Arthroscopy of the hip in children and adolescents

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Abstract Intra-articular abnormalities of the hip, such as labral tears, loose bodies, chondral lesions, ligamentum teres tears and femoral acetabular impingement are increasingly being recognized in the pediatric age group. Evaluation for these abnormalities starts with a good history and physical exam. Radiographic imaging with plain films and magnetic resonance imaging help confirm the clinical impression. Arthroscopy of the hip can be utilized to diagnose and treat these abnormalities. Arthroscopy of the hip is a challenging procedure with a learning curve that requires a thorough knowledge of the anatomy of the hip. The hip is a deeply recessed joint that has a large muscular envelope, thick joint capsule and convex and concave surfaces of the femoral head and acetabulum, respectively. The normal anatomy may be distorted due to childhood developmental disorders such as hip dysplasia, Legg–Calve–Perthes Disease and Slipped Capital Femoral Epiphysis that adds additional challenges to the arthroscopist. Isolated intra-articular abnormalities occur rarely and an underlying morphologic abnormality should be identified which also requires management. Complications can be minimized with attention to detail.

Keywords Arthroscopic treatment · Arthroscopic findings · Hip disorders · Children and adolescents

Introduction

The hip joint presents specific challenges to arthroscopic evaluation; the deeply recessed joint, thick joint capsule and the respective convex and concave surfaces of the femoral head and acetabulum. With refinement of techniques and the development of specialized instrumentation, arthroscopy of the adult hip has become established procedure for a variety of intra-articular problems [1–3]. Current indications in the adult hip include; labral tears, loose body removal, management of chondral flaps and osteochondral fractures, tears of the ligamentum teres, osteonecrosis, inflammatory arthritis, synovial chondromatosis, septic arthritis and management of femoral acetabular impingement (FAI).

The traditional method of managing intra-articular problems in children and adolescents has been an open arthrotomy, with or without, a surgical dislocation. Arthroscopy of the hip is being used more frequently in this age group because it is believed to be less invasive, has a lower morbidity with faster recovery, and provides excellent, if not better, visualization than an open procedure. The first experience in the pediatric age group was reported by Gross [4] in 1977. He used a 2.2-mm arthroscope and visualized the hip joint in a variety of childhood conditions including developmental dysplasia of the hip (DDH), Legg–Calve–Perthes Disease (LCPD), neuropathic subluxation, post sepsis, and in slipped capital femoral epiphysis (SCFE). Holgersson [5], in 1981, subsequently reported on his experience with chronic juvenile arthritis.

The indications for hip arthroscopy in children and adolescents are incompletely defined, but its role in managing disorders of the hip appears to be expanding. Intra-articular pathology most amenable to hip arthroscopy include labral tears, loose bodies, tears of the ligamentum

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teres and osteochondritis dissecans. Disorders most commonly associated with the above pathology include LCPD, SCFE, DDH, epiphyseal dysplasia and post trauma [6–8]. Hip pathology, typically seen in the adult, is also seen with pediatric sports injuries and idiopathic FAI.

Patient assessment

The goal is to differentiate intra-articular causes of discomfort from extra-articular etiologies through a thorough history and physical exam. Specific questions regarding description of the pain, its onset, precipitating factors (i.e., sitting, stairs, activities) and mechanical symptoms (i.e., catching, locking, popping and giving way) should be asked. Hip pain usually is located in the groin but may be referred distally to the thigh or knee. In this age group, the pain is frequently attributed to growing pains or a muscle strain. The patient should be asked to point out the location of their pain. Occasionally, the patient will demonstrate the “C” sign as described by Byrd [1] by holding their thumb and index finger in the shape of a “C” placing it over the greater trochanter.

On physical exam, palpate for tender areas over the pelvis and hip. Pain with the log roll maneuver indicates an intra-articular problem. The range of motion should be noted as well as recording the rotational profile, any leg length discrepancy and muscle atrophy. Trendelenburg’s test, neurology exam and assessment of gait should also be performed.

Pain with flexion, adduction and internal rotation (impingement sign) is suggestive of an intra-articular problem or FAI. A positive McCarthy sign [9] is also suggestive of impingement. This sign is tested for by flexing both hips and then extending the tested hip, first in internal rotation and then external rotation. A positive sign is the reproduction of the patients’ pain during extension. The flexion, abduction, external rotation (FABER) test or “figure of four” position tests for pathology, either at the sacroiliac joint or with tightness or pain from the psoas.

Conventional radiographs may give clues to the diagnosis and intra-articular derangements. Standard views include a supine AP pelvis and frog-leg lateral. Based on the underlying history (i.e., LCPD, DDH, SCFE) and physical exam, other views, such as a cross-table lateral, false profile, abduction/adduction and Dunn lateral (hips flexed 90°, abduction 20°) may be necessary.

The radiographs should be evaluated for dysplasia, impingement and malalignment. The femoral head–neck junction can be assessed on the cross-table, frog or Dunn laterals to identify a cam lesion [10–12]. The position of the anterior and posterior acetabular walls give information about the acetabular version. Acetabular retroversion is

suggested by the cross-over and posterior wall signs. The pelvis view needs to be taken with neutral rotation and standardized pelvic inclination such that the distance between the symphysis and sacrococcygeal joint is approximately 32 mm in men and 47 mm in women. Otherwise, the cross-over sign and the posterior wall sign are inaccurate [13]. A computed tomography (CT) or magnetic resonance imaging (MRI) study can be obtained to confirm a suspected abnormality in the acetabular version. A CT however, raises concerns about radiation exposure.

Magnetic resonance imaging or magnetic resonance arthrography (MRA) are generally obtained to further assess or confirm the intra-articular problem. The preferred technique uses a high resolution surface coil in three planes (sagittal, coronal and axial). MRA has been felt to provide a more sensitive and accurate picture.

Czerny et al. [14] reported on the accuracy of detection and staging of lesions of the acetabular labrum. Plain MRI and MRA were compared to the surgical findings in 22 cases. The authors reported a sensitivity of 90% and an accuracy of 91% with MRA compared to a 30% sensitivity and 36% accuracy with plain MRI. In a subsequent study, the MRA showed a sensitivity of 91%, specificity of 71% and accuracy of 88%. Keeney et al. [15] compared MRA versus the arthroscopic findings of 102 hips with labral pathology; the MRA showed a sensitivity of 71%, specificity of 44%, positive predictive value 93%, negative predictive value 13% and an accuracy of 69%. With respect to articular cartilage pathology, the MRA had a sensitivity of 47%, specificity of 89%, positive predictive value of 84% and negative predictive value of 59% and accuracy of 67%. Mintz et al. [16] used a non-contrast MRI protocol in 92 patients prior to arthroscopy and reported that labral and chondral abnormalities can be successfully identified.

Magnetic resonance imaging or MRA is useful in the evaluation of the contour of the femoral head–neck junction in cases of suspected FAI. Ito et al. [17] described morphologic variations in the head–neck offset as seen on MRI, reporting a reduction in the offset in the lateral to anterior aspect of the neck in young men and in older women. Nötzli et al. [18] used MRI data to calculate the alpha angle as a measure of the head–neck contour.

Arthroscopy of the hip is indicated in the patient that has an appropriate history of pain with mechanical symptoms and signs. MRA may confirm an intra-articular problem but is not necessarily a pre-requisite. Contra-indications to arthroscopy include; joints with moderate to severe restriction of motion, heterotopic bone, significant joint space narrowing by 50% and major signs of osteoarthritis. Obesity is a relative contra-indication to the procedure.

Technique

The procedure is performed under general anesthesia with muscle relaxation. Prophylactic antibiotics are not utilized. Either supine [19] or lateral [20] techniques can be used. The author uses the supine technique on a regular fracture table. The feet are anchored in boots, which often have to be tightened considerably to prevent slippage during the application of traction. Padding will help prevent neuropraxia developing in the feet. A well-padded perineal post is used and lateralized to the proximal thigh. The leg is positioned in slight flexion, abduction and internal rotation. The anatomy of the proximal femur may dictate the use of more or less abduction. The contralateral leg is abducted to accommodate positioning of the C-arm between the legs. A small amount of traction is applied to this limb. Traction is applied to the operative side until the joint is distracted approximately 1 cm. The force that is necessary in the adult is variable and averages between 25 and 100 pounds of pressure [1, 21, 22]. There is no comparable data for the pediatric age group.

The author generally uses two portals, anterolateral and anterior. The C-arm is used to help guide the portal placement (Fig. 1). The anterolateral portal is placed first and is the safest in regard to neurovascular structures. This portal is placed at the proximal anteromedial margin of the greater trochanter. After this portal is established, the remaining portals can be made under direct vision (Fig. 2). The anterior portal is made at the intersection of a sagittal line drawn down the leg through the anterior superior iliac spine and a transverse line drawn perpendicular to the body across the tip of the greater trochanter. Distal anterior and posterolateral portals are the most commonly used auxiliary portals. The anatomy of the various portals and proximity to neurovascular structures has been described by Byrd [23].

Portal development is made using a long spinal needle through which a guide wire can be inserted. The capsule is thick, but has a different consistency than the bone or labrum. The needle placement should not transgress the labrum. The cannulated system allows the obturator/cannula assembly to be introduced into the joint over the guide wire. Seventy and 30° arthroscopes are routinely used and freely exchanged between the portals for complete visualization of the joint. The portals are enlarged by passing an arthroscopic knife into the joint through the cannula. The cannula is then retracted to allow the capsular incision under direct vision of the arthroscope. This procedure improves the mobility of the arthroscope and instrumentation. An arthroscopic fluid pump is routinely used and maintained at a pressure between 40 and 60 mm Hg. There are no reported standards for pressure settings in the pediatric age group. Epinephrine is added to the fluid to

Fig. 1 X-ray view showing joint distraction of 1 cm, the arthroscope in the anterolateral portal, and localization needle for the anterior portal

Fig. 2 View from the anterolateral portal showing localization needle for the anterior portal

minimize blood obscuring visibility. Specialized instrumentation including motorized shavers, burrs and flexible-tip electrocautery devices are utilized.

The hip joint is divided into the central compartment (the intra-articular region) and the peripheral compartment (the intracapsular but extra-articular region). A thorough inspection of the central compartment is performed first with the hip distracted. A systematic approach should be developed to evaluate the labrum (Fig. 3), fovea (Fig. 4), ligamentum teres (Fig. 5), the articular surfaces of the femoral head and acetabulum and joint recesses [24, 25].

Fig. 3 A surgical probe is evaluating the labrum acetabular junction

Fig. 5 View of ligamentum teres and femoral head

Fig. 4 View of fovea and acetabulum

Fig. 6 View from peripheral compartment prior to release of traction. Note the femoral head, torn ligamentum teres and the intact labrum

Cartilage changes are recorded according to the Outerbridge classification [26]. The location and recording of the intra-articular pathology has generally been the clock face method. More recently, a geographic zone method has been developed [27]. After completion of the procedure in the central compartment, the arthroscope is positioned into the peripheral compartment and the traction released (Fig. 6). The hip is flexed to approximately 45° to relax the capsule allowing visualization (Fig. 7). It is not enough to identify an intra-articular abnormality. Isolated injuries do occur, but a search for an underlying morphologic variation needs to be undertaken. A dynamic assessment should be made of the joint from within the peripheral compartment by moving the hip in all motion planes looking for evidence of

FAI. The abnormal femoral head–neck offset in cam type FAI can often be best visualized with the hip flexed approximately 45° (Fig. 8). An osteoplasty for a cam lesion is performed using a motorized burr from superior to inferior along the femoral head–neck junction. Enough bone is removed to relieve the impingement and is generally a depth of 5–6 mm with a width of approximately 1 cm (Fig. 9).

At the end of the procedure, the hip joint and soft tissues are injected with a long acting anesthetic agent. Caution is necessary in selecting an appropriate agent. Bupivacaine has recently been reported to be toxic to human articular chondrocytes and a less toxic agent should be chosen [28]. The portals are closed in a standard fashion and dressings

Fig. 7 View from peripheral compartment with traction released. Note the femoral head and labrum

Fig. 8 View of femoral head neck junction

applied. Extravasated fluid will tend to saturate the dressings over several hours. The patients and their families should be cautioned about this.

The postoperative management is directly related to the pathology identified and the subsequent arthroscopic management. In debridement procedures, crutches are used as needed, followed by range of motion and subsequent strengthening of the hip musculature by closed-chain exercises. In procedures where there has been recontouring of the head–neck junction or a labral repair, crutches are utilized for 4–6 weeks. Range of motion is encouraged on a stationary bike, without resistance, early in the recovery period. Closed-chain exercises are started later.

Fig. 9 Osteoplasty for relief of cam impingement

Preoperative signs and symptoms generally are improved in about 3 months.

Complications

Potential complications of the procedure can be divided into those related to the traction, or to the procedure directly [1, 29, 30]. Traction-related problems include transient or permanent neuropraxias or palsies to the sciatic, femoral and pudendal nerves. The lateral femoral cutaneous nerve can also be damaged during creation of the anterior portal. The author has had several cases of foot neuropraxias related to compression from the traction boots. Pressure from the peroneal post has been reported to cause areas of necrosis and anal and vaginal tears have also been reported [1]. Traction-related complications can be minimized by appropriate padding and positioning, limiting the distraction force to only what is necessary and keeping the traction time to as short a time as possible.

Labral damage can occur during insertion of the cannulas, thus the importance of generating the portals under direct vision. Damage to the articular surfaces from the arthroscope and instrumentation can easily occur and must be minimized. There is a tendency to lever with the arthroscope and instrumentation to negotiate around the femoral head. Capsular incisions will help increase the mobility of the arthroscope and instruments, but attention to detail will help minimize iatrogenic damage. Complications related to fluid extravasation have also been reported [1].

The additional risks with an osteoplasty of the femoral head–neck junction include AVN and femoral neck fracture

[31]. Mardones et al. [32] have reported that up to 30% resection of the anterolateral quadrant of the head–neck junction did not significantly alter the load bearing capacity of the proximal part of the femur. There was a decrease in the amount of energy required to fracture. Other complications include adhesions at the capsulolabral margin and capsule with the region of bony resection [31].

Discussion

A list of the diagnoses and the author's experience is listed in Table 1. All patients had mechanical symptoms and a positive impingement test. The goal of the arthroscopic procedure was to identify the intra-articular pathology, the pattern of damage and to treat the etiology through subsequent reconstructive surgery if it could not be treated at the same time. The intra-articular pathology was treated with debridement or repair. The arthroscopic findings assisted in the planning of the subsequent surgery.

Hip dysplasia

Adolescent hip dysplasia frequently leads to pain related to a torn labrum (Fig. 10) or chondral abnormality. The intra-articular pathology may compromise the results of acetabular re-alignment or augmentation if left untreated [5, 33, 34]. I have preferred to evaluate the intra-articular pathology prior to the reconstructive procedure due to the excellent visibility provided by the arthroscopy of not only the labrum, but also the status of the cartilage of the acetabulum and femoral head. The choice of reconstructive or salvage procedure may be influenced by the extent of the changes identified in the articular cartilage. Labral repair is indicated where feasible.

Arthroscopy of the hip has been recently reported in the management of DDH in three children <2 years of age [35]. The authors report their indication is for failure of closed reduction. The pathoanatomy could be visualized and they were able to perform a limited debridement of the ligamentum teres and the pulvinar. Subsequently, the hips

Fig. 10 Torn labrum in patient with adolescent DDH

were felt to stabilize more easily. The authors recommended caution in interpreting their results. I have no experience with hip arthroscopy in this age group but find the concept intriguing. In addition to debridement of the ligamentum teres and pulvinar, other obstacles to a successful closed reduction could be treated by releasing the iliopsoas and transverse acetabular ligament.

Legg–Calvé–Perthes disease

Arthroscopic findings of the hip have been described in the early stages of LCPD. Gross [4] reported areas of flattening of the femoral head, cartilage fibrillation and dilation of the perichondral vascular ring, while Suzuki [36] found proliferation of the synovium and hypervascularity of the labrum. At this time there is little indication for arthroscopy of the hip in children with active LCPD. Adolescents and young adults, however, may present with mechanical signs and symptoms due to sequelae of earlier LCPD and benefit from arthroscopic management. A variety of intra-articular findings has been described [37–40]. Acetabular labral tears, tears of the ligamentum teres (Fig. 11), loose bodies, osteochondritis dissecans, chondral flaps, chondromalacia and groove defects of the femoral head (Fig. 12) are due to the disease process, and are amenable to arthroscopic treatment. The pattern of abnormality or damage can help plan subsequent reconstructive procedures. I have not performed an osteoplasty of the femoral head for LCPD, but have tended to debride the intra-articular abnormalities in a few instances and over coverage by the acetabulum was resected. The residual deformity of the proximal femur (coxa magna, coxa breva), often makes a full assessment of the peripheral compartment more difficult.

Table 1 List of diagnoses and number of arthroscopic cases

Diagnosis	No. of arthroscopic cases
DDH	52
LCPD	42
MED/SED	9
SCFE	8
AVN	6
FAI	4
Other	22

Fig. 11 Tear of ligamentum teres

Fig. 13 Large loose body from femoral head in patient with SED

Fig. 12 Groove defect of femoral head in LCPD

Epiphyseal dysplasia

In multiple epiphyseal dysplasia (MED) and spondyloepiphyseal dysplasia (SED), chondral flaps or loose bodies may occur (Fig. 13). Chondral fracture and delamination of the femoral head can occur suddenly with normal daily activities [41]. Arthroscopy can be used to remove the loose bodies and debride the chondral flaps. Avascular

necrosis may also occur in conjunction with MED and SED [42] leading conceptually, to further deformity of the femoral head and subsequent impingement type lesions as seen in LCPD.

Slipped capital femoral epiphysis

Futami [43], in 1992, reported his arthroscopic findings in patients presenting with a SCFE. The arthroscopy was performed prior to pinning of the slip and revealed erosion of the acetabular cartilage in the anterosuperior region and damage to the posterolateral aspect of the acetabular labrum. He also reported cartilaginous erosions and a transverse cleft on the anterior surface of the femoral head. Rab [44] used a mathematical model to study the geometry of SCFE and raised the concepts of impaction and inclusion. With impaction, the deformity could lead to erosion of the anterolateral acetabulum. With mechanical levering, there may be erosions in the anterosuperior acetabular cartilage and damage or detachment of the posterolateral acetabular labrum. Leunig [45] found a constant pattern of mechanical damage when doing a surgical dislocation for the management of 14 hips with SCFE. He reported damage to the labrum and either partial or full thickness loss of the adjacent acetabular cartilage. In my experience, similar changes were seen at arthroscopy. Arthroscopic osteoplasty may be beneficial in patients with previously stabilized mild slips that present with impingement signs and symptoms. In healed slips with more

significant deformity, a realignment osteotomy is indicated and an arthroscopic debridement of the intra-articular abnormalities can be performed as a conjunct.

Avascular necrosis

Ruch et al. [46] reported on the use of arthroscopy of the hip in avascular necrosis and developed a staging classification for the feasibility of performing a revascularization procedure. Kloen [47] noted anterosuperior flattening of the femoral heads which reduced the head neck ratio leading to cam impingement. A consistent pattern of labral pathology and acetabular chondral damage correlated with the femoral head changes. McCarthy [48] advocated arthroscopic treatment and/or staging of AVN in those patients with mechanical symptoms and signs. I have utilized an arthroscopic assessment of the hip in patients with mechanical symptoms in conjunction with core decompression.

Trauma

Arthroscopy of the hip for removal of retained loose bodies has been reported following hip dislocations and fracture dislocations in adults [49–52]. The procedure for removal has generally been performed at approximately three weeks post injury, due to the concern for excessive extravasation of fluid into the soft tissues and intra-abdominally [52]. In the pediatric age group, arthrotomy has generally been recommended for incongruent reductions. Torn ligamentum teres, osteochondral fragments and acetabular epiphysis-labrum, have been reported as being interposed, blocking the reduction [53–55]. Kashiwagi [56] reported on the arthroscopic removal of an avulsion fracture of the ligamentum teres following traumatic dislocation in a 10-year old. The author has experience with just two cases. One patient, age 9, had persistent hip pain following an open arthrotomy and removal of a loose body following an incongruous closed reduction. At arthroscopy, 6-months later, a torn and detached posterior labrum was debrided with resolution of the pain and a return to full activities. The second patient, age 16, presented 6-months following concentric reduction of a traumatic dislocation with pain and impingement symptoms and signs. At arthroscopy, a tear of the posterior labrum and ligamentum teres was identified as well as a large impaction lesion on the anterior femoral head. This patient continues with hip pain following debridement and microfracture of the femoral head lesion.

Sports injuries

Arthroscopy in the management of athletic hip injuries has been reported in the adult population [57–60] with only a

few references in the pediatric athlete [5, 61]. Pediatric and adolescent athletes may develop intra-articular hip problems from an isolated athletic injury or repetitive traumatic activity leading to labral tears, chondral or osteochondral lesions and tears of the ligamentum teres. Sports that involve repetitive flexion, flexion-abduction and extension-external rotation may be especially at risk. Isolated labral tears occur, but some author's caution that they occur infrequently and a search for an underlying morphologic abnormality (i.e., CAM impingement) should be ruled out [60, 62]. Arthroscopic debridement of labral tears has been reported to relieve pain and improve function [63–65]. Byrd [65], in adults, and Kocher [8], in children and adolescents, have reported improvement in the modified Harris Hip Score (HHS) with arthroscopic debridement of labral tears. The current emphasis is on labral repair [66, 67].

Femoral acetabular impingement

A common indication for hip arthroscopy in the adult is for the management of FAI. Two distinct types of FAI have been identified; cam and pincer [68]. Cam type impingement is caused by a reduced head–neck offset. Siebenrock et al. [69] noted that morphologic abnormalities in the shape of the head–neck junction was caused by an abnormal extension of the capital femoral epiphysis of unknown etiology. This abnormal contour of the femoral head–neck junction impinges against the acetabular rim with flexion and flexion internal rotation movement of the hip. This shearing force has been found to produce a reproducible pattern of damage to the anterosuperior acetabular rim of chondral avulsion and secondarily labral tear or detachment. Pincer type impingement is caused by an acetabular abnormality resulting in overcoverage of the femoral head. This can be related to a generalized protrusion or acetabular retroversion. The retroversion may be primary or secondary to previous reconstructive surgery. Impact between the femoral head and the anterior overcoverage leads to degeneration and tears of the labrum. The labrum may be hypoplastic and subsequent ossification of the rim may worsen the impingement. A contre-coup chondral lesion may develop to the posterior–inferior head or acetabulum. Both types of FAI have been associated with progressive joint degeneration [70, 71].

The standard treatment for FAI is an open surgical dislocation with labral repair in the cam lesions and labral re-fixation in the pincer lesions [72]. More recently, arthroscopic approaches have been reported in the adult population [62, 73]. The authors' experience is limited to four patients with primary FAI; three cam and one pincer. Both cam and pincer impingement can be seen following pelvic osteotomies such as a triple or PAO [74].

Both types of FAI are increasingly being recognized in the adolescent population. My limited experience in primary FAI has been with cam lesions that were treated with an arthroscopic osteoplasty. FAI in patients with an underlying diagnosis have often been encountered both pre and post reconstruction.

Septic arthritis

Arthroscopic lavage has been utilized in the management of septic arthritis of the hip. Several small series in the adult have been published reporting successful outcomes [75–77]. There are several reports in the use of arthroscopic lavage and drainage in the pediatric age group. Chung [78], in 1993, published the effectiveness of ablating infection in nine patients, ages 2–7, following high volume arthroscopic lavage, followed by 3–6 weeks of antibiotic treatment. Kim [79] reported excellent results and no complications in eight patients 2–14 years old, treated with arthroscopic drainage and debridement. More recently, El-Sayed [80] reported a comparison study of 20 hips treated with antibiotics and either open arthrotomy or arthroscopic drainage. At 12 month minimum follow-up, there was no statistical difference in the outcome. Hospital stay, however, was shorter in the arthroscopic group. My practice in Pediatric Orthopedics is at a tertiary care facility and I do not see patients with this diagnosis.

Other reported uses of hip arthroscopy in children and adolescents include excision of exostoses within the acetabular fossa in patients with hereditary multiple exostosis [81] and the management of inflammatory and synovial based disorders [82]. Krebs reviewed the role of hip arthroscopy in the treatment of synovial disorders and loose bodies [83].

Outcomes

There are no validated outcome measures specific to arthroscopy. The modified HHS has frequently been used to report outcomes. This score was developed for mold arthroplasty patients. In its modified form, pain and function are measured and converted to a 100-point scale. Kocher [8] used the modified HHS to report the outcomes in a heterogeneous group of hip disorders in children and adolescents. Scores improved from 53.1 to 82.9 with debridement of the intra-articular abnormalities with at least 1-year of follow-up. More recently Yen et al. [84] reported the results of 12 hips in patients 16 years or less with FAI using the modified HHS and a hip outcome score (HOS) activities of daily living (ADL) with follow-up ranging between 1 and 2 years. The modified HHS improved from 52 to 90 and the HOS ADL from 57 to 95.

In my heterogeneous group of patients, no outcome measures are being reported. Many of the patients undergoing arthroscopy had subsequent reconstructive surgery. Newer outcome measures are being developed specific to hip arthroscopy [85, 86].

Conclusion

Arthroscopy of the hip has become a standard procedure in the adult population for a variety of hip conditions. The indications and use of arthroscopy in children, adolescents and young adults continues to evolve. In the adult population for which arthroscopy is performed, the anatomy tends to be quite uniform. In children and adolescents, the underlying anatomy is more frequently abnormal due to the pre-existing disorders and their treatment. The landmarks are also frequently altered due to the large number of patients that have had previous surgery, either femoral or acetabular. There is a learning curve to this procedure. After obtaining specialty training in hip arthroscopy; attending continuing educational courses and cadaver labs, and 10-years of performing arthroscopy in a practice focused on hip deformity, I continue to find the procedure to be challenging. The procedure can be performed safely if there is attention to detail on the padding, positioning and time in traction. Care must be taken in developing portals to minimize damage to the soft tissues and labrum and avoiding iatrogenic damage to the cartilaginous joint surfaces, especially the femoral head, with the arthroscope, cannulas or instruments. Mobility of the arthroscope and instruments can be improved by increasing the size of the arthrotomies with an arthroscopic knife. Diagnoses in which arthroscopy of the hip can play a role include: DDH, LCPD, SCFE, MED and SED, AVN, loose bodies, trauma, inflammatory, FAI and labral tears. The intra-articular findings can also be used to guide future reconstructive surgery of the hip. Hip arthroscopy is also a useful adjunct to evaluating pain post reconstruction especially for impingement lesions. It must be remembered that the intra-articular pathology (i.e., labral tears) is secondary to an underlying abnormal bony morphology [87, 88]. Failure to recognize and address this abnormal bony morphology will result in a failed procedure and poor outcome.

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