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## Case Report

# Osteoid osteoma of the femoral neck mistaken as a synovial herniation pit<sup>☆</sup>

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### ARTICLE INFO

#### Article history:

Received 19 August 2021

Accepted 23 August 2021

#### Keywords:

Osteoid osteoma

Synovial herniation pit

Hip arthroscopy

### ABSTRACT

A 36-year-old man presented with 1 year of atraumatic left lateral thigh, groin, and hip pain, and imaging consistent with the diagnosis of femoroacetabular impingement and a labral tear. Imaging concurrently demonstrated a synovial herniation pit. The patient underwent hip arthroscopy, which included femoroplasty, acetabuloplasty, labral debridement, and synovectomy. His pain persisted and further workup confirmed an osteoid osteoma that was mimicking a synovial herniation pit. The osteoid osteoma was treated with radiofrequency ablation. At 18 months follow-up, the patient reported complete resolution of his symptoms. We present the case to highlight distinguishing imaging and clinical findings of these similar-appearing lesions. While neither condition is particularly rare individually, the misidentification of osteoid osteoma as a synovial herniation pit is a unique feature of this case that led to the patient's protracted clinical course.

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## Introduction

Synovial herniation pits are round to oval lucencies in the anterosuperior aspect of the femoral neck formed by herniation of soft tissue content into the bone through a cortical defect, resulting in a lesion between 3 and 15 mm in size well-circumscribed by sclerotic bone [1]. Typically unilateral, these have been estimated to occur in roughly 5% of normal hips, with recent literature demonstrating the abnormality in up to 30% of patients with femoroacetabular impingement. Prior reports of symptomatic synovial herniation pits treated with

corticosteroid injection or even surgical curettage [2,3]. However, consensus exists that these are reactive changes, and are unlikely to represent a source of pain for the majority of patients.

Visually similar, osteoid osteoma is a benign, bone forming tumor characterized by its small size, radiolucent central nidus and often prominent surrounding reactive bone [4]. Most frequently, osteoid osteomas occur in long bones of the lower extremity, with 50%-60% occurring in the femur or tibia. Within the femur, the juxta- or intra-articular regions of the femoral neck are most affected [5]. These tumors are most often cortical, but may also be cancellous or subperiosteal [5].

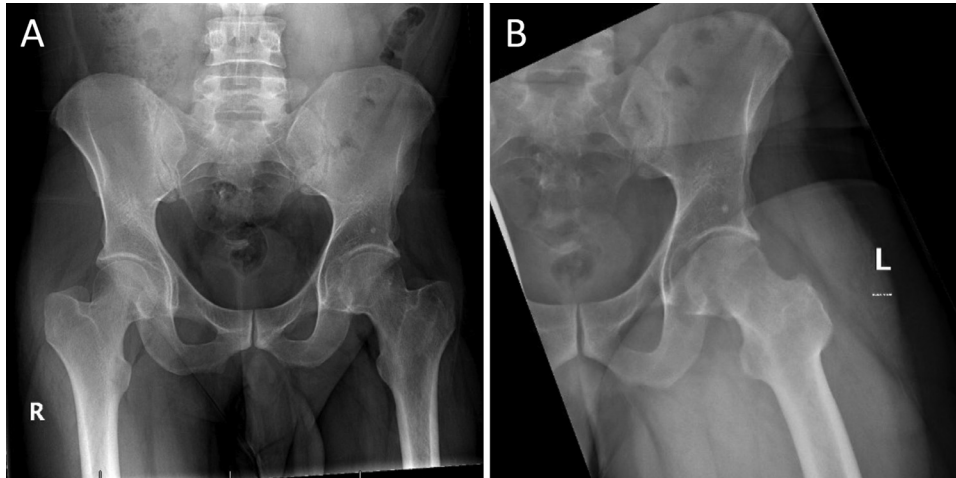
<sup>☆</sup> Declaration of competing interest: The authors have no conflicts of interest to declare.

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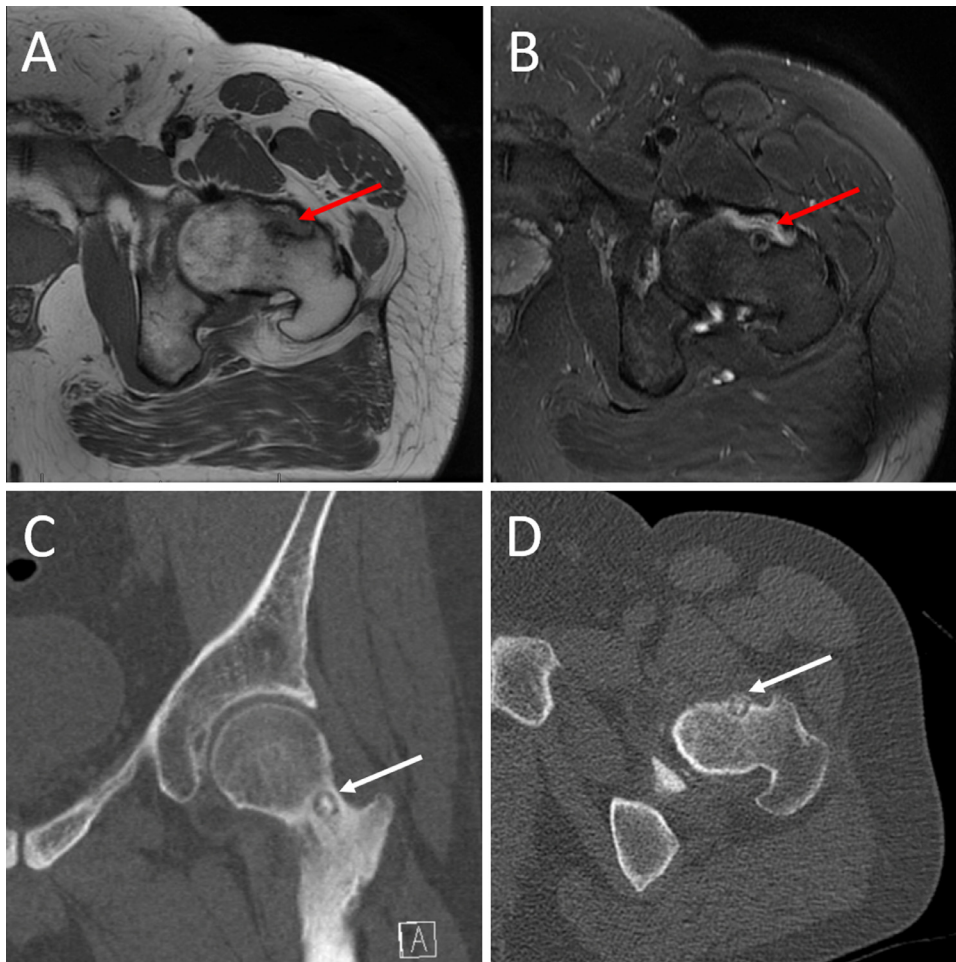
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<https://doi.org/10.1016/j.radcr.2021.08.058>

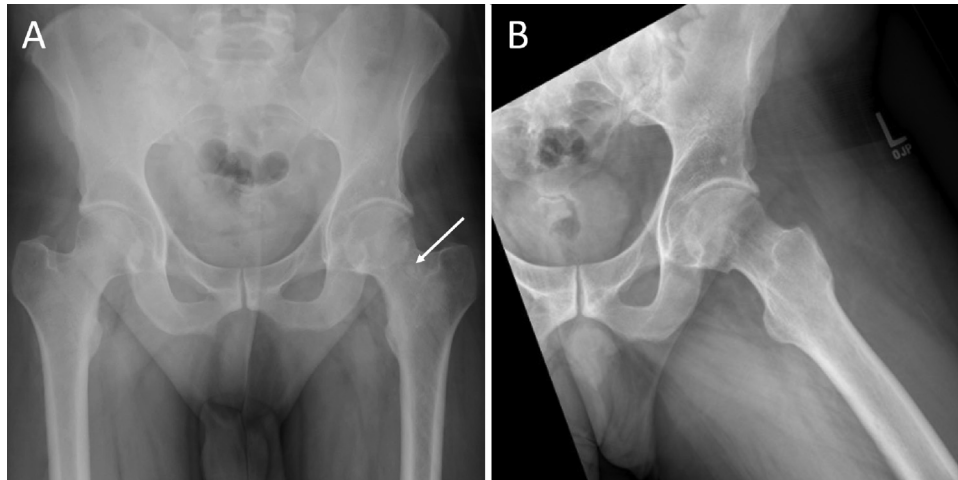
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**Fig. 1 – Radiographic evaluation prior to left hip arthroscopy.** Preoperative radiographic evaluation of the left hip demonstrates preserved joint spaces and no obvious bony pathology. (A) Anteroposterior pelvis radiograph. (B) Frog-leg lateral radiograph.



**Fig. 2 – Magnetic resonance and computed tomography imaging prior to left hip arthroscopy.** Magnetic resonance and computed tomography imaging of the left hip were obtained as part of the patient's initial workup. Axial (A) T1-weighted and (B) T2-weighted magnetic resonance imaging demonstrates joint effusion, synovitis, and the presumed synovial herniation pit (red arrows). (C) Coronal and (D) axial computed tomography demonstrate the presumed synovial herniation pit (white arrows) at the anterior head-neck junction of the left hip.



**Fig. 3 – Radiographs 6 months status postarthroscopic left hip surgery.**

**Postoperative radiographic evaluation of the left hip demonstrates a subtle radiolucency with a central radiodensity again thought to be representative of a synovial herniation pit. (A) Anteroposterior pelvis radiograph demonstrating presumed synovial herniation pit (white arrow). (B) Frog-leg lateral radiograph.**

Males are affected nearly twice as frequently as females [6]. The majority of patients are adolescents and young adults under age 20, with very few patients older than 40 [5]. Clinically, osteoid osteoma most frequently presents with pain more severe at night and responsive to non-steroidal anti-inflammatory medications (NSAIDs), and lesions within the joint or juxta-articular can present with synovitis [7]. Management can be conservative with NSAIDs or interventional with image guided radiofrequency ablation (RFA), image guided cryoablation or open surgical excision [7].

We present a case of a 36-year-old man with a left hip osteoid osteoma in which the diagnosis was obscured due to misidentification of the lesion as a synovial herniation pit on various imaging studies. This patient underwent surgery and physical therapy prior to diagnosis, and eventually received definitive treatment with CT guided RFA. The patient was informed that the data concerning the case would be submitted for publication, and he provided consent.

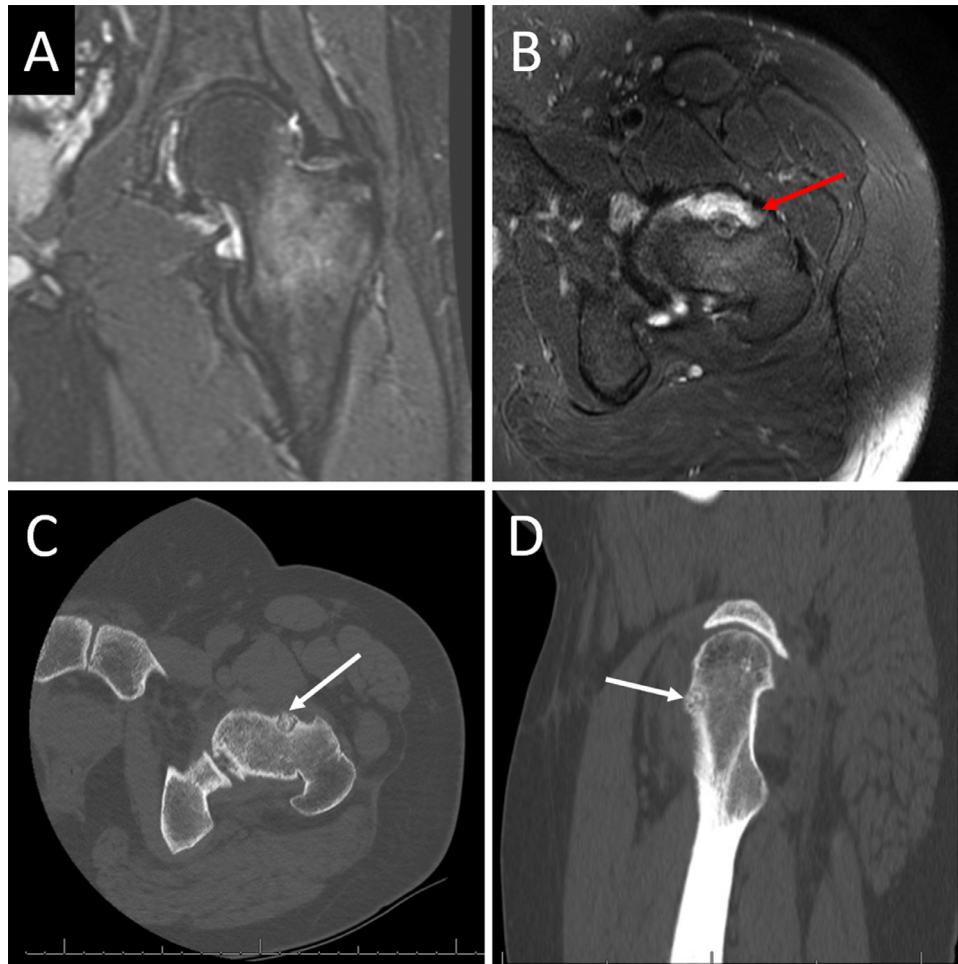
### Case report

The patient is a 36-year-old male with a history of atraumatic left lateral thigh, groin, and hip pain of more than 1 year duration. Exam demonstrated preserved range of motion but pain with combined internal rotation and hip flexion. Radiographs (Fig. 1) demonstrated preserved joint spaces and no obvious bony pathology about the left hip. Magnetic resonance (MR) imaging demonstrated a small labral tear along the anterior superior left acetabular labrum with moderate effusion, and a synovial herniation pit with mildly heterogeneous marrow signal along the left hip anterolateral femoral head and neck junction (Fig. 2), thought to represent cam impingement. An aspiration of the left hip joint was attempted but no fluid was obtained. At the time of joint aspiration, lidocaine injection

into the joint improved the patient's tolerance of FABER/FADIR testing.

One month after presentation, computed tomography (CT) revealed no acute bone abnormality with preserved joint spaces. A synovial herniation pit was again noted along the anterolateral femoral head neck junction (Fig. 2). At this time, his history, physical exam, MR imaging findings and response to an intra-articular lidocaine injection made him a candidate for left hip arthroscopy. Two months after presentation, the patient underwent left hip arthroscopy with femoroplasty of cam impingement, acetabuloplasty, labral debridement, and synovectomy. Intraoperative findings included frond-like appearances of the synovitis with significant erythema on the anterior femoral neck. The patient was also noted to have chondromalacia inferior to the labral tear, synovitis of the ligamentum teres, and a tear at the anterior superior labrum. Synovial biopsy revealed no evidence of neoplasia or metaplasia; inflammation was thought to be secondary to chronic traumatic changes in the setting of femoroacetabular impingement syndrome.

Two months postoperatively, the patient's pain had improved and he was making progress with physical therapy. Three months postoperatively, the patient reported continued discomfort at night, but endorsed improvement in his pain after surgery. Six months postoperatively, the patient complained of significant groin pain described as similar to his presurgical pain and inability to participate in his usual exercise activity due to pain. Plain radiographs noted a presumed synovial herniation pit at the left anterior femoral neck (Fig. 3). MR imaging (Fig. 4) demonstrated moderate increased T2 signal within the left femoral neck and focal oval-shaped cortical irregularity along with anterior femoral head and neck junction measuring 1.3 cm, reported to be likely representative a synovial herniation pit, as well as moderate synovial irregularity likely representing synovitis.



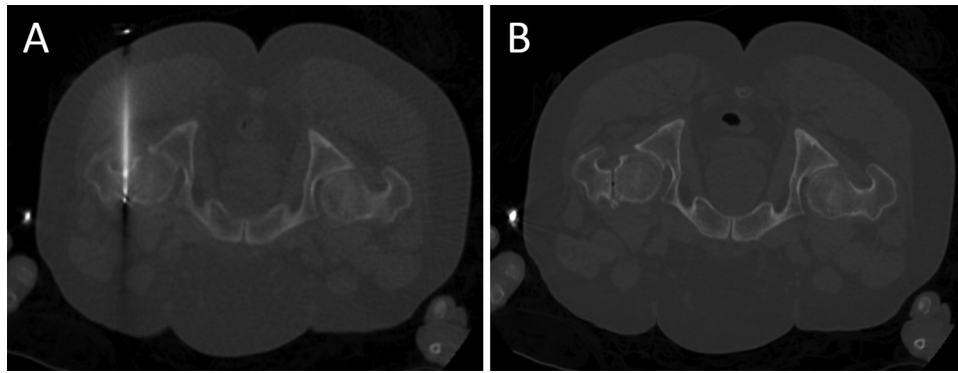
**Fig. 4 – Magnetic resonance and computed tomography imaging 6 months status postarthroscopic left hip surgery. Postoperative T2-weighted magnetic resonance imaging of the left hip in (A) coronal plane demonstrates diffuse marrow edema and (B) axial plane demonstrates bone lesion with a central nidus in the anterior femoral neck and reactive synovitis anterior to the femoral neck (red arrow). Computed tomography in (C) axial and (D) sagittal planes demonstrate a persistent cortically based bony lesion with a radiolucent central nidus in the anterior femoral neck (white arrows).**

Seven months postoperatively, the patient reported continued significant joint pain with limitation of activities. The patient was referred to an orthopedic oncology clinic specifically for the findings of proliferative synovitis in the hip joint. At this time he described pain that wakes him at night that responds well to NSAIDs. Due to the constellation of findings, including pain waking the patient at night and relieved with anti-inflammatory medications, along with diffuse bony edema in the femoral neck on imaging, the lesion previously thought to represent a synovial herniation pit was reconsidered to be a possible osteoid osteoma. The patient underwent CT imaging of the left hip (Fig. 4), demonstrating an ovoid cortically based, well-circumscribed, heterogeneously sclerotic region within the anterior aspect of the left anterior femoral head and neck junction measuring  $12 \times 9 \times 8$  mm (cranio-caudal  $\times$  transverse  $\times$  anteroposterior) indicative of osteoid osteoma. Eleven months postoperatively, the patient underwent CT-guided RFA (Fig. 5) of his osteoid osteoma. Pathology specimens taken at the time of ablation demonstrated trabecular bone fragments and foci of woven bone with osteoblastic

rimming compatible with osteoid osteoma. He noted immediate relief of his left hip pain after that procedure. The patient was seen 2 months following RFA and reported continued complete resolution of his symptoms and resumption of daily activities off of all NSAID therapy. Radiographs of the hip demonstrated no evidence of fracture secondary to his procedure. A phone call 18 months following RFA confirmed complete resolution of the patient's symptoms.

## Discussion

This case report describes a case of osteoid osteoma that was misidentified on radiograph, MR imaging and CT repeatedly as a synovial herniation pit. While neither condition is particularly rare individually, the misidentification of osteoid osteoma as a synovial herniation pit is a unique feature of this case that led to the patient's protracted clinical course. We aim to highlight differentiating imaging and clinical features of these conditions in this report.



**Fig. 5 – Computed tomography at the time of radiofrequency ablation of the left hip osteoid osteoma. Intraoperative computed tomography of the pelvis with the patient prone. (A) Axial localizing sequence demonstrates osteoid osteoma at the femoral head-neck junction. (B) Axial sequence demonstrates expected post-radiofrequency ablation changes.**

Synovial herniation pits appear in the superolateral quadrant of the femoral neck in radiographs as well-delineated round to oval radiolucencies on radiographs and as well-defined and homogenous areas of low signal intensity with a hypointense rim on T1-weighted MR imaging, with high signal intensity and a surrounding hyperintense rim on T2-weighted MR imaging [1,8]. CT demonstrates subcortical bone defects commonly surrounded by thin, well-demarcated sclerotic margins [9]. Differential diagnosis for nonclassic synovial herniation pits should include metastatic lesion, osteoid osteoma, Brodie abscess, intraosseous ganglion cyst, and stress fracture [10].

Osteoid osteoma, in contrast, is nonvisible in 28.6% of cases on plain radiography, even in the setting of typical clinical presentation [11]. Radiographic findings typically demonstrate an ovoid intracortical nidus, accompanied by cortical thickening and reactive sclerosis [11]. On T1-weighted noncontrast MR imaging osteoid osteoma appears as a central nidus without the characteristic peripheral sclerosis, while T2-weighted MR imaging demonstrates low signal intensity nidus and high signal intensity, unmineralized periphery [12]. Thin-slice CT is often required for diagnosis, since small nidi may not be apparent on MR imaging. Therefore, T1-weighted noncontrast MR imaging may best differentiate between synovial herniation pit, which demonstrates reactive sclerosis, and osteoid osteoma, which does not.

Important learning points highlighted by this case are common features osteoid osteoma and synovial herniation pit. Clinically, synovial herniation pits are most often asymptomatic incidental findings, but can be associated with clinical features of other conditions, commonly FAI [2]. Leunig et al suggest that synovial herniation pits may not be herniation of the synovium or soft tissue but rather juxta-articular fibrocystic change [13]. In contrast, osteoid osteoma has a distinct clinical presentation of progressive pain, worse at night, classically relieved by NSAIDs. These distinguishing clinical features led to the consideration of osteoid osteoma for this case 7.

The presented case is unique in that it involves a protracted clinical course as a result of initial missed diagnosis; the os-

teoid osteoma was repeatedly misidentified as a synovial herniation pit on multiple imaging modalities over the course of a year. Some distinguishing clinical features of osteoid osteoma in this patient were not elucidated after initial diagnosis of synovial herniation pit. Recognition of these features in conjunction with representative imaging findings led to the diagnosis. With appropriate treatment, the patient had an excellent outcome.

### Statement of informed consent

The patient was informed that data concerning the case would be submitted for publication, and he provided consent.

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