Osteoid Osteoma: The Role of Radionuclide Bone Imaging, Conventional Radiography and Computed Tomography in Its Management

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CASE PRESENTATION

A 16-yr-old male presented with a complaint of worsening lower back pain. The pain was exacerbated by exercise, radiated to both sides, and was severe enough to limit his activities. His primary physician diagnosed the problem as spondylolysis. His physical examination at that time was unremarkable except for focal tenderness in the L4-5 region of the back and mild lumbar paraspinal muscle spasm. He was treated with bed rest and non-steroidal anti-inflammatory agents.

The patients's past medical history was remarkable only for surgery for pyloric stenosis at the age of 12 yr.

On physical examination, the patient was a healthy appearing white male with normal vital signs, gait and posture. Examination of the back revealed a mild lumbar scoliosis with the convexity to the left. Tenderness was felt over the lower lumbar vertebral region with mild paraspinal muscle spasm. Pain was noted on straight leg raising radiating to the right side. Neurological examination revealed normal lower extremity motor strength, sensation and deep tendon reflexes.

Plain films of the spine demonstrated surgical clips in the midepigastrium (from his previous surgery for pyloric stenosis) and a mild lumbar levoscoliosis of about 17 degrees (Fig. 1).

A bone scan revealed a focus of increased activity in the right side of the L5 vertebra (Fig. 2). This study was supplemented by SPECT images. Axial reconstruction demonstrated an intense site of increased activity in the right side of the posterior elements of L5 (Fig. 3). These findings were consistent with a diagnosis of spondylolysis or osteoid osteoma.

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Computed tomography (CT) with thin slices through the level of the L5 vertebra revealed a lytic lesion in the medial aspect of the superior facet of L5 and thickening of the right lamina of L5 (Fig. 4). Sagittal reconstruction images demonstrate the lytic lesion with a sclerotic central nidus (Fig. 5). Based on these findings, the diagnosis of osteoid osteoma was made, and the patient was scheduled for surgical excision.

Prior to surgery, the patient was given 518 MBq (14 mCi) of ^{99m}Tc-MDP intravenously. A right-sided laminectomy and partial facetectomy were performed. The surgical specimens were then placed under a gamma camera. Intense focal uptake was noted in the biopsy specimens. Pathology of the biopsy specimens, which consisted of an irregular piece of bone measuring 3 × 2.5 × 1.5 cm, demonstrated an osteoid osteoma at the inactive physis of the fifth lumbar lamina.

The postoperative course was uncomplicated apart from incisional pain over the lumbar spine. The patient was discharged two days later and has done well with a resolution of symptoms.

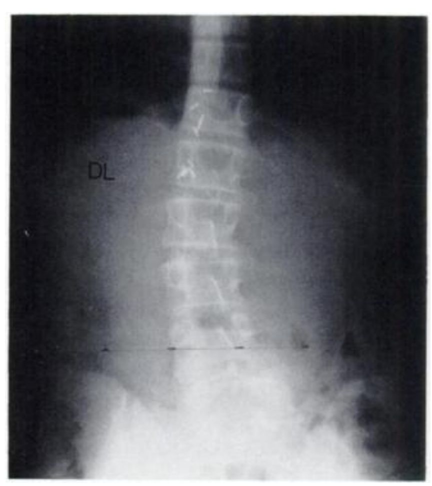

FIGURE 1. Radiograph of lumbar spine. There is a levoscoliosis of the lower lumbar spine. Surgical clips in the epigastrium are due to prior surgery for pyloric stenosis. (DL marks left side).

FIGURE 2. Bone scan. Planar images obtained 3 hr following the intravenous administration of 15 mCi of ^{99m}Tc-MDP. A focus of increased activity is present in the right side of L5.

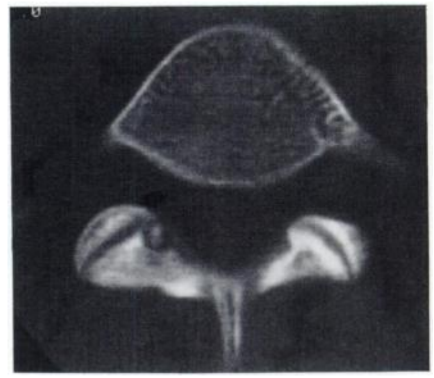

FIGURE 4. Computed tomography. Axial image through the L5 vertebral body. A lytic lesion is present in the medial aspect of the right superior facet.

DISCUSSION

Osteoid osteoma is a benign osteoid-forming tumor of bone. It is one of the most commonly found benign bone tumors (12%) and most often is observed in children and young adults. Although any bone may be affected, 40% of osteoid osteomas occur in the femur (*1,2*). In general, the lesions are small and invariably less then 1.5 cm in diameter (*2*). The diagnosis is usually evident radiographically but may be difficult to detect in the deeply placed and geometrically complex bones of the hip and spine. Ten percent of osteoid osteomas involve the posterior elements of the spine. The majority occur in the lumbar spine with the cervical spine next in frequency (*3*).

Spinal osteoid osteomas most frequently cause pain that may at first be intermittent and not severe but with time frequently becomes constant, intense and disabling (*1*). Prostaglandins, which have been recovered in large amounts from osteoid osteomas, are most likely responsible for this pain (*4*). Typically, the pain is, to some extent, relieved by prostaglandin inhibitors. Therefore, back pain which occurs at rest in young patients and is relieved by prostaglandin inhibitors, should lead one to suspect an osteoid osteoma. Other clinical features of the lesion include the frequent association of scoliosis and, infrequently, occurrence of radicular pain (*5,6*).

The typical lesion, as seen on the CT in this case, is approximately 1 cm in diameter with a round and lytic central nidus surrounded by a densely sclerotic rim (*1,2*). Skeletal scintigraphy has proved useful when an osteoid osteoma is suspected, but radiography is not diagnostic, particularly when the symptoms are atypical. The usual appearance is a round, localized lesion showing increased accumulation of technetium-labeled phosphonates, such as MDP, in both the postinjection or blood-pool images, as well as in the delayed images. Occasionally the lesion may be poorly defined, and with involution (regression) the uptake may be only slightly greater than the surrounding bone (*7*). The bone scan will indicate the site for further evaluation, if necessary, with either radiographs or computerized tomography. CT is most useful for precise localization of the lesion and differentiating it from other diagnoses.

Surgical removal may be facilitated by localizing the lesion either preoperatively or intraoperatively using radionuclide techniques. A mobile gamma camera equipped with a pinhole collimator will both identify the lesion and confirm its surgical removal (*6*). Alternatively, a scintilla-

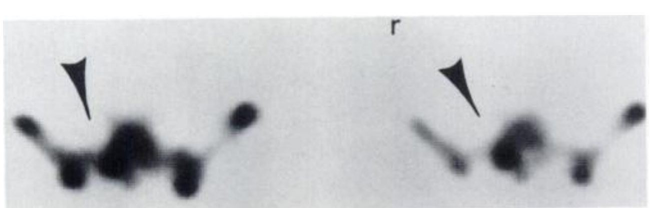

FIGURE 3. Bone scan. SPECT images reconstructed in the axial plane. An intense focus of increased activity is present in the right side of the posterior elements of L5.

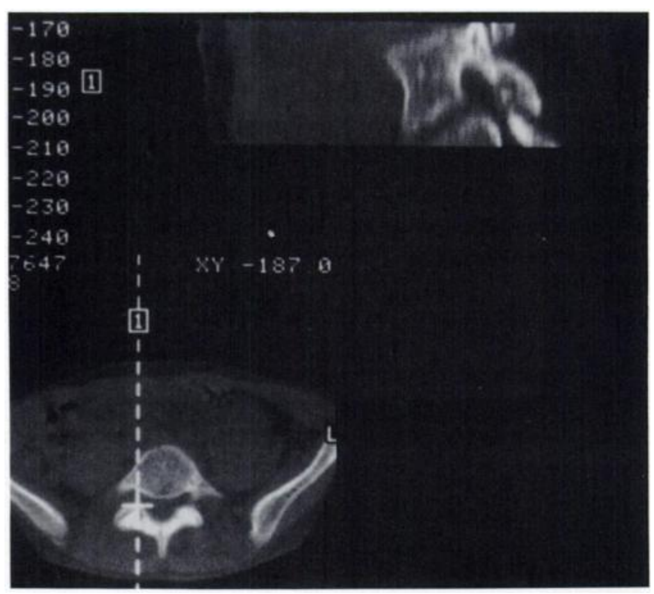

FIGURE 5. Computed tomography. A sagittal reconstruction demonstrates a sclerotic nidus that can be visualized within the lytic lesion.

tion probe, suitably sterilized, may be used to identify the "hot spot" prior to excision and then to confirm its removal by counting the surgical specimen and comparing the nidus to surrounding normal bone. An autoradiographic technique for identifying the nidus in the postoperative specimen also has been described, requiring exposure times of 2–8 hr (*9*). This has proven especially useful when intraoperative identification of the fragments is difficult.

Although eventual resolution of pain with time has been reported, the natural history of osteoid osteoma is uncertain and spontaneous recovery is rare. In contrast, total excision of the nidus completely relieves the pain (*1–3*). En bloc resection of the entire lesion best accomplishes this with the lowest risk of recurrence. Anatomic considerations, however, may dictate removal of only the nidus, leaving reactive bone in situ. For example, en bloc resection of the entire tumor from the femoral neck might risk a postoperative fracture. Similarly, osteoid osteomas placed deeply in the posterior elements of the spine are sometimes only partially resected. For these cases, the autoradiographic technique for postoperative scanning of the lesion, mentioned above, may prove helpful. Accurate identification and localization of the lesion using radioisotope imaging and computerized tomography are therefore necessary requirements for a successful operative resection.

Plain radiography is usually the initial imaging modality used in a patient with suspected osteoid osteoma. The diagnosis can often be made in the patient with the typical clinical presentation and characterictic radiographic findings. In those instances in which the radiographs fail to demonstrate the abnormality, a subsequent three-phase bone scan will usually locate the lesion. SPECT imaging may help in identifying the lesion site, but a follow-up CT scan will provide the best anatomic resolution of the tumor. Magnetic resonance imaging of osteoid osteomas has not been extensively studied and its role is not yet clearly defined.

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