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

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Introduction

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.

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

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.
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 intra-cortical 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
the average age of presentation to be 19 years with an age range from 19 months to 56 years. Furthermore, there are several case series which have included patients who were older than 60 years. 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. The differential diagnosis of OO includes Brodie's abscess, scirrhous 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. 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 dense and is usually central in location. 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 location 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; 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 washout in 82% of cases. A more recent study by Pottecher et al 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 medul- lary 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.

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

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 percentage of Ossification of intracapsular and subperiosteal 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.

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tissues. 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 specificity 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. 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, minimal invasive technique with high success rate and minimal complications. 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. 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.

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.

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.

References

1. Jaffe HL. Osteoid osteoma: a benign osteoblastic tumour composed of osteoid and atypical bone. Arch Surg 1935;31:709–728
2. Unni KK. In: Dahlin's Bone Tumours: General Aspects and Data on 10,165 Cases. 6th Revised Edition. Lippincott Williams & Wilkins; 2010
3. Mirra JM. Osseous tumours of the intramedullary origin. In: Bone Tumors: Clinical, Radiologic and Pathologic Correlations. Philadelphia: Lea & Febiger; 1989:248–438
4. Kirsch MM, Stull MA, Gilkey FW, Moser RP Jr. Osteoid osteoma. Radiographics 1991;11(04):671–696
5. Rehnitz C, Sprengel SD, Lehner B, et al. CT-guided radiofrequency ablation of osteoid osteoma: correlation of clinical outcome and imaging features. Diagn Interv Radiol 2013;19(04):330–339
6. Gulati Y, Maheshwari AV. Brodie's abscess of the femoral neck simulating osteoid osteoma. Acta Orthop Belg 2007;73(05):648–652
7. Chai JW, Hong SH, Choi JY, et al. Radiologic diagnosis of osteoid osteoma: from simple to challenging findings. Radiographics 2010;30(03):737–749
8. Yaniv G, Shabshin N, Sharon M, et al. Osteoid osteoma—the CT vessel sign. Skeletal Radiol 2011;40(10):1311–1314
9. Liu PT, Kujak JL, Roberts CC, de Chadarevian J-P. The vascular groove sign: a new CT finding associated with osteoid osteomas. AJR Am J Roentgenol 2011;196(01):168–173
10. Liu PT, Chivers FS, Roberts CC, Schultz CJ, Beauchamp CP. Imaging of osteoid osteoma with dynamic gadolinium-enhanced MR imaging. Radiology 2003;227(03):691–700
11. Potchio P, Sibileau E, Ahu S, et al. Dynamic contrast-enhanced MR imaging in osteoid osteoma: relationships with clinical and CT characteristics. Skeletal Radiol 2017;46(07):935–948
12. Woertler K. Benign bone tumors and tumor-like lesions: value of cross-sectional imaging. Eur Radiol 2003;13(08):1820–1835
13. Helms CA. Osteoid osteoma. The double density sign. Clin Orthop Relat Res 1987;(222):167–173
14. Helms CA, Hattner RS, Vogler JB III. Osteoid osteoma: radionuclide diagnosis. Radiology 1984;151(03):779–784
15. Littenberg B, Mushlin A. Diagnostics Technology Assessment Consortium. Technetium bone scanning in the diagnosis of osteomyelitis: a meta-analysis of test performance. J Gen Intern Med 1992;7(02):158–164
16. van der Naald N, Smeeing DPJ, Houwert RM, Hietbrink F, Goovaert GAM, van der Velde D. Brodie’s abscess. A systematic review of reported cases. J Bone Jt Infect 2019;4(01):33–39
17 Hoffmann RT, Jakobs TF, Kubisch CH, et al. Radiofrequency ablation in the treatment of osteoid osteoma-5-year experience. Eur J Radiol 2010;73(02):374–379
18 Chan R, Abdullah B, Aik S, Tok Ch. Radiofrequency ablation of a misdiagnosed Brodie’s abscess. Biomed Imaging Interv J 2011;7(02):e17
19 Carpintero-Benitez P, Aguirre MA, Serrano JA, Lluch M. Effect of rofecoxib on pain caused by osteoid osteoma. Orthopedics 2004;27(11):1188–1191
20 Huffman SD, Huffman NP, Lewandowski RJ, Brown DB. Radiofrequency ablation complicated by skin burn. Semin Intervent Radiol 2011;28(02):179–182