

2015

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Recommended Citation

Tamam C, Howse E, Tamam M, Barnes R, Kelsey T, Perry B, Stubbs A. Arthroscopic Excision of Acetabular Osteoid Osteoma: Computer Tomography-Guided Approach. . 2015 Jan 01; 4(2):Article 438 [p.]. Available from: <https://academicworks.medicine.hofstra.edu/publications/438>. Free full text article.

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Arthroscopic Excision of Acetabular Osteoid Osteoma: Computer Tomography–Guided Approach



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Abstract: Osteoid osteoma is a benign osteoblastic tumor that occurs in the subcortical shaft and metaphysis of the long bones of the lower extremities; however, intra-articular lesions are also possible. Intra-articular osteoid osteomas are rare, and clinical symptoms are often less specific and, thereby, may lead to misdiagnosis. The definitive treatment for osteoid osteoma is the excision of the nidus. We present the case of a 23-year-old man with a 4-year history of right anterior hip pain, subsequently diagnosed with a subarticular osteoid osteoma located in the right anterior acetabulum. Hip arthroscopic excision of the juxta-articular osteoid osteoma is presented as an effective treatment, with the advantage of less potential damage to normal bone and cartilage, as well as the additional benefits available with hip arthroscopy.

Osteoid osteoma (OO) is a benign osteoblastic tumor, representing 13% of all benign tumors.¹ Clinically, it is associated with nocturnal pain and is relieved by nonsteroidal anti-inflammatory drugs (NSAIDs).² OO is generally seen in male patients, with a male-female ratio of 3:1, and occurs between the ages of 5 and 25 years.² Although the most common lesion sites are the subcortical shaft and metaphysis of the long bones of the lower extremities, intra-articular locations are also possible.^{3,4} Intra-articular lesions may be misdiagnosed because clinical symptoms are often less specific and may include joint effusion, warmth, tenderness, stiffness, muscle atrophy, and joint

degeneration.⁵ These lesions show clinical similarities to septic arthritis and synovitis.⁶ The classic treatment for OO is the excision of the nidus. Failure to excise the nidus completely, however, will result in persisting symptoms. Open techniques have traditionally been used for nidus excision. We describe the case of a patient with OO of the acetabulum treated in a minimally invasive manner through hip arthroscopy.

A 23-year-old man presented with a 4-year history of right anterior hip pain. The pain, though constant, was noted to increase with activity, as well as at night. Bone scintigraphy showed increased focal uptake in the anterior acetabulum (Fig 1). A computed tomography (CT) scan defined a 10 × 7–mm sized ovoid lesion compatible with a subarticular OO located at the right anterior acetabulum (Fig 2).

Surgical Technique

We recommend multiple imaging modalities to localize and prepare for arthroscopic treatment of OOs of the acetabulum (Table 1). Technetium 99 bone scintigraphy, fine-cut CT, and magnetic resonance imaging (MRI) are each helpful in defining the bone lesion. Our preference is to use the bone scan to determine whether a bone lesion is active. The MRI scan is used to assess for bone edema and additional hip-based soft-tissue pathology. Finally, the CT scan is performed to map the bone lesion in relation to known anatomic landmarks such as the acetabular cotyloid fossa and lunate surface. In this case preoperative CT templating identified the OO to be approximately 5 mm

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The authors report the following potential conflict of interest or source of funding: A.J.S. receives support from Smith & Nephew Endoscopy, Bauerfeind, Johnson & Johnson.

Received September 2, 2014; accepted November 24, 2014.

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2212-6287/14749/\$36.00

<http://dx.doi.org/10.1016/j.eats.2014.11.018>

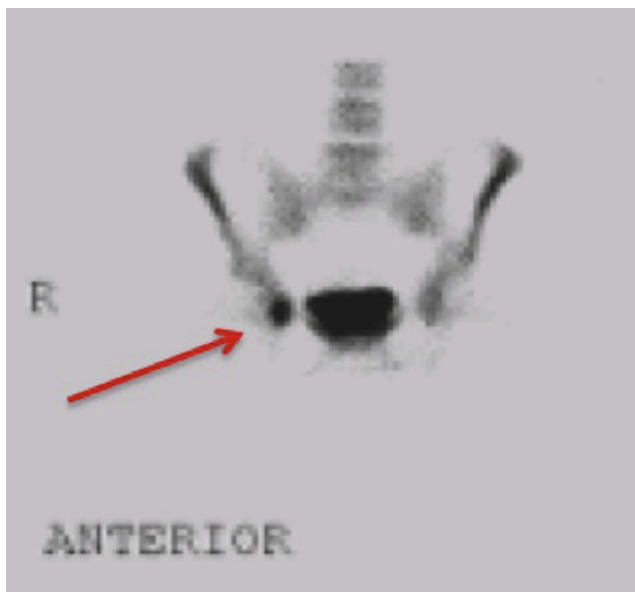


Fig 1. Bone scintigraphy showing an increased focal uptake “hot spot” (arrow) in the right anterior acetabulum at the site of the osteoid osteoma. Increased uptake may correlate with a more active, symptomatic lesion. (R, right.)

anterior to the acetabular fossa and 5 mm superior to the tip of the anterior lunate surface.

The goals of the surgical technique are to safely access the area of interest, define known anatomic landmarks, and resect abnormal tissue. Hip arthroscopy is performed using a modified supine technique, with the patient under general anesthesia on an orthopaedic fracture table. Out of traction, the hip is prepared and draped in the standard fashion. We performed a standard 2-portal diagnostic arthroscopy using anterolateral and modified anterior portals⁷ (Fig 3). For lesions of the anterior wall, as in this case, the anterolateral portal is used for visualization with a 70° arthroscope (Smith & Nephew, Andover, MA) and the modified anterior portal functions as the working instrument portal. For lesions of the posterior wall, the camera is placed in the modified anterior portal or anterolateral portal and the posterolateral portal functions as the working instrument portal. Diagnostic arthroscopy is performed within the central compartment, noting the condition of the cartilage, synovium, and ligamentum teres. In this case the right hip showed chronic synovitis within the central compartment at the junction of the transverse acetabular ligament and the anterior acetabular wall. This area of inflammation correlated with the preoperative bone scan, MRI, and CT locations.

Given the need for specificity of the lesion location, the arthroscope is positioned at the precise location of the lesion as defined by the fine-cut CT scan. By use of a 4.5-mm shaver blade (hip resection system; Smith & Nephew), as well as a TAC-S radiofrequency probe (radiofrequency ablation system; Smith & Nephew), a

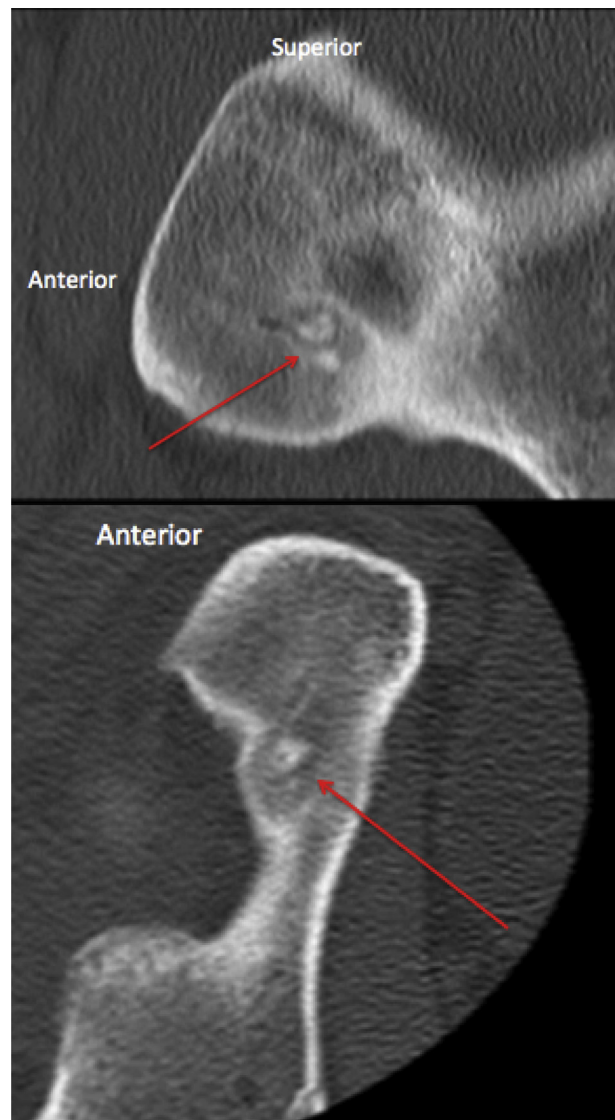


Fig 2. The fine-cut computed tomography scan defined a 10 × 7-mm sized lesion (arrows) compatible with a sub-articular osteoid osteoma located at the right anterior acetabulum.

focal synovectomy is performed within the central compartment at the pathologic area. Next, the bone overlying and surrounding the lesion is resected in a layered approach. By use of arthroscopic curved ring curettes and an arthroscopic 4-mm burr (hip resection system; Smith & Nephew), the affiliated bone is slowly removed in a submillimeter fashion. Bone resection is performed until identification of the lesion nidus by a pathognomonic cherry-red center (Fig 4). A 5-mm radial margin of bone is resected around the lesion center to healthy yellow-white-appearing bone (Video 1). During the resection process, care is taken to avoid significant iatrogenic damage to the surrounding articular cartilage surface of the femoral head and acetabulum.

Table 1. Pearls and Pitfalls of Arthroscopic Surgical Technique

Pearls
Obtain preoperative imaging comprising the following:
Fine-cut CT scan—lesion targeting
Technetium 99 bone scan—lesion activity
MRI scan—defining associated pathology
Observe for cherry-red nidus center
Use intraoperative traction to create effective space
Use a 4-mm or smaller burr to access remote lesions
Pitfalls
Failure to identify or excise the nidus completely
Chondrolysis from excessive RF use within the joint
Over-resection of bone, creating instability
Inaccessibility due to the constrained nature of the hip joint

CT, computed tomography; MRI, magnetic resonance imaging; RF, radiofrequency.

The histologic examination of the specimen confirmed the diagnosis of OO. The rehabilitation protocol comprised protected weight bearing for 2 weeks or until the patient's gait normalized, supplemented by early range of motion, as well as therapy based on activity deficits. During the postoperative period, the patient had instant and dramatic relief of pain. At his 4-month follow-up, he stated that his hip was asymptomatic.

Discussion

Juxta-articular and intra-articular localizations of OOs are rare and associated with a delayed diagnosis because of their nonspecific clinical presentation.^{3,5,8} Pain usually responds to NSAIDs and, therefore, is typically less dramatic.⁹ The release of cyclooxygenase-2 by osteoblasts of the nidus causes synovitis in the setting of intra-articular OO.¹⁰ The inflammatory response of the synovium may promote proliferation of chondrocytes with angiogenesis and promote migration of mesenchymal cells in the subchondral bone. These

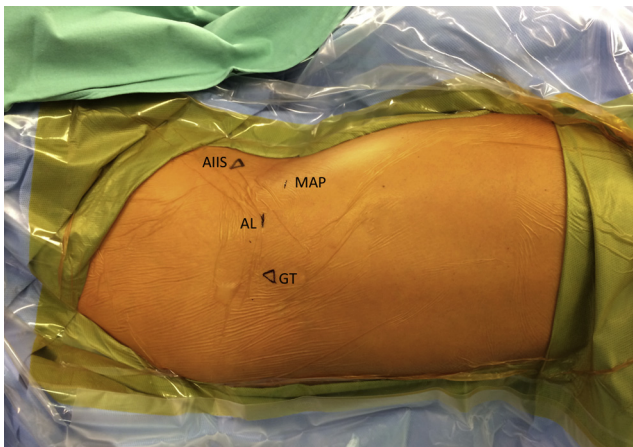


Fig 3. Arthroscopy portal placement. (AIS, anterior inferior iliac spine; AL, anterolateral portal; GT, greater trochanter; MAP, modified anterior portal.)

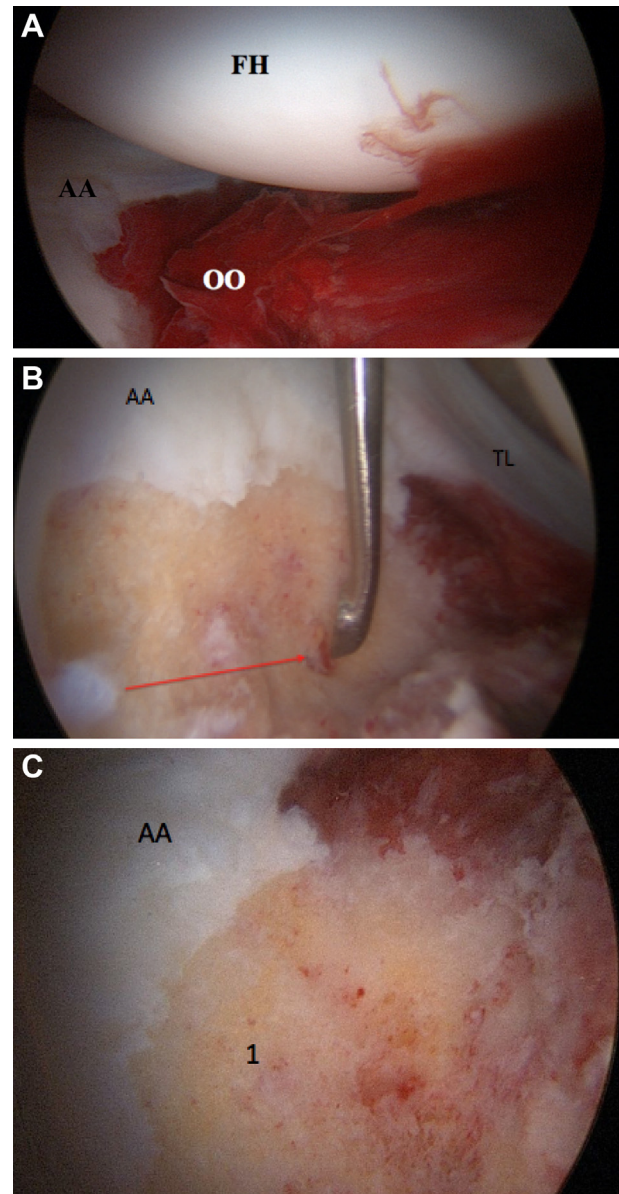


Fig 4. (A) Identification of focal synovitis above osteoid osteoma (OO) of acetabulum. (B) Central compartment view in right hip (70° arthroscope in anterolateral portal and curette from modified anterior portal), showing identification of lesion's pathognomonic cherry-red nidus (arrow) in bone. (C) Views after completed resection of osteoid osteoma (1) from acetabulum with residual healthy bone margin and preserved acetabular articular surface. A 70° arthroscope is in the anterolateral portal with instrumentation from the modified anterior portal. (AA, anterior acetabulum; FH, femoral head; TL, transverse acetabular ligament.)

changes may ultimately lead to development of secondary osteoarthritis and joint destruction.¹¹⁻¹⁴

The imaging modalities for the diagnosis of OO are plain radiographs, technetium 99m bone scans, CT scans, and MRI scans. Plain radiographs are insufficient to detect intra-articular OO, which is characterized by little or no reactive sclerosis.⁶ The radiolucent nidus is not

reliably detectable if below 3 mm in size and thus is often overlooked.¹⁵ MRI is generally accepted as the modality of choice for bone tumor exploration.^{16,17} The signal intensity of MRI is dependent on the age, size, vascularity, and amount of calcification present. In relation to intra-articular OO, the nidus cannot be identified because of masking of perilesional edema. In addition, an atypical presentation of the nidus may lead to misdiagnosis.^{18,19} Bone scintigraphy is a highly sensitive imaging modality. However, it shows a lower specificity than a CT scan particularly in case of intra-articular OO because of the associated synovial reaction location causing less intense uptake.²⁰ CT remains the examination of choice for intra-articular OO. Using axial or coronal imaging with high-resolution contiguous millimeter slice thickness and bony algorithm reconstruction provides accurate data regarding the size and location of the lesion.¹⁷

The treatment options for juxta-articular OO are conservative treatment, open surgical excision, radiofrequency ablation, and arthroscopy. Symptomatic treatment with nonsteroidal anti-inflammatory agents can be achieved with NSAIDs as part of conservative treatment. Regression in the lesion may take an average time of 36 months. During this time, however, chondral damage may occur and cause irreversible early osteoarthritis.^{21,22}

Open surgical excision has high success rates (88% to 100%).²³ However, this technique requires a large incision, wide dissection, and sometimes a hip dislocation, which results in considerable recovery time, as well as a risk of avascular necrosis.^{9,24} Radiofrequency ablation is a successful treatment method in extra-articular OO cases. The disadvantages of radiofrequency ablation are destruction of the articular cartilage around the lesion and incomplete excision of the lesion, which may result in recurrence.²⁵

Arthroscopic excision of juxta-articular OO is an effective treatment with the advantages of a minimally invasive surgical approach, thereby lessening the potential for damage to normal bone and cartilage. It also enables accurate targeting and excision of the lesion, as well as evaluation and treatment of concomitant pathologies. We recommend hip arthroscopy in cases of juxta-articular OO.

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