Annals of Nuclear Medicine Vol. 20, No. 3, 217–220, 2006

Osteoid osteoma simulating osteomyelitis: Differentiation with Tc-99m HIG scintigraphy

Şeyda TÜRKÖLMEZ, Derya ÇAYIR and Meliha KORKMAZ

Department of Nuclear Medicine, Ankara Training and Research Hospital, Ankara, Turkey

We present a case of osteoid osteoma with a history of mild pain, local swelling and point tenderness on the right lower leg. The diagnosis of osteoid osteoma was difficult due to the atypical clinical history and misleading radiological and bone scan findings. When it is difficult to differentiate an osteoid osteoma from osteomyelitis using CT, MRI or bone scan; HIG scintigraphy can be used to exclude an infection.

Key words: osteoid osteoma, osteomyelitis, ^{99m}Tc HIG scintigraphy

INTRODUCTION

OSTEOID OSTEOMA is a common benign bone tumor. The lesion is frequently localized in the cortex of long bones. The most clinical characteristic presentation is pain, which worsens at night and is relieved by aspirin. The typical radiological appearance is a bone forming lesion with a central nidus of vascular osteoid tissue surrounded by sclerotic bone.[1] When the typical clinical and radiological features are present, diagnosis is not difficult. However, osteoid osteoma lesions are most often misdiagnosed as an area of osteomyelitis. In the current case, the clinical history was not typical for osteoid osteoma. Radiological imaging findings could not differentiate an osteoid osteoma from osteomyelitis. Bone scan pattern did not precisely rule out the presence of an infection. In our case, the importance of ^{99m}Tc HIG (technetium-99m polyclonal human IgG) scintigraphy in differentiating osteoid osteoma from infection is defined.

CASE REPORT

A 16-year-old boy presented with a history of mild pain, local swelling and point tenderness on the right lower leg for several months. He had no history of nocturnal pain. Routine laboratory tests were within normal limits. Plain radiographs showed a lytic lesion with irregular cortical thickening in the lower right tibia (Fig. 1). A computed tomography (CT) through the diaphysis of the tibia demonstrated extensive cortical sclerosis on the right tibia. Sharply defined lucent focus is seen in the thickened cortex (Fig. 2). There is a subtle increase in marrow density when compared with the contralateral side. Magnetic resonance (MR) images revealed a lytic lesion associated with dense surrounding cortical thickening in the tibia diaphysis. Lytic focus was isointense to muscle on T1-weighted images and hyperintense compared with the muscle on T2-weighted images. The lesion did not demonstrate enhancement after Gd-DTPA injection (Figs. 3–5).

The radionuclide bone scan was performed 3 hours after administration of 15 mCi (555 MBq) of ^{99m}Tc MDP (technetium-99m methylene diphosphonate). Images were obtained with a low energy all-purpose collimator, using a single-head gamma camera (Siemens E.Cam, USA). On ^{99m}Tc MDP bone scan, there was increased blood flow throughout the lower right tibia, and equilibrium and delayed images showed an intense uptake of tracer in the right lower tibia (Figs. 6–8). ^{99m}Tc HIG (TechneScan® HIG, Mallinckrodt) scintigraphy was performed 4 and 24 hours after administration of 15 mCi of tracer. ^{99m}Tc HIG scintigraphy showed no increased tracer uptake in the right lower tibia (Fig. 9).

Received March 9, 2005, revision accepted October 25, 2005.

For reprint contact: Şeyda Türkölmez, M.D., Fırat Cad, Özbeykent Konutları, Fırat Apt, 186/20, Beysukent, Ankara, TURKEY.

E-mail: sturkolmez@yahoo.com

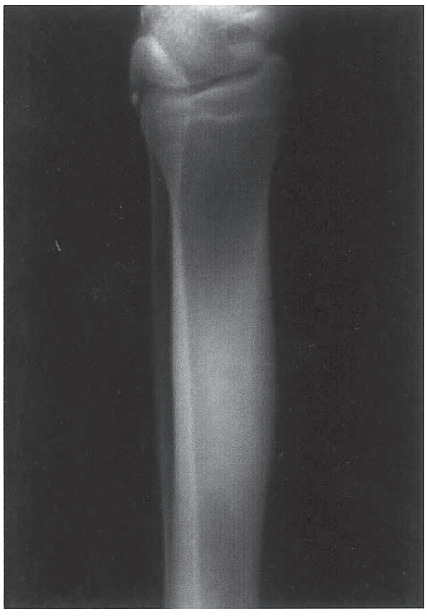

Fig. 1 Plain radiographs showed a lytic lesion with irregular cortical thickening in the lower right tibia.

DISCUSSION

Osteoid osteoma is described by Jaffe as a small, oval or round, nidus-like benign tumor of bone.[1] The majority of patients are in the second or third decades. It has a 3:1 male/female ratio. Generally, it has a typical clinical story and a diagnosis can be made from the history alone. Almost any bone can be affected. Osteoid osteoma is usually characterized by a sclerotic lesion that contains a small nidus.[2] It is important to localize the nidus for the surgeon to achieve prompt cure but it is often difficult to localize precisely the nidus with plain radiographs.

Plain radiography, computed tomography, magnetic resonance imaging, bone scintigraphy and angiography can be use for the diagnosis of osteoid osteoma. Osteoid osteoma can mimic several other bony conditions and present with a variety of symptoms and signs in a wide distribution throughout the body. Radiographic appearances of the lesion can also vary. Radiographically, the typical osteoid osteoma has a dense sclerotic area surrounding a lucent nidus.[3] On CT the nidus of osteoid

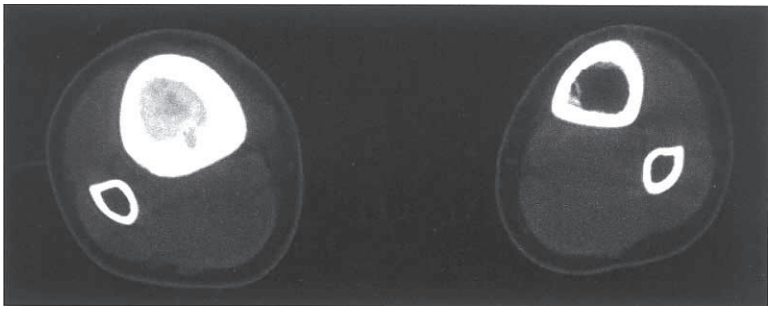

Fig. 2 Bone window CT through the diaphysis of tibia demonstrates extensive cortical sclerosis on right tibia. Sharply defined lucent focus is seen in the thickened cortex. There is a subtle increase in marrow density when compared with the opposite side.

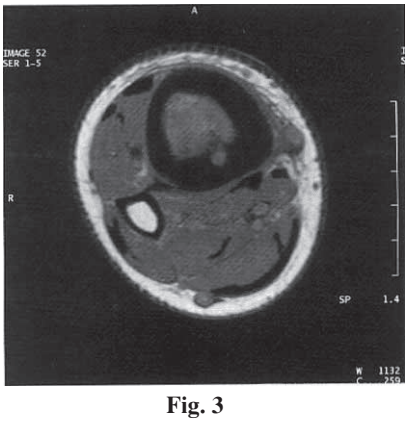

Fig. 3

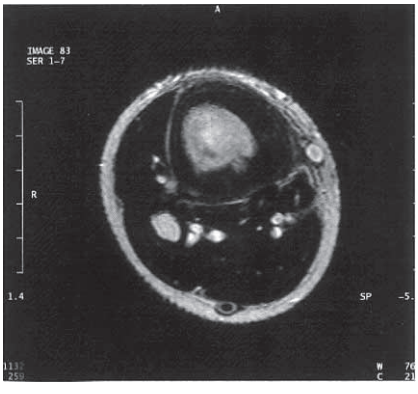

Fig. 4

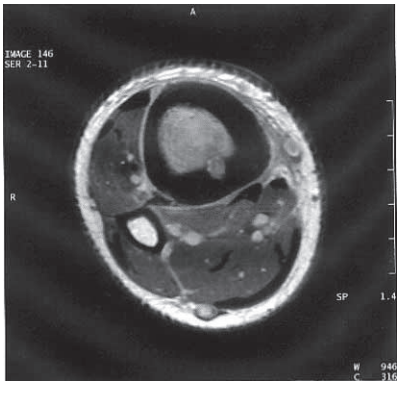

Fig. 5

Fig. 3 Axial T1-weighted MR image.
Fig. 4 Axial T2-weighted MR image. Axial T1- and T2-weighted MR images revealed a lytic lesion associated with dense surrounding cortical thickening in the tibia diaphysis. Lytic focus was isointense to muscle on T1-weighted image and hyperintense compared with the muscle on T2-weighted image.
Fig. 5 After Gd-DTPA injection, the lesion did not demonstrate enhancement.

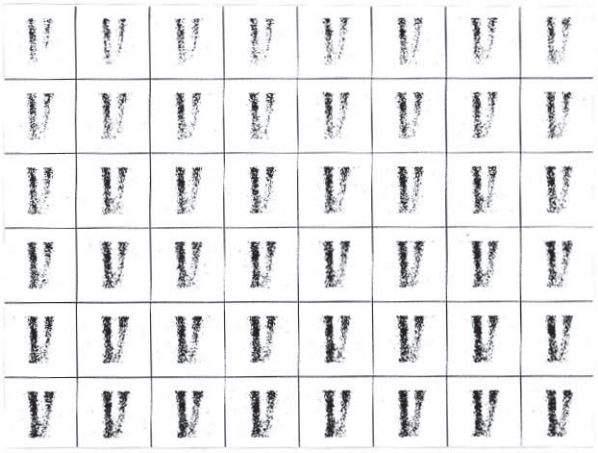

Fig. 6 On ^{99m}Tc MDP bone scan, there was increased blood flow throughout the lower right tibia.

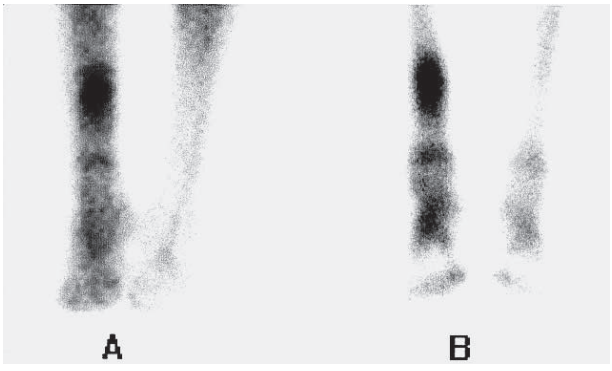

Fig. 7 Equilibrium (A) and delayed static (B) bone scintigraphic images showed an intense uptake of tracer in the right lower tibia.

Fig. 8

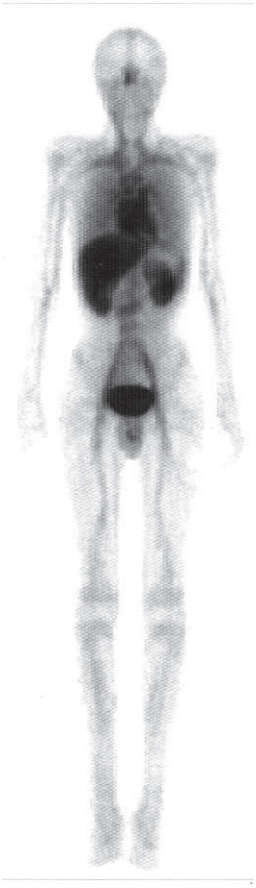

Fig. 9

Fig. 8 Anterior whole body bone scan image demontrated increased radioactivity accumulation.

Fig. 9 ^{99m}Tc HIG scintigraphy showed no increased tracer uptake in the right lower tibia.

osteoma most commonly appears as a well-demarcated, low-attenuation area, surrounded by various amounts of high-attenuation reactive sclerosis.[4]

On MRI T1-weighted images, the nidus demonstrates low to intermediate signal intensity, though on T2-weighted images the nidus intensity is increased.[2] The misleading appearance of osteoid osteoma on CT or MRI often leads to the diagnosis of osteomyelitis, stress fracture, inflammatory arthritis, or bone tumor. On bone scan, osteoid osteoma often demonstrates moderate tracer uptake, with a central area of more focal intense uptake. Most active osteoid osteoma lesions will demonstrate focal increased tracer on blood pool images, which is thought to represent vascular nidus. The radioactivity uptake on three phase bone scan may be indistinguishable from infection, metastatic disease, or a stress fracture.[5] Differentiation of an osteoid osteoma from osteomyelitis is often difficult, and osteoid osteoma lesions are most often misdiagnosed as an area of osteomyelitis.[6]

In the present case, the clinical history was not typical for osteoid osteoma. CT scan showed extensive cortical sclerosis and sharply defined lucent focus in the thickened cortex on the right lower tibia with subtle increase in marrow density. MR images revealed a lytic lesion associated with dense surrounding cortical thickening in the tibia diaphysis. Lytic focus was isointense to muscle on T1-weighted image and hyperintense compared with the muscle on T2-weighted image. The lesion did not demonstrate enhancement after Gd-DTPA injection. Differential diagnosis of similar-appearing lesions included chronic sclerosing osteomyelitis, chronic active osteomyelitis, and Brodie's abscess. Chronic sclerosing osteomyelitis is a rare low-grade chronic infection of bone causing sclerosis without destruction or sequestration. A chronic osteomyelitis results in a thick, irregular, sclerotic bone with radiolucencies, and elevated periosteum. A chronic abscess surrounded by marked sclerosis is known as Brodie's abscess.[7]

Radionuclide studies such as ^{111}In (indium-111)-labeled leukocytes, ^{67}Ga (gallium-67) citrate or ^{99m}TcNS Ab scintigraphy are the imaging modalities for determining whether infection is present. Osteoid osteoma may

possess the same bone scintigraphic characteristics as osteomyelitis. An osteoid osteoma, has not been found to be associated with increased ^{111}In accumulation.[8] In cases in which the bone scan is equivocal, Lisbona and Rosenthall suggest that ^{67}Ga imaging may be helpful in distinguishing acute/subacute osteomyelitis from osteoid osteoma. Although reporting on a series of only five patients, all cases of osteoid osteoma with intense ^{99m}Tc-MDP deposition demonstrated low grade ^{67}Ga, unlike osteomyelitis where gallium is known to concentrate intensely. These studies must be interpreted cautiously since avid ^{99m}Tc-MDP deposition with very low gallium uptake can be seen with fracture, infarction, chronic osteomyelitis and acute osteomyelitis under antibiotic treatment.[9]

In our case, there was significantly increased radioactivity accumulation on three phase bone scan; therefore it was not possible to differentiate an osteoid osteoma from chronic active osteomyelitis. ^{99m}Tc HIG scintigraphy, which is a sensitive technique for detecting inflammation and infection of the skeletal system,[10] was performed. The ^{99m}Tc HIG scan pattern precisely ruled out the presence of an infection. In conclusion, when it is difficult to differentiate an osteoid osteoma from chronic active osteomyelitis using CT, MRI or bone scan, HIG scintigraphy can be used to exclude an infection.

REFERENCES

1. Jaffe HL. Osteoid osteoma: a benign osteoblastic tumor composed of osteoid and atypical bone. *Arch Surg* 1935; 31: 709–728.
2. Klein MH, Shankman S. Osteoid osteoma: radiologic and pathologic correlation. *Skeletal Radiol* 1992; 21 (1): 23–31.
3. Sim F, Dahlin D, Beabout J. Osteoid osteoma: Diagnostic problems. *J Bone Joint Surg* 1975; 57: 154–158.
4. Mahboubi Soroosh. CT appearance of nidus in osteoid osteoma versus sequestration in osteomyelitis. *J Comput Assist Tomogr* 1986; 10 (3): 457–459.
5. Helms CA. Osteoid Osteoma: The double density sign. *Clinical Orthopaedics and Related Research* 1987; 222: 167–173.
6. Helms CA, Hattner RS, Vogler JB. Osteoid osteoma: Radionuclide Diagnosis. *Radiology* 1984; 151 (3): 779–784.
7. Dahnert W. Musculoskeletal system. In: *Radiology Review Manual*. Grayson TH (ed) 2nd ed. Baltimore; Lippincott Williams & Wilkins, 1993: 1–24.
8. Resnick D. Tumors and tumor-like lesions of bone: imaging and pathology of specific lesions. In: *Diagnosis of Bone and Joint Disorders*, Resnick D (ed), 3rd ed. Philadelphia; WB Saunders, 1995: 3786–3796.
9. Lisbona R, Rosenthall L. Role of radionuclide imaging in osteoid osteoma. *Am J Roentgenol* 1979; 132: 77–80.
10. van der Lubbe PA, Arndt JW, Calame W, Ferreira TC, Pauwels EK, Breedveld FC. Measurement of synovial inflammation in rheumatoid arthritis with Tc-99m labeled human polyclonal immunoglobulin G. *Eur J Nucl Med* 1991; 18: 119–123.