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EFFICACY OF SKULL IMAGING IN ROUTINE BONE SCANNING

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The frequency of abnormal skull images in patients undergoing ^{99m}Tc-Sn-diphosphonate bone imaging has been reviewed. In 181 patients with known malignant tumors, 47% had abnormal scans of the axial skeleton and 28% had abnormal skull images. Only 2 of these 181 patients had abnormal skull images and a normal scan of the axial skeleton. In 38 patients with benign disorders the skull image was abnormal in 6, all with Paget's disease. No patient with a benign disorder had skull involvement alone.

Bone scanning is a sensitive means to detect and determine the extent of skeletal metastatic disease (*1–5*). Bone scan abnormalities are often apparent prior to radiographic changes. In many previous studies of bone scan accuracy employing ^{85}Sr, ^{87m}Sr, or ^{18}F, routine imaging has been limited to the axial skeleton (*2,4*). With the increasing availability of whole-body imaging devices and of high-photon yield ^{99m}Tc-labeled bone-seeking radiopharmaceuticals, whole-body imaging has been recommended to increase the yield of the study. Recently, it has been suggested that skull metastases are common in patients with breast carcinoma and may represent the first area of involvement (*6*). To evaluate the efficacy of routine skull imaging we reviewed a series of 219 consecutive bone scans each of which included scintillation camera images of the skull.

METHODS

Two-hundred-nineteen bone scans were performed during the 3-month period reviewed (November 1973–January 1974). All patients were scanned 3–4 hr after intravenous administration of 15 mCi of ^{99m}Tc-Sn-diphosphonate. The patients were encouraged to drink water and asked to void prior to scanning. A dual 12.7-cm crystal rectilinear scanner was used with 2:1 minification of the image. A count density of at least 750 counts/cm^2 was obtained. The routine axial skeleton scan extended from the proximal femurs to the shoulders. Both lateral and anterior skull images were obtained with a scintillation camera. The axial skeleton and skull images were separately interpreted as normal or abnormal and the results were compared.

RESULTS

Most of the scans in this series (83%) were requested in patients with known malignant tumors in order to detect metastatic skeletal involvement (Table 1). Of the patients with known malignancy, 47% had abnormal axial skeleton images and 28% had abnormal skull images. Only two patients with abnormal skull images had normal images of the axial skeleton. In patients with benign disorders, the axial skeleton images were abnormal in 34%. Abnormal skull images in these patients were found only in those with Paget's disease, all of whom also had abnormal images of the axial skeleton.

Axial skeletal abnormalities were found in 50% of patients with prostatic carcinoma, in 44% with breast carcinoma, and in 41% with lung carcinoma. The skull images were abnormal in 25% of patients with breast and prostatic carcinoma and slightly less often (14%) in those with lung carcinoma. Of the two patients with normal axial skeleton images and abnormal skull images, one had breast carcinoma and one had epidermoid carcinoma of the vagina. The latter patient had a repeat bone scan 6 months after the initial study which again demonstrated the

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TABLE 1. COMPARISON OF AXIAL SKELETON AND SKULL IMAGING

Diagnosis	Axial skeleton normal		Axial skeleton abnormal		Total
	Skull normal	Skull abnormal	Skull normal	Skull abnormal	
Malignant tumors	94	2	37	48	181
Breast carcinoma	30	1	11	13	55
Lung carcinoma	17	0	8	4	29
Prostate carcinoma	12	0	6	6	24
Unknown primary	6	0	4	7	17
Lymphoma–leukemia	6	0	2	3	11
Miscellaneous tumors	23	1	6	15	45
Benign lesions	25	0	7	6	38
Paget's disease	0	0	2	6	8
Miscellaneous	25	0	5	0	30

skull lesion and showed new areas of axial skeletal metastatic disease. Followup was not available in the patient with breast cancer.

DISCUSSION

Bone scanning has been demonstrated to be a sensitive method of detecting metastatic skeletal disease (*1–5*). Although some previous studies have included skull images, the frequency of isolated skull abnormalities was not discussed (*1,3*). Galasko (*3*) found abnormal skull images with ^{18}F in 44% of patients with advanced breast carcinoma. Hopkins and Kristensen (*6*) recently reported that skull abnormalities were present in addition to other osseous metastases in 16/31 patients (53%) with breast cancer imaged with ^{99m}Tc radiopharmaceuticals. A skull abnormality was the first evidence of skeletal metastatic disease in 32% of their patients. As noted in Table 1, 25% (14/55) of the breast carcinoma patients in our series had evidence of skull metastases; the skull abnormality was the sole evidence of skeletal metastatic disease in only one of our patients.

Our results suggest that routine skull images in addition to axial skeletal images are of limited value. Although skull metastases are detected in many patients, we found only two patients with abnormal skull images and normal axial skeleton images in a group of 219 consecutive patients. Detection of additional metastases in the skull will usually not alter patient management unless the skull lesions are symptomatic. In patients with malignant tumors and normal images of the axial skeleton, additional images of the skull are indicated because the results may then alter management.

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