Arthroscopic Management of Hip Pathomorphology

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Abstract
The role for the arthroscopic correction of femoroacetabular impingement continues to evolve. As the understanding of hip pathomorphology improves and arthroscopic techniques for managing these disorders advance, the indications for arthroscopic femoroacetabular correction become clearer. Attention to detail with respect to diagnoses and surgical management is critical to optimize outcomes in this patient population. Studies have shown comparable outcomes for arthroscopic management and open surgical techniques. Further study is required to better define the role for arthroscopic versus open surgical management of selected pathomorphologies of the hip.

Indications and Contraindications
Indications and contraindications for the arthroscopic management of FAI are based on a physician’s ability to treat the underlying pathomorphology. Arthroscopic indications include focal anterior acetabular overcoverage, mild to moderate degrees of acetabular retroversion, coxa profunda, associated rim fractures and os acetabuli, and anterolaterally based cam lesions. Relative contraindications for arthroscopic treatment include associated significant structural instability, extra-articular greater trochanteric impingement, posteriorly based cam lesions, and moderate to advanced degenerate arthritis. More specifically, structural instability cannot be corrected with arthroscopy. Patients with center-edge angles less than 20°, evidence of femoral head lateralization, a break in the Shenton line, and more severe degrees of acetabular retroversion with a low volumetric acetabulum may be better treated with a corrective pelvic osteotomy. To more completely define instability in patients with milder degrees of structural instability, it is important to take into account other factors, such as acetabular inclination, the femoral neck-shaft angle, and femoral neck version. Although global rim resections can be performed for protrusio acetabuli, there are limitations associated with arthroscopic dynamic assessment. Ultimately, younger patients with more severe protrusio may be better treated with an open surgical dislocation.

Surgical Technique Overview
When performing hip arthroscopy, the surgeon must be capable of treating a three-dimensional problem while viewing a two-dimensional image. Consequently, three-dimensional CT is valuable in better defining the pathology and correlating it with ar-
Most procedures can be performed using a two-portal technique, with anterolateral and mid-anterior portals. A posterolateral portal can be used when posterior acetabular rim pathology is treated (Figure 1). Initially, central compartment arthroscopy is performed with traction. Generous capsulotomies from the midanterior to anterolateral or posterolateral portals are created to access most of the acetabular rim and the anterolateral femoral head-neck junction. Inspection of the labrum, labrochondral junction, acetabulum, and femur should confirm the suspected pathomorphology and guide specific procedures (Figure 2). Labral ecchymosis, calcification, ossification, extension of the acetabular rim well beyond the labrochondral junction, and difficulty visualizing or accessing the central compartment despite adequate distraction on fluoroscopy are all consistent with pincer-type FAI (Figure 2, A). Labrochondral disruptions, with varying degrees of acetabular chondral delaminations, are consistent with cam-type FAI (Figure 2, B). Many patients will have a combination of these findings because of the presence of both cam- and pincer-type FAI. All the described findings should be correlated with preoperative imaging studies and evaluated with intraoperative dynamic assessment.

Rim resections for pincer-type FAI are typically performed with the hip in traction, with or without labral takedown. The labrum can be taken down from the acetabular rim with an arthroscopic knife along the area of the pincer-type impingement. Rim resection is then performed with a motorized burr. Alternatively, more focal areas of pincer-type FAI with an intact labrum can be resected peripheral to the labrum without labral takedown. Intraoperative fluoroscopy can help guide and confirm appropriate resec-

Figure 1  Typical portals used for hip arthroscopy (left hip shown) include the midanterior portal (MA), the anterolateral portal (AL), and the posterolateral portal (PL).

Figure 2  A, Arthroscopic image of the left hip shows labral bruising (L) and abnormal extension of the acetabular rim (arrows) beyond the labrochondral junction consistent with pincer-type impingement. B, Arthroscopic image of the left hip shows a chondral delamination with probing of the labrochondral junction. C, Arthroscopic image of the left hip after labral refixation (L) with mattress sutures shows maintenance of the labral seal (arrows) against the femoral head (FH). D, Arthroscopic image of the left hip after rim resection (AR), labral refixation (L), and femoral resection osteoplasty (FN) shows maintenance of the labral seal.
tions if the pelvis is properly aligned to re-create a well-centered, preoperative anteroposterior pelvic radiograph.\textsuperscript{24} (Figure 3). This is primarily achieved by aligning the anterior superior iliac spines parallel to the floor and ceiling.\textsuperscript{24} The extent and degree of rim resection is ultimately based on intraoperative findings, dynamic assessment, and preoperative imaging studies (Figure 4). The labrum is then refixed with suture anchors placed approximately 1 cm apart. A mattress and labral base refixation may be preferred to a loop-around refixation to preserve the sealing function of the labrum (Figure 2). Overresection of pincer-type pathology or resections in the setting of acetabular dysplasia should be avoided and can lead to iatrogenic postoperative instability.\textsuperscript{25–27}

After treating the central compartment pathology, traction is released and the hip is flexed to approximately 40°. Portals can be maintained during traction release by withdrawing the arthroscope from the central compartment, which allows for visualization of the femoral head-neck junction. Dynamic assessment is then performed to evaluate for impingement secondary to cam-type FAI. Impingement is indicated by abnormal lifting of the acetabular labrum by the head-neck junction, levering of the femoral head out of the acetabulum, and/or limitations in hip range of motion with a firm end point during dynamic testing. The cam lesion is identified and correlated with preoperative imaging studies. Greater degrees of flexion and external rotation allow for visualization of the anteroinferior femoral head-neck junction and the medial synovial fold, whereas greater degrees of extension and internal rotation allow for visualization of the superoposterior femoral head-neck junction and the retinacular vessels.\textsuperscript{5} A motorized burr is used to re-create a normal femoral-head neck junction; a repetition of dynamic assessment and intraoperative fluoroscopy can confirm appropriate femoral resection (Figure 4). A broader, more conservative resection is generally preferred over a more focal, aggressive resection because it may better maintain the labral seal. Resecting
greater than 30% of the femoral neck width is reported to significantly increase the risk for postoperative femoral neck fractures.\textsuperscript{28} Impingement is a unique condition, with each case varying with respect to the region and extent of bony resections. At the completion of the procedure, a motorized shaver is used to meticulously remove all residual bony debris to minimize the risk for postoperative heterotopic ossification. Closure of the capsulotomy is controversial and should be considered in patients with capsular laxity, generalized hypermobility, and borderline dysplasia.

### Table 1
Clinical Outcomes After Arthroscopic Management of Femoroacetabular Impingement

<table>
<thead>
<tr>
<th>Study</th>
<th>Hips</th>
<th>Mean Follow-up (Years)</th>
<th>Clinically Good or Excellent Outcomes</th>
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</tr>
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<td>3.5</td>
<td>DB, 68%; LR, 92%</td>
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<td>Singh and O’Donnell\textsuperscript{16}</td>
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<td>1.8</td>
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ADL = activities of daily living; DB = debridement (labral resection); HHS = Harris Hip score; HOS = Hip Outcome score; LR = labral refixation; MHHS = modified Harris Hip score; NAHS = Nonarthritic Hip score; NA = not available; OA = osteoarthritis; RTP = return to play; SF-12 = Medical Outcomes Study 12-Item Short Form; THA = total hip arthroplasty; VAS = visual analog pain scale; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index.

(Courtesy of Asheesh Bedi, MD, and Bryan Kelly, MD, New York, NY.)

### Postoperative Management
Early postoperative range of motion begins on the day of surgery with well-leg cycling or a continuous passive range-of-motion machine. Limits are placed on the extremes of external rotation for patients with capsular repairs. Foot-flat weight bearing is advised for 2 to 3 weeks until the patient is able to ambulate with a non-antalgic gait. Weight-bearing restrictions are maintained for 4 to 8 weeks if microfracture is performed or osteopenic bone is encountered during bony resections. Nonsteroidal anti-inflammatory drugs are taken for 2 to 3 weeks postoperatively to decrease
the risk of heterotopic bone formation.

**Arthroscopic Outcomes and Complications**

Reports and systematic reviews evaluating arthroscopic management of FAI in properly selected patients have noted significant improvements in pain and functional scores.\(^1\)\(^-\)\(^22\) (CM Larson, MD, et al, San Francisco, CA, unpublished data presented at the Arthroscopy Association of North America annual meeting, 2011) (Table 1). To date, there has been only one review article comparing arthroscopic and open surgical treatment of FAI.\(^1\)\(^1\) This report found substantial improvement in outcomes after both open and arthroscopic approaches, but neither treatment was found to be clearly superior. Cadaver studies have shown that arthroscopic femoral resections for anteriorly based cam-type FAI are comparable to anterior femoral resections performed with an open surgical approach.\(^29\),\(^30\)

Complications have been reported after arthroscopic management of FAI.\(^5\)\(^-\)\(^28\),\(^31\),\(^32\) Specifically, undersection of bony impingement has been reported as a primary reason for failure in arthroscopic hip procedures.\(^31\) Iatrogenic hip instability and femoral neck fractures also have been reported after hip arthroscopy; this emphasizes the importance of appropriate diagnosis, surgical technique, and the avoidance of bony oversection.\(^25\)\(^-\)\(^28\),\(^31\),\(^32\) Hip joint preservation procedures in the presence of substantial osteoarthritis will lead to higher failure rates regardless of the surgical approach.\(^20\)

**Summary**

The understanding of FAI is evolving, and new patterns of impingement are being identified. With appropriate patient selection, indications, and surgical technique, hip arthroscopy has been shown to be effective in treating these
Adult Reconstruction: Hip

disorders. Published outcomes and systematic reviews support a role for hip arthroscopy in patients with FAI; however, further studies are required to better define the most appropriate surgical approach when treating the varying patterns of FAI.

References

24. Larson CM, Wulf CA: Intraoperative fluoroscopy for evaluation of bony resection during ar-


**Video Reference**
