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Osteoid Osteoma of the Calcaneus: Percutaneous Radiofrequency Ablation

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Osteoid osteoma of the foot can pose particular problems in diagnosis, especially when positioned in a juxta-articular location. It can cause reactive synovitis and simulate arthritis without periostitis. An atypical presentation may delay diagnosis and thus delay treatment. Different modes of treatment have been described including medical management with nonsteroidal, antiinflammatory drugs, and open surgical resection with intralesional, marginal, or wide surgical margins. In recent years, several computed tomography-guided percutaneous techniques have been used to achieve ablation of the nidus with minimal tissue invasion. We report a case of a 39-year-old man with an 8-month history of persistent foot pain who underwent percutaneous radiofrequency ablation of an osteoid osteoma involving the calcaneus. The patient related an immediate relief of pain and had no recurrence of symptoms or the lesion at 3-year follow-up. (The Journal of Foot & Ankle Surgery 44(6):469–472, 2005)

Key words: osteoid osteoma, radiofrequency ablation, calcaneus, foot

Osteoid osteoma is a relatively common benign bone tumor that is usually found in children and young adults. Schajowicz (1) estimates that it accounts for approximately 11% of all benign bone tumors and 5% of all primary bone tumors. The clinical feature of the lesion is local pain, typically more severe at night, which often promptly responds to aspirin and other nonsteroidal, antiinflammatory drugs. Although there is a predilection for the cortex of the shaft of long bones, lesions involving the foot have been previously reported (2). When they occur in the hand or foot, they can appear in an intra- or juxta-articular location. A reactive synovitis and effusion may occur that can simulate arthritis without periostitis (3). Although the historical findings are somewhat consistent, these atypical presentations can pose a particular problem in diagnosis, often leading to a delay in treatment (4, 5).

Several methods have been recommended as the "treatments of choice" and have included medical management with nonsteroidal, antiinflamatory drugs and open surgical resection with intralesional, marginal, or wide surgical margins (6). In recent years, several computed tomography (CT)-guided percutaneous techniques have been used to achieve ablation of the nidus with minimal tissue invasion (7, 8). The method of treating osteoid osteoma with thermocoagulation with the use of a percutaneously placed electrode has been previously described (9, 10), but only a few have affected the small bones of the foot (11, 12). We report a 39-year-old patient with an 8-month history of persistent foot pain who underwent percutaneous radiofrequency (RF) ablation of an osteoid osteoma involving the calcaneus.

Case Report

A 39-year-old man was evaluated at our institution, complaining of foot pain for 8 months. There was no history of trauma. Symptoms were most severe in the lateral aspect of the hindfoot and ankle. Initially the pain was intermittent, and partially relieved by ingestion of aspirin. He had been treated with multiple conservative programs without minimal relief. They included cold, rest, and different modes of physiotherapy. Later, the pain became constant and severe and did not respond to medication.

On physical examination, there was minimal swelling about the right hindfoot. He had full range of motion of the ankle and subtalar joint with mild pain. Plain radiographs showed sclerotic area in the calcaneus just inferior to the subtalar joint (Fig 1). A magnetic resonance image showed a well-circumscribed area of low-signal intensity in the

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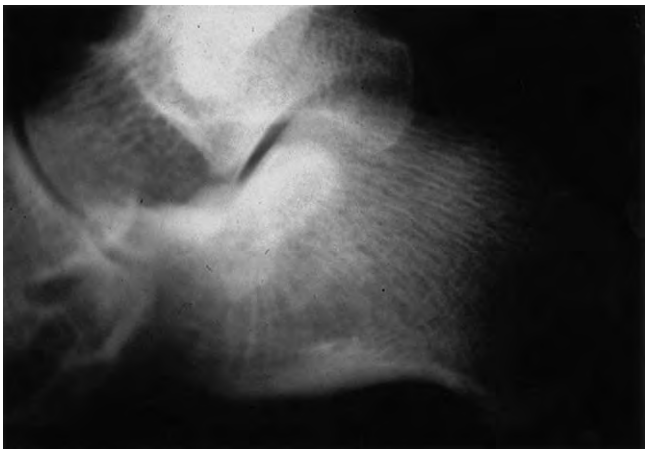

FIGURE 1 Lateral radiograph of the right foot that shows mild sclerosis inferior to the posterior facet of the subtalar joint.

FIGURE 2 A sagittal magnetic resonance image shows a well-circumscribed area of low-signal intensity in the right calcaneus, adjacent to the subtalar joint.

anterolateral aspect of the right calcaneus with surrounding edema (Fig 2). A CT scan was obtained and revealed a small lesion with a sclerotic rim in the anterolateral aspect of the right calcaneus adjacent to the posterior talocalcaneal joint (Fig 3).

Clinical examination and radiological studies led to the diagnosis of osteoid ostoema, and the patient underwent percutaneous RF ablation under CT guidance. After a general anesthetic, the patient was placed in a supine position on the CT bed, and the lesion was imaged. Under CT guidance, a bone-biopsy needle was percutaneously introduced into the lesion through a lateral approach (Fig 4). A

FIGURE 3 Axial CT of the right calcaneus shows the small lesion small with a sclerotic rim.

sample of tissue was obtained for frozen section. An RF electrode with a 5-mm exposed tip was introduced through the channel created by the needle (Fig 4). The electrode was connected to an RF generator (Radiotherapeutics, Sunnyvale, CA) that monitored the temperature at the tip of the electrode. The power output was adjusted to gradually bring the temperature of the tip to 90° Celsius. This temperature was maintained for 6 minutes, during which time a sphere of tissue approximately 1 cm in diameter was ablated through thermal conduction. The small skin wound was sutured, and the patient was allowed to bear weight immediately after the procedure. The diagnosis was confirmed histologically (Fig 5). The patient related an immediate relief of pain. At 3-year follow-up, there was no evidence of recurrence, and the patient was pain free.

Discussion

The characteristic and exquisite pain produced by osteoid osteoma is an interesting feature of this lesion. Schulman et al (13) identified nerve fibers within the matrix of the nidus in 16 of 18 lesions studied. They concluded that pain may be mediated by autonomic nervous system via those fibers, which are sensitive to changes in vascular pressure.

Initial treatment of the patient with osteoid osteoma usu-

FIGURE 4 (*A*) A bone-biopsy needle was percutaneously introduced into the lesion under CT guidance. (*B*) CT scan showing the channel created by the needle. (*C*) The RF electrode in the center of the nidus.

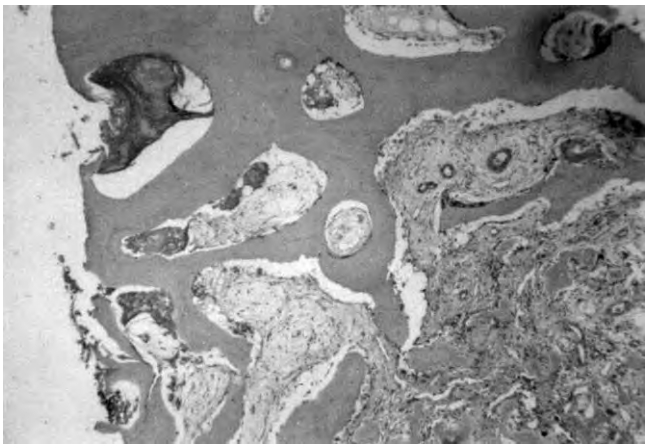

FIGURE 5 Photomicrograph of biopsy specimen showing evidence of osteoid osteoma. Note the bone sclerosis and small focus of immature bone with osteoblasts and osteoclasts, separated by fibrous and vascularized medullary tissue.

ally consists of trial nonsteroidal antiinflammatory drugs (6). Complete surgical excision is the classic treatment for those patients who continue to have substantial pain despite conservative treatment. En bloc resection ensures complete removal of the nidus, minimizing the chance of recurrence. However, the lesion is difficult to identify intraoperatively, requiring an excessive amount of bone resection, which may result in weakening of the bony structure and an increased risk of fracture. In this particular case, with en bloc resection, part of the articular surface may have been violated to completely resect the lesion.

During the last 10 years, minimally invasive procedures to treat osteoid osteoma have been further developed, because they require fewer health care resources and are associated with a shorter period of convalescence (7–9, 12, 14). Percutaneous ablation with RF is now a well-established procedure to treat these lesions involving long bones and pelvis (6, 9, 13). Different modes of treatment when these lesions occur in the foot have been described (4, 7, 12, 14, 15). Only isolated cases involving the foot being treated with this technique have been previously reported (11, 12). RF ablation of osteoid osteoma requires only small osseous access to allow insertion of the electrode. Bone loss therefore is minimal, even less than with other percutaneous techniques (7) and does not cause significant structural weakening. This is particularly useful in foot lesions that are often juxta-articular, which may otherwise require an open arthrotomy. Experimental RF treatment causes necrosis of bone in a spherical area approximately 1 cm in diameter (10). Consequently, it ensures an adequate ablation of the nidus. For these reasons, it appears to be a valuable alternative treatment for osteoid ostoema involving the foot and ankle, with outcomes equivalent to operative excision (10, 12). Although it has not been previously reported, RF ablation may cause chondral damage via thermal necrosis, when dealing with juxta-articular lesions.

Percutaneous RF ablation is a safe and efficient alternative treatment for osteoid osteoma involving foot and ankle, because it can be performed on an outpatient basis, it has not been associated with complications, and it is associated with a short period of convalescence.

References

1. Schajowicz F. Histological typing of bone tumors. Berlin, Heidelberg, Springer-Verlag, 1993.
2. Bakotic BW, Huvos AG. Tumors of the bones of the feet: the clinicopathologic features of 150 cases. J Foot Surg 40:277–286, 2001.
3. Soler JM, Piza G, Aliaga F. Special characteristics of osteoid osteoma in the proximal phalanx. J Hand Surg (Br) 22:793–797, 1997.
4. Barca F, Letti Acciaro A, Spina V. Intra-articular osteoid osteoma of the lower extremity: diagnostic problems. Foot Ankle Int 23:264–267, 2002.
5. Rosenthal DI, Springfield DS, Gebhardt MC, Rosenberg AE, Mankin HJ. Osteoid osteoma: percutaneous-radiofrequency ablation. Radiology 197:451–454, 1995.
6. Kneisl JS, Simon MA. Medical management compared with operative treatment for osteoid osteoma. J Bone Joint Surg 74-A:179–185, 1992.
7. Donley BG, Philbin T, Rosenberg GA, Schils JP, Recht M. Percutaneous CT guided resection of osteoid osteoma of the tibial plafond. Foot Ankle Int 21:596–598, 2000.
8. Muscolo DL, Velan O, Pineda Acero G, Ayerza MA, Calabrese ME, Santini Araujo E. Osteoid osteoma of the hip. Percutaneous resection guided by computed tomography. Clin Orthop 310:170–175, 1995.
9. Barei DP, Moreau G, Scarborough MT, Neel MD. Percutaneous radiofrequency ablation of osteoid osteoma. Clin Orthop 373:115–124, 2000.
10. Rosenthal DI, Hornicek FJ, Wolfe MW, Jennings LC, Gebhardt MC, Mankin HJ. Percutaneous radiofrequency coagulation of osteoid osteoma compared with operative treatment. J Bone Joint Surg 80-A: 815–821, 1998.
11. Ghanem I, Collet LM, Kharrat K, Samaha E, Deramon H, Mertl P, Dagher F. Percutaneous radiofrequency coagulation of osteoid osteoma in children and adolescents. J Pediatr Orthop B 12:244–252, 2003.
12. Lindner LJ, Ozaki T, Roedl R, Gosheger G, Winkelmann W, Wörtler K. Percutaneous radiofrequency ablation in osteoid osteoma. J Bone Joint Surg 83-B:391–396, 2001.
13. Schulman L, Dorfman HD. Nerve fibers in osteoid osteoma. J Bone Joint Surg 52A:1351–1356, 1970.
14. Resnick RB, Jarolem KL, Sheskier SC, Desai P, Cisa J. Arthroscopic removal of an osteoid osteoma of the talus: a case report. Foot Ankle Int 16:212–215, 1995.
15. Shereff MJ, Cullivan WT, Johnson KA. Osteoid-osteoma of the foot. J Bone Joint Surg 65-A:638–641, 1983.