

Accumulation of Tc-99m HMDP in hepatic metastasis from colon carcinoma without detectable calcification

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A 51-year-old man was found to have hepatic metastasis from colon carcinoma. Bone scintigraphy with ^{99m}Tc-hydroxymethylene diphosphonate showed a ringlike accumulation corresponding to the hepatic mass, which was without calcification on computed tomography. Treatment with chemotherapeutic agents was started. After 4 months, computed tomography showed that the mass was smaller than before and that the margin was calcified. The extraosseous accumulation of the radionuclide may be evidence supporting earlier speculation on calcification that could not yet be detected by computed tomography.

Key words: bone scanning, technetium-99m-HMDP, liver accumulation, metastatic tumor, extraosseous accumulation

INTRODUCTION

ACCUMULATION of bone-seeking radiopharmaceuticals in the liver, abdominal wall, or ribs¹ or in metastases to the liver from colon,²⁻⁷ breast,⁸ or lung⁹ cancer has been described. The extraosseous accumulation of phosphate compounds is sometimes found without calcification, being detected by radiological or histological inspection. In such patients, radiological calcification may occur later¹⁰ but there have been no longitudinal studies demonstrating abnormal radionuclide accumulation before radiological calcification was detected in an individual subject. Here we report a patient in whom a ringlike accumulation of ^{99m}Tc-hydroxymethylene diphosphonate (HMDP) was detected in a hepatic metastasis from colon carcinoma before calcification could be detected by computed tomography. After treatment with chemotherapeutic agents, the metastasis was smaller than before, and calcification could be detected radiologically.

CASE REPORT

A 51-year-old man came to our hospital with general fatigue and right hypochondralgia one year after surgery for colon carcinoma. On admission, the patient was of moderate build and well-nourished. The liver was palpable on the right midclavicular line 5 cm below the costal margin, but ascites was absent. Laboratory tests showed a white blood cell count of 5,800/mm³, red blood cell count of 399 × 10⁴/mm³, total bilirubin of 0.5 mg/dl, aspartate aminotransferase activity of 31 IU/L, alkaline phosphatase activity of 538 IU/L, serum albumin of 4.1 g/dl, lactate dehydrogenase activity of 1,596 WU/L, serum Ca of 4.2 mEq/L, serum P of 2.6 mEq/L, α-fetoprotein of 15 ng/ml, and carcinoembryonic antigen of 838 ng/ml. Enhanced computed tomography (CT) showed a large heterogeneous solid mass of low density with an irregular border, mostly in the right lobe of the liver, but calcification was absent (Fig. 1). Whole body bone scintigraphy was started 3 hr after an injection of 680 MBq of ^{99m}Tc-HMDP and gave no evidence of bone metastasis, but it showed increased tracer uptake in a ring shape in the right upper quadrant of the abdomen corresponding to the mass seen on the CT scan.

Treatment with injections of 5-fluorouracil and cisplatin was started. After 4 months, carcinoembryonic antigen

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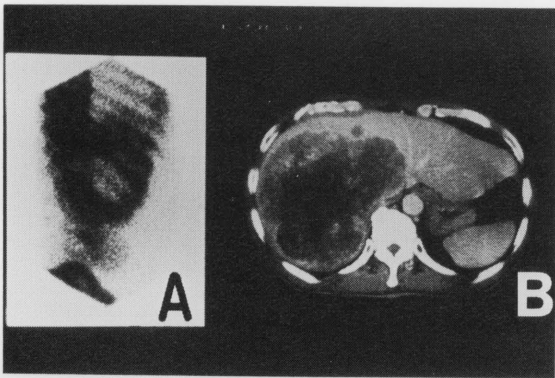


Fig. 1 Bone scan with ^{99m}Tc -HMDP and CT scan on admission. (A) ^{99m}Tc -HMDP scan shows a ringlike accumulation in the right upper quadrant. (B) Abdominal CT scan shows a large heterogeneous, solid mass of low density and without calcification mostly in the right lobe of the liver.

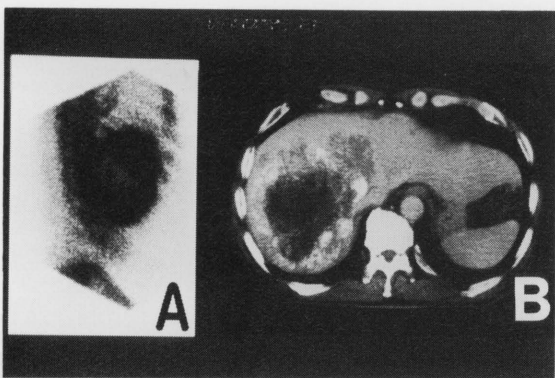


Fig. 2 Bone scan with ^{99m}Tc -HMDP and CT scan after 4 months. (A) ^{99m}Tc -HMDP scan shows a ringlike accumulation corresponding to the calcification seen on the CT scan. (B) Abdominal CT shows the mass to be smaller than that in Figure 1. Areas of calcification are scattered at the margin of the mass.

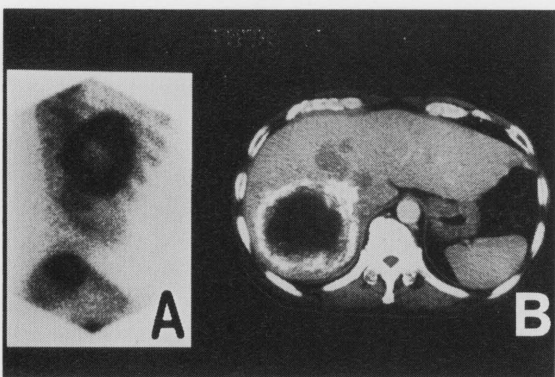


Fig. 3 Bone scan with ^{99m}Tc -HMDP and CT scan after 8 months. (A) ^{99m}Tc -HMDP scan shows the same finding as shown in Figure 2. (B) Abdominal CT shows the mass to be smaller than that in Figure 2. There is a dense area of calcification at the margin of the mass.

had decreased to 200 ng/ml. Abdominal CT showed that the mass was smaller than before, with scattered areas of calcification in the area peripheral to the mass; the CT number of the areas was 170 to 300 (that of the aorta was about 100; Fig. 2). Bone scintigraphy with ^{99m}Tc -HMDP demonstrated a ringlike pattern of radioactivity corresponding to the calcification seen on the CT scan. After 8 months, abdominal CT showed that the mass was smaller than before, with areas of calcification at the periphery (Fig. 3). Bone scintigraphy with ^{99m}Tc -HMDP gave the same findings about calcification as the preceding CT scan. The patient died of metastases to the lungs.

DISCUSSION

In 12 of 22 patients with hepatic metastases from colon carcinoma, Shih et al.⁶ found extraosseous uptake of ^{99m}Tc -HMDP by the metastases; in two patients, the pattern of uptake was ringlike. The radioactivity of the ring was at least as high as that of the ribs, suggesting that calcification was continuing in the periphery of the tumor. Some hepatomas had central necrosis that could be identified when the central area was seen not to be perfused during imaging done with radioindium;¹¹ this necrotic area, where a blood supply was lacking, had a ringlike appearance. The ring or "doughnut" sign seen in cerebral tumors presumably is caused by the same mechanism.¹² A ringlike pattern of tracer uptake in hepatic metastases from colon cancers may also be explained by insufficient blood supply if the mass is large.

The mechanism of extraosseous uptake of bone-seeking radiopharmaceuticals in tumors other than bone tumors may involve the increased amount of calcium bound to the cell membranes in some tumors,¹³ or the greater uptake of proteins from the plasma by some tumors than by normal tissue,¹⁴ but we do not know details of the mechanism of noncalcified tissue uptake of ^{99m}Tc phosphate compounds. The tumor uptake is not an artifact of free pertechnetate because the stomach, where pertechnetate is concentrated, is not imaged.¹⁵ Ion exchange between intracellular calcium phosphate and bone-scanning agent incorporating phosphate may also be a mechanism of uptake.¹⁰

Radiological calcification may develop later where bone agents now accumulate, if the subject survives, but there has been no report of calcification being detected after such accumulation in an individual patient. The case presented here is of interest because the abnormal accumulation of radioactivity during bone scintigraphy in the absence of detectable calcification was later followed by calcification seen by abdominal CT.

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