Unexpected Bone Marrow Uptake of Thallium-201 in Nonsecretory Myeloma

Haluk Burcak Sayman, Kerim Sönmezoglu, Enis Altiok, Gevher Devranoglu and Burhan Ferhanoglu

Departments of Nuclear Medicine and Hematology, Istanbul University, Cerrahpasa Medical School, Istanbul, Turkey

A 43-yr-old man was referred for any possible parathyroid abnormality that could explain his hypercalcemia and slightly increased parathormone levels. The thallium-technetium scan showed a diffuse abnormal thallium uptake incidentally in the bone marrow, otherwise parathyroid scan appearance was normal. He had an essentially normal bone scan, although subsequent nanocolloid scintigraphy demonstrated bone marrow expansion. Further investigations, including a bone marrow aspiration biopsy, confirmed the diagnosis of nonsecretory myeloma. This finding suggests that ^{201}Tl imaging can be a useful tool to investigate those patients suffering from similar myeloid disorders causing bone marrow hyperplasia.

Key Words: thallium-201; multiple myeloma; bone marrow

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Thallium-technetium (Tl-Tc) parathyroid scintigraphy is the method of choice in investigating patients with high levels of parathormone and serum calcium (*1*). With use of this technique, it is possible to identify the abnormal parathyroids not only in the neck, but also in other locations such as the mediastinum (*2*). In addition to its uptake in parathyroid tissue, ^{201}Tl can accumulate significantly in both differentiated (*3*) or undifferentiated thyroid cancers (*4*), as well as adenomatous goiter, chronic thyroiditis, malignant lymphoma of the thyroid (*5*), cervical thymoma (*6*), bronchogenic carcinoma (*7*), Hodgkin's disease (*8*), breast cancer (*9*) and brain tumors (*10*). However, its diagnostic value has not, to our knowledge, been reported in multiple myeloma. We recently observed an excessive ^{201}Tl uptake in the skeleton of a patient with hypercalcemia who had undergone a double-isotope parathyroid scintigraphy. Further examinations including a bone marrow aspiration biopsy revealed nonsecretory myeloma as the final diagnosis.

CASE REPORT

A 43-yr-old male patient with high levels of serum calcium was referred for a parathyroid scan. There was a 6-mo history of fatigue, weakness and dyspnea on exertion. He had a pathologic left clavicle fracture 4 wk ago. His physical examination was normal with no palpable lymphadenopathy and hepatosplenomegaly, except a pale skin color.

A Tl-Tc simultaneous dual-isotope subtraction study was performed to attempt identification of any possible parathyroid abnormality. Following intravenous injection of 40 MBq [^{99m}Tc]pertechnetate, the patient waited for 20 min for maximum uptake in the thyroid. Then, 80 MBq of ^{201}Tl were administered intravenously. Five minutes later, simultaneous double-isotope acquisition was performed with a large field of view gamma camera fitted with a high-resolution collimator. Two images with 128 × 128 matrix were collected for 10 min on a computer (Siemens Microdelta, Erlangen, URG). The ^{99m}Tc image was then rescaled to its half maximum pixel value and subtracted from the ^{201}Tl image. During image processing, excessive thallium uptake in the bones, seen in the field of view, was an unusual finding. While the sternum, both clavicles, anterior ribs and both shoulders were considerably visualized in the thallium image, there was not such an uptake in the ^{99m}Tc image (Fig. 1). The patient was recalled and scheduled for a ^{99m}Tc-MDP bone and a ^{99m}Tc-nanocolloid marrow scan after consulting with hematologists. A bone marrow aspiration biopsy was also planned.

The laboratory findings were: parathormone 3.1 ng/ml (normal 0–2.7), serum creatinine 1.92 mg/dl (normal <1.5), serum urea 29 mg/dl (normal 24–49) (suggesting myeloma kidney, which may be associated with Bence-Jones nephropathy or caused by pyelonephritis), total protein 7.8 mg/dl (normal 6–8), albumin 4.5 mg/dl (normal 3.5–5), total serum calcium 11.5 mg/dl (normal 8.5–10.5). His immunoglobulin levels were: IgA 33 mg/dl (normal 100–490), IgG 819.5 mg/dl (normal 800–1700), IgM 27.5 mg/dl (normal 50–320), without monoclonal spike. Blood cell counts were: red, 2.4 × 10^6/mm^3 (normal 4.7–6.1 × 10^6), white, 4700/mm^3 (normal 4800–10800) with hemoglobin 8 g/dl (normal 14.0–16.0 g/dl) and hematocrit 24.5% (42%–50%), showing deep anemia. The beta-microglobulin level was 21 mg/l (normal 1.2–2.5).

The results of the bone and bone marrow scans are shown in Figures 2 and 3. The bone scan appearance was normal except for an increased uptake at the biopsy site in the mid sternum. There was diffusely increased uptake in the colloid scan, especially apparent in the femora which implied marrow expansion.

Bone marrow examination revealed multiple myeloma, showing 97% infiltration of plasmacytes, some containing abnormal nuclei. Those myeloid and erythroid elements of the marrow were extremely suppressed by the hyperproliferated plasma cells.

Radiographic examination of the cranium indicated multiple lytic lesions without apparent sclerosis. There were no other abnormal radiologic findings.

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For correspondence or reprints contact: Associate Professor, Dr. Haluk B. Sayman, I. U. Cerrahpasa Medical School, Dept. of Nuclear Medicine, Aksaray, Istanbul, Turkey.

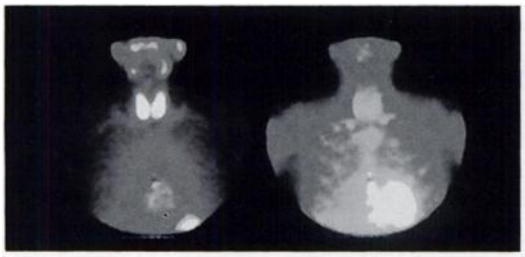

FIGURE 1. Images acquired at the 140 keV photopeak of ^{99m}Tc (left) and the 75 keV photopeak of ^{201}Tl (right, showing abnormal bone marrow uptake).

DISCUSSION

Although it has been used primarily for cardiac imaging, ^{201}Tl-chloride has found a wide acceptance for imaging malignancies. The mechanism of uptake is not clear, but it appears in general to be related to the vascularity and the cellularity of the tumors (*8*). Glucose consumption and an increased metabolic rate were also proposed factors (*11*). Since thallium is an analog to potassium, it is transported across the cell membrane partly by the stimulated sodium-potassium ATPase system and partly by passive diffusion.

The malignancy in this particular case was unsuspected, and further examinations after suspicious diffuse bone uptake of thallium led us to the correct diagnosis. Normally, there should be no significant ^{201}Tl uptake in bone marrow (*12*). It has been reported that the hypermetabolic bone marrow after therapy with granulocyte stimulating factor may show a diffuse ^{201}Tl chloride uptake (*11*). Although this patient had severe anemia, his bone marrow examination revealed an abnormal infiltration of plasma cells with suppressed myeloid and erythroid series. This condition is consistent with multiple myeloma and basically does not indicate compensation against the patient's anemia. Therefore, the uncommon accumulation of ^{201}Tl in the bone marrow may be related to tumor cell infiltration rather than bone marrow hyperplasia secondary to anemia.

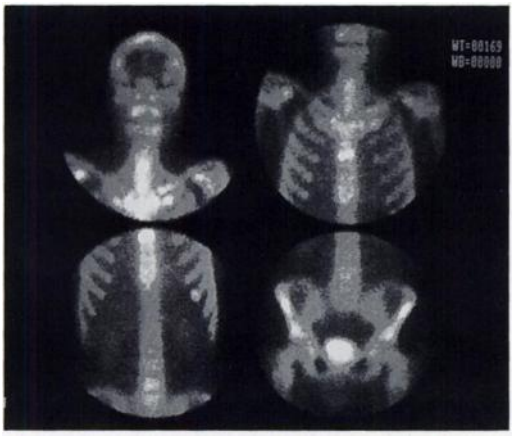

FIGURE 2. Technetium-99m-MDP bone scintigraphy shows increased focal tracer uptake at the biopsy site of the sternum.

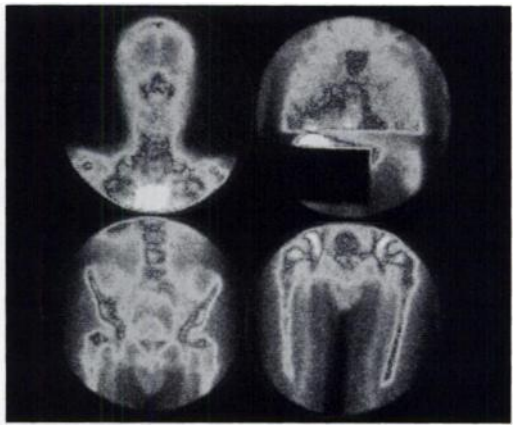

FIGURE 3. Technetium-99m nanocolloid scintigraphy shows bone marrow expansion in the femora.

In conclusion, ^{201}Tl bone marrow scintigraphy can be considered a useful tool to investigate patients with suspicious malignancies in the bone marrow. However, further workup should be done in larger patient groups in order to confirm our observation.

REFERENCES

1. Ferlin G, Borsato N, Camerani M, et al. New perspectives in localizing enlarged parathyroids by technetium-thallium subtraction scan. *J Nucl Med* 1983;24:438–441.
2. Winzelberg GG, Hydovitz JD. Radionuclide imaging of parathyroid tumors: histological perspectives and newer techniques. *Semin Nucl Med* 1985;15: 161–170.
3. Dadparvar S, Krishna L, Brady LW, et al. The role of iodine-131 and thallium-201 imaging and serum thyroglobulin in the management of differentiated thyroid carcinoma. *Cancer* 1993;71:3767–3773.
4. Némec J, Zamrazil V, Pohunke D, et al. The rational use of Tl-201 scintigraphy in the evaluation of differentiated thyroid cancer. *Eur J Nucl Med* 1984;9:261–264.
5. Ochi H, Sawa H, Fulcuda T, et al. Thallium-201 chloride thyroid scintigraphy to evaluate benign and/or malignant nodules. *Cancer* 1982;50:236–240.
6. Fukuda T, Itami M, Sawa H, et al. A case of thymoma arising from undescend thymus-high uptake of Tl-201. *Eur J Nucl Med* 1980;5:465–468.
7. Basara BE, Wallner RJ, Hakki AH, Iskandrian AS. Extracardiac accumulation of thallium-201 in pulmonary carcinoma. *Am J Cardiol* 1984;53:358–359.
8. Linde R, Basso L. Hodgkin's disease with hypercalcemia detected by thallium-201 scintigraphy. *J Nucl Med* 1987;28:112–115.
9. Lee VW, Sax EJ, McAneny DB, et al. A complementary role of thallium-201 scintigraphy and mammography in the diagnosis of breast cancer. *J Nucl Med* 1993;34:2095–2100.
10. Kim KT, Black KL, Marciano D, et al. Thallium-201 SPECT imaging of brain tumors: methods and results. *J Nucl Med* 1990;31:965–969.
11. Abdel-Dayem HM, Sanchez J, Al-Mohannadi S, Kempf J. Diffuse thallium-201-chloride uptake in hypermetabolic bone marrow following treatment with granulocyte stimulating factor. *J Nucl Med* 1992;33:2014–2016.
12. Atkins HL, Budinger TF, Lebowitz E, et al. Thallium-201 for medical use. Part III: human distribution and physical imaging properties. *J Nucl Med* 1977;18:133–140.