

Bone Agent Localization in Hepatic Metastases

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We present the bone scintigrams of two patients, which demonstrate diffuse extraosseous uptake of a bone agent in metastatic masses in the liver, one from a primary lung tumor and one from a primary breast tumor. The bone imaging agent did not localize in the brain metastases in these patients. CTs of the abdomen in both patients showed massive metastases in the liver with multiple areas of tumor necrosis. The CT of the abdomen of the breast cancer patient showed multiple small hepatic calcifications. Autopsy revealed massive tumor necrosis with calcifications in the enlarged liver. In routine bone scintigraphy, diffuse uptake of bone agents in the liver of a patient with a known malignancy should be considered suggestive of massive hepatic metastases.

Key Words: bone imaging; hepatic metastases

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Bone scintigraphy using ^{99m}Tc phosphonate compounds is an important diagnostic tool for pathological conditions of the skeleton and comprises at least one third of the daily nuclear medicine workload. When the findings of bone scans are interpreted, incidental nonosseous localization of bone imaging agents is not observed infrequently, especially in the right upper-abdominal region (1–3). A common cause for the localization of bone imaging agents in the liver is the presence of metastatic deposits from lung carcinoma, breast carcinoma, colon carcinoma and osteosarcoma (1,2,4). We present the case histories of two patients with hepatic metastases and cerebral metastasis; one was from lung carcinoma and the other from breast carcinoma. Both patients had diffuse localization of a bone agent in their liver metastases but not in their brain metastases.

CASE 1

A 62-y-old man was admitted to the hospital because of hepatomegaly. A CT of his chest showed a 4.1-cm mass in the right middle lobe of the lung (Fig. 1A), and a CT of the abdomen showed numerous lower-density lesions of various

sizes throughout the enlarged liver. Some of the lesions had a lower density in the center, a finding indicating central necrosis (Fig. 1B). A CT of the head showed a deep-seated enhancing lesion in the right parietal lobe adjacent to the falx (Fig. 1C). A bone imaging study showed a linear lesion in the left chest wall (4th rib laterally) and diffuse liver uptake (Fig. 2). The biopsy of the liver confirmed metastatic small-cell carcinoma from the lung.

CASE 2

A 30-y-old woman had a segmental mastectomy of the left breast and dissection of the left axillary lymph nodes for moderate to poorly differentiated infiltrating ductal carcinoma of the left breast. The tumor was Grade II to Grade III and was estrogen-receptor negative and progesterone-receptor positive. None of 23 axillary lymph nodes contained cancer cells. Physical examination demonstrated massive ascites and marked hepatomegaly. A CT of the abdomen (Fig. 3) showed multiple hepatic metastases with multiple calcifications. A CT of the head showed multiple enhancing lesions. Two bone scans, performed 6 mo apart, yielded identical results and showed no abnormal radiotracer localization in the skeletal system. They did, however, show a diffuse increase in the right side of the abdomen extending to the right kidney, which showed downward displacement (Fig. 4). A liver biopsy confirmed metastatic, poorly differentiated adenocarcinoma. After the mastectomy, the patient had local irradiation, 5000 rads with a 1000-rad boost to the scar area. She then had chemotherapy with Adriamycin for the metastatic disease. The patient died 3 wk after the second bone scan. Autopsy findings showed that the liver weighed 3630 g (normal 1500 g). Most of the liver had been replaced by necrotic tumor nodules, and less than 10% of the liver maintained a relatively normal appearance. Microscopic examination revealed many areas of metastases with extensive tumor necrosis. Postmortem examination of the brain revealed multifocal cerebral and cerebellar metastases with no evidence of tumor necrosis.

DISCUSSION

Massive hepatic necrosis, other than that caused by massive hepatic metastases, resulting in diffuse hepatic uptake of a bone

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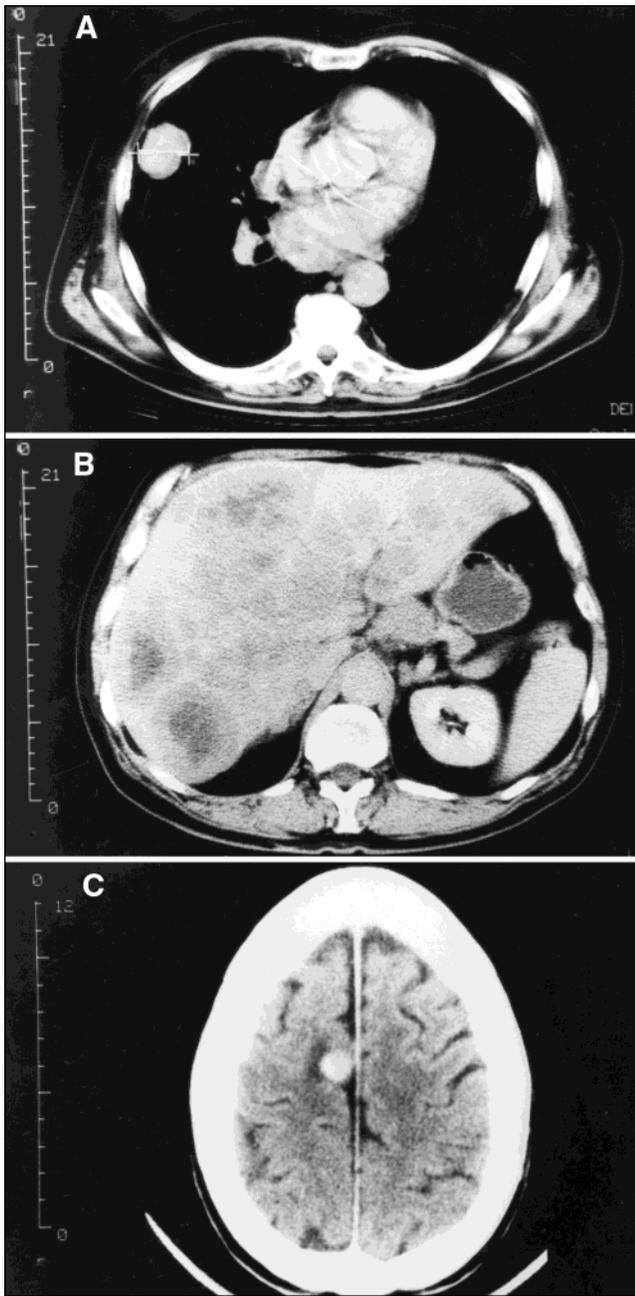


FIGURE 1. (A) CT of the chest showing a mass measuring 4.1 cm in diameter in the right middle lobe. (B) CT of the abdomen showing numerous low-density lesions of various sizes throughout the enlarged liver. Some have a lower-density center, indicating central necrosis. (C) CT of the head showing an enhancing lesion in the deep right parietal lobe adjacent to the falx.

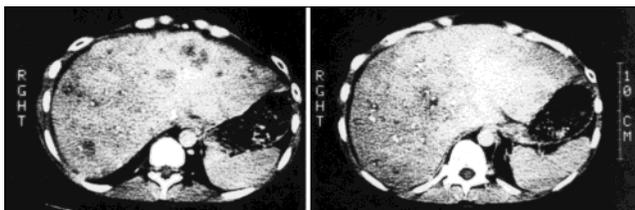


FIGURE 3. CT of the abdomen showing multiple metastatic deposits in the liver with multiple foci of calcifications.

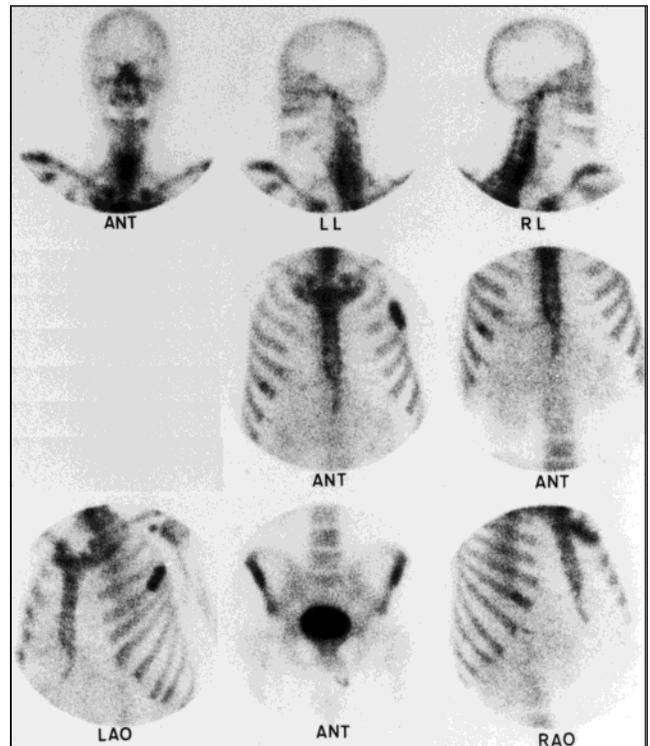


FIGURE 2. Technetium-99m-HMDP bone images showing an intense linear uptake in the left fourth rib laterally and diffuse uptake in the right upper abdomen corresponding to the enlarged liver. The bone imaging agent is not localized in the brain lesion or primary lung carcinoma.

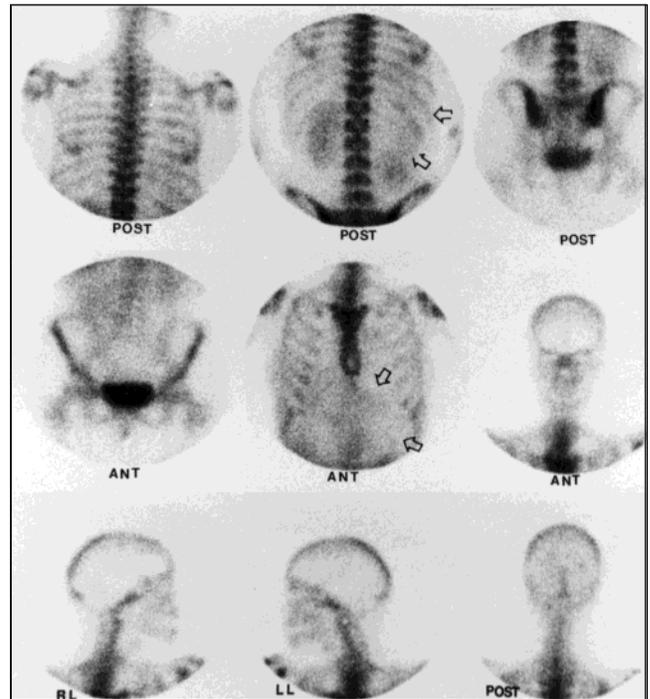


FIGURE 4. Technetium-99m-HMDP bone images showing diffuse uptake (open arrows) in the right abdomen corresponding to the liver. No bone agent localization was seen in the brain lesion.

imaging agent has been reported (5–7). Diffuse hepatic uptake in the liver also has been reported to accompany acute duodenal bleeding and hypotension (8), cocaine abuse (9), osteosarcoma treated with methotrexate (10), and hypoxia caused by respiratory failure (11). One should be aware that localization of a bone imaging agent in the liver, as a response to hypoxia of the liver tissue, is nonspecific for hepatic metastases. Nevertheless, in routine bone scintigraphy, diffuse uptake in the liver of a patient with a known malignancy should be considered suggestive of massive hepatic metastases.

REFERENCES

1. Shih WJ, Domstad PA, Lieber A, et al. Localization of ^{99m}Tc -HMDP in hepatic metastases from colonic carcinoma. *AJR*. 1986;146:333–336.
2. Gentili A, Miron SD, Belon EM. Nonosseous accumulation of bone-seeking radiopharmaceuticals. *Radiographics*. 1990;10:871–881.
3. Shih WJ, Coupal JJ, Domstad PA, DeLand FH. Diffuse thoracoabdominal radioactivity seen in bone imaging. *Clin Nucl Med*. 1986;11:254–258.
4. Romyn AM, Bushnell DL, Freeman ML, Kaplan E. Visualization of metastatic liver disease on technetium-99m bone scintigraphy. *Clin Nucl Med*. 1987;12:264–267.
5. Hakim S, Joo KG, Baeumler GR. Visualization of acute hepatic necrosis with a bone imaging agent. *Clin Nucl Med*. 1985;10:697–698.
6. Hansen S, Stadalnik RC. Liver uptake of ^{99m}Tc -pyrophosphate. *Semin Nucl Med*. 1982;12:89–91.
7. Lyons KP, Kuperus J, Green HW. Localization of Tc-^{99m} -pyrophosphate in the liver due to massive liver necrosis: case report. *J Nucl Med*. 1977;18:550–552.
8. Timmons JH, Hartshorne MF, Telepak RJ, Buckner AB. Tc-^{99m} MDP uptake in ischemic hepatopathy. *Clin Nucl Med*. 1988;13:759–760.
9. Whitten CG, Luke BA. Liver uptake of Tc-^{99m} PYP. *Clin Nucl Med*. 1991;16:492–494.
10. Flynn BM, Treves ST. Diffuse hepatic uptake of technetium-99m methylene diphosphonate in a patient receiving high dose methotrexate. *J Nucl Med*. 1987;28:532–534.
11. Shih WJ, Coupal J. Diffuse and intense Tc-^{99m} HMDP localization in the liver due to hypoxia secondary to respiratory failure. *Clin Nucl Med*. 1994;19:116–120.