ISSN: 2572-3243

Pietrzak et al. J Musculoskelet Disord Treat 2018, 4:057
DOI: 10.23937/2572-3243.1510057
Volume 4 | Issue 3
Open Access

Journal of
Musculoskeletal Disorders and Treatment

REVIEW ARTICLE

Hip Arthroscopy: A Narrative Review of the Current Literature

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Abstract

The incidence of hip arthroscopy is increasing worldwide. This is due to improved knowledge of the surgical anatomy, expansion of surgical indications, evolution and refinement of surgical instrumentation and continued reports of good long-term functional results. However hip arthroscopy remains a technically challenging surgical procedure with a described "steep" learning curve. This narrative review discusses key areas of hip arthroscopy including indications, outcomes, issues regarding the learning curve and potential peri-operative complications with particular interest in the most recently published literature. It highlights that while benefits exist with hip arthroscopy, consideration must be paid to patient selection and adequate training.

Keywords

Hip arthroscopy, Learning curve, Complications

Introduction

Hip arthroscopy has been performed for almost 90 years since Burman first described the technique in 1931. Technical limitations resulted in stagnation of hip arthroscopy progress until the 1970s with televisual advancements [1]. There has been a recent exponential growth the use and literature surrounding hip arthroscopy that presents an opportunity to assess the current status of this technique in terms of indications, learning curve, complications and outcomes.

The popularity of hip arthroscopy in diagnosis and treatment conditions affecting the hip can be seen in the increases on national databases and trainee experience. The British national database recorded a 250% increase in hip arthroscopies performed from 2007 to 2011 [2], there is a similarly shown increase in America by Board examinees [3]. Correspondingly there has been a similar trend in exponential scientific reporting surrounding hip arthroscopies with Ayeni, et al. [4] highlighting a 500% increase in recent literature.

An explanation for this may be the improvement in instrumentation and technique over the recent 2 decades with subsequent expansion of potential indications for hip arthroscopy. Whilst it is an attractive surgical area allowing novel interventions to improve pain and function with avoidance of open procedure or arthroplasty there is a definite learning curve and well described complications that should be considered. Examining the indications and outcomes of arthroscopy can compare contemporary surgical experience to described benefits and allow recommendations for future surgical practice and research direction.

Indications

In 1939 the hip arthroscopy indications used were charcot and infected joints. Modern indications include but are not limited to: femoro-acetabular impingement (FAI), chondral & labral lesions, infection, ligamentum teres injuries, snapping hip syndromes, recalcitrant trochanteric bursitis, external and internal prominences and certain trauma situations [5]. It is important to briefly review these indications in order to understand the balance of beneficial outcomes and risks of complications.

Femoro-acetabular impingement (FAI) is a common cause of hip pain in young adults. Untreated FAI may result in osteoarthritis (OA) development due to aberrant contact between the acetabulum and femoral head. The described mechanisms of either decreased

Citation: Pietrzak JRT, Donaldson MJ, Kayani B, Rowan FE, Haddad FS (2018) Hip Arthroscopy: A Narrative Review of the Current Literature. J Musculoskelet Disord Treat 4:057. doi.org/10.23937/2572-3243.1510057

Accepted: August 16, 2018: **Published:** August 18, 2018

head-neck offset (Cam type lesion) or acetabular over coverage (pincer type lesion) may occur alone or in combination [6]. Radiological diagnosis of FAI is difficult as features may be present in asymptomatic hips. Plain X-Rays may be inadequate to provide a definite diagnosis while gandolinium enhanced arthrography lacks sensitivity and specificity for the diagnosis of labral and chondral pathology. Hip arthroscopy allows detailed dynamic is emerging as the diagnostic gold standard. Hip arthroscopy can be used to debride lesions and address associated labral and chondral pathology to prevent ongoing impingement hip pain, associated symptoms and potentially the development of OA [7].

After FAI the other most common modern indication to consider is labral pathology and chondral injury. Discrete labral tears with instability or pain may be addressed by arthroscopy with repair or debridement. Chondral injuries with or without labral pathology, most commonly in athletes may be amenable to arthroscopic debridement, microfracture or chondrogenic procedures [8].

Hip arthroscopy is indicated for both diagnosis and treatment of synovial hip conditions, removal of foreign bodies and even trauma [9]. Several small series have shown that hip arthroscopy maintains a role to play in the treatment of septic arthritis of the hip, allowing expediated recovery, reduced hospital stay and equivalent outcomes to open debridement at 12 months follow up [10].

In addition to intra-articular indications hip arthroscopy presents a treatment modality for several peri-articular conditions especially where conservative management has failed. Persistent trochanteric bursitis has shown benefit and improved recovery after arthroscopy debridement. Painful snapping hip syndromes can be investigated and addressed arthroscopically with iliotibial band or psoas tendon releases demonstrating promising results as a better surgical option than open procedures [9].

Learning Curve

The described 'learning curve' of any procedure can be considered in terms of time taken to achieve technical proficiency allowing comparative outcomes to peers. During this period of learning there may be increased procedural time and increased risk of complications to patients. A 'steep' learning curve is described in the literature relating to hip arthroscopy as the skills and experience required to master therapeutic use are difficult to obtain whilst minimising complications [3]. There are numerous reports outlining a decrease in the complication rate with experience [11].

The reliance on specialised instrumentation and familiarity with these is compounded by limited maneuverability, depth of the joint, distance of hands from the point of the operating instruments that are associated with the procedure. Surgeon handedness may play a role in the hip arthroscopy learning curve as technical differences exist between left and right hip arthroscopy based on the surgical approach exists [12]. Buyukdogan, et al. [12] proposed that the use of the dominant hand for the instruments and non-dominant hand for the scope during hip arthroscopy may improve surgical technique and lessen the complication rate. Hip arthroscopy can be done in both lateral decubitus and the supine positions. Although it is difficult to make direct comparisons between the two positions, the supine position has been associated with increased neuropraxic injuries, labral penetration and HO. A greater risk of fluid extravasation and loose bodies eluding the surgeon occurs in the lateral decubitus position [13].

Experience in hip arthroscopy of at least 30 cases of is associated with measured reductions in operating times and complication rates at this point of experience [3]. Beyond this there may be complications that change in terms of type or severity even though the rate decreased [14]. An example being avoidable 'learning curve' issues such as iatrogenic cartilage injuries and wire breakage replaced by complications related to increasingly difficult pathology and associated procedures. In the treatment of difficult cases especially trauma leading surgeons seemingly advocate high experience being necessary to address complexities encountered arthroscopically (as opposed to open surgery) due to distorted anatomy and or haemarthrosis in trauma.

Given that surgical experience is a non-modifiable risk factor Dietrich, et al. [15] propose that hip arthroscopic training should be undertaken in a specialist centre to ensure that the supervision decreases the potential number of complications and maximizes patient outcome.

Outcomes

The outcomes of hip arthroscopy can be measured in terms of improvement of symptoms, delay for future operations and avoidance revision operations and complications. The difficulty in achieving and reporting outcomes is exemplified in the vast lack of consensus in Smith's 2016 [16] survey of 75 international surgeons evaluating practice preferences including diagnosis, technique and post-operative management. There is a lack of uniformity creating difficulty in evaluation outcomes and incidence of complications as hip arthroscopy practice and training is diverse.

Improvement of symptoms can be measured as the rate of return-to-play for high-level athletes after arthroscopic surgical intervention. For FAI this has been reported as 83% to 93% [17,18]. Elite or professional athletes have greater return-to-play rates and higher satisfaction rates than amateur or recreational athletes after arthroscopic surgical interventions for FAI [17,19]. For lower level athletes reduced outcomes are if the time to surgery was greater than 8 months and in patients with an increased body mass index (BMI) [19].

Patient reported outcomes (PROs) are another commonly used measurement however there are numerous scores used which creates difficulty in comparison. Two commonly employed scores are the modified Harris Hip Score and Non-Arthritic Hip Score which can be compared through percentage improvement (rather than direct numerical comparison). Hip arthroscopy without osteoplasty has demonstrated benefit of 10-year 47% improvement, comparable to arthroscopy with osteoplasty (as in FAI surgery) of 40% improvement but limited long term data [20].

One of the controversial areas hip arthroscopy is associated with is use in patient with osteoarthritis. The limited benefits are commonly overshadowed by high rate and reduced time to future surgery, especially hip arthroplasty. Through reviewing 17 studies including the results of 9,954 patients that were 40 years or older Horner, et al. concluded that there are some improvements following hip arthroscopy for femoral osteo-chondroplasty & labral repair [21]. Conversely no notable improvements were seen in patients older than 40 years with labral debridement. Increasing rates of conversion to THA were seen with increasing age. The rate of conversion to THA in this review was 18.1% for patients 40 or older, 23.1% for patients older than 50 years and for patients older than 60 was 25.2%. The mean time to THA was 25.0 months post procedure. BMI and the presence of OA were associated with poorer outcomes.

The need to revise hip arthroscopy has mostly been associated with residual impingement. Degen, et al. [22] reported on 311 cases of revision arthroscopy with a survival rate of 88.1% and 74.9% at 2 and 5 years respectively. In this report, age > 50 years and a diagnosis of OA was implicated in greater revision surgery rates whereas lower re-operation rates were seen if a labral repair was performed or if a higher volume surgeon (> 164 cases/year) did the operation. Harris, et al. [23] reported that the rate of re-operation after hip arthroscopy is 6.3% at 16 months of which 30% were revision hip arthroscopies. The indications for revision arthroscopy in order of prevalence include residual FAI, labral lesions, chondral defects, adhesions and untreated instability [24]. Patients undergoing hip arthroscopy with pre-existing osteoarthritis are at high risk of conversion to THA within 12 months. There are reports that THA outcomes after a revision arthroscopy has been previously performed are inferior to those occurring after index hip arthroscopy [25].

A summary of risk factors for poorer outcomes are [26]:

- Patients older than 40 years
- Significant chondral damage in the weight bearing area (Outerbridge 2 or more)
- Advanced radiological osteo-degeneration (Tönnis 3 or higher)
- < 2 mm joint space narrowing
- MRI evidence of femoral head chondral lesions including subchondral cysts.

In addition to these poorer outcome predictors obese patients have lower baseline and post-operative scores, yet improve to the same degree as non-obese patients. Importantly however obese patients are 11 times more likely to develop post-operative complications [27].

Complications

Reported complication rates in hip arthroscopy vary between 1 to 8% [25]. There are no in the differences between primary or revision procedure. A statistically significant increase in complications were seen in cases lasting longer than 60 minutes and in those performed on obese or female patients. However, through recently reviewing a national athlete based database Truntzer, et al. [28] found incidence of major complications to be three times higher in the 2581 hip arthroscopies studied than is commonly reported in the literature. This presents evidence that complications may be under-reported.

Fortunately, most complications have limited impact on the patient, generally resolve without permanent long-term impact [11]. The definition of major and minor complications remains controversial. However, hip fracture, pulmonary embolism, deep infection, dislocation and death are generally considered major complications. Whilst the majority of complications occur, and are recognized perioperatively it is useful to categorized intra-operative, early post-operative and late post-operative complications.

Intra-operative complications

Intra-operative complications include injury to the acetabular labrum and articular cartilage, direct neurovascular injury, traction-related injuries, inadequate osseous resection, chondral damage and fluid extravasation.

Acetabular labrum injury is apparently common with up to 20% rate of occurrence. Typically, if iatrogenic injury occurs it is to the superior or anterosuperior labrum when establishing the anterolateral portal [29]. Femoral head cartilage is also at risk. The probability of injury may be mitigated by improving visualization.

Direct neurovascular injury may involve the femoral bundle anteriorly, the lateral femoral cutaneous nerve antero-laterally and the sciatic nerve and gluteal vessels posteriorly. These are rare but potentially devastating complications. Larson, et al. [25] report an alarming incidence of 16.5% for nerve injury most commonly the lateral femoral cutaneous nerve or its branches. Appreciation of the anatomy and careful surgical technique is paramount to avoid subsequent iatrogenic injury. Nerve injuries are most likely due to traction with the exception of lateral femoral cutaneous nerve distinct anatomy at risk for direct/penetration injury [11]. This also explains why arterial injuries are comparatively rare.

Effective distraction techniques, typically using a traction table, are essential to adequately expose the hip joint. In addition to nerve injuries from compression or distraction soft tissues may also be injured. Whilst usually brief and resolving the consequences of perineal post associated injuries is up to 7% of cases [29]. More serious consequences resulting from Telleria, et al. [30] reported that the amount of traction and not necessarily the duration was more strongly responsible for sciatic nerve changes in 76 hip arthroscopies.

The use of suture anchors provides effective fixation of the soft tissue to bone but may result in inadvertent damage to articular cartilage and bone. In addition anchors that evert the labrum compromise adequate function and may lead to early deterioration. Those placed at the 1 o'clock position of anchor fixation and anterio/mid-anterior portals have reported higher incidence of these issues so care is warranted [31].

Key preventative strategies for the mentioned complications concern improving visualization with distraction of > 10 mm followed by 20 ml or more of fluid distension with normal saline prior to portal insertion. However, 'trialling traction' (releasing during prep and draping) and limiting to 22.7 kg (50 lb) is also recommended to reduce nerve injury.

Associated complications

Although not a direct complication of arthroscopy it is important to consider the potential of harms of hypothermia and fluoroscopy use in surgery. The incidence of hypothermia in hip arthroscopy in cases of FAI is 2.7% [32]. The use of fluoroscopy is recommended in hip arthroscopy, however radiation may have harmful effects for both the patient, surgeon and surgical team. In a single surgeon's experience, Smith, et al. [33] reported that both the dose of radiation and fluoroscopy time was linked to a surgeon's learning curve and decreased statistically significantly over the first 100 cases. Patients with increased BMI and surgery for FAI have greater radiation exposure for surgeons.

Early post-operative complications

The early post-operative complications to consider are iatrogenic hip instability, under resection prompting requirement for early revision surgery and unrecognised potential for deep vein thrombosis (DVT). The incidence of septic arthritis after hip arthroscopy is presumably low as there are very few reports of septic arthritis in the literature.

Hip instability may be due to soft tissue laxity, insufficient bony cover or a combination of the two. Instability after hip arthroscopy varies and with reports of rate up to 0.58% [28]. The outcomes of capsular repair, capsular partial repair or non-repair is controversial and the literature is lacking with further long-term studies are needed.

It may be understandable that given the risk of instability inexperienced surgeons could trend towards conservative amount of resection. An unfortunate consequence is insufficient reshaping of cam and pincer lesions at index arthroscopy which was reported in 92% of 37 cases of revision hip arthroscopy by Philippon, et al. [24]. Improved results may be achieved with rigorous pre-operative planning, imaging and the use of intra-operative image intensifier to assess adequacy of bone resection.

A meta-analysis of 14 studies and 2850 patients reported an incidence of venous thromboembolism (VTE) of 2% leading to the suggestion that chemoprophylaxis may not be necessary in low-risk patients [34]. With simple DVT prophylaxis including TED stockings and early mobilization a thrombo-embolic event incidence of 0.2% was reported in 1615 consecutive hip arthroscopies [25]. Increased risks for VTE in this analysis included older age, obesity, COC, trauma and prolonged traction [34].

Late post-operative complications

Osteonecrosis of the femoral head, adhesions, heterotopic ossification (HO), femoral neck fractures, trochanteric bursitis and iliopsoas tendinitis may occur post-operatively.

Osteonecrosis after hip arthroscopy is rare however may occur as a result of pre-operative injury, increased intra-operative intra-articular pressure from the arthroscopic infusion, hip distraction, capsulectomy and damage to the lateral epiphyseal branch of the medial femoral circumflex artery especially at risk when reshaping cam lesions. The recommended area of resection should be limited to a depth of 5-7 mm and width of 8-12 mm while ensuring that the retinacular vessels running along the lateral femoral neck are not damaged intra-operatively [35,36].

Adhesions may occur most commonly in 2 areas: between the capsular side of the labrum and capsule after labral repair or in the peripheral compartment between femoral neck and capsule after osteoplasty [37]. Resultant impingement may manifest as groin pain and limited rotation and flexion. A high index of suspicion must be maintained and adhesions are best radiologically evaluated with MR arthrography.

The increase hip arthroscopy for FAI and use of larger capsulotomies has seen an increase in the prevalence of heterotopic ossification (HO). Randelli, et al. [38] reported HO in 1.6% of 300 cases of hip arthroscopy for FAI in which no prophylaxis for HO was prescribed. Conversely Beckmann, et al. [39] showed the incidence of HO with NSAID prophylaxis was 5.6% as opposed to 25% for those patients who did not. Bone debris and soft tissue injury to the gluteal muscles may instigate HO formation.

As much as 30% of the femoral neck diameter can be resected without adversely risking neck of femur fracture [35], this is beyond normal neck resection for cam lesions. Zingg, et al. [40] reported on 7 fractures (1.9%) in a series of 376 consecutive osteochondroplasties for FAI. The authors identified male gender, older age, increased height and higher femoral offset for fractures. These fractures generally occurred at an average of 4.4 weeks. Surgeons should have a high index of suspicion for this complication should any pain suddenly interrupt an uneventful post-operative period. To mitigate the risk of femoral neck fracture partial weight-bearing may be advised for the first 6 weeks after arthroscopic resection of cam-type lesion in FAI management.

Future of Hip Arthroscopy

Hip arthroscopy has evolved dramatically from that which Sampson [41] referred to as "a procedure looking for indications" only 20 years ago. Ongoing development of instrumentation in the future will allow more specialized and complex procedures to be performed more. Computer-assisted planning and navigation could be implemented to ascertain areas requiring resection due in FAI, allowing more accuracy and reducing outlying potential complications of under or over resection. Earlier intervention and treatment initiation by clinicians detecting patients at risk for cartilage breakdown will become a reality due to evaluation of serum and synovial biomarkers [42]. Adjuncts to hip arthroscopy to aid joint preservation will develop and progress including growth factors, gene therapy and stem cells.

Conclusion

Hip arthroscopy is an effective surgical procedure with the potential to relieve symptoms, improve function and allow an expedited return to sport with reduction of potential for osteoarthritis. Important considerations in patient selection for improved outcomes are younger age, higher activity level, low BMI and discrete surgical pathology. Overcoming the surgical learning curve and adequate planning and execution with mind to visualization balanced with traction can also avoid complications. The exciting applications and future of hip arthroscopy should be balanced with adequate training in a specialist centre and ongoing monitoring to ensure outcomes are maintained.

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