Hip Arthroscopy in Adults

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Abstract
The acceptance and rates of hip arthroscopy are increasing in the United States and abroad and the literature describing it is expanding. Indications for hip arthroscopy include labral tears, loose bodies, femoroacetabular impingement, ruptured ligamentum teres, chondral injuries, adhesive capsulitis, instability, synovial disease, disorders of the iliotibial tendon, external coxa saltans, tears of the hip abductors, and diagnosis of unresolved intra-articular hip pain. Current techniques in the central and peripheral compartments include, but are not limited to, labral debridement, labral repair, chondroplasty, microfracture, synovectomy, loose body removal, acetabuloplasty, proximal femoral osteoplasty, and iliotibial release, with other procedures possible in the peritrochanteric space. Long-term outcomes are limited, but early data shows good results for many arthroscopic procedures in the hip when they are performed in the absence of degenerative disease. Improved techniques and technology are allowing for more advanced procedures to become popularized, but long-term outcome data about hip arthroscopy is still relatively sparse.

For decades, hip arthroscopy was rarely performed, and at one time, it was believed to be an impossibility. However, over time, hip arthroscopy has become an increasingly popular and more frequently performed procedure, with indications that are continually being refined. Reported indications for hip arthroscopy include labral tears, loose bodies, femoroacetabular impingement (FAI), ruptured ligamentum teres, chondral injuries, arthritis, adhesive capsulitis, instability, synovial disease, disorders of the iliotibial tendon, tight iliobibial band, tears of the hip abductors, and diagnosis of unresolved intra-articular hip pain. While hip arthroscopy has reasonable outcome data for some diagnoses, only limited outcome data are available regarding hip arthroscopy for many of the aforementioned indications, and additional research is needed before definitive statements can be made regarding the merits of the approach.

History
Based on a 1931 cadaveric study on arthroscopic procedures throughout the body, which included 20 hips, Burman is credited as being the first to report on hip arthroscopy. Despite the fact that he concluded, even with traction, “it is impossible to separate the head of the femur from the acetabulum” and, therefore, “manifestly impossible to insert a needle between the head of the femur and the acetabulum,” he made many important contributions to the procedure. First, Burman recognized the importance of joint distraction in achieving hip visualization. Second, he acknowledged the necessity of extra-long instruments to enter the hip joint, due to its thick soft tissue envelope. Last, he described the anterolateral portal, still used today as a common arthroscopic portal of the hip.

The first clinical application of hip arthroscopy was in Japan, in 1939, by Takagi, who treated four patients. Included in his series were two Charcot joints, one case of tuberculous arthritis and one secondary to septic arthritis.
While these indications are much different from what is seen in the world of hip arthroscopy today, they represent the first reported use of hip arthroscopy in patients.

Reports on hip arthroscopy were limited until the early 1980s as seen when the editors of *Arthroscopy* reviewed their rate of hip arthroscopy-related publications. There was approximately one article each year from 1984 to 1994. A more recent literature review demonstrated that there have been 10 or more articles published yearly from 2003 onward.6

**Indications and Contraindications**

The reported indications for hip arthroscopy are broad and include labral tears, loose bodies, FAI, ruptured ligamentum teres, chondral injuries, arthritis, adhesive capsulitis, instability, synovial disease, disorders of the iliopsoas tendon, tight iliotibial band, tears of the hip abductors, and a diagnosis of unresolved intra-articular hip pain.7 While these diagnoses appear to warrant hip arthroscopy, many of them have limited outcome data or only case reports.

Acetabular labral tears represent one of the most common indications for arthroscopy of the central compartment. Labral tears are the most common cause of mechanical symptoms in the hip, with 80% of them generating an audible or palpable click.7 Ninety to 95% of labral tears are in the anterosuperior quadrant, and they are often associated with an acetabular chondral lesion.8,9 While labral tears were previously viewed as an isolated injury secondary to a twisting or traumatic event, recently they have been appreciated as secondary phenomena of FAI. Wegner and colleagues found structural abnormalities on the plain films of 87% of patients with labral tears and these abnormalities often suggested FAI.9 In contrast, posterior labral tears are often secondary to a high-energy trauma with a posteriorly directed force such as a dashboard injury; associated structural abnormalities are, therefore, typically absent.8 Kelly and colleagues10 classified the etiology of labral tears into five categories: trauma, FAI, capsular laxity, dysplasia, and degeneration.

Prior studies on isolated debridement of labral tears reported good results. Santori and Villar11 concluded that 67% of patients were pleased with the outcome, with modified Harris hip score (HHS) improvements from 48 to 90 points after an average follow-up of 3.5 years.

Recently, investigators have been reporting on the outcome of acetabular labral repairs. Espinosa and coworkers12 had superior results with open labral repair versus open labral debridement in a cohort with FAI. There were excellent results in 80% of the repair group and compared to 28% of the debridement group. Furthermore, rates of radiographic markers of degenerative change were lower in the repair group.12 Arthroscopic labral repair requires an accessory distal lateral portal.10 Kelly and associates10 reported on performing over 400 cases with anchors used for labral avulsions and free suture used to repair intrasubstance tears.

Microfracture is a treatment option for an isolated chondral lesion without surrounding degeneration. Eight to 10 weeks of protected weightbearing is recommended following microfracture.13 With this protocol, Byrd and colleagues14 reported 86% success at 2-year follow-up. Philippon and coworkers15 performed second-look arthroscopies on nine acetabular chondral lesions that were microfractured and noted a 91% fill rate at 20 months.

Hip arthroscopy has also been used in the setting of degenerative joint disease. This procedure utilizes a combination of microfracture, chondroplasty, osteophytectomy, and labral debridement; however, in one study, only 34% of 41 patients found the procedure worthwhile.16 That being said, the procedure may be indicated in cases where an effort is made to delay total hip arthroplasty.

Rupture of the ligamentum teres is a diagnosis that has recently begun to receive attention in the literature. Either a twisting injury or frank traumatic hip subluxation or dislocation is implicated as the causative event. Multiple positional etiologies have been proposed, including hyperabduction and a combination of flexion, adduction, and internal rotation. Gray and Villar17 classified these lesions as complete, incomplete, and degenerative. Ruptures of the ligamentum teres are the third most common intra-articular hip diagnosis in athletes and represented the diagnosis in 41 of 271 cases.18 In this series, males equaled females, and the average patient age was 28 years. Of patients presenting with anterior groin pain, 83% complained of mechanical symptoms, 65% reported a history of major trauma, and ruptured ligamentum teres was the preoperative diagnosis in only two cases.18 Therefore, it is imperative to examine the hip for this diagnosis intraoperatively when a history of trauma and mechanical symptoms are present. After debridement, modified HHS improved from 47 to 90.18

The largest series on arthroscopic irrigation and debridement of a septic hip in adult patients consists of six cases.19 In five out of six patients, the causative organism was *Staphylococcus aureus*. Patients were lavaged with 6 to 8 liters of saline and then treated with 3 weeks of intravenous antibiotics, followed by 3 additional weeks of oral antibiotics. Modified HHS averaged 97.5 after treatment.

Hip arthroscopy also has been used in the setting of acute trauma. Arthroscopic acetabular bullet removal has been described.20 However, extreme caution must be exercised when utilizing hip arthroscopy in the traumatic setting. Bartlett and associates21 report a case of arthroscopic removal of retained intra-articular fragments 12 days after open reduction and internal fixation of an acetabular fracture, and 5 weeks post-injury. The patient went into asystole during the hip arthroscopy. The abdomen was noted to be distended and an exploratory laparotomy was performed, which released 8 liters of intra-abdominal fluid under pressure that had been compressing the inferior vena cava. It was concluded that this fluid must have tracked through soft tissue and bony defects that were the result of the prior trauma and fixation.

Loose bodies represent a clear indication for hip ar-
throscopy. However, when synovial chondromatosis is the preoperative diagnosis, multiple loose bodies will be present, and a decision about the feasibility of extracting all of them arthroscopically must be considered. If an attempt is made to extract the loose bodies by arthroscopy, care must be made to explore the peripheral compartment and even the iliopsoas tendon sheath, because loose bodies will often reside there.

FAI is an increasingly appreciated entity, and it is possible to address both cam and pincer impingement arthroscopically. Philippon and colleagues reviewed 37 revision hip arthroscopies and found unaddressed signs of FAI in 36 of these cases. After the revision hip arthroscopy, HHS values increased from 53 to 77.

Hip instability is a rare indication for hip arthroscopy. Byrd reviewed four patients who underwent thermal capsulorrhaphy for hip instability with minimum 2-year follow-up; HHS increased from 52.5 to 90.5. These patients had generalized ligamentous laxity and increased anterior translation of the femoral head in the acetabulum, with extension and external rotation when observed arthroscopically.

Internal snapping hip, or internal coxa saltans, results from snapping of the iliopsoas tendon over prominent anterior structures, often the iliopectineal eminence. Various investigators cite differing treatment methods, but all share the common goal of iliopsoas release. Using inferior accessory portals, one group aims to release the psoas tendon portion, leaving the muscular iliacus, thus, protecting the femoral nerve. Wettstein and coworkers perform a similar procedure, but more proximally, therefore, obviating the need for inferior accessory portals. A third group releases the entire iliopsoas complex off of the lesser tuberosity, using accessory inferior portals. This results in 8 weeks of hip flexion weakness.

There are only limited reports discussing arthroscopy of the peritrochanteric space. Indications are trochanteric bursitis, external coxa saltans, or snapping of the iliobibial band over the greater trochanter, and tears of the gluteus medius. Access to the peritrochanteric space is achieved by redirecting the anterior portal between the greater trochanteric bursa and the iliobibial band or creating an accessory portal between the tip of the greater trochanter and the vastus ridge. Once in the peritrochanteric space, trochanteric bursitis can be debrided, the iliobibial band can be fractionally lengthened, and tears of the gluteus medius can be repaired with suture anchors.

Besides hip ankylosis, which is a definitive contraindication to hip arthroscopy, as it would preclude intra-articular navigation, the contraindications are relative and must be determined on an individual patient basis. Poor bone quality may lead to concerns regarding the ability to tolerate traction and, therefore, be viewed as a relative contraindication. Additionally, while instruments for hip arthroscopy are long, morbid obesity may necessitate the use of instruments longer than those commercially available and, therefore, preclude hip arthroscopy. Finally, any medical condition or local soft tissue concern that would preclude surgery is a contraindication.

Diagnostic Modalities
As previously mentioned, many of the indications for hip arthroscopy are intra-articular in nature. Due to the ambiguity of the hip physical examination and inaccuracy of radiologic modalities for many hip-related diagnoses, the practitioner sometimes defers definitive diagnosis until the arthroscopic procedure is performed. Two maneuvers in the physical examination of the hip are often useful in identifying intra-articular pathology. First, the impingement sign involving flexion, adduction, and internal rotation can be used to diagnose labral tears; however, its specificity for this diagnosis relative to other intra-articular diagnoses has not been established. Also, the McCarthy extension sign, which is elicited by moving the affected hip from flexion into extension, followed by internal rotation and then external rotation, can be helpful in making a diagnosis of intra-articular pathology. Plain radiographs are useful in diagnosing arthritis, loose bodies, and FAI, but otherwise are limited in the evaluation of intra-articular hip pain. Magnetic resonance imaging (MRI), with or without intra-articular contrast, has emerged as the most useful study in diagnosing labral tears and chondral defects. Based on a series of 23 patients, Edwards and associates concluded that MRI was not useful in detecting chondral softening or defects less than 1 cm in size. Another study revealed the sensitivity of MRI for labral tears and acetabular-sided chondral injuries at greater than 90%, with sensitivity for femoral-sided chondral injuries at greater than 85%. However, this study only included patients who underwent hip arthroscopy. Therefore, determining specificity and negative predictive value was limited by the high rate of pathology in the study population. Keeney and colleagues investigated the utility of magnetic resonance arthrography (MRA) as a diagnostic modality for assessing potential labral tears. They found a 71% sensitivity, 44% specificity, 93% positive predictive value, and a 13% negative predictive value. While it is an invasive procedure, an additional benefit of MRA is the ability to combine a long-acting anesthetic with the administration of contrast. A positive diagnostic hip injection with temporary resolution of pain is a reliable sign of intra-articular hip pathology.

Complications
The potential complications associated with hip arthroscopy include broken intra-articular instruments, iatrogenic chondral damage, and nerve palsies, most commonly of the lateral femoral cutaneous and pudendal nerves. The largest study on hip arthroscopy included 1054 patients and reported an overall complication rate of 1.4%, with a 2.8% rate of inadequate visualization.
one of the most common complications of hip arthroscopy, ranging from 0% to 6.4%. It can manifest as perineal paresthesia or dysesthesia or may result in erectile dysfunction. Much of the data on pudendal nerve palsy is from the trauma literature. Kao and coworkers reviewed 65 femoral nailings done on a fracture table and detected a 15% pudendal nerve palsy rate. All of the palsies were transient, with symptoms lasting up to 173 days. Another study identified the importance of minimizing traction duration and intensity during hip arthroscopy procedures. Results demonstrated that of 106 patients, the 10 patients who sustained palsies had a total of 73.3 kg-hrs of traction, while those without palsies had a total of 34.9 kg-hrs of traction. This was a statistically significant difference. As such, efforts are made to minimize the duration and intensity of traction, lateralize the perineal post to protect the pudendal nerve as it crosses the ischial tuberosity, and maximize the size of the post so that all forces are well-distributed.

**Technique**

There are two main positions for hip arthroscopy: supine and lateral. One of the primary goals of patient positioning for hip arthroscopy is to allow for adequate distraction of the hip joint, which requires a distractive force be placed across the hip joint, essentially in line with the femoral neck. A straight longitudinal traction vector is inadequate.

In the supine position, a certain amount of abduction combined with the lateralizing force of a perineal post are both required to create the appropriate resultant force in line with the femoral neck. The ideal distraction vector will be dependent on the patient’s anatomy, namely the neck-shaft angle. For this reason, the perineal post is placed more laterally than one would place for a hip fracture. The other reason for the lateralization of the post is to protect the pudendal nerve and its perineal branch, which passes just medial to the ischial tuberosity.

The main advantage of supine positioning is that the setup is less cumbersome than the lateral position. In an effort to minimize the risk of neuropraxia during supine positioning, a group from Yale reported on a technique where a post is not used intraoperatively. Instead, the patient is supported with a deflated beanbag, pillows, and tape. They had no complications with 30 patients, but intraoperative stability of the patient can be tenuous.

There are multiple proposed benefits of the lateral position. First, in obese patients, the redundant subcutaneous tissue falls anteriorly and posteriorly, resulting in less subcutaneous tissue to be passed through with the instruments, and, thus, easier navigation in the hip joint. Furthermore, obesity may preclude supine hip arthroscopy because of the insufficient length of the instruments to traverse the soft tissues; however, a lateral position could allow for the procedure. Also, visualization may be superior in the lateral position, because it allows for greater use of the 30° scope, which has a wider field of view than the 70° scope. In the lateral position, the paratrochanteric portals pierce the superior hip capsule, which is thinner than the more inferior capsule. Also, the post can be placed 10 to 15 cm distal to the perineum and used to lever the femoral head out of the acetabulum. When the lateral position is used, the hip is typically flexed 10° to 20° to relax the ligament of Bigelow and abducted 0° to 20° to provide the appropriate distractive force vector.

As with the set-up for the supine position, a fracture table is typically required for lateral positioning, which necessitates an unscrubbed assistant to adjust the traction on the limb intraoperatively. In an effort to eliminate this need and also make lateral positioning an option in centers where a fracture table is unavailable, Bushnell and associates developed and described a positioner that is on the sterile field. It utilizes a femoral traction pin and can be mounted on a standard operating table. Additionally, this positioner affords knee flexion, which minimizes tension on the sciatic nerve.

The literature demonstrates that a minimum of 8 to 10 mm of joint distraction is necessary for adequate visualization during hip arthroscopy. As previously mentioned, decreasing the magnitude and duration of traction limits the risk of nerve palsies. While the literature is inconclusive regarding the amount of time the limb is in traction, the recommendation is typically for less than 2 hours. Additionally, a total force of 25 to 100 pounds is typically required.

Distraction can be achieved with straight traction or a combination of traction and distention. Release of the vacuum phenomenon is achieved via insertion of a spinal needle into the distracted hip joint. When this is followed by injection of 40 cc of saline, an additional 1 mm of joint distraction on average is obtained. In order to achieve this distraction without competing with the patient’s muscular tone, a complete motor blockade is required with the anesthesia.

Distraction allows visualization of the intra-articular region of the intracapsular space, termed the central compartment. It is the navigation of this central compartment that requires joint distraction to separate the articular surfaces of the femoral head and acetabulum. Once the arthroscopy of the central compartment is complete, traction is released and the hip can be flexed approximately 45° to relax the anterior capsule and to provide access to the peripheral compartment. The peripheral compartment refers to the intracapsular, but extra-articular region anterior to the femoral neck. Some hip arthroscopists will also navigate the iliopectas tendon sheath and bursa, and the peritrochanteric space, including the greater trochanteric bursa.

The three most commonly used portals in hip arthroscopy are the anterior, anterolateral, and posterolateral portals. Together, these give excellent visualization to the central compartment of the hip. The anterior portal is made at the intersection of a transverse line tangential to the tip of the greater trochanter and a longitudinal line made distal to the
anterior superior iliac spine. The anterolateral and posterolateral portals are made on their respective sides of the tip of the greater trochanter. The anterior portal penetrates the sartorius, rectus femoris, and anterior joint capsule and lies an average of 3 mm from branches of the lateral femoral cutaneous nerve. Typically, this nerve has branched before the portal insertion site, and due to anatomical variability could be distal, proximal, medial, or lateral to the portal; however, care must be taken given its subcutaneous position. The anterior portal lies approximately 4 cm lateral to the femoral nerve. The anterolateral portal penetrates the gluteus medius muscle and lateral capsule and averages 4.4 cm from the superior gluteal nerve in a predominantly distal direction. The posterolateral portal penetrates both the gluteus medius and minimus before entering the lateral capsule and lies an average of 2.9 cm superior and anterior from the sciatic nerve.

A posterior portal has been described when the patient is placed in the lateral position, but requires an 8 cm incision, in addition to a mini-arthrotomy, with direct visualization and release of short external rotators to protect the sciatic nerve. Additional distal portals have been described to allow access to the peripheral compartment of the hip. It is possible to enter the central compartment by inadvertently navigating through the labrum; however, violation of the labrum should be avoided by directly observing insertion of the spinal needle, guidewire, and obturator placement into the joint. This technique is more difficult in the primary portal; however, the outline of the labrum can often be appreciated on the air arthrogram of the hip joint and subsequently avoided.

Once the central compartment is entered, maneuvering through the joint can be challenging due to the curved space of the central compartment and the generally straight nature of arthroscopic instruments. To aid in the navigation of the central compartment, curved shavers, flexible radiofrequency devices, and angled awls have all been introduced. Slotted cannulas that also serve as specula can be used to maintain the portal and route to the hip, while allowing for instruments of different shapes and sizes to be passed. It is important to maintain an intracapsular position with the cannula and to use the closed side of the cannula to protect from the prominent side of the device being passed (such as the tip of an awl). In addition, Shen and Meislin described a method for using a shaver without an outer cannula in order to maximize maneuverability. Lastly, an arthroscopic knife can be used to increase the size of the capsular rent at each portal site. While this will increase maneuverability, it will also increase fluid extravasation.

Outcomes

Data for overall outcomes following hip arthroscopy are limited. Byrd and Jones prospectively reported on the outcomes of 35 consecutive patients with a minimum 2-year follow-up. Median HHS improved from 57 to 85.

The greatest improvements were in those patients with diagnoses of loose bodies, labral tears, and synovitis, with HHS improvements of 34, 27, and 26 points respectively. A Belgian group recently reported 5 to 10 year data on 56 consecutive hip arthroscopy patients; 80% of the patients reported that they would have the surgery again.

Conclusion

While hip arthroscopy has a long history, it has only recently gained acceptance throughout the orthopaedic community. The indications are still being refined, and final judgment regarding its merits must be reserved until more data are available regarding outcomes.

Disclosure Statement

None of the authors have a financial or proprietary interest in the subject matter or materials discussed, including, but not limited to, employment, consultancies, stock ownership, honoraria, and paid expert testimony.

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