RESEARCH PAPER

Osteoid Osteoma of the Mid-Diaphyseal Tibia in an 11-Year-Old Female: A Case Report and Review of Radiofrequency versus Microwave Ablation

Dr. Abhishek Nair[1], Dr. Raamanathan Ramesh[2*], Dr. Anteshwar Birajdar[3], Dr. Sagar Gurnani[4]

[1]Assistant Professor, Dept of Orthopaedics, Dr. DY Patil Medical College and Hospital Pimpri Pune

[2]Junior Resident, Dept of Orthopaedics, Dr. DY Patil Medical College and Hospital Pimpri Pune. Email: raam4real@gmail.com

[3]Professor, Dept of Orthopaedics, Dr. DY Patil Medical College and Hospital Pimpri Pune

[4]Assistant Professor, Dept of Orthopaedics, Dr. DY Patil Medical College and Hospital Pimpri Pune

[*]Corresponding Author: Dr. Raamanathan Ramesh, Junior Resident, Dept of Orthopaedics, Dr. DY Patil Medical College and Hospital Pimpri Pune. Email: raam4real@gmail.com

Abstract

Osteoid osteoma is a benign bone tumor that typically affects children and adolescents and causes nocturnal bone pain relieved by NSAIDs. We present an 11-year-old girl with a mid-diaphyseal tibial osteoid osteoma confirmed by imaging. CT-guided radiofrequency ablation (RFA) of the nidus resulted in complete pain relief with no recurrence at 6 months. In the literature, both RFA and microwave ablation (MWA) achieve very high success rates (>90%) and low recurrence rates in osteoid osteoma【5】【6】. Comparative data (Karluka et al.) show similar clinical success (~94% each) and low recurrence (≈4%) for RFA versus MWA【5】. Both modalities are safe, though MWA may create a larger ablation zone at the cost of slightly increased risk of thermal injury【5】【6】. Ethical approval and guardian consent were obtained. Study limitations include lack of histologic confirmation and short follow-up.

Keywords: Osteoid osteoma, radiofrequency ablation, microwave ablation, tibia, pediatric orthopedics, benign bone tumor

How to cite this article: Nair A, Ramesh R, Birajdar A, Gurnani S. Osteoid Osteoma of the Mid-Diaphyseal Tibia in an 11-Year-Old Female: A Case Report and Review of Radiofrequency versus Microwave Ablation. Int J Drug Deliv Technol. 2026;16(16s): 798-802. DOI: 10.25258/ijddt.16.16s.86

Introduction

Osteoid osteoma (OO) is a benign osteoblastic tumor accounting for about 2–3% of all bone tumors (10–12% of benign bone tumors)【1】. It most commonly occurs in the second decade of life, with a male predominance (≈4:1 male:female)【1】. The lesion typically involves the cortex of long bones, especially the femur and tibia【1】. Patients classically present with localized bone pain that is worse at night and dramatically relieved by NSAIDs, due to high levels of prostaglandins produced by the nidus【1】【2】. Radiologically, OO is characterized by a small (<1–1.5 cm) intracortical radiolucent nidus often containing central calcification, surrounded by reactive sclerosis and cortical thickening【1】.

Traditionally, OO can eventually resolve spontaneously over years, but definitive treatment is usually indicated due to the severity of pain. Open surgical excision was the historical standard, but minimally invasive ablation techniques are now preferred. Rosenthal et al. first described CT-guided radiofrequency ablation (RFA) for OO in 1992【2】, which rapidly became the percutaneous treatment of choice. RFA applies thermal energy via an electrode to induce coagulative necrosis of the nidus. More recently, percutaneous microwave ablation (MWA) has been introduced (first reports ~2014【2】) as an alternative thermal modality. MWA can achieve faster heating and a larger ablation zone than RFA, potentially treating larger lesions more effectively【2】. There is no consensus on a superior modality; both achieve high success. This report presents a pediatric tibial

OO case and includes a literature review comparing RFA and MWA in terms of efficacy, safety, and recurrence.

Case Report

An 11-year-old female presented with 4 months of left shin pain. The pain was a dull, aching discomfort in the anterior lower leg, markedly worse at night and partially relieved by ibuprofen. There was no history of trauma, fever, or weight loss. Physical examination showed tenderness localized to the midshaft of the left tibia without swelling or redness. Neurologic and vascular exams were normal. Laboratory studies (CBC, ESR, CRP) were unremarkable.

Plain radiographs (AP and lateral views of the tibia) showed focal cortical thickening of the mid-diaphysis (Figures 1–2). A faint intracortical radiolucency was suspected within the thickened cortex. Given the classic history and radiographic finding, CT imaging was obtained and confirmed a 7 × 6 mm intracortical nidus with central calcification and extensive reactive sclerosis in the left tibial midshaft. No other bone lesions or pathology were seen. The diagnosis of osteoid osteoma was made based on these findings; no biopsy was performed. The patient's guardian provided informed consent for the procedure and for this case report.

Investigations

Figure 1. *Lateral radiograph of the left tibia.* This image demonstrates focal cortical thickening (arrow) in the mid-diaphysis. On osteoid osteoma radiographs, an intracortical nidus and surrounding sclerosis are often seen【1】.

Figure 2. *Anteroposterior radiograph of the left tibia.* The arrow indicates a small intracortical lucency (the nidus) within the thickened cortex. The combination of a small radiolucent nidus surrounded by sclerotic bone is pathognomonic for OO【1】.

Subsequent CT of the left tibia (axial and sagittal views) precisely localized the nidus, confirming a 7 mm cortical nidus with central mineralization and peri-nidal sclerosis. No joint or marrow abnormalities were noted. MRI was not performed, as CT provided sufficient detail. (Bone scintigraphy was not needed given the clear focal CT finding.) All findings were concordant with osteoid osteoma of the tibial diaphysis.

Treatment

The patient underwent CT-guided radiofrequency ablation under general anesthesia. With CT fluoroscopic guidance, an RF electrode (14-gauge cooled-tip) was advanced into the nidus. The position was confirmed within the lesion, and radiofrequency energy was applied, heating the nidus to 90 °C for 6 minutes【3】. The procedure was completed without complications. Post-ablation, the patient reported immediate decrease in pain. She was observed overnight and discharged on oral analgesics. By 2 weeks post-procedure, she was completely pain-free and resumed full activities.

Discussion

Osteoid osteomas primarily affect pediatric and young adult patients. Although more common in males, they can occur in females as well【1】. Our patient's presentation (night pain, NSAID response) and imaging findings were entirely typical of OO, despite her gender and the mid-diaphyseal tibial location (less common than proximal femur). OO pain is thought to result from high prostaglandin levels produced by the nidus【2】, explaining the dramatic NSAID relief.

Imaging is crucial. Plain radiographs may show a cortical thickening and a radiolucent nidus, as seen in our case (Figures 1–2). CT is the gold standard for visualizing the nidus. Intraoperative navigation or MRI is not generally needed when CT localizes the lesion. In our patient, CT clearly demonstrated the nidus, obviating the need for biopsy; prior series have shown biopsy is not required if imaging is definitive【3】.

For definitive treatment, minimally invasive ablation is now standard. In recent years, RFA and MWA have proven safe and effective. RFA has decades of data: for example, Rosenthal et al. reported 91% long-term success in 117 OO patients (initial success rate 91%)【3】, with only minor complications (cellulitis, dystrophy) in a few cases. Subsequent studies show similarly high efficacy. In pediatric series, complete pain relief is reported in roughly 90–100% of cases with RFA (with rare major complications)【3】.

MWA is a newer option. A systematic review reported a pooled clinical success rate of 95.8% in OO treated with MWA, with only 2.8% recurrence【6】. Rinzler et al. treated 24 pediatric patients with MWA and achieved 100% technical and clinical success, with minor complications in 17% (numbness, infection) and no major events【4】.

Comparative studies find virtually no difference between RFA and MWA for OO. Karluka et al. (2025) reported 100% technical success for both. Clinical success was 92.6% for RFA versus 96.2% for MWA (difference not statistically significant)【5】. They observed 4% total recurrence (one recurrence in each group) and one major complication (a severe skin burn) in the MWA group【5】. Abdalla et al.'s review similarly noted high success (~96%) and very low recurrence (2.8%) with MWA【6】.

Table 1 (below) summarizes reported outcomes. Both modalities yield >90% success. The choice may depend on lesion characteristics: Karluka et al. noted that lesions ≥10 mm in size had higher failure rates regardless of ablation type【5】. In our case (nidus ~7 mm), RFA effectively ablated the lesion in one session.

Outcome	RFA (Karluka et al.)	MWA (Karluka et al.)
Technical success	100% (27/27)	100% (26/26)
Clinical success	92.6% (25/27)	96.2% (25/26)
Recurrence	3.7% (1/27)	3.8% (1/26)
Major complications	0%	3.8% (1/26)

Table 1. Outcomes of percutaneous RFA vs. MWA for osteoid osteoma (data from Karluka et al. 2025). Both methods achieve similarly high success and low recurrence【5】.

Complication profiles are also comparable. RFA complications are rare; reported issues include skin burns or transient neuropathy, generally under 5%【3】. MWA complications can include skin or nerve thermal injury, but these too are uncommon. In the Karluka series, one skin burn (3.8%) occurred in the MWA group and none in RFA【5】. Abdalla et al. found an overall 11.2% complication rate with MWA (mostly minor burns or numbness)【6】. Thus, both techniques are generally safe when performed under CT guidance by experienced operators.

This case has limitations. We did not obtain histopathology, so diagnosis is clinicoradiologic; however, OO diagnosis is often made radiologically and clinically with high confidence. Follow-up is currently only 6 months; longer follow-up (≥2 years) is ideal to fully assess recurrence. As a single-case report, it cannot establish broad conclusions. Nevertheless, it illustrates the typical presentation and effective treatment of pediatric OO.

Conclusion

We report a classic osteoid osteoma of the tibia in a pediatric patient, successfully treated with CT-guided RFA. The patient experienced complete pain relief and remained disease-free at 6 months. Our review highlights that both RFA and microwave ablation are highly effective options for OO【5】【6】. Current evidence shows comparable efficacy for RFA and MWA (clinical success ~90–98%) with low recurrence【5】【6】; choice of modality may hinge on lesion size and operator experience. We also note that appropriate informed consent was obtained from the patient's guardian for treatment and publication. Limitations of this report include absence of histologic confirmation and relatively short follow-up. Future larger studies and longer follow-up will further clarify optimal management of osteoid osteoma.

Figures

Fig1 :-X-ray: Small cortical lucency with surrounding sclerosis in the anterior mid-tibia

Fig2 :- CT scan: ~6 × 5 mm cortical nidus in the anterior tibial diaphysis with cortical thickening and reactive sclerosis

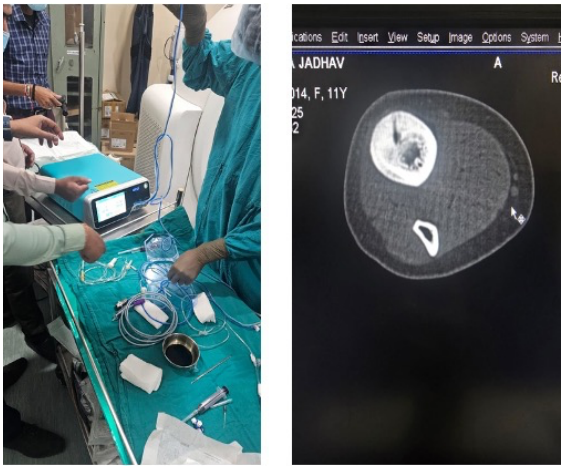


Fig3:-CT scan: ~6 × 5 mm cortical nidus in the anterior tibial diaphysis with cortical thickening and reactive sclerosis

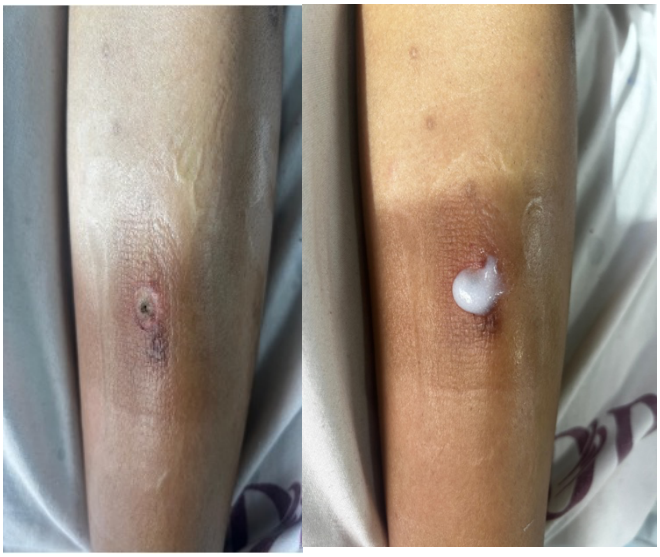
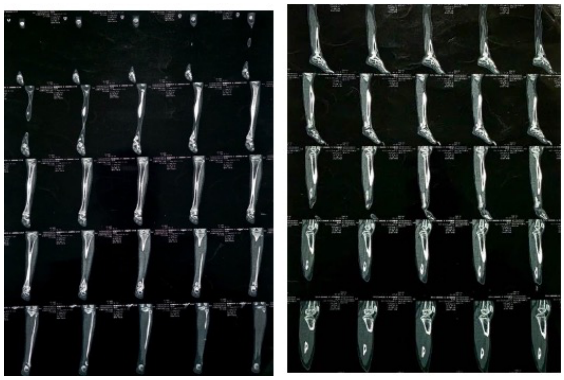


Fig4:Wound Post Microwave Ablation was treated with application of silver nitrate ointment locally twice daily for a week



References

1. Nijland N, Gerbers JG, Bulstra SK, et al. Evaluation of accuracy and precision of CT guidance in radiofrequency ablation for osteoid osteoma. *PLOS ONE*. 2017;12(4):e0176653.
2. Shu R, Chang L, Han K, et al. The surgical management of osteoid osteoma: A systematic review. *Frontiers in Oncology*. 2022;12:823557.
3. Rosenthal DI, Hornicek FJ, Torriani M, Gebhardt MC, Mankin HJ. Osteoid osteoma: Percutaneous treatment with radiofrequency energy. *Radiology*. 2003;229(1):171-175.
4. Rinzler ES, Shivaram G, Shaw D, Monroe EJ, Koo KS. Microwave ablation of osteoid osteoma: Initial experience and efficacy. *Pediatric Radiology*. 2019;49(4):566-570.
5. Karluka I, Mazıcan M, Andic C, et al. Radiofrequency vs. microwave ablation in osteoid osteoma: Comparative outcomes and prognostic factors. *Journal of Clinical Medicine*. 2025;14(21):7814.
6. Abdalla E, Ceballos R, Sherar S, et al. Efficacy and safety of microwave ablation in managing osteoid osteoma: A systematic review. *Cureus Journal of Plastic Surgery & Hand Surgery*. 2025;52:e.
7. Chai JW, Hong SH, Choi JY, Koh YH, Lee JW, et al. Radiologic diagnosis of osteoid osteoma: From simple to challenging findings. *RadioGraphics*. 2010;30(3):737-749.
8. Noordin S, Allana S, Hilal K, et al. Osteoid osteoma: Contemporary management. *Orthopedic Reviews (Pavia)*. 2018;10(3):7496.
9. Ghanem IP. The management of osteoid osteoma: Updates and controversies. *Current Opinion in Pediatrics*. 2006;18(1):36-41.
10. Boscainos PJ, Cousins GR, Kulshreshtha R, et al. Osteoid osteoma: Clinical presentation and imaging. *Orthopedics*. 2013;36(6):792-800.