



A Rare Presentation of Osteoid Osteoma in a 77-Year-Old Patient, Treated with Computer Tomography–Guided Percutaneous Radiofrequency Ablation

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Abstract

Osteoid osteoma (OO) is a benign bone forming tumor characterized by small size and a disproportionate amount of pain. They are most commonly seen between the ages of 5 and 30 years; however, they can be seen in the older patient albeit infrequently. The hands and feet are the least common site of OO among the extremity bones. We present a case of an OO in the hand of a 77-year-old man who underwent successful treatment with computed tomography–guided percutaneous radiofrequency ablation. We believe this is the oldest recorded patient in the medical literature with a histologically confirmed OO. The condition should therefore be considered in the differential diagnosis of a painful sclerotic bone lesion in this age group to avoid a delay in diagnosis and subsequent treatment.

Keywords

- ▶ bone tumor
- ▶ osteoblastic tumor
- ▶ osteoid osteoma
- ▶ radiofrequency ablation

Introduction

Osteoid osteoma (OO) is a benign bone forming tumor that was first introduced to the medical literature as a distinct clinical and pathological entity by Jaffe in 1935.¹ He described five cases of benign osteoblastic tumors composed of atypical bone and osteoid who underwent surgical excision on the belief that they were an “inflammatory osteomyelitis” but no pus was identified at the time of surgery. OO is now recognized to be a relatively common benign skeletal tumor. It is the third commonest primary benign bone tumor accounting for ~12.9% of all benign bone tumors.²

OO can occur in almost any bone, but there is a predilection for the lower limb with 50% of lesions occurring in the femur or tibia.² They usually occur in younger patients with approximately half presenting between 10 and 20 years. OO is uncommon in patients younger than 5 years or older than 40 years³ and therefore may not be considered in the differential diagnosis of a bone lesion of a patient after

middle age. We describe a case of a histologically proven OO in patient aged 77 years who was treated with computed tomography (CT)–guided percutaneous radiofrequency ablation (RFA). We believe this is the oldest recorded case of a patient with OO in the medical literature to date.

Case Report

A 77-year-old man was referred to our institution with a 6-month history of increasing pain in swelling in the metacarpal region of his right/left hand. There was no preceding history of trauma. His medical history was unremarkable. Clinical examination demonstrated soft tissue swelling on the dorsum of the left hand with no overlying erythema or warmth. Full blood count was within normal limits, and the serum C-reactive protein and erythrocyte sedimentation rate were mildly elevated.

X-ray of the hand demonstrated cortical thickening and sclerosis of radial border of the middle finger metacarpal.

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Fig. 1 Radiograph of the hand of a 77-year-old man shows cortical thickening of the radial border of the middle finger metacarpal with a central cortical lucency (white arrow).

Within this area, there was a central focal lucent area (→**Fig. 1**).

Magnetic resonance imaging (MRI) demonstrated a thickened cortex with intense intramedullary and periosteal edemas. A small central cortical lucency was demonstrated measuring 0.5×0.5 cm. Given the patient's age, it was felt that this was most likely to be osteomyelitis with an intracortical abscess (→**Fig. 2**). OO was also considered at this time but on balance was felt less likely due to patient's age. Other differential diagnoses considered included stress fracture, florid reactive periostitis, and sclerotic metastasis. As the

symptoms were not settling and blood cultures were negative, the patient underwent a CT-guided biopsy of the lesion to get a definitive diagnosis.

The CT scan immediately prior to the biopsy demonstrated cortical sclerosis of the metacarpal and thickening with a well-defined focal central lucency (→**Fig. 3**). Given the CT findings, this was felt to be classical of an OO, and therefore, the decision was taken to undertake a CT-guided biopsy and percutaneous RFA in the same sitting. The biopsy was performed with a coaxial 15G Bonopty biopsy system (14G penetration set) (AprioMed, Sweden), and the sample was sent for histology and microbiology. CT-guided



Fig. 3 Reformatted coronal computed tomography image showing cortical sclerosis and a cortical lucency typical of an osteoid osteoma.

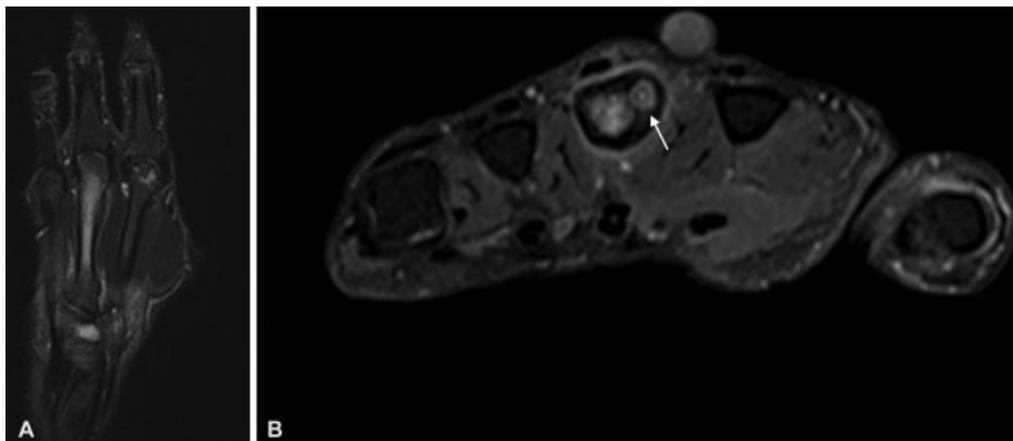


Fig. 2 (A) Coronal short tau inversion recovery (STIR) sequence of the hand shows cortical thickening of the metacarpal with intramedullary marrow edema. (B) Axial STIR sequence of the hand showing cortical sclerosis with periosteal and intramedullary edemas. There is a 5-mm cortical lucency at the radial border of the metacarpal.

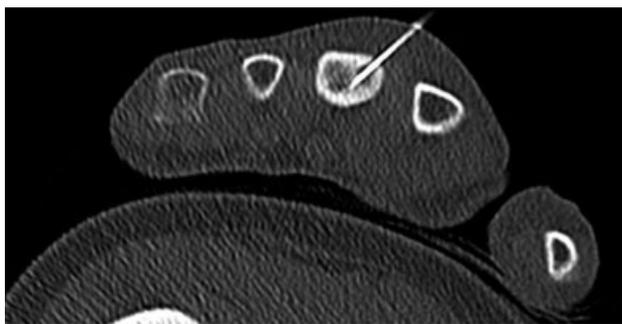


Fig. 4 Intraprocedural axial computed tomography image with radiofrequency probe in the lesion.

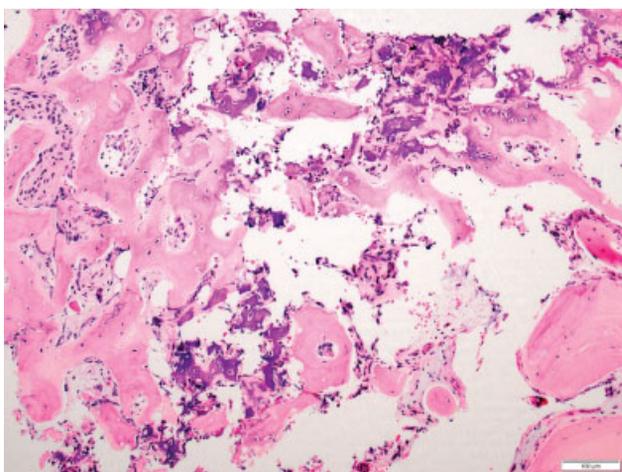


Fig. 5 Photomicrograph of the tumor (hematoxylin and eosin staining) showing the typical features of an osteoid osteoma with thin trabeculae of woven bone surrounded by osteoclasts.

percutaneous RFA was then performed using the Neurotherm NT1100 RF Generator (Abbott, United States). A 16G 15-cm RFA probe with a 5-mm exposed tip was placed into the center of the lesion. Ablation was performed by heating the tip of the probe to 90 degrees for 6 minutes (► **Fig. 4**). This created an ablation zone of ~5 mm which was felt sufficient to cover the lesion. Given the risk of a skin burn, the skin and subcutaneous tissues were protected with generous instillation of local anesthetic which increased the distance between the active part of the electrode and the skin surface. The skin was monitored with visual inspection and touched throughout the procedure. No periprocedural complications were observed and the patient was discharged on the same day. Microbiological cultures were negative. Histology confirmed fragments of a nidus of an OO with woven bone lined by osteoblasts (► **Fig. 5**). The patient has complete resolution of his symptoms at his 3 months follow-up and he remains symptom free at 6 months.

Discussion

There are numerous reports in the medical literature of OO in older individuals. A large series from the Armed Forces Institute of Pathology which included 225 patients showed

the average age of presentation to be 19 years with an age range from 19 months to 56 years.⁴ Furthermore, there are several case series which have included patients who were older than 60 years.^{2,4} The oldest recorded patient with an OO in the medical literature was from a series from the Mayo Clinic who was 72 years old at the time of diagnosis.⁵ The differential diagnosis of OO includes Brodie's abscess, sclerosing osteomyelitis, stress fracture, osteoma, osteosarcoma, and Ewing's sarcoma. Given our patients demographic, the most likely diagnosis on the initial imaging was between an osteomyelitis with a Brodie's abscess and an OO.

The nidus of a classical cortical OO and a Brodie's abscess can have very similar imaging findings and, in many cases, can be indistinguishable from each other. On conventional nonenhanced MRI, the nidus of a cortical OO has an intermediate signal on T1-weighted sequences and is hyperintense signal on fluid sensitive sequences. If the nidus is sufficiently mineralized, it may be low signal on all sequences. There is also associated periosteal and intramedullary edemas. On MRI, a Brodie's abscess can demonstrate the penumbra sign which is a thin rim of higher intensity signal at the periphery of the abscess on T1-weighted images which represents surrounding granulation tissue around the central abscess.⁶ If the abscess is small, the penumbra sign can be difficult to visualize, however. CT can be used to help differentiate between the two conditions. In a cortical OO, the nidus of the lesion is usually surrounded by reactive sclerosis. The nidus is usually rounded and well defined with a smooth periphery measuring less than 1.5 cm. The nidus may or may not contain various amount of mineralization. The mineralization can have different appearances and can be amorphous, ring like, or dense⁴ and is usually central in location.⁷ Conversely, a Brodie's abscess usually has an irregular outer surface. A sequestrum, which may or may not be present, is usually located in an eccentric location⁷ rather than centrally. The abscess cavity can measure anywhere from a few millimeters to several centimeters. Other CT findings associated with an OO are the presence of feeding vessels to the nidus^{8,9}; however, these could be confused with a thin sinus tract or a cloaca.

High-resolution dynamic contrast MRI may be useful in differentiating an OO from a Brodie's abscess. Liu et al in 2003 showed the nidus demonstrated a peak enhancement in the arterial phase with early washout¹⁰ in 82% of cases. A more recent study by Pottecher et al¹¹ demonstrated early arterial enhancement of the nidus in 93% of cases. Interestingly, they also showed that the nidus in small and flat bones demonstrated faster contrast uptake than in long bones as medullary and endosteal lesions did when compared with intracortical and subperiosteal lesions. Conversely, the enhancement pattern in a Brodie's abscess is different with slower enhancement with no arterial peak.¹²

Bone scintigraphy can be helpful in the diagnosis of OO. Due to the vascular nature of the nidus, the early phase of the bone scan will show intense tracer uptake. On delayed phase imaging, a "double density" sign has been described which represents the intense tracer uptake of the nidus and the less intense tracer uptake of the surrounding reactive

tissues.^{13,14} Unfortunately, the pattern of tracer uptake in infection can be similar to that of an OO, and while it is very sensitive, it has low specificity¹⁵ and cannot reliably differentiate between the two disease processes.

A Brodie's abscess and an OO are treated differently. The mainstay of treatment of a Brodie's abscess is often surgical drainage often in conjunction with antimicrobial therapy.¹⁶ The treatment of choice for OO is excision or destruction of the nidus. The preferred method of destroying the nidus nowadays is percutaneous RFA, which is a well-established minimally invasive technique with high success rate and minimal complications.¹⁷ This treatment has largely replaced open surgical excision or curettage of the nidus. In our case where the CT findings were classical for an OO, it was felt reasonable to proceed to percutaneous biopsy and RFA in the same sitting. When the diagnosis is in doubt, a biopsy is advisable first and following definitive histology, the appropriate treatment can be commenced. If a cortical abscess is misdiagnosed and an inadvertent RFA is performed, it should not burn any bridges for definitive treatment further down the line, although there is a single case report in the medical literature in which the inadvertent ablation of a Brodie's abscess led to worsening infection and abscess formation.¹⁸ Nonsteroidal anti-inflammatory can be useful in the control of symptoms of an OO, but there are issues with the long-term use of such medications which are exacerbated in the elderly patient, particularly in those with preexisting renal, pulmonary, and gastrointestinal-related issues. This, therefore, makes their use as a definitive treatment strategy for OO less favorable than RFA.¹⁹

RFA in the hand bones can be performed but should be practiced with caution due to the close proximity to the skin and adjacent nerves and blood vessels. Preprocedural ultrasound immediately prior to the placement of the penetration needle will identify any tendons and vessels in the needle path and therefore can be avoided. In addition, infiltration of subcutaneous local anesthetic can increase the distance between the OO and the skin surface thereby reducing the risk of a skin burn. Retraction of the outer cannula, so that it does not contact the exposed tip of the radiofrequency electrode, is mandatory and should be checked throughout the procedure, and a CT image should be saved to confirm this maneuver has been performed. As, with any RFA procedure, the grounding pad should be carefully placed on the skin, ensuring full skin contact using the largest available grounding pad on a well-vascularized site to reduce the risk of grounding pad site thermal injury.²⁰

Conclusion

In summary, OO is rare benign bone forming tumor much more frequently encountered in children and young adults, and hence may be overlooked in the elderly patient which may lead to a delay in the correct diagnosis and the appropriate treatment. It should be considered in the differential diagnosis in a painful sclerotic cortically based lesion in the patient of any age and not just in children and young adults. CT-guided percutaneous RFA is the treatment of choice with

a high success rate and fewer complications than open surgical excision.

Declaration of Patient Consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflict of Interest

None declared.

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