

# Splenic Accumulation of Technetium-99m-Methylene Diphosphonate in a Transfusion-Dependent Patient with Chronic Myelogenous Leukemia

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Intense splenic activity was incidentally observed on a radionuclide bone scan, performed for the evaluation of cellulitis versus osteomyelitis, in a transfusion-dependent patient with chronic myelogenous leukemia.

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**P**resence of intense splenic activity on a radionuclide bone scan is an unusual finding. We present a case of prominent splenic accumulation of technetium-99m-methylene diphosphonate ( $^{99m}\text{Tc}$ -MDP), incidentally observed on a bone scan in a patient with chronic myelogenous leukemia (CML).

## CASE REPORT

A 37-yr-old female with relapsed CML following bone marrow transplantation was admitted to the hospital for cellulitis of the right foot.

Philadelphia chromosome-positive CML had been diagnosed 15 yr prior to admission, with a markedly elevated white blood cell and platelet count, and a leukocyte alkaline phosphatase score of zero. Initially, she was treated with chemotherapy and had done well for 10 yr, when she entered an accelerated phase. She then underwent T-cell depleted allogeneic bone marrow transplantation, and, although CML relapsed a year later, she had a relatively stable course for several years. One year prior to admission, due to progressive liver dysfunction caused by non-A non-B hepatitis, she was started on interferon therapy. In this setting, she became transfusion-dependent and thrombocytopenic. Since then, she has been managed on an outpatient basis with hydroxyurea and interferon, and with transfusion of purified red blood cells approximately every two weeks. Several days prior to admission she sustained minor trauma to her right foot, followed by progressive tenderness, swelling, and erythema of the right

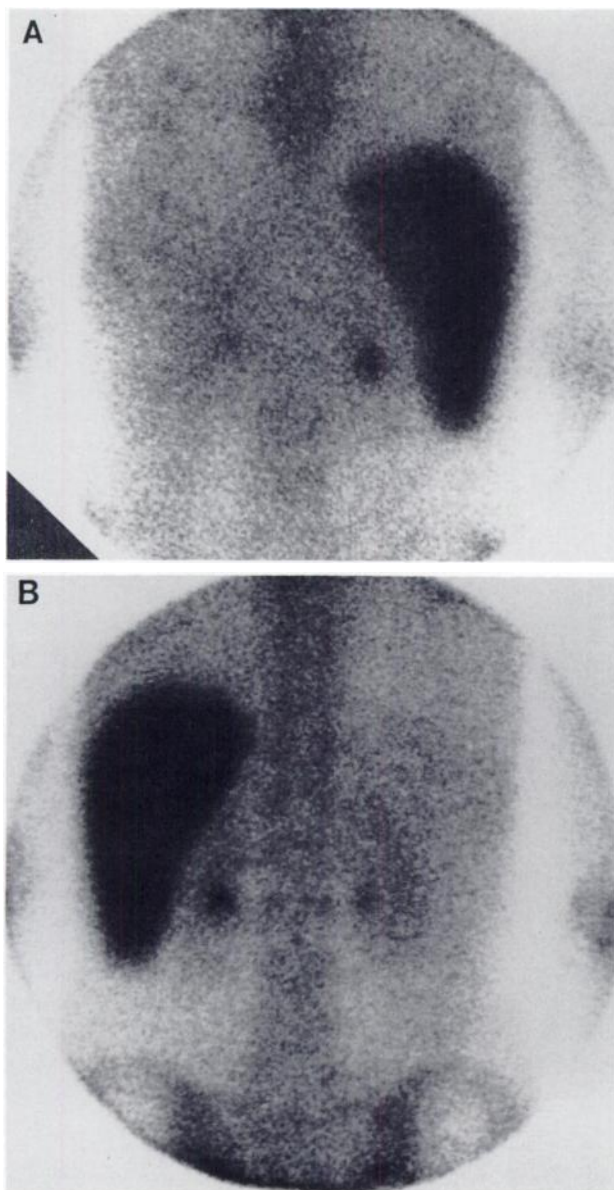
foot. In addition, clinical examination revealed mild jaundice, and a spleen palpable for three finger breadths below the left costal margin. She was referred for radionuclide bone imaging for evaluation of right foot cellulitis versus osteomyelitis. No abnormalities of the bone were observed on a bone scan performed with  $^{99m}\text{Tc}$ -MDP. Intense, homogeneous tracer accumulation was present in a grossly enlarged spleen (Fig. 1). A mild hepatic uptake of the bone agent was noted as well.

## DISCUSSION

Although accumulation of bone-seeking radiopharmaceuticals in the spleen is an exceptional phenomenon, it is well-known and documented in patients with sickle cell disease (1-3). Several other isolated clinical instances of splenic uptake of  $^{99m}\text{Tc}$ -MDP have been reported including Hodgkin's disease (4), non-Hodgkin's lymphoma (5), "smouldering leukemia," a syndrome with diagnostic features of acute myelogenous leukemia (6), thalassemia major (7), glucose-6-phosphate dehydrogenase deficiency (8), metastatic breast carcinoma (9), bronchogenic carcinoma (10), angiosarcoma of spleen (11), subcapsular splenic hematoma (12), severe combined immunodeficiency disease (13), calcified and noncalcified hemangioma (14,15), and splenic artery calcification (16). Recently, a case of intense splenic uptake of bone imaging agent in a patient with chronic lymphocytic leukemia was described (17). Our case is the first, to our knowledge, demonstrating a similar finding in the patient with chronic myelogenous leukemia.

Some of the mechanisms proposed to explain accumulation of bone-seeking agents in the spleen include infarction, acidosis and hypoxia with calcification, excess iron deposition, increased local phosphatase activity, and tumor avidity. In most of above cited cases, significant deposition of hemosiderin in the spleen was the common feature. It has been already established that local high concentration of extracellular iron will result in abnormal uptake and retention of  $^{99m}\text{Tc}$  bone

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**FIGURE 1**

(A) Technetium-99m-MDP bone scan shows no abnormalities of the bone. However, intense tracer accumulation was present in an enlarged spleen (B) and mild hepatic uptake of the tracer was also noted.

agents in soft tissue in the absence of elevated calcium levels (18). Cases with concentration of bone imaging agents at sites of iron dextran administration in humans and animals have been reported (18,19). In addition, the localization of  $^{99m}\text{Tc}$  has been observed at sites where stagnant blood or dying red cells are being broken down (spleen), and, presumably, wherever decoupling of iron from hemoglobin is occurring (18). It has been proposed that high local concentrations of calcium or iron in vivo produce changes in tissue distribution of the  $^{99m}\text{Tc}$  bone agents through the exchange of ligands (20).

It is most likely that a locally elevated concentration

of iron, secondary to frequent transfusions and increased red blood cell sequestration, may account for the intense splenic accumulation of  $^{99m}\text{Tc}$ -MDP in our patient.

## REFERENCES

1. Goy W, Crowe WJ. Splenic accumulation of  $^{99m}\text{Tc}$ -diphosphonate in a patient with sickle cell disease: case report. *J Nucl Med* 1976; 17:108-109.
2. Guest J, Park HM. Splenic uptake of  $^{99m}\text{Tc}$ -diphosphonate in sickle cell disease. *Clin Nucl Med* 1977; 2:121-123.
3. Harwood SJ. Splenic visualization using  $^{99m}\text{Tc}$ -methylene diphosphonate in a patient with sickle cell disease. *Clin Nucl Med* 1978; 3:308-309.
4. Winter PF. Splenic accumulation of  $^{99m}\text{Tc}$ -diphosphonate. *J Nucl Med* 1976; 17:850.
5. Birch SJ, Garvie NW, Ackery DM. Splenic accumulation of technetium-99m-methyl diphosphonate in non-Hodgkin's lymphoma. *Br J Radiol* 1980; 53:161-163.
6. Nisbet AP, Maisey MN. Splenic accumulation of technetium 99m-methylene diphosphonate. *Br J Radiol* 1982; 55:454-455.
7. Howman-Giles RB, Gilday DL, Ash JM, Brown RG. Splenic accumulation of Tc-99m-diphosphonate in thalassemia major. *J Nucl Med* 1978; 19:976-977.
8. Lieberman CM, Hemingway DL. Splenic visualization in a patient with glucose-6-phosphate dehydrogenase deficiency. *Clin Nucl Med* 1979; 4:405-406.
9. Costello P, Gramm HF, Steinberg D. Simultaneous occurrence of functional asplenia and accumulation of diphosphonate in metastatic breast carcinoma. *J Nucl Med* 1977; 18:1237-1238.
10. Sirotta P, Nelp WB. Unexplained transient splenic uptake of Tc-99m-MDP in bronchogenic carcinoma. *Clin Nucl Med* 1984; 9:495-497.
11. Mathews J, Sziklas JJ, Spencer RP. Functional asplenia and uptake of bone imaging agent in angiosarcoma of spleen. *Clin Nucl Med* 1985; 10:527-528.
12. Sty JR, Starshak RJ, Hubbard A. Accumulation of Tc-99m-MDP in the spleen of a battered child. *Clin Nucl Med* 1982; 7:292.
13. Charron M, Rosenthal L. Visualization of the spleen with radiophosphate in severe combined immunodeficiency disease. *Clin Nucl Med* 1988; 13:339-341.
14. Halgrimson CG, Rustad DG, Zeligman BE. Calcified hemangioma of the spleen. *JAMA* 1984; 252:2959-2960.
15. Cooper SG, Strauss EB, Levine AH. Detection of noncalcified splenic hemangioma by radionuclide bone scan. *J Nucl Med* 1989; 30:1111-1112.
16. Shukla LW, Lin DS, Kutka N. Splenic uptake in bone imaging. *Semin Nucl Med* 1988; 18:71-73.
17. McHugh K, Lee DM, Batty VB. Splenic accumulation of technetium-99m in chronic lymphocytic leukaemia. *Br J Radiol* 1988; 61:957-959.
18. Francis MD, Tofe AJ. Experimental biochemistry of infarct imaging. Presented at the Donner Laboratory-Kaiser Hospital Workshop on Imaging Myocardial Infarcts, Oakland, CA, October 1974.
19. Byun HH, Rodman SG, Chung KE. Soft-tissue concentration of  $^{99m}\text{Tc}$ -phosphates associated with injections of iron dextran complex. *J Nucl Med* 1976; 17:374-375.
20. McRae J, Hambright P, Valk P, Bearden AJ. Chemistry of  $^{99m}\text{Tc}$  tracers. II. In vitro conversion of tagged HEDP and pyrophosphate (bone-seekers) into gluconate (renal agent). Effects of Ca and Fe (II) on in vivo distribution. *J Nucl Med* 1976; 17:208-211.