

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: <http://Elsevier.com/locate/radcr>

Case Report

Intra-articular osteoid osteoma of the calcaneus: a case report and review

Tomo Hamada MD, Hidenori Matsubara MD, PhD^{*}, Hiroaki Kimura MD, PhD, Takao Aikawa MD, Yasuhisa Yoshida MD, Hiroyuki Tsuchiya MD, PhD

Department of Orthopedic Surgery, Kanazawa University Hospital, 13-1 Takara-machi, Kanazawa 920-8641, Japan

ARTICLE INFO

Article history:

Received 15 April 2016
Received in revised form
18 May 2016
Accepted 20 May 2016
Available online 24 June 2016

Keywords:

Osteoid osteoma
Calcaneus
Osteoarthritis
Misdiagnose
MRI

ABSTRACT

Osteoid osteoma of the calcaneus is rare and frequently misdiagnosed as arthritis because of similar symptoms. In addition, radiographic findings may be nonspecific, and magnetic resonance imaging (MRI) may show a bone marrow edema and changes in adjacent soft tissue. A 19-year-old man presented with a 6-month history of persistent pain and swelling in the left hind foot; diagnostic computed tomography and MRI analyses revealed lesions suggesting an intra-articular osteoid osteoma of the calcaneus. Initial MRI did not show specific findings. On operation, the tumor was removed by curettage; pathologic findings demonstrated woven bone trabeculae surrounded by connective tissue, confirming the diagnosis. To the best of our knowledge, MRI scans in all cases of calcaneal osteoid osteoma reported till 3 months after the injury exhibited a nidus. We believe that calcaneal osteoid osteoma should be considered as a differential diagnosis in patients undergoing MRI 3 months after symptom presentation; early computed tomography is critical in diagnosis.

© 2016 the Authors. Published by Elsevier Inc. under copyright license from the University of Washington. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Osteoid osteoma accounts for approximately 11% of all benign bone tumors and is usually found in children and young adults [1]. It causes localized pain that typically peaks at night and has to be resolved with aspirin or other nonsteroid anti-inflammatory drugs (NSAIDs) [2]. In over 50% of cases, the tumor localizes in the femur and tibia, whereas in 4% of cases, it occurs in the foot and ankle region [3,4].

Osteoid osteomas are usually found in the cortex of the shaft of long bones and have a characteristic radiographic and clinical appearance [5]. Furthermore, osteoid osteoma in the hind foot may exhibit less reactive sclerosis which may often lead to misdiagnosis. When osteoid osteoma develops in the hind foot, there is often a delay in diagnosis as it mimics other, more frequently occurring pathologies. This is a report of a rare case of intra-articular osteoid osteoma of the calcaneus in a young male who was initially misdiagnosed with stress fracture and subtalar arthritis.

Competing Interests: The authors have declared that no competing interests exist.

^{*} Corresponding author.

E-mail address: ortho331@yahoo.co.jp (H. Matsubara).
<http://dx.doi.org/10.1016/j.radcr.2016.05.008>

1930-0433/© 2016 the Authors. Published by Elsevier Inc. under copyright license from the University of Washington. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).



Fig. 1 – MRI performed 4 months after the onset of symptoms. Coronal and sagittal T2-weighted MRI showing bone marrow edema of the calcaneus and development of arthritis.

Case report

A 19-year-old man presented with a 6-month history of persistent pain and swelling in the left hind foot. He was recreational tennis player, with no previous history of trauma or any medical conditions. Initial magnetic resonance imaging

(MRI) of the foot performed at the family doctor's clinic did not show any abnormality compared with the other foot, except for bone marrow edema of the calcaneus. Under a possible diagnosis of stress fracture in the calcaneus, he was treated with NSAIDs and physiotherapy. Since these conservative treatments had no effect, he consulted a hospital 4 months after the onset of initial symptoms. Here, T2-weighted MRI

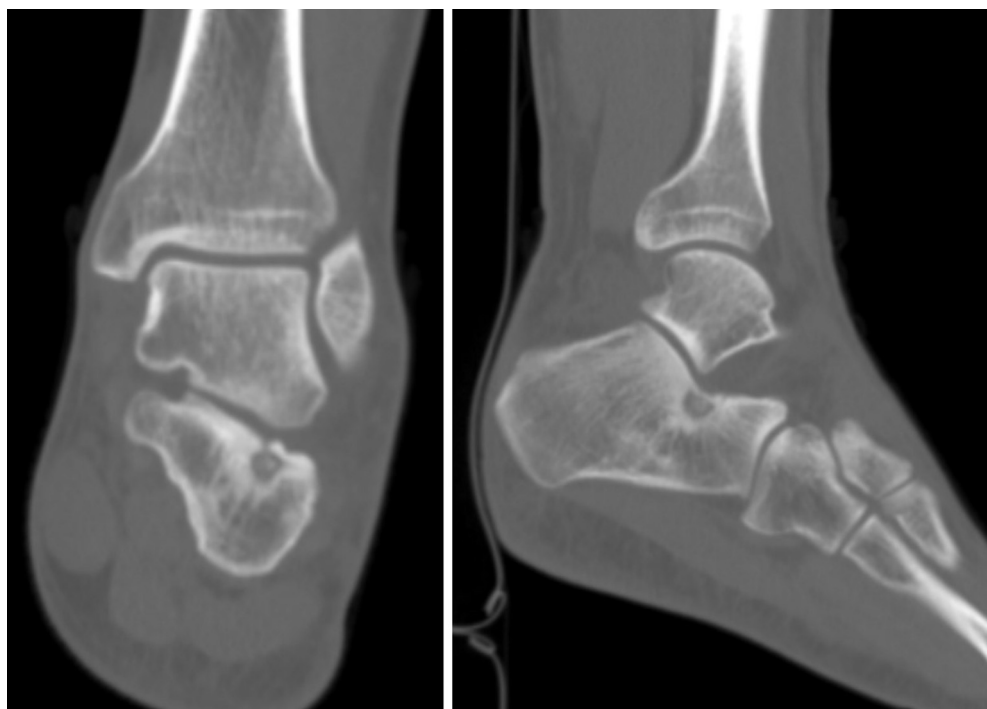


Fig. 2 – CT performed 6 months after the onset of symptoms. Coronal and sagittal CT showing the nidus with a sclerotic rim.

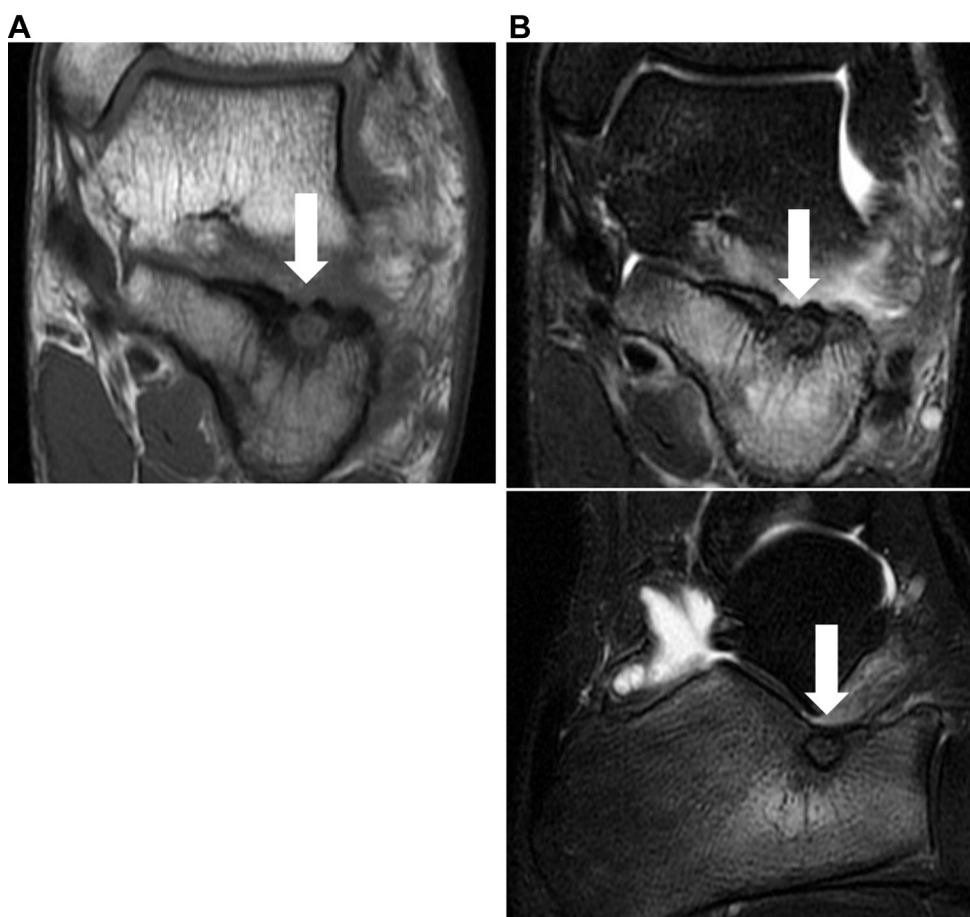


Fig. 3 – MRI performed 6 months after the onset of symptoms. (A) T1-weighted MRI showing the low-signal-intensity nidus (arrow). (B) Coronal and sagittal T2-weighted fat-suppressed MRI showing the intermediate signal intensity nidus (arrows).

revealed bone marrow edema of the calcaneus and development of arthritis in the posterior region of the subtalar joint (Fig. 1). No bony lesions were observed, and subtalar arthritis was diagnosed. The patient was treated with a splint, NSAIDs, and ice. Although these treatment measures were effective in reducing the symptoms, they were unable to cure him completely.

Eventually, the patient was referred to our hospital 6 months after the onset of symptoms. Physical examination showed definite tenderness at the tarsal sinus, and the patient complained of pain in the hind foot when the ankle joint was in the supinated and pronated positions. Moreover, episodes of pain at night remained unresolved. C-reactive protein levels and other biochemical tests showed normal results, and radiography failed to reveal any abnormalities. Computed tomography (CT) scan revealed a tiny radiolucent nidus (diameter, 7 mm) adjacent to the subtalar joint having a sclerotic rim in the left calcaneus (Fig. 2). The MRI clearly demonstrated a bony lesion with low signal intensity in T1-weighted images and intermediate signal intensity in T2-weighted fat-suppressed images (Fig. 3). Bone marrow edema of the calcaneus, development of arthritis in the posterior region of the subtalar joint, and edema in the surrounding soft tissues were observed (Fig. 3). The bone scan

demonstrated intense uptake at the nidus (Fig. 4). The patient was diagnosed with osteoid osteoma of the calcaneus, and excisional biopsy and curettage were performed.

Identification of the subtalar joint was carried out under fluoroscopic guidance, and a horizontal incision was made. The nidus was identified without incision of the subtalar joint capsule, and the gray-brown tissue (Fig. 5) was removed by curettage until the normal spongy structure of the calcaneus was seen. The remaining defect was densely filled with an artificial bone graft after completion of cauterization. The pain was seen to disappear within the first week after surgery. Pathologic findings demonstrated woven bone trabeculae surrounded by connective tissue, confirming the presence of osteoid osteoma (Fig. 5). No postsurgical tumor recurrence or complications were observed clinically and radiographically. One year after the operation, the patient was symptom free and experienced no limitations when playing tennis.

Discussion

The talus is the most frequently involved site in the foot [6], whereas the calcaneus is rarely involved. Osteoid osteoma in



Fig. 4 – Bone scan showing increased radionuclide uptake at the nidus in the left calcaneus.

unusual locations may complicate the diagnostic process, with some patients being previously misdiagnosed as having os trigonum syndrome, calcaneal stress fracture, avulsion injury of the calcaneofibular ligament, subtalar arthritis, or ankle sprain [7–10]. Many authors have reported cases of calcaneal osteoid osteoma being located in the intra-articular area, at which the tumor can be very difficult to diagnose [8–11]. Typical findings in normal osteoid osteomas include a radiolucent lesion with a nidus appearance surrounded by bone sclerosis [3,5]. However, the appearance of intra-articular osteoid osteomas differs from that of normal osteomas. In the former, reactive cortical thickening is minimal [12]. In addition, Kayser et al. [13] reported that tarsal osteoid osteomas, such as those of the calcaneus, may display less reactive sclerosis, which can be misleading. On MRI, the nidus may show a low T1 signal, a variable T2 signal, and variable contrast enhancement [12,14,15].

Moreover, the clinical symptoms of intra-articular osteoid osteomas are often observed before radiographic findings

become apparent [10] and may resemble those of arthritis [3,16,17]. When calcaneal osteoid osteoma is accompanied by severe inflammatory changes, such as subtalar arthritis joint effusion and edema of the calcaneal bone marrow and surrounding soft tissue, the nidus may be masked impeding proper diagnosis. We have reviewed cases of calcaneal osteoid osteoma initially misdiagnosed based on MRI performed 3 months after the onset of symptoms [7,9,11]. Yang et al. [7] reported that a week after initial presentation, the MRI showed only a moderate bone bruise on the calcaneus and signal changes in the calcaneofibular ligament. However, after 3 months, the MRI clearly demonstrated a bony lesion, and the surrounding sclerotic area was found to have expanded. Aratake et al. [11] reported that T2-weighted MRI performed 2 months after the onset of symptoms showed a high-intensity area in the calcaneal bone marrow, retention of joint fluid, and development of synovitis in the posterior region of the ankle joint. Moreover, after 5 months, the CT image demonstrated a bony lesion surrounded by sclerotic bone marrow, confirming a diagnosis of osteoid osteoma. Sanhudo [9] reported that 3 months after initial presentation, the MRI revealed increased signal changes around the large os trigonum, and 7 months after symptom development, it demonstrated a smaller lesion. In the present case, 4 months after symptom onset, the MRI only showed intramedullary bone marrow edema of the calcaneus and signal changes in the subtalar joint. However, the nidus of the osteoid osteoma could not be seen.

To the best of our knowledge, MRI scans in all cases of calcaneal osteoid osteoma reported till 3 months after the injury exhibited a nidus, with cases being treated only 3 months after initial presentation [7–11]. Therefore, we believe that calcaneal osteoid osteoma should be considered as a differential diagnosis in patients undergoing MRI 3 months after symptom presentation. Some authors have reported that CT visualizes nidus more accurately and effectively than MRI [18–21]. Moreover, Khurana et al. [16] have reported that using thin-section CT helps in early and correct diagnosis of osteoid osteoma.

We conclude that the diagnosis of calcaneal osteoid osteoma is difficult and believe that early CT is critical in diagnosis.

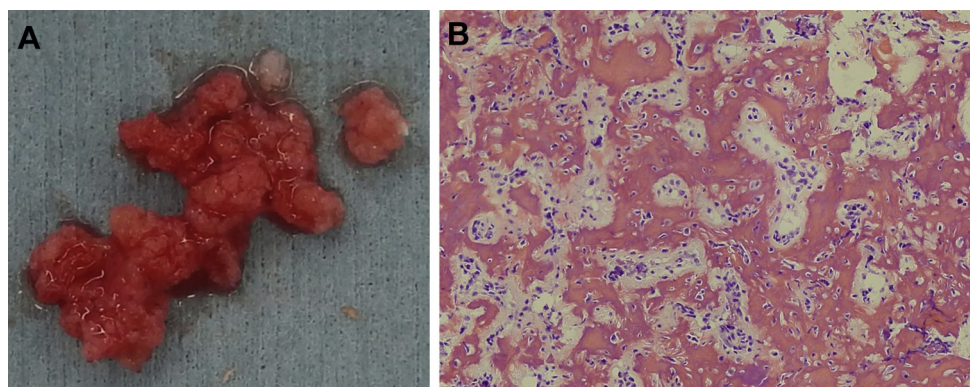


Fig. 5 – The gray-brown tissue that was removed by curettage. (A) Macroscopic images revealed gray-brown tissue. (B) Pathologic findings included woven bone trabeculae surrounded by connective tissue.

REFERENCES

- [1] Schajowicz F. *Histological typing of bone tumors*. 2nd ed. Heidelberg: Springer-Verlag; 1993.
- [2] Makley JT, Dunn MJ. Prostaglandin synthesis by osteoid osteoma. *Lancet* 1982;2:42.
- [3] Resnick D, Niwayama G. Tumors and tumor-like lesions of bone: imaging and pathology of specific lesions. In: Donald R, Michael K, Guerdon DG, editors. *Diagnosis of bone and joint disorders*. Philadelphia: WB Saunders Co; 1988. p. 3621–35.
- [4] Unni KK, Inwards CY, Bridge JA, Kindblom LG, Wold LE. *Tumors of the bones and joints*. American registry of pathology. Washington, DC: American Registry of Pathology in collaboration with the Armed Forces Institute of Pathology; 2005.
- [5] Temple HT, Scully SP. Tumors. In: Mizel MS, Miller RA, Sciolo MW, editors. *Orthopaedic KNOWLEDGE update: foot and ankle 2*. Rosemont (IL): American Academy of Orthopaedic Surgeons; 1998. p. 11–26.
- [6] Moser Jr RP, Kransdorf MJ, Brower AC, Hudson T, Aoki J, Berrey BH, et al. Osteoid osteoma of the elbow. A review of six cases. *Skeletal Radiol* 1990;19:181–6.
- [7] Yang JH, Park JH, Min KW, Kim HJ, Jung JY. Post-traumatic extra-articular osteoid osteoma of the calcaneus following military training. *J Orthop Sci* 2011;16:326–8.
- [8] Lo AB, Chow AH, Wong WC, Hui JP, Yuen MK. Osteoid osteoma of the calcaneum: a small painful lesion causing confusing symptoms. *Hong Kong Med J* 2012;18:70–2.
- [9] Sanhudo JA. Osteoid osteoma of the calcaneus mimicking os trigonum syndrome: a case report. *Foot Ankle Int* 2006;27:548–51.
- [10] Pogliacomi F, Vaienti E. Misdiagnosed iuxta-articular osteoid osteoma of the calcaneus following an injury. *Acta Biomed* 2003;74:144–50.
- [11] Aratake M, Shigeyuki M, Atsushi H, Takeuchi R, Saito T. Case of juxta-articular osteoid osteoma of calcaneus mimicking arthritis. *J Foot Ankle Surg* 2012;51:237–40.
- [12] Chai JW, Hong SH, Choi JY, Koh YH, Lee JW, Choi JA, et al. Radiologic diagnosis of osteoid osteoma: from simple to challenging findings. *Radiographics* 2010;30:737–49.
- [13] Kayser F, Resnick D, Haghighi P, Pereira Edo R, Greenway G, Schweitzer M, et al. Evidence of the subperiosteal origin of osteoid osteomas in tubular bones: analysis by CT and MR imaging. *AJR Am J Roentgenol* 1998;170:609–14.
- [14] Ebrahim FS, Jacobson JA, Lin J, Housner JA, Hayes CW, Resnick D. Intraarticular osteoid osteoma: sonographic findings in three patients with radiographic, CT, and MR imaging correlation. *AJR Am J Roentgenol* 2001;177:1391–5.
- [15] Allen SD, Saifuddin A. Imaging of intra-articular osteoid osteoma. *Clin Radiol* 2003;58:845–52.
- [16] Khurana JS, Mayo-Smith W, Kattapuram SV. Subtalar arthralgia caused by juxtaarticular osteoid osteoma. *Clin Orthop Relat Res* 1990;252:205–8.
- [17] Szendroi M, Kollo K, Antal I, Lakatos J, Szoke G. Intraarticular osteoid osteoma: clinical features, imaging results, and comparison with extraarticular localization. *J Rheumatol* 2004;31:957–64.
- [18] Hayes CW, Conway WF, Sundaram M. Misleading aggressive MR imaging appearance of some benign musculoskeletal lesions. *Radiographics* 1992;12:1119–34. discussion 1135–6.
- [19] Assoun J, Richardi G, Railhac JJ, Baunin C, Fajadet P, Giron J, et al. Osteoid osteoma: MR imaging versus CT. *Radiology* 1994;191:217–23.
- [20] Lefton DR, Torrisi JM, Haller JO. Vertebral osteoid osteoma masquerading as a malignant bone or soft-tissue tumor on MRI. *Pediatr Radiol* 2001;31:72–5.
- [21] Youssef BA, Haddad MC, Zahrani A, Sharif HS, Morgan JL, al-Shahed M, et al. Osteoid osteoma and osteoblastoma: MRI appearances and the significance of ring enhancement. *Eur Radiol* 1996;6:291–6.