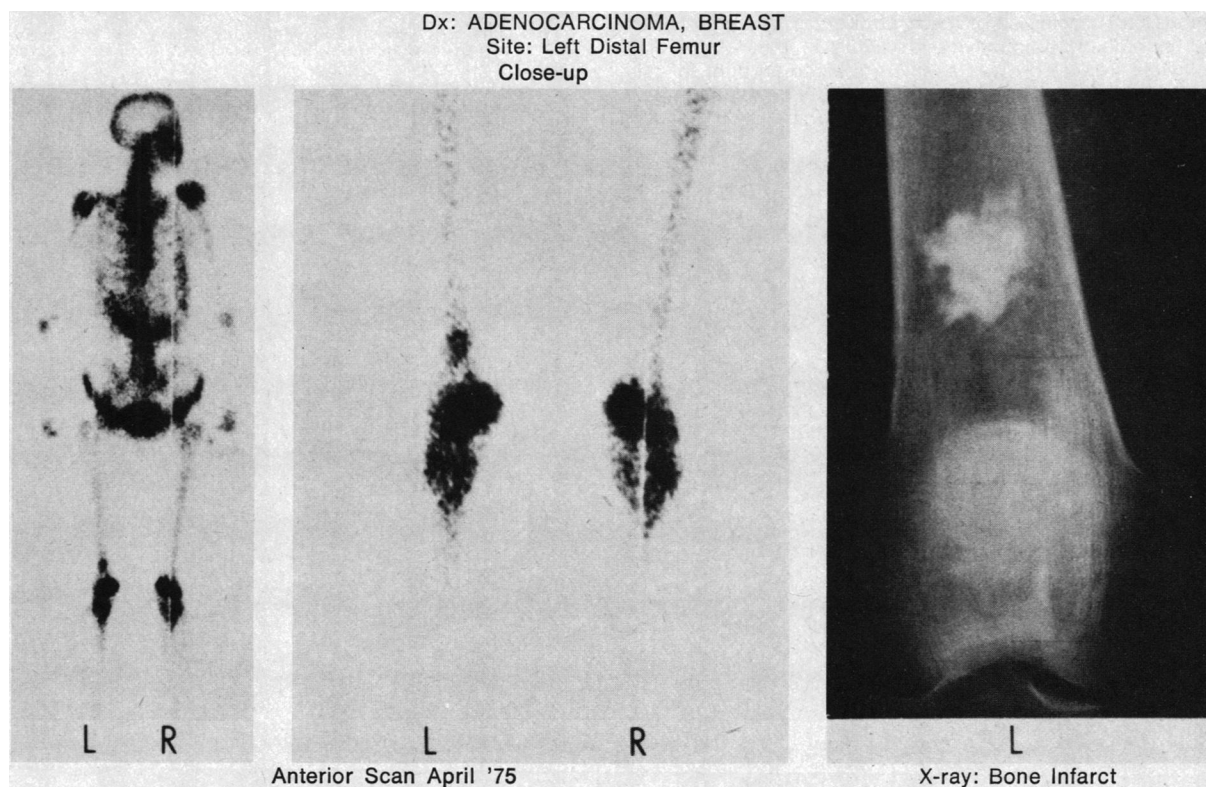


Figure 4.—Bone scan of a 67-year-old woman with adenocarcinoma of the breast. A single focus of increased radioactivity is seen in the left distal femur. The radiograph showed a bone infarct.

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findings of Corcoran and associates.¹⁵ In their investigation of 172 solitary scan abnormalities they were able to confirm the cause in 90 patients. Only 64 percent of these 90 lesions were due to metastatic disease.

The surprisingly high incidence of benign

causes of solitary lesions on bone scan even in patients with known malignancy should *not* discourage the use of the bone scan for early detection of osseous metastasis. Rather it serves to emphasize the importance of attempting to exclude a benign cause for such a lesion once it has been discovered. This can usually be accomplished by noninvasive radiologic or other laboratory methods.

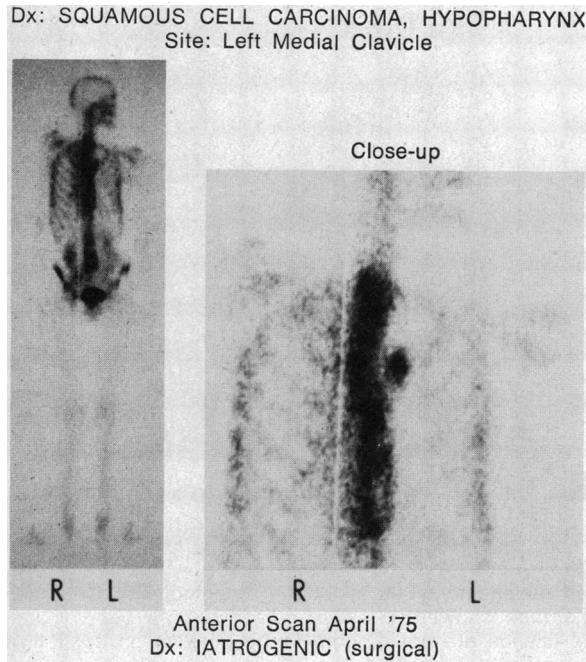


Figure 5.—Bone scan of a 57-year-old man with squamous cell carcinoma of the hypopharynx. A single focus of increased radioactivity is visible in the left medial clavicle. No lesion was seen on the radiograph. In this patient radical dissection of the left side of the neck had been carried out before scanning.

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