INCREASED LOCALIZATION OF ^{99m}Tc-PYROPHOSPHATE IN A BONE ISLAND: CASE REPORT

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A positive ^{99m}Tc-pyrophosphate bone scan is reported in a proven case of large compact bone island. Pyrophosphate uptake in this case is presumed to be due to either large size or growth of the bone island. A radionuclide bone scan does not always differentiate bone islands from metastatic or inflammatory sclerotic bone lesions.

Bone islands are foci of compact lamellar bone located within normal spongiosa (*1*). They produce sclerotic well-defined intramedullary densities on radiographs (*1–4*). The increased localization of bone-scanning agents in a variety of sclerotic bone lesions is well known (*5–7*), but uptake in a bone island has not been described previously. Radionuclide bone scanning has been suggested as a means of differentiating bone islands from osteoblastic metastases and other lesions with focally increased bone density (*8–10*), since this distinction cannot always be made by radiography (*4*). The present case shows that a bone island can, however, also show increased uptake of ^{99m}Tc-pyrophosphate and that scintigraphic differentiation of bone islands from other sclerotic bone lesions is therefore not as reliable as previously reported.

CASE REPORT

A 32-year-old white man was admitted with an enlarged left supraclavicular lymph node. Biopsy showed metastatic malignant melanoma. Two years previously a pigmented lesion, thought to be a junctional nevus, had been excised from his left cheek. Retrospective histologic examination resulted in a revised diagnosis of malignant melanoma, superficial spreading type.

Physical examination was normal except for firm nontender left anterior cervical adenopathy. Three hours after intravenous administration of 15 mCi of ^{99m}Tc-pyrophosphate, anterior and posterior whole-body scans and a scintiscan of the right hip were obtained. These showed a focal area of increased activity in the posterior intertrochanteric region of the right femur (Figs. 1 and 2A). Conventional and high-resolution magnification radiographs were then obtained, showing a 3-cm ovoid area of increased

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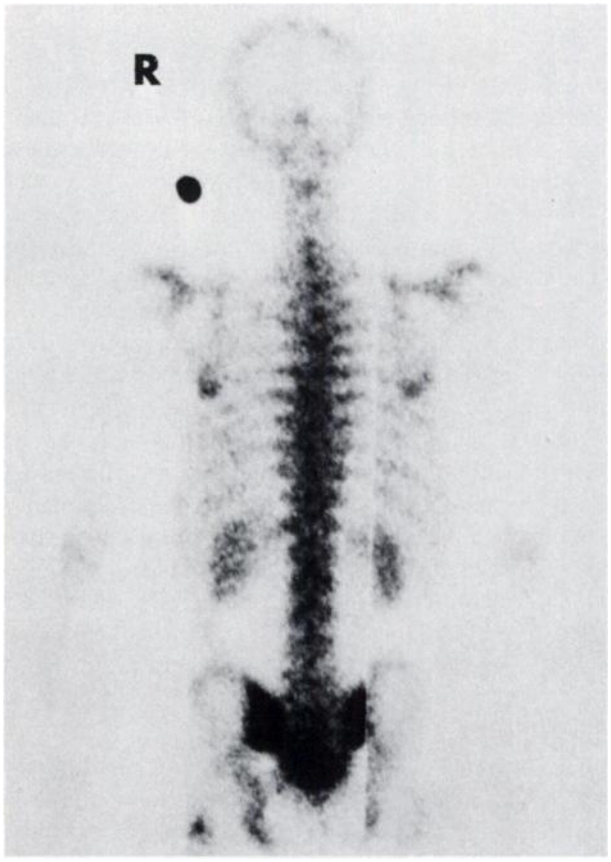

FIG. 1. Portion of whole-body scan, posterior projection, taken 3 hr after intravenous administration of 15 mCi of ^{99m}Tc-pyrophosphate. Note single area of increased uptake in intertrochanteric region of right femur.

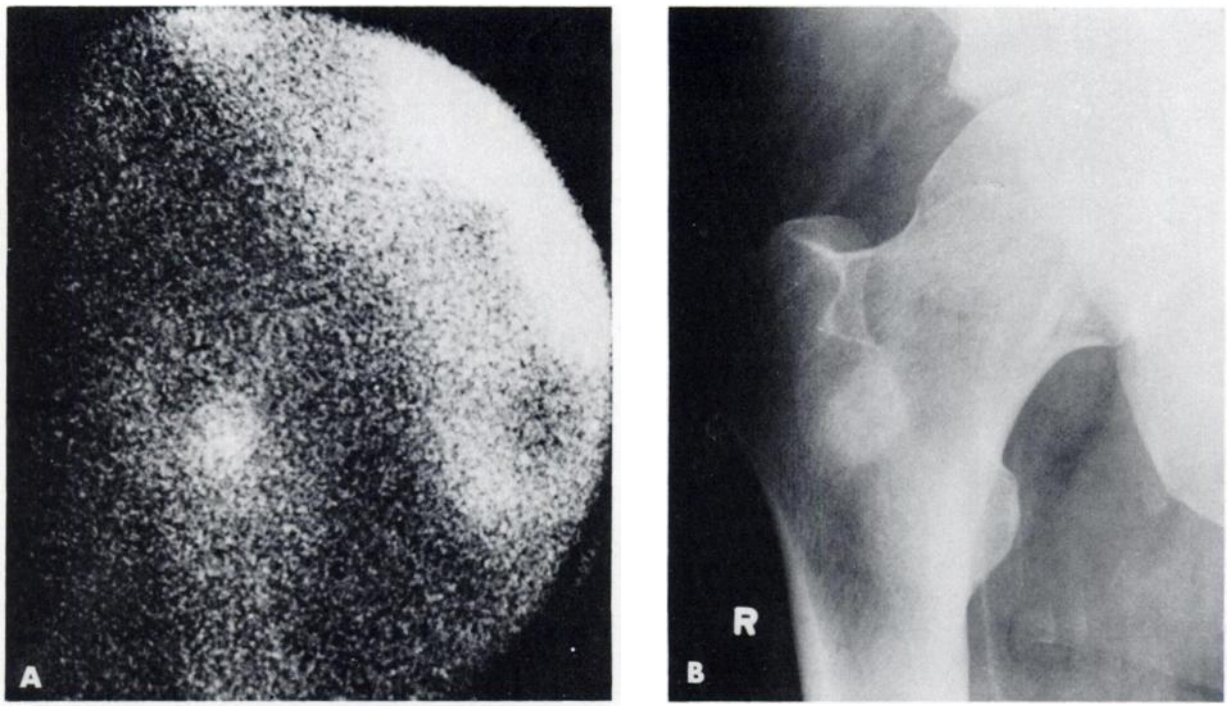

FIG. 2. (A) Scintiscan of right hip, posterior projection, again shows focal area of increased uptake in intertrochanteric region. (B) Direct magnification (3×) radiograph of proximal right femur shows 3-cm ovoid sclerotic lesion in identical location, oriented along axis of main trabecular architecture. It has fairly well-defined margins, no sclerotic rim or lytic areas, and no periosteal new-bone formation. Trabeculae extend from spongiosa into and through sclerotic lesion.

bone density in the same region, with features characteristic of a bone island (Fig. 2B). Despite a thorough search, no other sites of possible metastasis were found.

The positive bone scan seemingly contradicted the radiographic impression of a bone island. Because skeletal metastases from malignant melanoma can be sclerotic (*11,12*), and because the presence of distant bony metastasis would require treatment different from the left radical neck dissection otherwise indicated, a closed biopsy of the sclerotic intramedullary lesion in the right femur was undertaken using biplane radiographic monitoring. This produced fragments of sclerotic compact bone, the margins of which had thickened trabeculae radiating into the surrounding normal spongiosa. There was no evidence of brown pigment or tumor cells. The diagnosis of bone island was thus established and left radical neck dissection was subsequently performed.

DISCUSSION

The skeletal uptake of technetium-tagged phosphorus compounds (*13–15*) is thought to be due primarily to increased regional blood flow (*16*). Thus, the usual absence of focal bone-scan abnormality in bone islands (*5*) has been attributed to uniform regional blood flow resulting from presumed metabolic inactivity (*9*). Actually, the pathophysiology of bone-island formation and persistence is unknown (*1,4*), as is the vascular anatomy (*17*). However, as a bone island forms, it would seem that increased new bone production should occur (*1*), presumably accompanied by increased regional blood flow. Extensive microcirculation in cortical compact bone (*17*) and penetration of compact bone by ^{99m}Tc-polyphosphates (*18*) have been reported. Growth in bone islands has been documented radiographically (*2,3*). Under such circumstances a bone island might be expected to show increased radionuclide uptake, which led us to the conclusion that the scintigraphic findings in the present case indicate active bone-island growth.

Another factor that would account for the scintiscan detection of this lesion is its size. While most bone islands are less than 1 cm in diameter (*4*), the lesion in the present case was 3 cm in diameter. Its volume would be about 27 times that of the average bone island. Since radionuclide uptake is roughly proportional to the volume of such a lesion, the effect of any small incremental uptake in bone-island tissue would be greatly enhanced by the size of the lesion.

The distribution of bone islands either actively growing or greater than 1 cm in diameter in the adult population is unknown (*2*) but probably small (*3,4*). Similarly, the distribution of bone islands

producing positive bone scans in adults is likely to be small. Nonetheless, a bone island can show increased uptake on a bone scan and a large or growing bone island should be included in the differential diagnosis of any sclerotic bone lesion that is positive on scan.

REFERENCES

1. KIM SK, BARRY WF: Bone island. *Am J Roentgenol Radium Ther Nucl Med* 92: 1301–1306, 1964

2. BLANK N, LIEBER A: The significance of growing bone islands. *Radiology* 85: 508–511, 1965

3. KIM SK, BARRY WF: Bone islands. *Radiology* 90: 77–78, 1968

4. SMITH J: Giant bone islands. *Radiology* 107: 35–36, 1973

5. DENARDO GL, VOLPE JA: Detection of bone lesions with the strontium-85 scintiscan. *J Nucl Med* 7: 219–236, 1966

6. HÖR G, FREY KW, KEYL W, et al: Vergleich von Szintigraphie und Röntgendiagnostik bei Osteomyelitis. *Fortschr Geb Roentgenstr Nuklearmed* 110: 708–716, 1969

7. MCCOMBS RK, OLSON WH: Positive ^{18}F bone scan in a case of osteoid osteoma: Case report. *J Nucl Med* 16: 465–466, 1975

8. CHARKES ND, SKLAROFF DM: The osseous system. In *Clinical Scintillation Scanning*, Freeman LM, Johnson PM, eds, New York, Hoeber, 1969, p 367

9. CHARKES ND: Diagnosis of skeletal system disease. Bone scanning. In *Nuclear Medicine*, 2nd ed, Blahd WH, ed, New York, McGraw-Hill, 1971, p 479

10. SERAFINI AN: The skeletal system. In *Practical Nuclear Medicine*, Ashkar FS, ed, New York, Medcom, 1974, p 116

11. SELBY HM, SHERMAN RS, PACK GT: A roentgen study of bone metastases from melanoma. *Radiology* 67: 224–228, 1956

12. STEINER GM, MACDONALD JS: Metastases to bone from malignant melanoma. *Clin Radiol* 23: 52–57, 1972

13. SUBRAMANIAN G, MCAFEE JG, BELL EG, et al: ^{99m}Tc-labeled polyphosphate as a skeletal imaging agent. *Radiology* 102: 701–704, 1972

14. PEREZ R, COHEN Y, HENRY R, et al: A new radiopharmaceutical for ^{99m}Tc bone scanning. *J Nucl Med* 13: 788–789, 1972

15. CASTRONOVO FP, CALLAHAN RJ: New bone scanning agent: ^{99m}Tc-labeled 1-hydroxy-ethylidene-1,1-disodium phosphonate. *J Nucl Med* 13: 823–827, 1972

16. GENANT HK, BAUTOVICH GJ, SINGH M, et al: Bone-seeking radionuclides: An in vivo study of factors affecting skeletal uptake. *Radiology* 113: 373–382, 1974

17. BROOKES M: *The Blood Supply of Bone. An Approach to Bone Biology*, London, Butterworths, 1971, pp 92–122

18. TILDEN RL, JACKSON J, ENNEKING WF, et al: ^{99m}Tc-polyphosphate: Histological localization in human femurs by autoradiography. *J Nucl Med* 14: 576–578, 1973