Technical Note

Cartilage-Preserving Arthroscopic-Assisted Radiofrequency Ablation of Periacetabular Osteoid Osteoma in a Young Adult Hip

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Abstract: Osteoid osteomas are benign bone lesions that commonly occur in the lower extremities and spine, with the radiographic evidence of a central nidus surrounded by circumferential reactive bone. Although nonsteroidal anti-inflammatory drugs can provide symptomatic relief and are used as an important diagnostic tool, surgical intervention is the definitive treatment. Arthroscopic-assisted radiofrequency ablation has been shown to be an effective technique to directly visualize and treat the lesion while minimizing damage to the articular cartilage.

Osteoid osteomas (OO) is a benign bone lesion that commonly appears in the lower extremities but is prevalent anywhere in the axial or appendicular skeleton with presentation causing pain, localized swelling, and joint stiffness, especially when near a joint.[1] It appears radiographically with a radiolucent nidus centered within sclerotic bone and is most effectively visualized using computed tomography (CT).[1] The nidus produces elevated levels of prostaglandin, which are the primary source of pain in patients with these lesions.[2]

OOs typically manifest during adolescence and are most prominent in young adults. Nonsteroidal anti-inflammatory drugs (NSAIDs) can control symptoms briefly and sometimes spontaneously induce regression.[2] With lesions localized around the hip, clinical manifestations of OO include the abductor lurch, positive Trendelenburg sign, and restricted range of hip motion resulting from synovitis.[2]

Although conservative treatment with NSAIDs can be used to manage and treat OO, surgical intervention is considered in refractory cases. Methods of surgical technique have included arthroscopic excision, which removes the lesion with the surrounding sclerotic bone.[3] More recently, radiofrequency ablation (RFA) has emerged as a minimally invasive and successful alternative to surgical curettage. Studies have shown that both techniques are viable in primary interventional settings, but RFA techniques yield fewer complications and remain just as effective. In recurrent symptomatic cases, secondary RFA yields a higher success rate than primary RFA.[4] Juxta-articular lesions, however, such as those close to the articular surface of the acetabulum, may be precluded from RFA treatment owing to concern about cartilage injury.

Surgical Technique

Indications and Preoperative Imaging

Although the clinical presentation of OO is most commonly reported night pain with symptomatic relief of NSAIDs, frequent positive physical examination tests around the hip include a limp, FADIR (flexion, adduction, internal rotation), and limited range of motion.[5] Imaging is necessary to confirm diagnosis and identify localization of the nidus. Standard radiography

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Fig 1. Preoperative radiographic images of anteroposterior bilateral hips are the standard preoperative imaging utilized in assisting in a diagnosis and can indicate the presence of the osteoid osteoma.

can identify location of the lesion, but magnetic resonance imaging (MRI) and computed tomography (CT) are used to determine the presence of surrounding edema and more extensive understanding of the osseous pathology (Figs 1 and 2). Conservative treatment is often the primary standard of care. A diagnostic intra-articular corticosteroid lidocaine injection is given to indicate the source of pain in most primary and revision cases in the hip. In both primary and revision cases of OO, an extensive workup is needed to aid in an appropriate diagnosis, and if conservative care fails and the symptoms are associated with the sclerotic lesion, the patient may be a good candidate for surgical intervention.

Diagnosis and Treatment of OO

Diagnostic arthroscopy is performed with the patient positioned supine under general anesthesia with the operative extremity in traction. Using fluoroscopic guidance, the standard anterolateral (AL) portal is established at the 12 o'clock position, the modified anterior portal (MAP) at the 2 o'clock position, and the distal accessory anterolateral (DALA) portal using the arthroscope in the anterolateral portal. With arthroscopic visualization, a small area of cartilage delamination is noted in the acetabulum, at the suspected location of the lesion. The capsulolabral tissue is debrided to identify the bony acetabular rim. Triangulating from the suspicious area of cartilage in combination with fluoroscopy and close review of preoperative cross-sectional imaging, a guidewire is drilled into the acetabular rim toward the lesion. Care is taken not to violate the articular surface. A change in normal bone structure and color is identified ∼11 mm from the acetabular rim, localizing the osteoid osteoma around the 1:30 clockface position. Using a 2.4-mm drill, the primary hole is overdrilled with a burr to enlarge the hole (Stryker Sports Medicine, Kalamazoo, MI). At this point, the lesion is well visualized, with loose tissue fragments inside appearing pink in nature, consistent with the nidus tissue (Fig 3A). The lesion is curetted, debrided, and ablated for 60 seconds using an RFA device (Stryker Sports Medicine) (Fig 3B). Throughout the ablation, the articular cartilage is visualized to ensure no visible damage occurs. Afterward, the bone socket shows no evidence of any gross OO tissue and is backfilled using calcium phosphate bone substitute (Zimmer Biomet, Warsaw, IN) (Fig 4).

Assessment and Correction of Femoroacetabular Impingement Morphology and Labral Tear

A labral tear from 12 to 3 o'clock is identified and repaired using 2 PEEK suture anchors (Stryker Sports

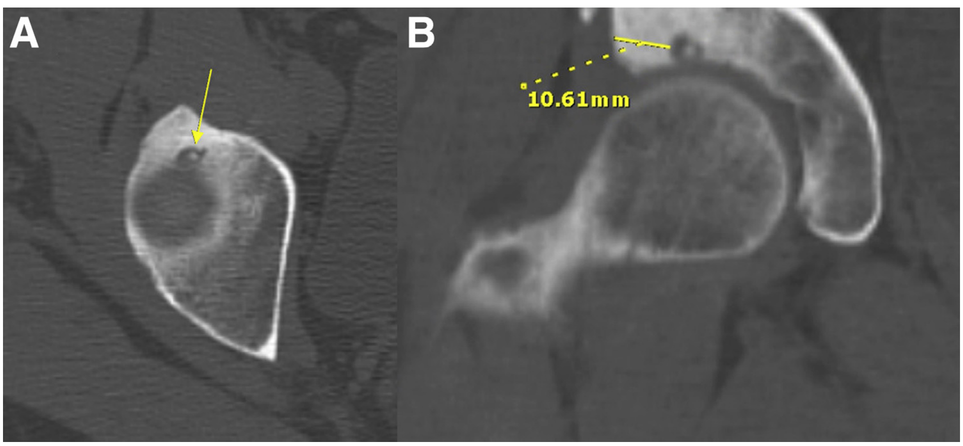

Fig 2. Identification of peri-acetabular osteoid osteoma in right hip. (A) Axial view on computed tomography (CT) showing the nidus with circumferential reactive bone around it (arrow). (B) Coronal view of the same hip identified the lesion 11 mm in from the acetabular rim which contributes in the surgical approach.

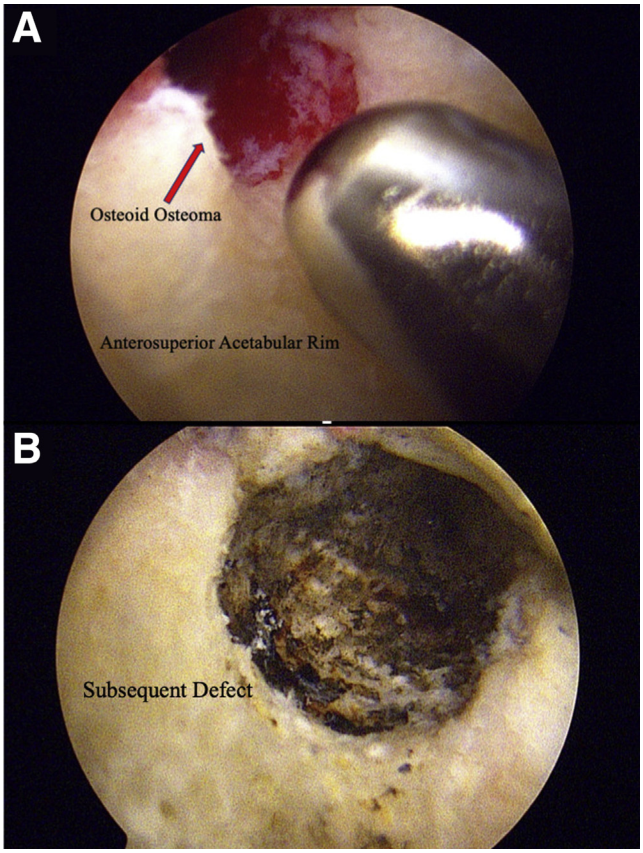

Fig 3. Intraoperative photos of the osteoid osteoma. (A) Visualization of the osteoid osteoma tissue and its characteristically bright pink tissue and (B) the post-ablation bone defect left with no evidence of any osteoid osteoma tissue as confirmation intervention.

Medicine) (Fig 5). Fluoroscopy provides visualization of the cam deformity, and using an arthroscopic burr, a femoral osteochondroplasty is performed from the

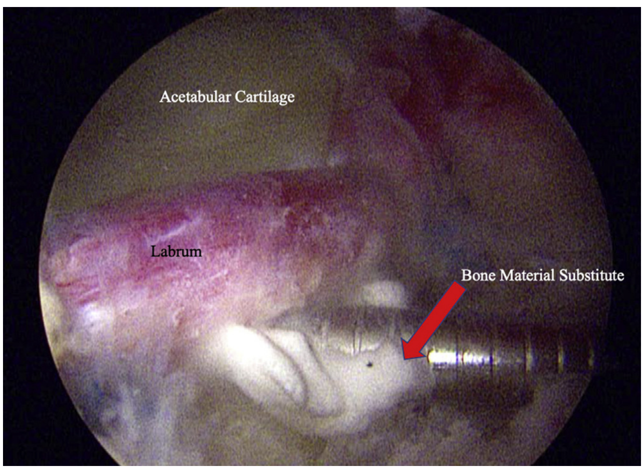

Fig 4. Intraoperative photo shows backfilling of the subsequent bone defect using calcium phosphate bone substitute as a bone growth aid to prevent consequential fracture from the defect.

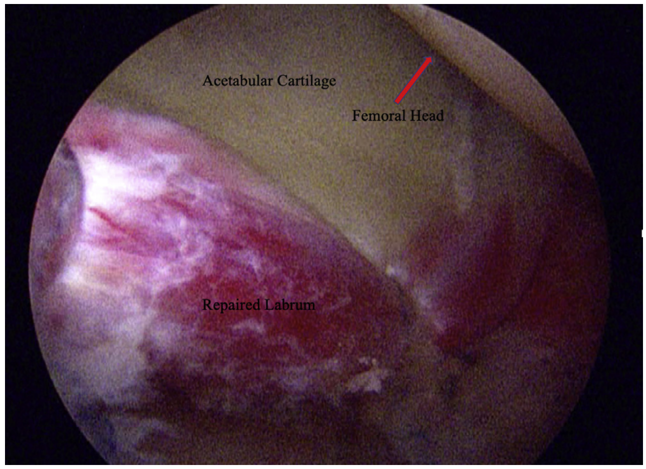

Fig 5. Identification of the repaired labrum with associated surrounding anatomical structures after identifying femoroacetabular impingement pathology and labral tear.

12 o'clock lateral synovial folds to the 6 o'clock medial synovial folds. Dynamic examination and fluoroscopic imaging confirms that the entire cam deformity is excised. A capsular closure device (Stryker Sports Medicine) is used to plicate the T-capsulotomy by passing a suture from the acetabular leaflet to the femoral leaflet, tensioning both ends, and then tying together the ends with an arthroscopic knot technique.

Discussion

A successful surgical treatment of OO includes safely accessing the bone lesion, thoroughly analyzing the surrounding anatomic areas, and excising or ablating the nidus (Table 1). A critical component to this case is to preserve the acetabular cartilage and backfill the remaining defect. Direct visualization allows for confirmation of the lesion and the ability to ensure

Table 1. A Guide to Identifying Periacetabular Osteoid Osteomas and the Necessary Steps to Ablate the Lesion

1. Position the patient Supine on a Lower-extremity Extension Table.
2. Use fluoroscopic guidance to establish the 3 arthroscopic portals: AL, MAP, DALA.
3. Complete a diagnostic evaluation of the surrounding anatomic structures, including the cartilage, labrum, capsule, and bone.
4. Use fluoroscopic and direct visualization to localize the lesion and drill a diagnostic hole.
5. Identify the osteoid osteoma tissue and burr down until the lesion is directly visualized.
6. Place the RFA device in the hole and ablate for 60 seconds with the device facing away from the cartilage.
7. Place the arthroscope in the hole to analyze the ablation site for any remaining osteoid osteoma tissue.
8. Repair any labral tears if needed.
9. Resect any impinging cam pathology if indicated.
10. Close T-capsulotomy.

AL, anterolateral; DALA, distal anterolateral accessory; MAP, modified anterolateral portal; RFA, radiofrequency ablation.

Table 2. Advantages and Disadvantages when Using Arthroscopic-Assisted RFA versus Other Common Techniques

Advantages	Disadvantages
Arthroscopically assisted with minimal incisions	Ablation of potentially healthy bone
Preservation of articular cartilage while using RFA	Potential cartilage damage without careful use of RFA device
Direct visualization with arthroscope to ensure negative margins	
Reduced radiation exposure with fluoroscopy vs intraoperative CT	

CT, computed tomography; RFA, radiofrequency ablation.

that the acetabular cartilage surface is not damaged during the ablation process (Video). Once the bone lesion is ablated, a subchondral kit (Zimmer Biomet) is used to fill the defect with calcium phosphate bone substitute.

Although OOs are atypical in the acetabulum, ablation has become an effective technique for interventional treatment, with multiple studies reporting success in >96% of each respective cohort.[6] Ablation has become a staple in treating OO; however, complications can include destruction of the surrounding articular cartilage and residual defects from the resection site. Literature referencing arthroscopic-assisted intervention of osteoid osteomas within the acetabulum has described established techniques ranging from open curettage to mechanical burring. OOs around the acetabulum can often border the cortical bone-subchondral interface, making ablation challenging. Three technique case reports[7-9] used arthroscopic-assisted radiofrequency ablation of lesions; however, what differentiates the technique used in our case is the preservation of the acetabular cartilage and subsequent filling of the lesion with bone graft substitute.

Complications of this technique primarily include direct ablation at high temperatures for prolonged periods, especially in areas adjacent to a chondral surface, where heat transfer can directly cause damage and healthy bone can be destroyed (Table 2). A large cohort study noted a 1% complication rate due to RFA generator malfunction, which resulted in OO recurrence and a case of thrombophlebitis.[5] Limitations of this technique include the length of time for ablation. Ablation time is dependent on the discretion of the arthroscopist and is indicative of visual and fluoroscopic feedback.

Based on imaging and surgical outcome, the described arthroscopic technique for both diagnosis and ablation of the lesion is an effective method to treat the hip while accurately and safely removing the OO (Table 2).

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