

# Case Resolution

**Ricardo Trueba**

*Magnetic Resonance and Computed Tomography Department, Grupo Médico Rostagno, Diagnóstico por Imágenes (Buenos Aires, Argentina)*

*See case presentation on page 3.*

## DIAGNOSIS

Femoral neck osteoid osteoma

## DISCUSSION

Osteoid osteoma is a benign bone tumor that rarely exceeds 1.5cm in greatest dimension. This lesion can be found in any bone in the body but are most commonly located in long bones, such as the femur and tibia, accounting for 10% to 12% of all benign bone tumors. Osteoid osteomas may occur at any age and most commonly occur in persons aged 4 to 25 years, with an approximate male:female ratio of 3:1.

Osteoid osteoma is characterized by a “nidus” associated with reactive osteosclerosis, cortical thickening, and bone marrow edema. The term “nidus” refers to the tumor itself, which is composed of bone at various stages of maturity within a highly vascular connective tissue stroma. The center of the nidus is usually the most densely mineralized region and presents a variable amount of calcification.

Osteoid osteoma is classified according to the location of the nidus:

- **Cortical** (the most common type): typically associated with a fusiform cortical thickening in the shaft of a long bone, especially femur and tibia.
- **Intramedullary**: typically located in the femoral neck, the carpal and tarsal bones, and the vertebral posterior elements. Reactive osteosclerosis is usually mild to moderate at this location.
- **Subperiosteal**: most commonly located in the neck of the talus. It is also frequently located along the medial aspect of the femoral neck and in hands and feet.

Radiographs characteristically show a round or oval radiolucent area representing the nidus (usually <2cm), with a variable amount of central mineralization, and a variable degree of surrounding sclerosis and cortical thickening. Identification of the nidus can be challenging in the presence of extensive osteosclerosis.

CT provides the best characterization of both the nidus and the surrounding osteosclerosis. The nidus is visualized as a well-defined round or oval lesion of decreased attenuation, with variable degrees of central mineralization. When present, reactive osteosclerosis can range from mild to extensive and be accompanied by periosteal reaction and new bone formation, which may obscure the nidus. CT imaging, using thin transverse sections (2-3mm) with multi-planar reformatted images through a bone algorithm and viewed with bone window settings, provides the best definition of small nidi. Although the use of IV contrast material is not necessary, hypervascular nidus (non-calcified nidus) of an osteoid osteoma enhances on dynamic CT scans.

MRI shows a nidus with low to intermediate signal intensity on T1-weighted images and variable signal intensity on T2-weighted images, depending on the amount of mineralization present in the nidus center. The increase in spatial resolution may result in a calcified nidus being visualized like a central area of low signal intensity (the mineralized portion) and a high-signal-intensity periphery (the unmineralized portion). There is signal hyperintensity in the reactive zone surrounding the nidus on T2-weighted or STIR images when edema in the adjacent bone

RICARDO TRUEBA, MD • ricardotrueba@gmail.com 

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marrow and soft tissue is present. The nidus may demonstrate strong enhancement following the IV administration of gadolinium-based contrast agents. Imaging findings may be nonspecific and mimic other conditions (stress fracture or osteomyelitis) if extensive surrounding edema obscures the nidus. MR imaging may fail to depict small nidi because the signal in the nidus often is similar to that in cortical bone.

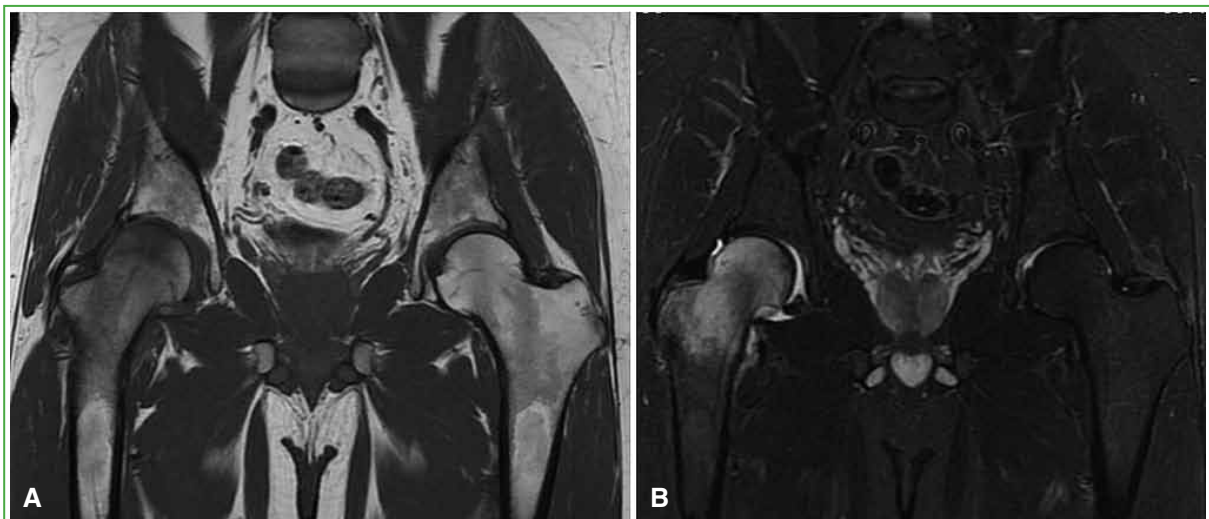
## DIFFERENTIAL DIAGNOSIS

Severe inflammatory changes may hinder the osteoid osteoma diagnosis and mimic other conditions:

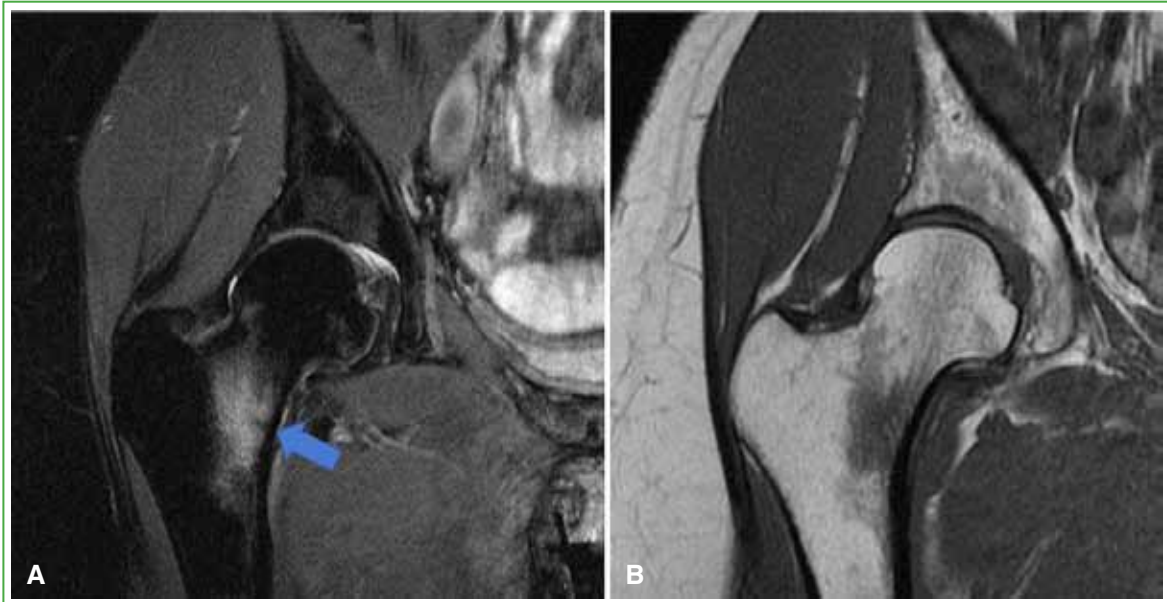
- Prominent periosteal reaction and a young age: *osteomyelitis or malignant bone tumor (Ewing sarcoma)*.
- Severe synovial hypertrophy and significant joint effusion: *septic arthritis or chronic inflammatory arthritis*.
- Extensive soft-tissue and bone marrow edema that obscures the nidus: *traumatic injury (stress fracture) (Figure 7), transient osteoporosis (Figure 8) or infection*.

Pain may be relieved with the administration of nonsteroidal anti-inflammatory drugs. Treatment strategy varies depending on the patient's clinical condition. If the patient is otherwise healthy and the pain does not cause major discomfort, the tumor is treated with anti-inflammatory agents to relieve symptoms. If the conservative therapy fails or if the tumor location could cause growth disorder, scoliosis or osteoarthritis, surgical or percutaneous ablation may be considered. Although effective, surgical removal has many potential complications, including difficult intraoperative identification of the tumor, local recurrence due to incomplete resection, and resection of weight-bearing bone that may require prolonged hospital stays and complicate the recovery (Figure 9).

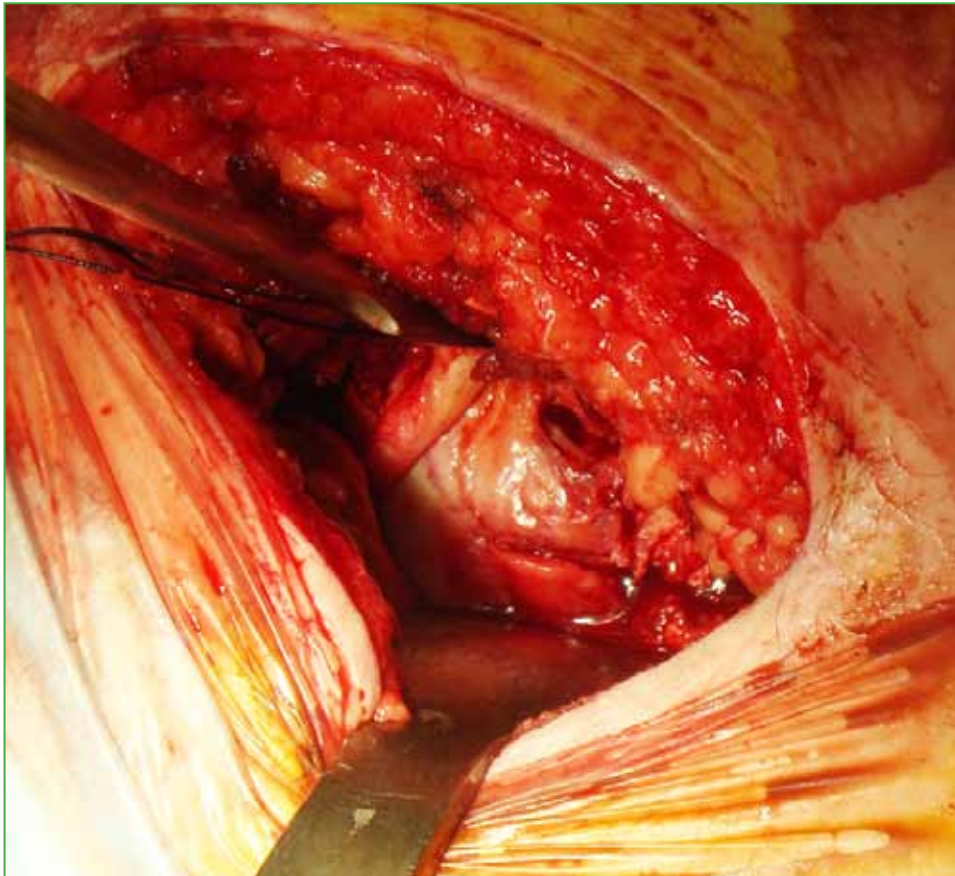
Recently, CT-guided radiofrequency ablation has become a less invasive alternative to surgical removal. This approach can be performed under mild sedation and consists of a radiofrequency probe being introduced into the tumor nidus through a cannulated needle under CT guidance so that heat is applied locally to destroy tumor cells (Figure 10).



**Figure 7.** Frontal MRI T2-weighted (A) and STIR (B) sequences of the right hip. Images show bone marrow edema (increased signal intensity) affecting the femoral head and neck, associated with a joint effusion in a 30-year-old patient.



**Figure 8.** Frontal MRI STIR (A) and T1-weighted (B) sequences of the right hip. Images show bone marrow edema (increased signal intensity) affecting the femoral neck, with a small cancellous fracture line (arrow) associated with joint effusion in a marathon runner.



**Figure 9.** Osteoid osteoma surgical treatment.



**Figure 10.** CT-guided radiofrequency ablation.

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Conflict of interests: Authors claim they do not have any conflict of interest.