Technical Note

Arthroscopic Technique for Reduction and Fixation of an Acetabular Rim Fracture

Anthony A. F. Essilfie, M.D., Dylan T. Lowe, M.D., and Thomas Youm, M.D.

Abstract: Acetabular rim fractures can accompany patients with femoroacetabular impingement. Frequently, the acetabular rim fracture is excised. However, if the osseous fragment of the acetabular rim fracture is large enough to result in instability, then the acetabular rim fracture should be reduced and secured with internal fixation. The purpose of this technical note was to describe the arthroscopic technique of internal fixation of an acetabular rim fracture.

Introduction

Approximately 8% of patients undergoing a hip arthroscopy for femoroacetabular impingement (FAI) have an os acetabuli.[1,2] The os aceatbuli is commonly associated with large cam lesions in FAI. The terms "os acetabuli" and "acetabular rim fracture" have often been used interchangeably in the literature. However, Martinez et al. has stated that os acetabuli and acetabular rim fractures are the result of two distinct etiologies. They state that os acetabuli is of a cartilaginous origin and oriented parallel to the joint surface, whereas an acetabular rim fracture is the result of a FAI and results in a vertical separation line perpendicular to the joint surface.[3] As a result, the osseous fragment will be referred to as an acetabular rim fracture for this technical note, given the patient's large cam morphology and vertical orientation of the osseous fragment.

Treatment of these osseous fragments must be tailored to the specific history and physical exam with corresponding radiographic findings. Over-resection of large segments of acetabular rim can result in hip instability or increased progression of osteoarthritis.[4] Typically, when removal of the osseous fragment results in a lateral center edge angle (LCEA) that is less than 25° on the AP or an anterior center edge angle (ACEA) less than 20° on a false profile view, then fixation of the osseous fragment is recommended.[5] The purpose of this surgical technique is to present our surgical approach to acetabular rim fracture repair.

Indications

A focused history and physical exam is paramount in order to make the correct choice for treatment. Commonly, acetabular rim fractures are found in patients with cam type FAI (Fig 1).[6] Therefore, patients frequently have groin pain associated with activity, positive flexion adduction internal rotation impingement test, and limited internal rotation at 90° of hip flexion, as well as limited flexion.

X-ray evaluation with an AP pelvis, Dunn lateral, and false profile should be obtained to assess the FAI morphology, as well as to evaluate for the presence of an acetabular rim fracture. Assessment of the Tönnis grade, lateral center edge angle (LCEA), anterior center edge angle (ACEA), and Tönnis angle should be made. Generally, when resection of the osseous fragment results in a LCEA less than 25° on the AP or an ACEA less than 20° on a false profile view, then fixation of the osseous fragment is recommended. As illustrated in Fig 2, the LCEA would have been 18° if the osseous fragment was resected (Fig 2), which indicates the patient for fixation of the acetabular rim fracture (Table 1). Computed tomography with 3-D reconstructions was obtained for preoperative planning to evaluate size and location of the osseous fragment (Fig 3). MRI is commonly performed to assess for any cartilage defects,

New York University Langone Orthopedic Hospital, New York, New York, U.S.A.

The authors report the following potential conflicts of interest or sources of funding: T.Y. is a paid consultant for Arthrex, outside the submitted work. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

Received June 22, 2021; accepted August 24, 2021.

Address correspondence to Anthony A. F. Essilfie, M.D., New York University Langone Orthopedic Hospital, New York, NY, 10010, U.S.A. E-mail: Anthony.essilfie@gmail.com

2212-6287/21916

https://doi.org/10.1016/j.eats.2021.08.036

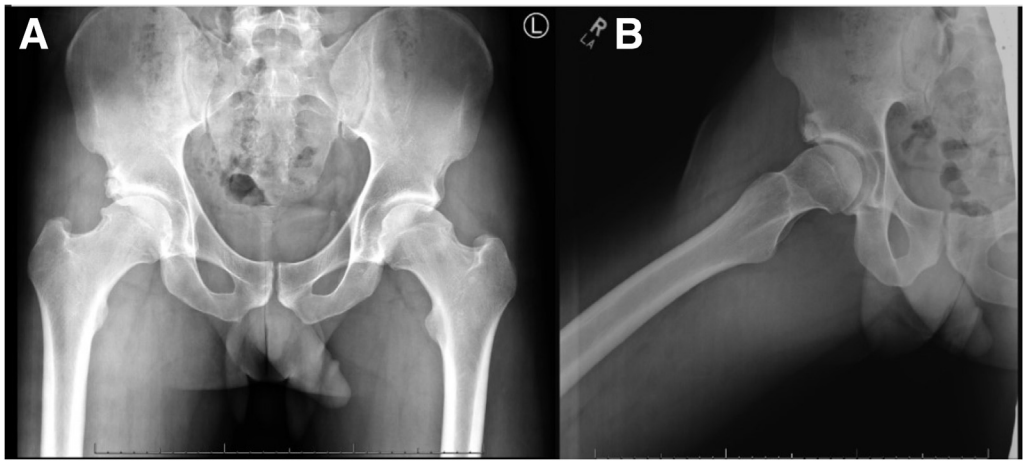

Fig 1. AP (A) and Dunn lateral (B) of the right hip displaying an acetabular rim fracture with a vertical fracture line relative to the hip joint in the setting of a large cam lesion.

labral injuries, or other soft tissue pathology in the hip region (Fig 4).

Surgical Technique

Patients are placed supine on a standard traction table with a well-padded perineal post (Smith & Nephew, Andover, MA). The nonoperative foot is placed in a traction boot, and traction is applied to the nonoperative side first. This is followed by gross traction applied to the operative leg at 45° of abduction and then internally rotated 15° and adducted against the perineal post to ultimately have the pelvis centered on the perineal post. The hip distraction was confirmed using fluoroscopic imaging.

The anterolateral (AL), mid-anterior (MA), and distal anterolateral accessory (DALA) portals were used to perform the hip arthroscopy via an interportal capsulotomy. Next, the capsule was elevated off of the acetabular rim (Video 1, Table 2, Figs 5 and 6). The rim fracture was identified with the aid of fluoroscopic imaging. Care was taken not to detach the labrum from the osseous fragment (Fig 7). After preparation of the bony bed with a shaver, the osseous fragment was reduced via the MA portal and provisional fixation with a K wire was used via the DALA portal (Fig 8). The depth of the K wire was measured, and the K wire was drilled with a cannulated drill bit. The hole was tapped, and a 4.0-mm partially threaded screw was placed (Fig 9).

A 5.5-mm bur was used to contour the osseous fragment to the native acetabular rim. Subsequent labral repair was performed using 3 knotless suture anchors. One anchor was placed medial to the osseous fragment, another lateral to the fragment, and one proximal to the osseous fragment. Next, traction was released, and the peripheral compartment was entered via the interportal capsulotomy. The cam lesion was removed using a 5.5-mm bur. The cam resection was confirmed with dynamic fluoroscopic images. Before completion of the procedure, the hip was checked for confirmation of a good suction seal. Lastly, the interportal capsulotomy was closed with 0 vicryl suture.

After surgery, the patient was placed in a hip abduction brace to limit external rotation and extension. The patient was made flat foot weight bearing for 4 weeks. Aspirin, 81 mg twice daily, was prescribed for deep vein thrombosis prophylaxis, and Celebrex 200 mg daily for 2 weeks was prescribed for heterotopic ossification prophylaxis. Initial postoperative anteroposterior pelvis displayed an appropriate reduction of the hip joint and continuity of the sourcil with appropriate hardware positioning (Fig 10).

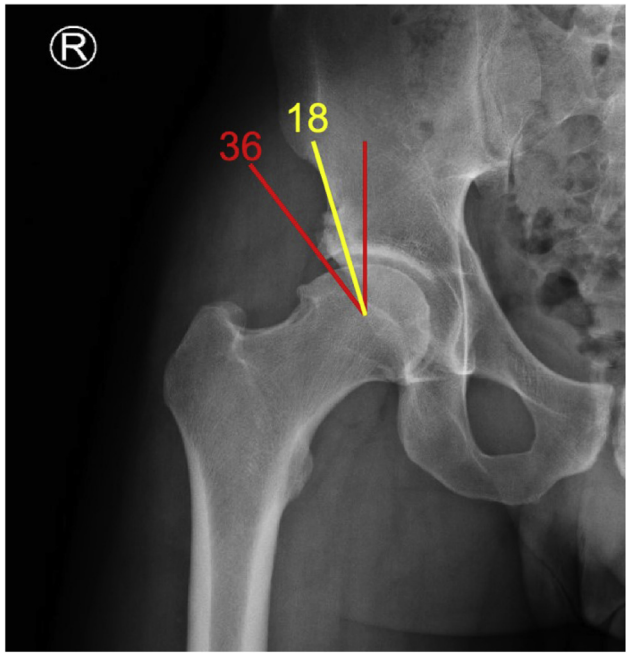

Fig 2. Anteroposterior view of the right hip with an LCEA of 18 (yellow line) if the osseous fragment were to be excised. LCEA, lateral center edge angle.

Table 1. Advantages and Disadvantages

Advantages	Disadvantages
Maintains appropriate coverage of the femoral head	Prolonged traction time
Allows for reduction and repair of both the osseous fragment and the labrum	Possible intra-pelvic perforation

Discussion

Acetabular rim fractures are frequently associated with large cam lesions in the setting of symptomatic FAI. When excision of the osseous fragment results in an LCEA less than 25° on AP view or an ACEA less than 20° on the false profile view, then it is recommended that the osseous fragment should be repaired in order to prevent instability to the hip joint. This arthroscopy-assisted acetabular rim fracture reduction and internal fixation technique allowed for restoration of the acetabular coverage, while addressing concomitant hip pathology during the hip arthroscopy.

Different methods of arthroscopic management of acetabular rim fractures or os acetabuli in conjunction with FAI has been reported. Recently, DeFroda et al. reported on a "suture-on-screw" technique to minimize the number of suture anchors needed for labral repair.[7] This is similar to the technique described by Pascual-Garrido, where a vicryl stitch is used.[5] Although the use of a suture on the screw does decrease the number of suture anchors needed for labral repair, the surgeon must be mindful not to tangle it during instrumentation.

The advantage of this procedure is to maintain acetabular coverage since hip stability is the main indication for fixation of the osseous rim fracture.[8] Additionally, there is a report of accelerated development of osteoarthritis with resection of an os acetabuli.[4]

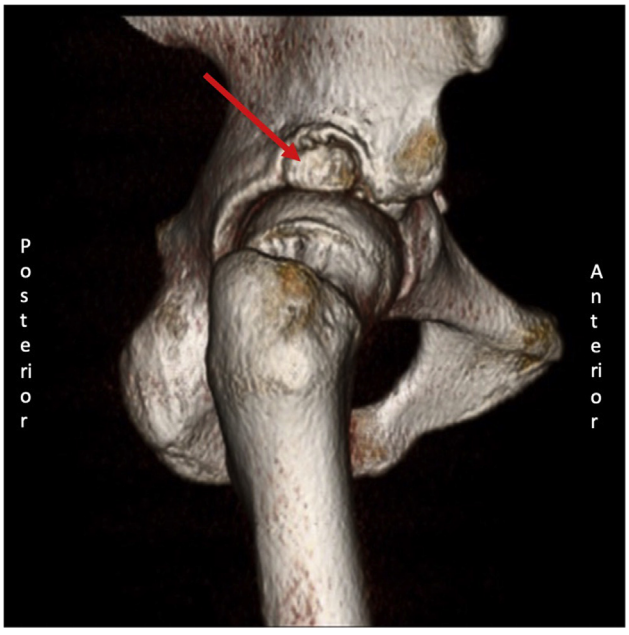

Fig 3. Three-dimensional computed tomography scan showing the acetabular rim fracture labeled with an arrow.

Fig 4. MRI of the right hip displaying the acetabular rim fracture and associated labral tear (labeled with an arrow) with cam lesion on the femoral head (labeled with an asterisk).

Table 2. Pearls and Pitfalls

Pearls	Pitfalls
Preserve capsule when elevating the capsule from the acetabulum	Provides quality tissue for subsequent capsular closure
Mobilize the osseous fragment from fibrous tissue while preserving labral tissue on the fragment for subsequent repair	Allows for appropriate reduction of the fragment and provides labral tissue necessary to provide the suction seal function of the labrum
Gently prepare the bony bed to promote healing	Over-resection of the bony bed can result in an incongruent joint and inappropriate reduction of the osseous fragment
Use cannulated guidewire and screw set	Prevents screw from loosening and floating in the joint
Place suture anchor proximally or use the suture wrapped around the screw head for labral repair	The osseous fragment usually has a labral tear so the surgeon must appropriately plan for placement of suture anchor or use a suture wrapped around the screw head

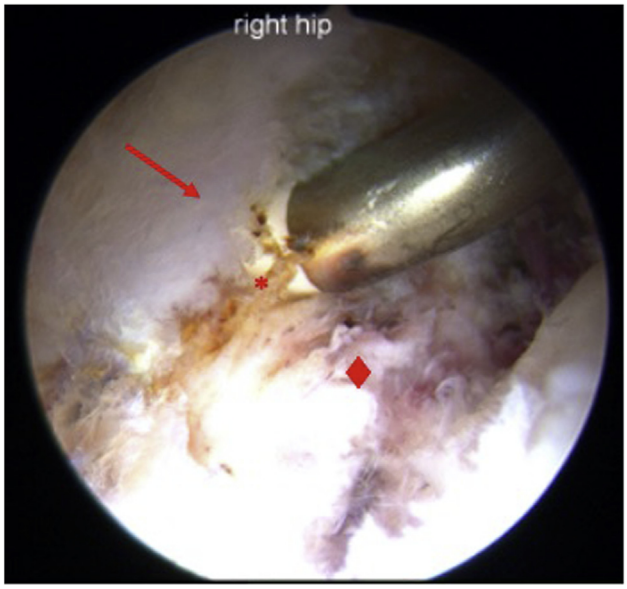

Fig 5. Arthroscopic view of the right hip from the anterolateral portal displaying the osseus fragment from the acetabular rim fracture and associated labral tear. The capsule is marked with an arrow, the osseous fragment is labeled with an asterisk and the labrum is labeled with a diamond.

Therefore, it is prudent to evaluate the remaining acetabular coverage if the osseous fragment were to be removed to determine whether the fragment should be resected or fixed.

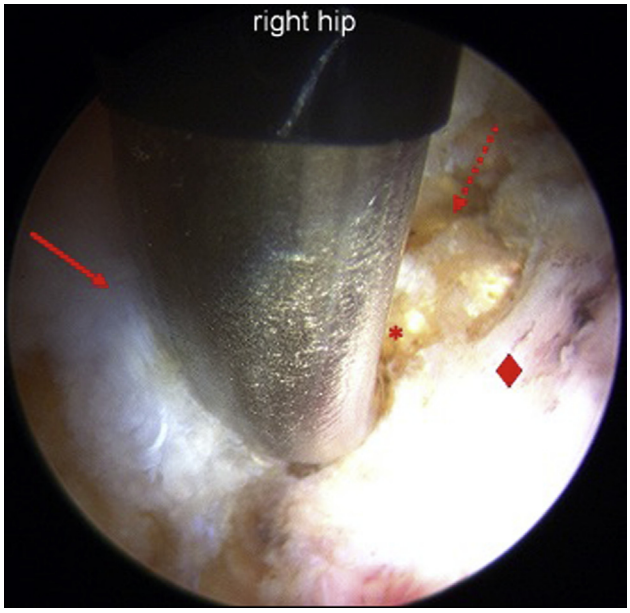

Fig 6. Arthroscopic view of the right hip from the anterolateral portal showing the fracture line of the osseous fragment from the acetabulum (labeled with a dashed arrow). The capsule is marked with an arrow, the osseous fragment is labeled with an asterisk, and the labrum is labeled with a diamond.

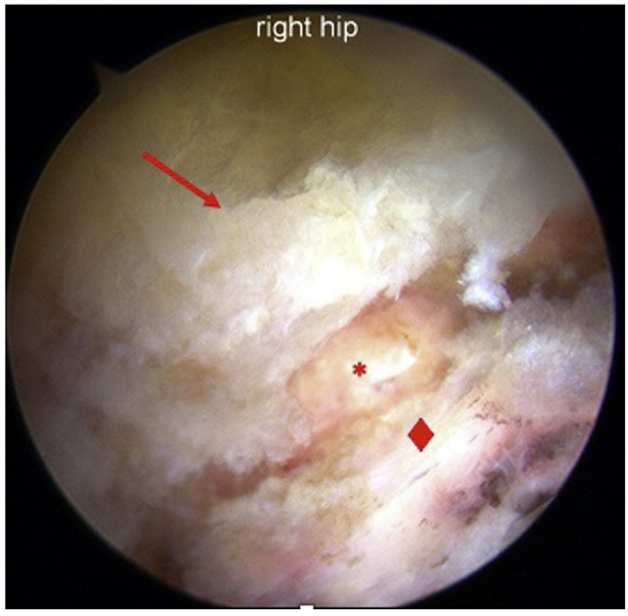

Fig 7. Arthroscopic view of the right hip from the anterolateral portal of the osseous fragment, capsule, and labrum after debridement. The capsule is marked with an arrow, the osseous fragment is labeled with an asterisk and the labrum is labeled with a diamond.

Girodano et al. has a case series of 21 patients who underwent hip arthroscopy for FAI with a rim fracture compared with a control group of patients with FAI and

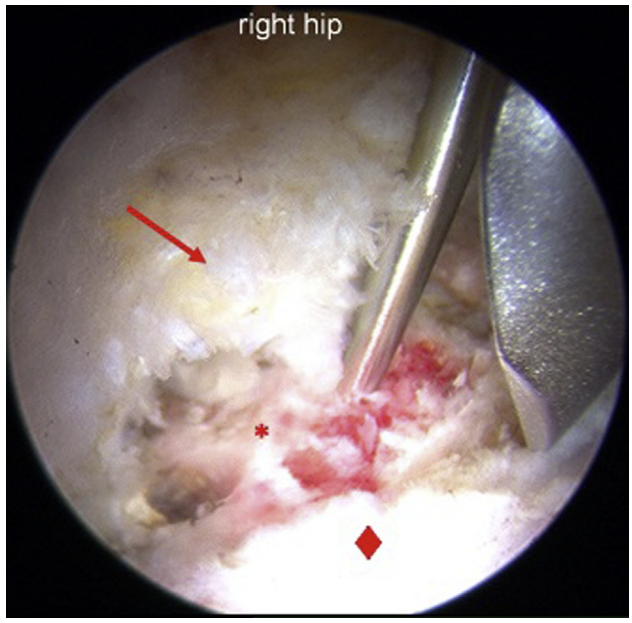

Fig 8. Arthroscopic view of the right hip from the anterolateral portal showing the slight debridement to stimulate healing followed by insertion of a guidewire with the aid of a sled to assist with insertion of instrumentation. The capsule is marked with an arrow, the osseous fragment is labeled with an asterisk, and the labrum is labeled with a diamond.

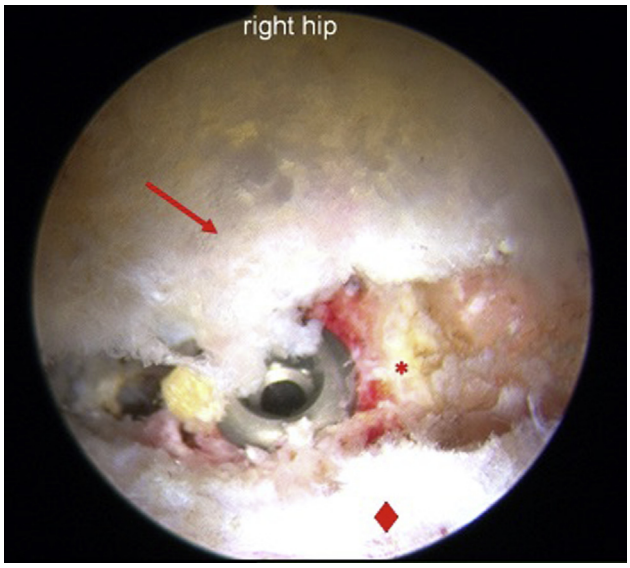

Fig 9. Arthroscopic view of the right hip from the anterolateral portal, showing insertion of a single cannulated screw into the osseous fragment. The capsule is marked with an arrow, the osseous fragment is labeled with an asterisk, and the labrum is labeled with a diamond.

no acetabular rim fracture that showed no difference in clinical outcomes at a minimum of 2-year follow-up.[9] However, 20 out of 21 of these patients underwent excision of the osseous fragment. Reports on outcomes of arthroscopic fixation of "os acetabuli" or acetabular rim fractures are scarce. At present, there are only case reports in the literature. Epstein et al. were the first to report on the arthroscopic reduction and internal fixation of an acetabular rim fracture in 2009. Their patient had a large cam lesion and an acetabular rim fracture that would have resulted in a LCEA of 18° if resected, so

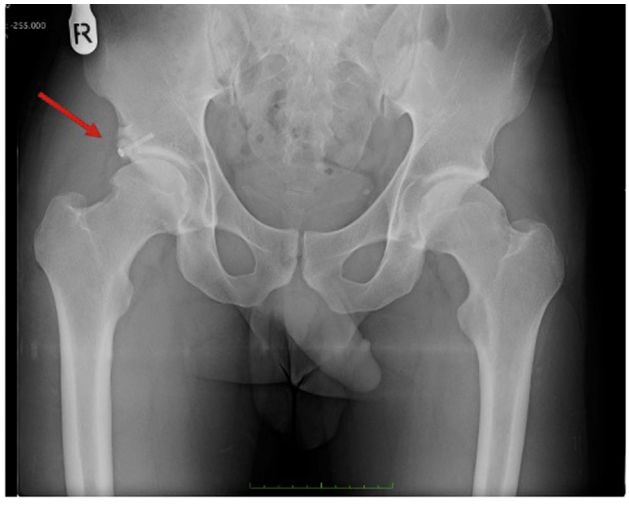

Fig 10. Anteroposterior pelvis with appropriate rim fracture reduction and continuity of the sourcil, as well as appropriate positioning of the hardware.

arthroscopic fixation was performed and the patient had a modified Harris Hip Score (mHHS) of 100 at 1 year post op.[10] Larson et al. has a case report on 2 patients that underwent arthroscopic fixation of acetabular rim fracture, and by 2 years postoperative, the mHHS was greater than 98 for both patients.[8] Rafols et al. described the staged fixation of bilateral acetabular rim fractures. At the 2-year follow up, the patient had improved his mHHS from 81.3 to 100 on the right and 87.1 to 96.1 on the left.[11]

In summary, arthroscopic reduction and fixation of an acetabular rim fracture maintain the stability of the hip and avoids potential iatrogenic instability associated with resection of a large acetabular rim fracture fragment. In the hands of an experienced hip arthroscopist, this procedure can be done with minimal increase in traction time. We recommend this surgical technique when fixation is indicated and look forward to more outcome studies of this technique in the future.

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