Arthroscopic Repair of Hip Labrum With Suture Anchors

Kartik Shenoy, M.D., Amos Z. Dai, B.S., Siddharth A. Mahure, M.D., M.B.A., Daniel J. Kaplan, M.D., Brian Capogna, M.D., and Thomas Youm, M.D.

Abstract: The acetabular labrum and the transverse acetabular ligament form a continuous ring of tissue on the periphery of the acetabulum that provides a seal for the hip joint and increases the surface area to spread load distribution during weight-bearing. When a labral tear is suspected, the treatment algorithm always begins with conservative management, including physical therapy and nonsteroidal anti-inflammatory drugs. When conservative management fails, patients become candidates for arthroscopic labral repair. In the last 2 decades, the rate of hip arthroscopy has increased nearly 4-fold. However, as hip arthroscopy is performed more frequently, there is a need for a proper technique to minimize morbidity, because hip arthroscopy has been known to have a steep learning curve. We present a method for arthroscopic hip labral repair using suture anchors without a capsular repair. This Technical Note highlights our technique for labral repair, along with pearls and pitfalls of hip arthroscopy.

Hip arthroscopy is becoming a more powerful tool in the orthopaedic surgeon's armamentarium for diagnosing and treating various hip pathologies. It was first described as early as 1931 by Burman[1] with limited success; however, technological advancements have made hip arthroscopy more facile. It is now successfully performed most commonly for femoroacetabular impingement (FAI), labral tears, and cartilage damage.[2] In the last 2 decades, the rate of hip arthroscopy has increased nearly 4-fold.[3,4] However, as hip arthroscopy is performed more frequently, there is a need for a proper technique to minimize morbidity, because hip arthroscopy has been known to have a steep learning curve.[5]

The treatment algorithm always begins with conservative management, including physical therapy and nonsteroidal anti-inflammatory drugs. When conservative management fails, patients with a clinical examination and imaging findings consistent with a labral tear are candidates for arthroscopic labral repair.

We present a method for arthroscopic hip labral repair using suture anchors without a capsular repair. This Technical Note highlights our technique for labral repair, along with pearls and pitfalls of hip arthroscopy (see Video 1).

Surgical Technique

Preoperative Assessment

Patients with FAI and associated labral tears typically present with symptoms of pain localized to the groin that worsens with activity or prolonged sitting, and mechanical symptoms such as locking, catching, and giving way.[6] On physical examination, patients will have range of motion limitations in internal rotation and adduction. Special tests such as the anterior impingement test and the posteroinferior impingement tests may be performed to strengthen the diagnosis of FAI. Initial workup should include plain radiographs (anteroposterior, cross-table lateral, and false profile views) to evaluate for cam lesions, pincer lesions, alpha angle, head-neck offset, and acetabular version. Magnetic resonance imaging provides further information regarding labral and cartilage abnormalities.[7] Typical findings include abnormal head-neck morphology, anterosuperior cartilage abnormality, and anterosuperior labral pathology. Indications for arthroscopic surgical management include the presence of

From the NYU Hospital for Joint Diseases, New York, New York, U.S.A.

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Address correspondence to Amos Z. Dai, B.S., NYU Hospital for Joint Diseases, 301 E 17th Street, Suite 1500, New York, NY 10003, U.S.A. E-mail: amos.z.dai@gmail.com

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Table 1. Indications and Contraindications for Arthroscopic Labral Repair

Indications	Contraindications
Symptoms for greater than 6 mo	Severe articular cartilage damage
Radiographic evidence of FAI abnormalities	Labrum intrasubstance degeneration, calcification, or ossification
Failure of conservative treatment	Frayed or flap labral tears
Labral detachment	
Mid-substance labral tear	

FAI, femoroacetabular impingement.

symptoms for more than 6 months, radiographic confirmation of FAI abnormalities, and failure of conservative treatment. The main contraindication is the presence of severe articular cartilage damage. Although the ultimate decision to perform a labral debridement versus refixation and/or repair is made at the time of diagnostic arthroscopy, magnetic resonance imaging can help determine whether the labral tear is amenable to repair. Tear location, tear type, and labral tissue quality are the most important factors in this decision. Generally, labral tears are considered repairable when they lack significant intrasubstance degeneration, calcification, ossification, or a complex tear pattern.[8] In the presence of these characteristics, debridement should be performed. Furthermore, detached labra and mid-substance tears are more amenable to repair, whereas degenerative, flap, and frayed tears should be

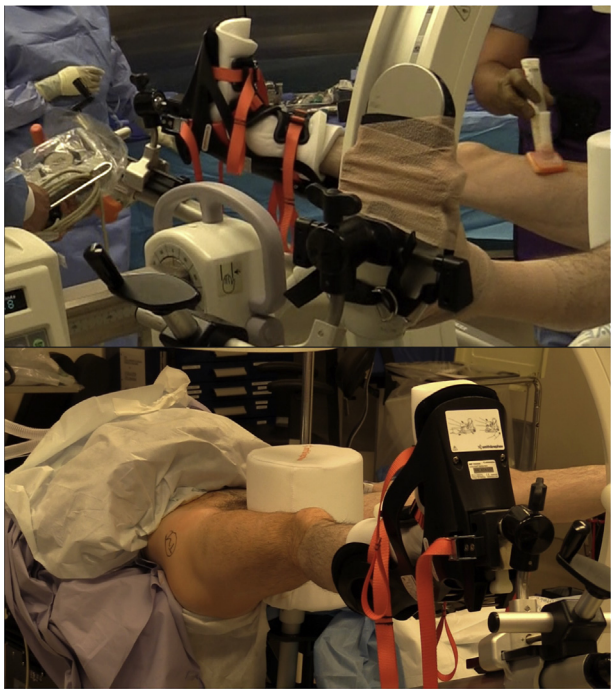

Fig 1. Patient positioning for arthroscopic hip labral repair. The patient is placed supine on a traction table with an extra-large, well-padded perineal post. The patient's feet are secured in boots at the end of each leg of the table.

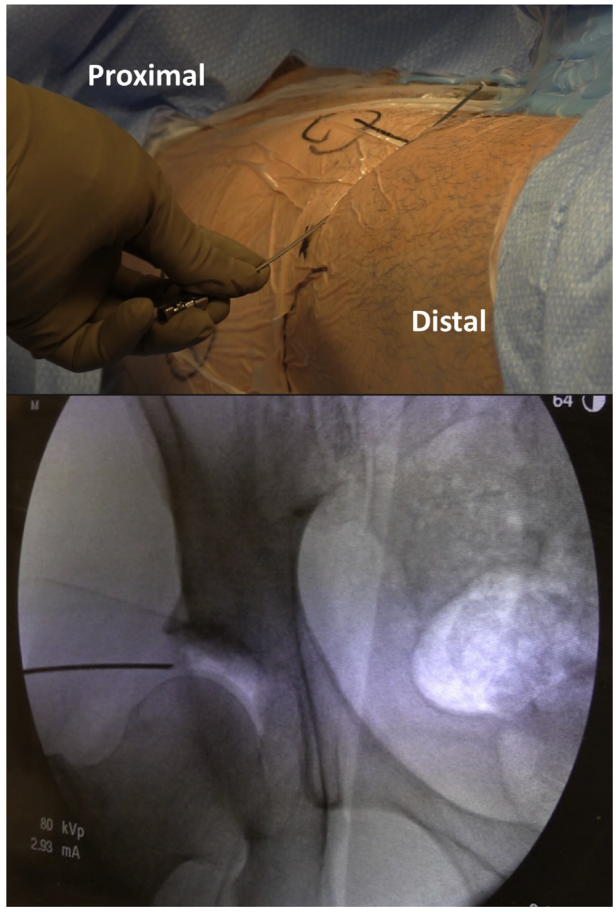

Fig 2. Use of fluoroscopic guidance for portal placement. The anterolateral viewing portal is made under fluoroscopic guidance using an 18-gauge spinal needle, approximately 2 cm proximal and 2 cm anterior from the anterosuperior border of the greater trochanter. The needle enters inferior to the superolateral aspect of the joint on the fluoroscopic anteroposterior radiograph. The needle is oriented at an angle of approximately 20° posterior and 15° cranial.

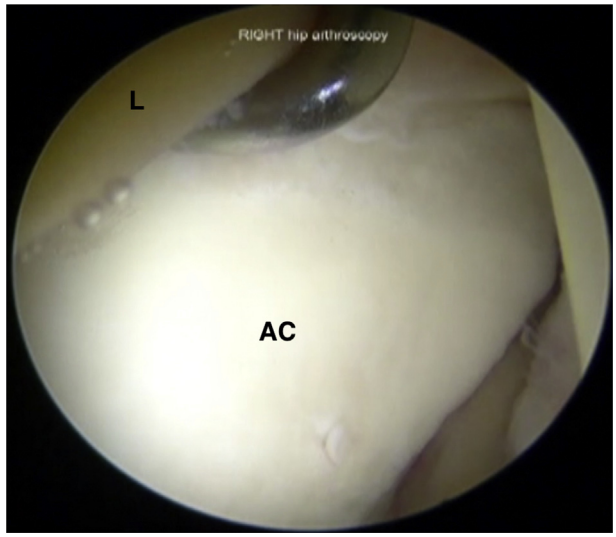

Fig 3. Arthroscopic assessment of the labral tear using a probe. View is from the anterolateral portal. (AC, articular cartilage; L, labrum.)

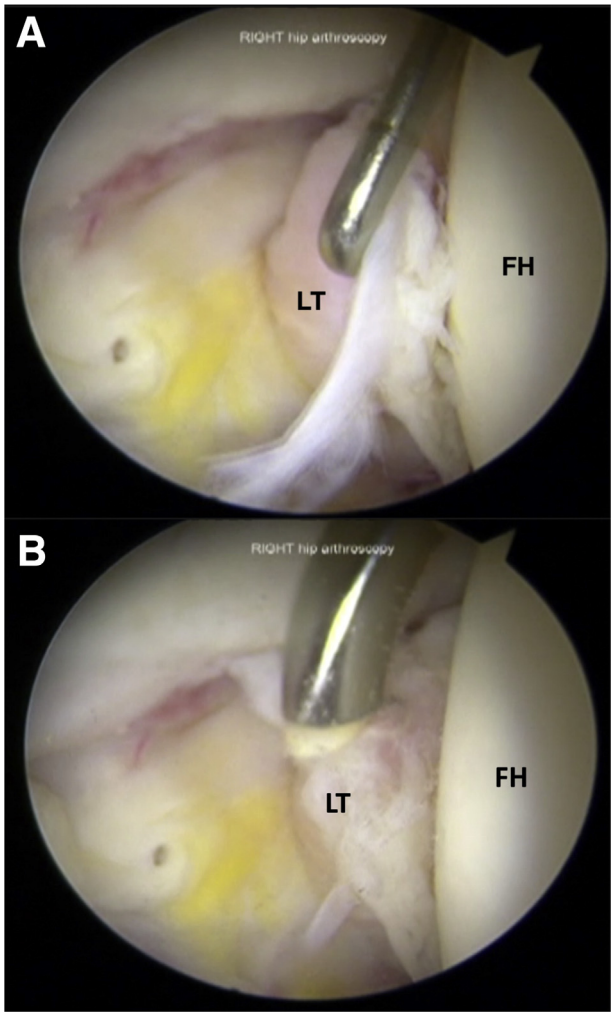

Fig 4. (A) Arthroscopic assessment of the partial tear of the ligamentum teres using a probe. (B) Partial tears are debrided with a curved electrocautery. View is from the anterolateral portal. (FH, femoral head; LT, ligamentum teres.)

debrided.[9] A summary of indications and contraindications for labral repair is provided in Table 1.

Positioning

The patient is placed supine on a traction table with an extra-large, well-padded perineal post. The patient's feet are secured in boots at the end of each leg of the table (Fig 1). The shoulders are abducted and the arms are positioned on padded arm boards. A large C-arm is positioned on the contralateral side and controlled with a foot pedal. The nonoperative leg is abducted to 30°. Traction is then applied to the operative leg to distract the hip joint. The operative leg is then slightly adducted to lateralize the femoral head. Confirmation of adequate traction is obtained with fluoroscopy.

Portal Placement

Proper portal placement will ensure that the entirety of the joint can be visualized and easily accessed with the surgical instruments. For labral repair, 2 portals are made: anterolateral and mid-anterior. First, the anterolateral viewing portal is made under fluoroscopic guidance using an 18-gauge spinal needle, approximately 2 cm proximal and 2 cm anterior from the anterosuperior border of the greater trochanter. The needle enters inferior to the superolateral aspect of the joint on the fluoroscopic anteroposterior radiograph (Fig 2). The needle is oriented at an angle of approximately 20° posterior and 15° cranial. After confirmation of proper position and angle, a skin incision is made. A trochar is inserted, the portal is progressively dilated, and a disposable cannula (PEEK [polyether ether ketone] FlowPort Cannula, Stryker, Kalamazoo, MI) is inserted followed by the 70° arthroscope.

The mid-anterior portal is made under direct visualization with an 18-gauge spinal needle. It is located approximately 5 cm distal to the anterior portal at an angle of 45° and ends up approximately half the distance between the anterior superior iliac spine and the greater trochanter. The skin is incised and a trochar is inserted. The portal is progressively dilated and a disposable cannula is inserted.

Surgical Technique

Through the mid-anterior portal, a partial horizontal capsulotomy is performed between the 2 portals. The joint is inspected for loose bodies, cartilage wear, synovitis, and labral tears. Any extensive synovitis is debrided and ablated with a shaver and electrocautery (VAPR Radiofrequency System, DePuy Synthes, Raynham, MA). The labrum is assessed with a probe, and tear size is estimated (Fig 3). The ligamentum teres is inspected with a probe and partial tears are debrided with a curved electrocautery (Fig 4).

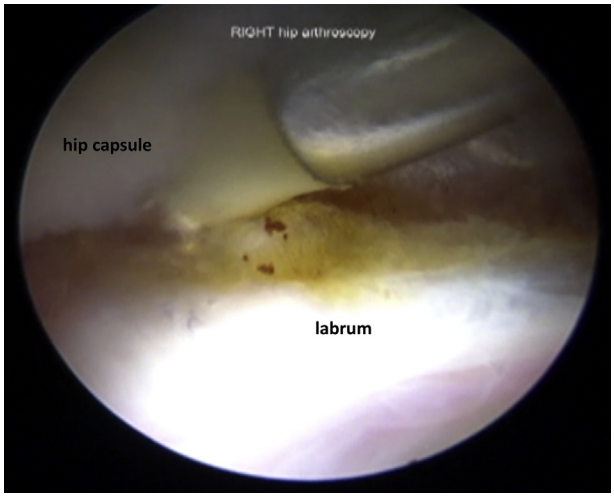

Fig 5. Creation of a plane between the hip capsule and the labrum using electrocautery. View is from the anterolateral portal.

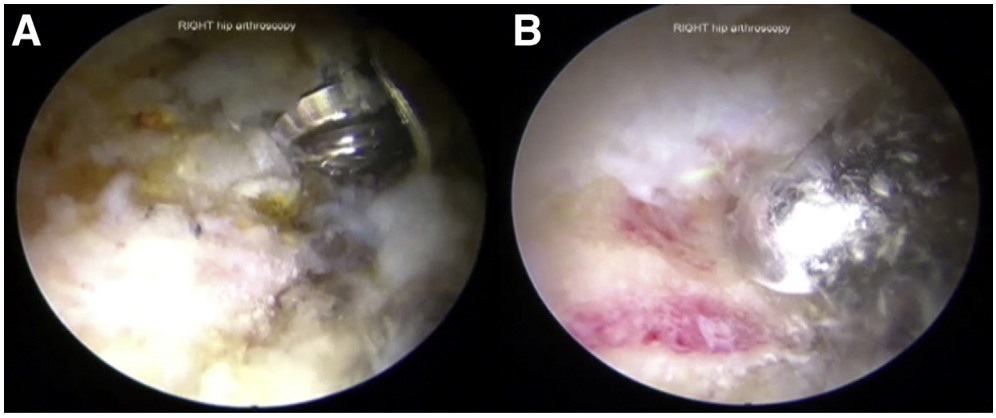

Fig 6. Pincer and subspine resection. (A) A 5.5-mm burr is used to perform acetabuloplasty and subspine (also known as anterior inferior iliac spine) resection (if found to be prominent or impinging). (B) These are resected until a bleeding bed of cancellous bone is created. View is from the anterolateral portal.

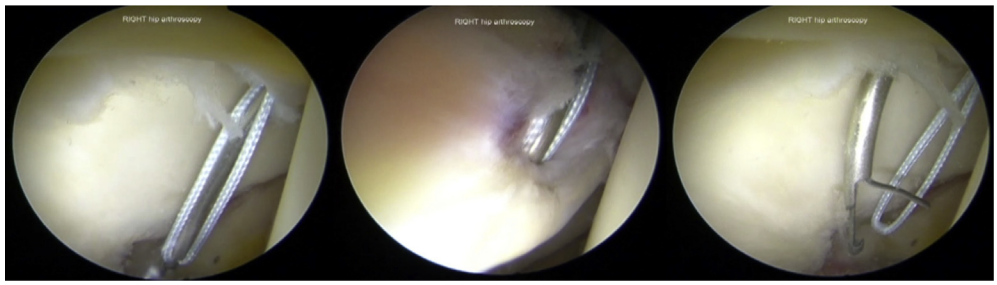

Fig 7. A self-retrieving Suture Lasso (Nanopass, Stryker) is used to pass the suture at the chondrolabral junction and again through the labrum in the mid-substance area in a vertical mattress configuration. View is from the anterolateral portal.

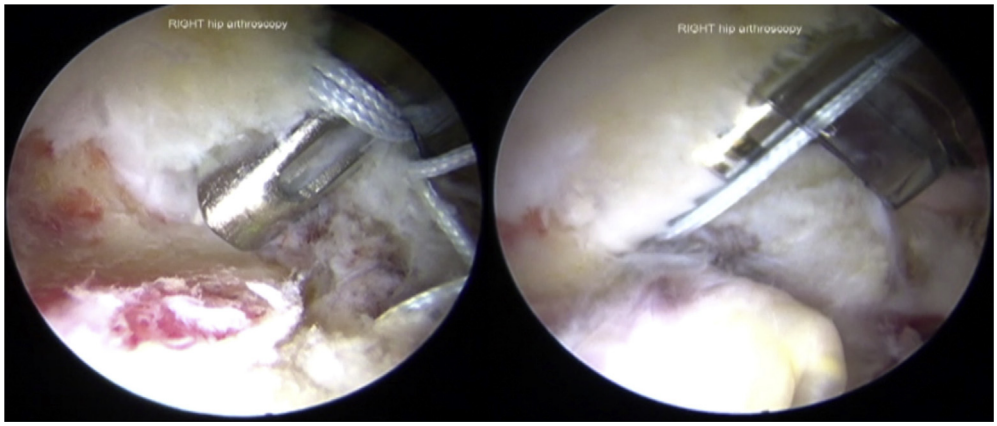

Fig 8. A 2.9-mm PushLock (Arthrex) knotless suture anchor is used to secure the sutures and accompanying labrum to the acetabular rim. View is from the anterolateral portal.

Using electrocautery, a plane is created between the labrum and the capsule (Fig 5). Care is taken to preserve and not resect the capsule for capsular repair and healing. Margins of the plane created are determined by the size of the labral tear. Fluoroscopy is used to confirm the location of the focal crossover sign and subspine impingement. A 5.5-mm burr is used to perform acetabuloplasty and subspine (also known as anterior inferior iliac spine) resection if found to be prominent or impinging. These are resected until a bleeding bed of cancellous bone is created and both visual and radiographic signs of adequate resection are seen (Fig 6).

After management of the acetabular-sided lesion, attention is turned toward repairing the labrum. No. 2 FiberWire (Arthrex, Naples, FL) sutures are passed through the torn labrum in a base-fixation configuration with a vertical mattress technique. A self-retrieving Suture Lasso (Nanopass, Stryker) is used to pass the suture at the chondrolabral junction and again through the labrum in the mid-substance area in a vertical mattress configuration (Fig 7). The small diameter of

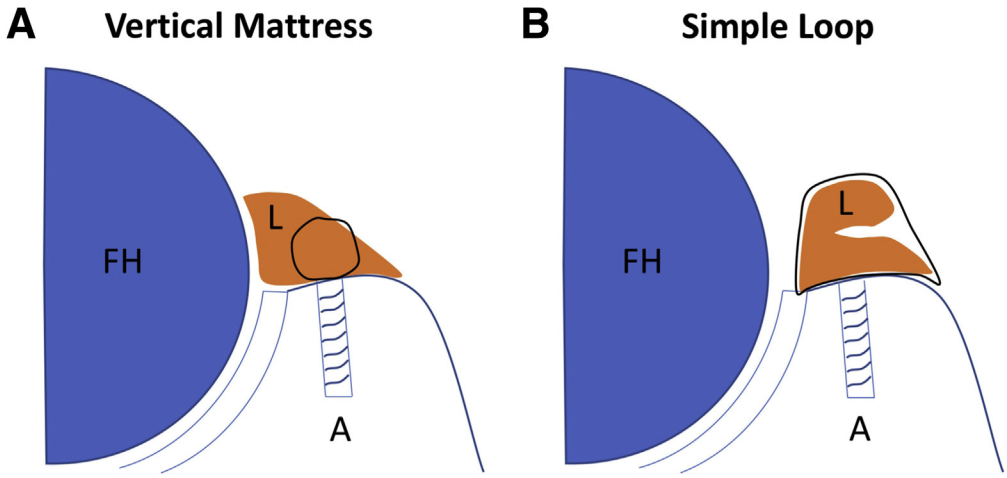

Fig 9. (A) Base fixation with the vertical mattress technique for labral repair. (B) A simple loop technique for labral repair. The black loops represent sutures. (A, acetabulum; FH, femoral head; L, labrum.)Adapted from Fry and Domb.[10]

this device reduces the risk of intrasubstance splitting and/or tearing of the labrum.[10]

A 2.9-mm PushLock (Arthrex) knotless suture anchor is then used to secure the sutures and accompanying labrum to the acetabular rim (Fig 8). Free ends of the sutures are cut with an arthroscopic knot cutter. In contrast to the simple loop stitch technique (Fig 9), the base-fixation technique preserves the anatomic triangular shape of the labrum. This provides the maximum contact area between the labrum and femoral head, which recreates the suction seal function of the labrum.

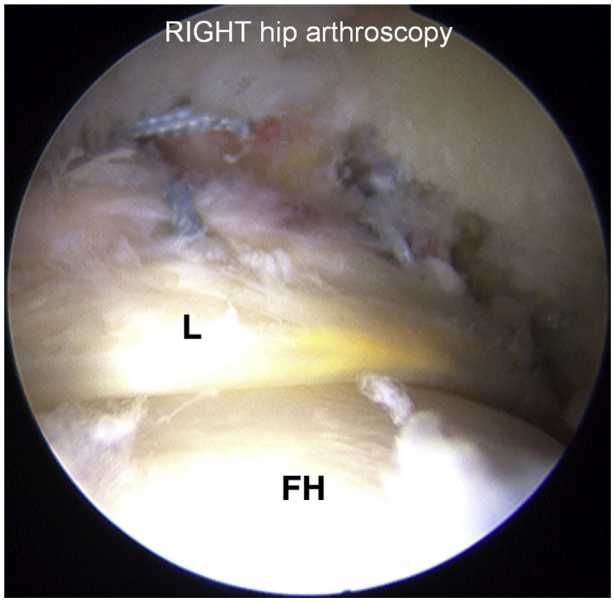

Fig 10. Completed labral repair showing restoration of the labral suction seal effect. Three suture anchors were placed using a base-fixation vertical mattress configuration and one was placed using a simple loop technique as the labrum was more attenuated at the anteromedial aspect of the labral tear. View is from the anterolateral portal. (FH, femoral head; L, labrum.)

However, in some cases the labrum may be too thin (<3 mm) to support a labral stitch and therefore a simple loop technique should be employed.[10] Sutures and suture anchors are secured sequentially until the entirety of the labral tear is restored, in a posterolateral to anteromedial direction. In our case, 3 suture anchors were placed using a base-fixation vertical mattress configuration and 1 was placed using a simple loop technique as the labrum was more attenuated at the anteromedial aspect of the labral tear (Fig 10). In the simple loop technique, before insertion of the anchor, 1 suture end is tensioned to prevent inversion of the labrum and replicate the suction seal morphology of the labrum. Any cartilage flaps or delamination at the chondrolabral junction is further debrided with electrocautery (Fig 11). Leg traction is released and the

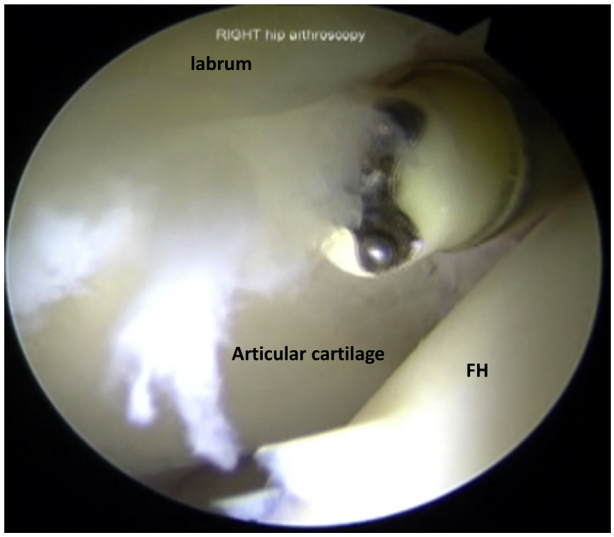

Fig 11. Any cartilage flaps or delamination at the chondrolabral junction is further debrided with electrocautery. View is from the anterolateral portal. (FH, femoral head.)

Fig 12. Cam lesion resection. With the patient's hips flexed to 45°, the peripheral compartment of the hip is assessed arthroscopically and fluoroscopically. C-arm fluoroscopy is used to pinpoint the femoral head-neck junction, and a femoral neck osteochondroplasty is performed with a 5.5-mm burr. The red arrow denotes the cam lesion. View is from the anterolateral portal.

labrofemoral contact is assessed through a range of motion.

On completion of the labral repair, any cam lesions are then addressed. With the patient's hips flexed to 45°, the peripheral compartment of the hip is assessed arthroscopically and fluoroscopically (Fig 12). In this case, there was evidence of decreased femoral head and neck offset anterolaterally. C-arm fluoroscopy is used to pinpoint the femoral head-neck junction, and a femoral neck osteochondroplasty is performed with a 5.5-mm burr. Periodic fluoroscopy is used to ensure sufficient resection of the cam lesion. The leg is dropped to 20° of flexion and then full extension to expose the anterolateral and lateral aspects of the femoral neck, respectively.

Postoperative Protocol

A standard postoperative protocol is used. Celecoxib and aspirin are prescribed to prevent heterotopic ossification and venous thromboembolism, respectively. Patients are made 50% partial weight-bearing and are placed into a hinged hip brace for 1 week to prevent hyperextension. They are advanced to weight-bearing as tolerated 4 weeks postoperatively. Initially, flexion is limited to 90°, but after 4 weeks or when the patients can range the hip with minimal pain, they can begin further range of motion. After approximately 3 months, the patients have typically completed physical therapy and are without restrictions.

Discussion

The acetabular labrum and the transverse acetabular ligament form a continuous ring of tissue on the periphery of the acetabulum that provides a seal for the hip joint and increase the surface area to spread load distribution during weight-bearing.[11] They are most commonly associated with FAI and hip dysplasia. Other causes include acetabular dysplasia, trauma, capsular laxity, and joint degeneration. If not recognized and treated appropriately, damage to the articular surface and the development of early degenerative disease can occur.[12]

In most patients, the tear is located at the anterior or anterosuperior aspect of the acetabulum because of the presence of a cam lesion or because of dysplasia. As a result, abnormal mechanical forces placed on the chondrolabral junction through repetitive movements

Table 2. Pearls, Pitfalls, and Potential Complications of Hip Arthroscopy

Pearls	Pitfalls	Complications
Perform a thorough initial history and physical examination to avoid performing hip arthroscopy in the setting of extra-articular pathology	Careless placement of a spinal needle leading to iatrogenic damage to the articular surface or labrum	Transient neuropraxia caused by traction (pudendal nerve most common)
Place perineal post just lateral to midline against the medial aspect of operative extremity to avoid neuropraxia	Anterior portal placed too medial, causing injury to the lateral femoral cutaneous nerve	Development of heterotopic ossification
Careful study of anatomy is required to allow optimal portal placement without damage to neurovascular structures	Excessive hip flexion and distraction during portal placement causing sciatic nerve injury	Rare possibility of instrument breakage
Force vector of traction should be in line with the femoral neck to allow for appropriate joint visualization with minimal traction requirements (usually 25 to 50 lbs)	Injuries to the urogenital region may be reduced by placement of a well-padded (8-10 mm) and positioned perineal post	Although exceptionally rare, abdominal compartment syndrome may occur because of fluid extravasation

lead to an accumulation of microtrauma resulting in a tear.[12]

When nonoperative management fails, operative management can include a variety of procedures including open surgical hip dislocation, arthroscopic hip labral debridement or repair, or a combination of both open and arthroscopic procedures. Arthroscopy has come into favor recently given its minimally invasive appeal. In 2009, Larson and Giveans[8] showed that arthroscopic repair has better outcomes than debridement. Although it is preferred to repair the labrum, not all tears are amenable. In the same study, they describe the ideal labral tear for repair as lacking intrasubstance degeneration, calcification, ossification, or complex tearing.[8] Furthermore, the location of a tear can play a role in making the decision between debridement and repair. Tears located on the periphery have greater vascularity due to a majority contribution from the hip capsule and therefore have a higher potential of healing.[13]

A recent review of the literature and quantitative analysis by Haddad et al.[14] looked at the outcomes for debridement versus repair. The studies focusing on debridement showed a mean rate of 82% for good or excellent outcomes using the modified Harris hip score. However, 5 of the included studies looked at repair versus debridement, and in each of them, the repair group had higher modified Harris hip scores and a higher rate of good to excellent outcomes.[14]

Despite the high rate of good to excellent outcomes, hip arthroscopy is not without its complications. The rate of complication in the literature ranges from 1% to 20%, and in a database review of 1,325 patients, the complication rate was 1.21%. Although infrequent, complications included bleeding occasionally requiring transfusion, infection, deep vein thrombosis, and return to the operating room.[15] In addition, sensory neuropraxias from the perineal post can occur as well. Given the low complication rate, hip arthroscopy is considered a relatively safe procedure. However, surgeons should be aware of complications and take precautions to prevent them from occurring (Table 2).

As the indications for hip arthroscopy continue to evolve, a proper technique needs to be practiced in order to minimize complications and maximize outcomes. We believe that although hip arthroscopy can be technically challenging to the novice, our presented technique achieves the aforementioned goals and provides a foundation for any level arthroscopist.

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