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Small Tumor, Mighty Symptoms : Radiologic Diagnosis of Intra-Spongious Osteoid Osteoma in a Pediatric Femur

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ABSTRACT

Osteoid osteoma is a benign osteoblastic tumor that commonly affects children and adolescents and can cause significant nocturnal pain. We present the case of a 9-year-old girl with persistent pain in the distal third of the right femoral diaphysis, notably relieved by aspirin. Plain radiographs showed a subtle lucent lesion, while CT imaging revealed a well-defined 6 mm intra-spongious nidus with mild reactive sclerosis. This case highlights the diagnostic challenges of intra-spongious osteoid osteomas, which are often inconspicuous on radiographs. CT remains the gold standard for nidus identification and preprocedural planning. Recognizing the characteristic clinical presentation, combined with advanced imaging, allows timely and minimally invasive treatment, such as CT-guided radiofrequency ablation. Early diagnosis is essential to relieve pain, prevent prolonged disability, and avoid unnecessary interventions.

KEYWORDS

Osteoid Osteoma, Intra-Spongious, Distal Femur, Pediatric Bone Tumor, Case report

MAIN ARTICLE

INTRODUCTION

Osteoid osteoma is a benign osteoblastic tumor accounting for 10–12% of pediatric bone tumors. Clinically, patients present with nocturnal pain relieved by NSAIDs, most commonly aspirin [1]. Lesions located in the intra-spongious bone may be subtle on radiographs, which can delay diagnosis. Advanced imaging, particularly CT, plays a critical role in detection and treatment planning [2].

METHODS

A 9-year-old girl presented with a 3-month history of right thigh pain, worse at night, and relieved by aspirin. No history of trauma or systemic symptoms was reported. Physical examination revealed localized tenderness over the distal femoral diaphysis. Plain radiographs and CT imaging were performed. The location, size, and characteristics of the lesion were assessed.

RESULTS

- **Radiograph:** Mildly lucent lesion in the distal third of the femoral diaphysis, subtle due to intra-spongious location (Figures 1 and 2).
- **CT scan:** A well-defined 6 mm nidus within the trabecular bone, surrounded by mild reactive sclerosis; cortical bone remained intact (Figure 3).

The clinical presentation and imaging confirmed the diagnosis of intra-spongious osteoid osteoma.

DISCUSSION

Osteoid osteoma is a benign osteoblastic tumor representing approximately 10–12% of all benign bone tumors in the pediatric population. It predominantly affects children and adolescents, with a male-to-female ratio of approximately 2–3:1. The distal femur, proximal tibia, and posterior elements of the spine are among the most common locations, although intra-spongious lesions can occur anywhere in the long bones. Lesions are typically small, less than 1.5 cm in diameter, but their location within cortical, subperiosteal, or intra-spongious bone can influence both symptom severity and radiographic detectability.

Clinical Presentation and Variability

The hallmark symptom of osteoid osteoma is nocturnal pain, which is classically relieved by nonsteroidal anti-inflammatory drugs (NSAIDs), particularly aspirin. However, clinical presentation can vary depending on lesion location. Diaphyseal intra-spongious lesions, as in this case, may present with vague limb pain or limping, often leading to delayed diagnosis. Swelling or tenderness may be subtle, and systemic symptoms are generally absent, distinguishing osteoid osteoma from infectious or malignant conditions. Awareness of this variability is critical for early detection, especially in children where subjective pain reports may be inconsistent [1,3].

Imaging Modalities and Their Relative Advantages

Plain radiographs are typically the first-line imaging modality but may fail to detect intra-spongious lesions due to the lack of cortical reaction or the small size of the nidus. Computed tomography (CT) is considered the gold standard for osteoid osteoma detection, offering high spatial resolution that enables precise nidus localization and assessment of surrounding sclerosis. CT is also indispensable for preprocedural planning in minimally invasive treatments. Magnetic resonance imaging (MRI) is valuable for evaluating associated bone marrow edema and soft tissue changes, although the nidus may be less conspicuous on MRI than on CT. Bone scintigraphy can demonstrate focal increased uptake, particularly useful for lesions in complex anatomical sites, but lacks the specificity of CT [1,2,3].

Treatment Options and Outcomes

Historically, surgical excision was the mainstay of treatment, aiming to remove the nidus completely. However, open surgery is associated with increased morbidity, prolonged recovery, and the potential for incomplete nidus removal. Percutaneous CT-guided radiofrequency ablation (RFA) has become the preferred treatment, offering a minimally invasive alternative with rapid pain relief, high success rates (>90%), and low complication rates. Other techniques, such as percutaneous laser ablation or ethanol injection, have been described but are less widely adopted. Post-procedural follow-up typically involves clinical assessment, with imaging reserved for cases of persistent or recurrent pain. Recurrence is rare but can occur if the nidus is incompletely ablated [2,3].

Differential Diagnosis:

Accurate diagnosis requires differentiation from other pediatric bone lesions that can present with localized pain or subtle imaging findings :

1. **Osteomyelitis:** Infection may mimic osteoid osteoma on imaging but usually presents with systemic symptoms (fever, elevated inflammatory markers) and diffuse marrow changes rather than a well-defined nidus.
2. **Stress fracture:** Especially in the distal femoral diaphysis, stress fractures present with linear cortical defects, periosteal reaction, and history of repetitive activity, which differs from the small central nidus of osteoid osteoma.
3. **Osteoblastoma:** Larger than 2 cm, often more aggressive, and may involve cortical disruption; pain is less classically relieved by NSAIDs.
4. **Bone cysts or fibrous dysplasia:** Usually asymptomatic or associated with painless swelling; CT imaging shows different trabecular patterns and absence of central nidus.
5. **Malignant lesions (e.g., Ewing sarcoma, osteosarcoma):** Typically associated with aggressive periosteal reaction, rapid progression, systemic symptoms, and elevated inflammatory markers; radiologic appearance is distinct from the well-circumscribed nidus of osteoid osteoma.

Recognizing the **classic clinical feature of nocturnal pain relieved by NSAIDs** is critical in narrowing the differential diagnosis and avoiding unnecessary interventions. Percutaneous CT-guided radiofrequency ablation is now the preferred treatment, offering rapid pain relief, minimal complications, and faster recovery compared to surgical excision [3].

CONCLUSION

This case illustrates the importance of combining detailed clinical history with high-resolution imaging for timely diagnosis of intra-spongious osteoid osteoma in pediatric patients. Awareness of the lesion's subtle radiographic features and characteristic pain pattern allows differentiation from infectious, traumatic, or neoplastic conditions. CT imaging enables precise localization of the nidus, guiding minimally invasive treatment such as radiofrequency ablation. Early recognition and intervention not only alleviate pain and prevent prolonged disability but also reduce the risk of unnecessary surgery or misdiagnosis.

Pediatricians, orthopedic surgeons, and radiologists should remain vigilant for intra-spongious osteoid osteomas in children presenting with persistent nocturnal leg pain.

FIGURES:



Figure 1: Plain radiographs of the femur showing frontal (A) and lateral (B) views. An intra-spongious nidus is identified, surrounded by reactive sclerosis in the distal third of the femoral diaphysis

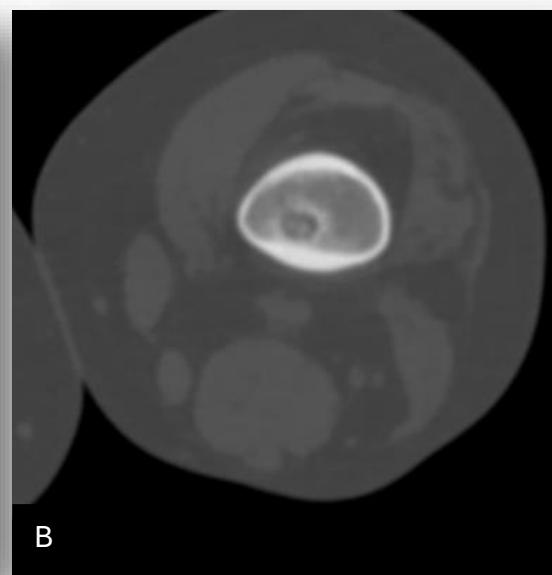


Figure 2: Computed tomography of the distal femur. Coronal CT image in the bone window (A) and axial CT image in the soft-tissue window (B) demonstrate a well-defined intra-spongious nidus located in the distal third of the femoral diaphysis, associated with surrounding reactive sclerosis.

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