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New Review Regarding the Role of Hip Arthroscopy

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Abstract

Background: Arthroscopy is a treatment option for FAI and associated labral tears. It presents low complication rates and good clinical outcomes, especially in cases where joint damage is absent. The surgical procedure aims to treat labral pathology and correct FAI, restoring the labrum anatomy and joint-sealing function, thus decreasing pain and possibly preventing progression to osteoarthritis.

Purpose: This article will be useful for Young Orthopaedic Surgeon who, should be well trained regarding the technique and to be careful in-patient selection, because this definitely will improve clinical outcome. Also, for athlete to be aware of clinical success rate to return to their previous level of competition.

Method: Literature Review.

Results: Arthroscopic treatment for FAI and Labral tear repair resulted in statistically and clinically significant improvements in outcome parameters.

Conclusion: Hip arthroscopy is a useful and effective minimally invasive procedure for the diagnosis and management of selected patients and some precautions.

Keywords: Acetabular labral tear; Femoral acetabular impingement; Hip pain; Hip arthroscopy; Technique

Article Summary

Article Focus

- This article focuses on the different surgical methods available by Hip arthroscopy to restore Acetabulum labrum in hips either repair or reconstruction and success rate.
- This article shows also the role of hip arthroscopy in FAI Femoro-acetabular impingement management and clinical outcome.
- Finally, I highlight which patient will get the successful procedure and get really improved.

Key Messages

- There is abundance of researches done on role of hip arthroscope in management of Lebrum tear and FAI, However, in this article I try to concentrate who will get clinically improved.
- This work depends on reviewing a lot of studies.
- Consideration must be paid to patient selection and adequate Surgeon training.

Strength and Limitation

- There are several studies with long follow up periods and large cohort sizes in regards hip arthroscope role in management different hip pathological disorders. The longevity of the studies is of benefit as they allow us to see long term benefits of the techniques.
- Limitation presents opinions and the expertise of high-volume specialized orthopaedic hip surgeon, which are not necessarily generalizable.

Introduction

Hip arthroscopy is rapidly becoming a more frequently performed procedure in the world. 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

In the UK National Non-Arthroplasty Hip Registry reported a greater than doubling in the number of arthroscopies performed between 2012 and 2015 [1]. Similar trends have been observed in the United States [2]. Overall, hip arthroscopy has been shown to be a safe and successful intervention for a wide variety of indications [2-4]. Unfortunately, conversion to an ipsilateral Total Hip Replacement (THR) following hip arthroscopy is necessary up to 16% of patients [5-7]. Identifying factors pre-operatively that might predict the need for subsequent arthroplasty would benefit both patient and surgeon.

Acetabular Labral Tear

The Acetabular labrum can get torn with wear and tear or trauma [8]. While these can often be easily seen on MRI, we have to be careful when thinking about a labral tear as a common source of pain. Why? Research has shown that lots of people without hip pain have labral tears [9-11]. In fact, in one study, 69% of patients without hip pain had labral tears! Hence, if you develop hip pain and a later MRI shows a labral tear, you need to be very cautious about linking that labral tear to your pain.

FAI

FAI stands for Femoro-acetebular Impingement which is the most common reason hips get arthroscopic surgery. This means that either bone spurs develop on the socket (pincer) or on the bottom of the ball (cam). A bone spur is just an area where the bone has grown bigger and not necessarily anything that is the cause of pain. Again, we need to be really careful about thinking of these bone spurs as causing pain. For example, in one study, the pincer type was shown to be protecting the joint from further arthritic breakdown and not hurting the joint [12]. In another study, more than 90% of healthy young adults without hip pain had one or more hip MRI findings of FAI! [13].

Evaluation and Diagnosis

The hip is a complex unit of static and dynamic stabilizers and is a key link between the axial and appendicular skeleton. Thus, "hip pain" and more specifically labral tears can have Various and Sometimes Multiple Aetiologies Such as Trauma, Osteoarthritis, Instability, And Most Commonly Femoro Acetabular Impingement Syndrome (FAIS). It is important to determine the underlying cause of the labral tear as it will dictate the appropriate treatment of the underlying etiology. A multi-faceted approach is utilized beginning with basic imaging and a detailed history and physical exam.

Physical Exam

Many patients can have normal to increased range of motion of the hip but may be painful either in the groin or laterally. The FABER position can provide useful information through the presence of anterior pain with the knee close to the table.

Imaging

1. X ray AP pelvis, false profile, and Dunn lateral are obtained to assess for femoral head under coverage (dysplasia) and over coverage (pincer lesion, coxa profunda, acetabular protrusio) and CAM morphology [14]. It is important to identify those individuals that lack bony stability or have pre-existing degenerative joint disease [15]. Radiological findings of FAI in an asymptomatic population are around 20% and increase up to 60% to 80% in athletes [13]. An interesting systematic review of an asymptomatic population established the prevalence of 'cam' deformity in 37% and 'pincer' deformity in 67%. As the relationship between FAI and hip osteoarthritis is not clear, the current literature does not show any benefit with prophylactic surgical procedures in the asymptomatic population who have radiological signs of FAI [16].

2. CT offer the advantage of three-dimensional imaging of the bony morphology of FAI. This becomes a useful tool with both pre-operative planning and intra-operative bone resection [17].

3. Magnetic Resonance Imaging (MRI) offers visualization and characterization of the labral tear. While MRI arthrogram is the gold standard, the arthrogram generates additional morbidity and cost. Thus, we prefer high-resolution (3 T) non-contrast MRI. In addition to identifying and characterizing the labral tear, the MRI can identify associated or alternative pathology such as gluteal tendinopathy, ischiofemoral impingement, stress fractures, hamstring tendinopathy, or neoplasms [17].

Arthroscopic Management for Labral Tear and FAI

Laberal Tear Repair or Reconstruction

A-Repair

For labral sutures, 2.7 mm anchors were placed at every 1 cm of damaged labrum and positioned 2–3 mm from the acetabular rim to avoid penetrating the joint surface. The labrum was repaired with a loop or trans labral suture, and the suture knot was secured in the direction of the labrum capsular side. After fixation, traction was removed, and restoration of the labrum joint-sealing function was assessed. The mean procedure time was 99 min, and the mean traction time during the procedure was 75 min. In most cases patients remained in hospital overnight as this was the standard institution protocol. On average, patients were discharged from the hospital 21 hours after the procedure (ranging from 16 to 24 hours) [18]. Postoperative rehabilitation was based on a four-stage protocol focusing on patients' return to normal activities, as described by Wahoff and Ryan [19].

B-Reconstruction

The most common indication for labrum reconstruction was a young, active patient with minimal arthritis and non-salvageable or deficient Labrum. Other indications include Instability, pain and

hypotrophic dysfunctional labrum.

For these patients, reconstruction was identified as a more effective treatment than labral repair. Arthroscopic reconstruction was performed using either a hamstring allograft or auto graft. Originally, hamstring auto grafts used for this procedure. Subsequently, to decrease the risk of donor site morbidity, the reconstruction protocol changed to hamstring allografts, unless the patient specifically requested otherwise.35 The portion of the diseased labrum that was non-functioning was debrided with a 5-mm shaver. The defect size was determined using a measuring probe from the labral repair/reconstruction kit (Arthrex) [20].

FAI Femoro-Acetabular Impingement

A-Pincer Type

Correction of a 'pincer' type deformity should be performed with acetabular rim trimming. Excessive acetabular rim trimming should be avoided, since 1 mm rim trimming will decrease by approximately 2.4˚ of the CE angle (Figure 1). Therefore, acetabular rim resections greater than 4 to 5 mm could create an iatrogenic dysplastic hip. Currently, limited acetabuloplasty and labral re-fixation without detachment have demonstrated the same clinical outcomes as acetabuloplasty with labral detachment in the treatment of 'pincer' [21].

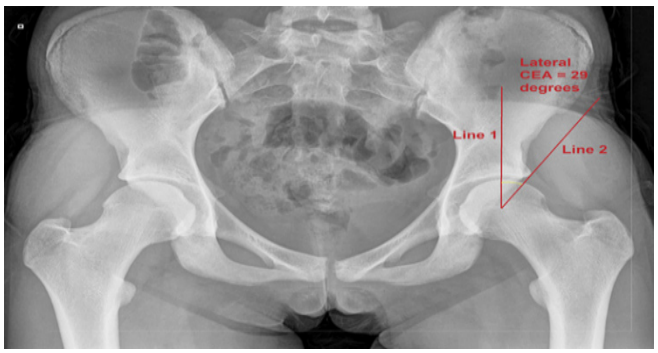

Figure 1: Lateral Centre-Edge Angle (CEA) on an anteroposterior pelvic radiograph in a left hip. Line 1 is the vertical reference and is perpendicular to the transverse axis of the pelvis. Line 2 is from the center of the femoral head through the most superolateral portion of the acetabulum. The lateral CEA is formed by the angle between these 2 lines [22].

B-CAM Type

'Cam' deformity in FAI appears commonly at the anterosuperior head-neck junction and extends from the medial synovial fold to the anterolateral insertion of the retinacular vessels (Figure 2A). Playing some types of sports, such as football, more than three times a week by patients during skeletal growth was associated with a pathological alpha angle [21].

The alpha angle measures the extent to which the femoral head deviates from spherical. It is measured by first drawing the best fitting circle around the femoral head, then a line through the center of the neck and the center of the head. From the center of the femoral head, a second line is drawn to the point where the superior surface of the head–neck junction first departs from the circle. The angle between these two lines is the alpha angle (Figure 3) [23].

Restoration of the normal head-neck shape should be our main goal, but clinical outcome is more related to the pre-operative articular damage than the post-operative head-neck shape restoration. Rarely, extensive 'cam' resection could weaken the femoral neck and lead to a femoral neck fracture. Risk factors associated with this complication are violation of weight-bearing restrictions, female sex and age older than 50 years [21].

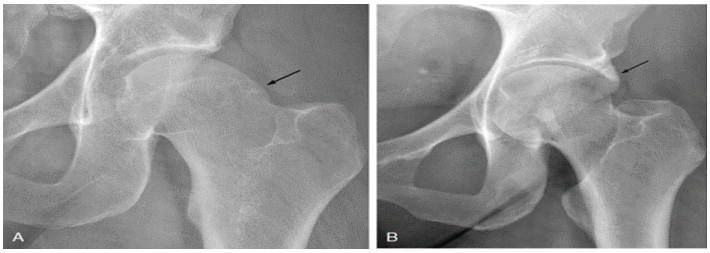

Figure 2A: CAM-type femoro acetabular impingement with a dysplastic bony bump at the superolateral femoral head neck junction. B, Pincer-type femoro acetabular impingement with overc overage of the femoral head by the acetabulum (arrow) [24].

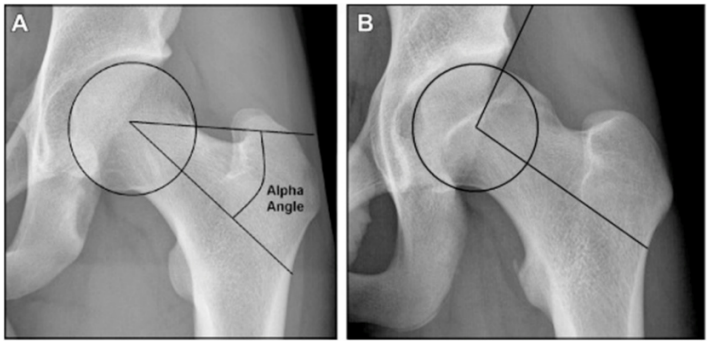

Figure 3: The alpha angle quantifies a sphericity of the femoral head. A. A normal alpha angle of 41˚ is shown representing a spherical femoral head. B. An abnormal alpha angle of 98˚ is shown representing a cam deformity [23].

Clinical Outcome

The Successful clinical outcomes of hip arthroscopy can be measured in terms of:

- Improvement of symptoms which can be measured as the rate of return to play for high-level athletes after arthroscopic surgical intervention.

- Delay for future operations and,
- Avoidance revision operations and complications.

Important Considerations

Patient selection

It was hypothesized that factors including sex, age, Body Mass Index (BMI), articular cartilage status, radiographic joint space, hip dysplasia, FAI morphology and labral treatment would predict outcomes after hip arthroscopic surgery. The predictors of positive and negative outcomes identified in this review are supported by existing literature on outcomes after hip arthroscopic surgery.

Gender

Both male and female sex has been associated with positive outcomes after hip arthroscopic surgery [25-27]. However, female sex as an identifiable factor appears to be clearer as a negative predictor. Although there is no clear consensus, the role of soft tissue laxity in female patients, possibly leading to negative outcomes, could be postulated. This is a potential area for further investigation in future studies.

Age

Patients with FAI who are older than 45 years should proceed with caution, as this demographic was more likely to have negative outcomes regardless of sex [27,28].

BMI

Furthermore, in the setting of FAI, female and overweight patients (BMI >24.5 kg/m^2) with a prolonged duration of preoperative pain may be prone to negative outcomes after arthroscopic surgery.

Articular cartilage status

Osteoarthritic changes and pre-existing cartilage damage have been thought to be factors associated with negative outcomes after hip arthroscopic surgery. The constellation of degenerative changes and decreased joint space (≤2 mm) strongly predicted negative outcomes after arthroscopic surgery for FAI [26,29,30].

Hip Dysplasia

A retrospective study of 110 patients confirms that the presence of cartilaginous wear and hip dysplasia predispose patients to early hip arthroplasty following arthroscopy, with the presence of both conferring a 5-fold increased risk of subsequent arthroplasty [31].

FAI Morphology

FAI is often related to sports activities. In a retrospective study of athletes undergoing hip arthroscopy for FAI, the most common sports related to FAI surgery were hockey, soccer and American football. In football players, increasing the 'alpha' angle was the only independent predictor of groin pain; also, higher 'alpha' angles were associated with chondral delamination and labral injuries. Return to sport after FAI surgery was investigated in a systematic review of a cohort of 418 athletes, with a rate of return to the previous level of competition of 88% [21].

A cohort study by (Sansone, et al., 2017) was done to report outcome 2 years after the arthroscopic treatment of Femoro Acetabular Impingement (FAI) using validated outcome measurements. Two hundred and eighty-nine patients underwent arthroscopic surgery for FAI. The mean follow-up time was 25.4 months. Pre-operative scores compared with those obtained at follow-up revealed statistically and clinically significant improvements for all measured outcomes. At the 2-year follow-up, 236 patients (82%) reported they were satisfied with the outcome of surgery. The authors concluded that arthroscopic treatment for FAI resulted in statistically and clinically significant improvements in outcome parameters [32].

Labral Treatment

Repair of labral tears is preferred than resection of labral tears for preservation of the function of the joint. Many clinical outcome studies have provided supporting biomechanical data and conclusions. Multiple comparative cohort studies and one prospective randomized study have demonstrated that patients undergoing labral repair have significantly better outcomes than labral debridement.

The systematic review by Ayeni, et al., which includes most of these studies as well as the outcomes of open procedures, found similar results favouring repair over debridement. Other recent studies also discovered labral debridement procedures caused micro motions in the hip joint, contributing to the development of OA. With these reports in mind, we repaired acetabular labrum tears whenever possible, considered that the labrum is essential for joint-cartilage protection [33].

According to the available evidence at this time, **hip labrum reconstruction** is a relatively new technique that shows short and mid-term improvement in patient-reported outcomes and functional scores postoperatively. The main indication for reconstruction is an irreparable, calcific, hypotrophic <3 mm or hypertrophic >8 mm, and non-functional labrum in young patients with no or minimal arthritis (Tonnis 0–1). This review had larger study sample with reported decrease in failure rates compared with the previous review. Long-term follow-up results with higher quality studies were not available in the literature based [34].

Complications

Reported complication rates in hip arthroscopy vary between 1 to 8% [35].

Intra-Operative Complications

1. **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 porta [36].
2. **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 [37].
3. 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** [38].
4. 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% [39]. The use of fluoroscopy is recommended in hip arthroscopy, however radiation may have harmful effects for both the patient, surgeon and surgical team [40].

Post-Operative Complications

Early

1. **Hip 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. [41].
2. **VTE,** 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 [42]. 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 [37]. Increased risks for VTE in this analysis included older age, obesity, COC, trauma and prolonged traction [42].

Late

1. **Osteonecrosis of the femoral head**, 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 [43].
2. **Adhesions** between the capsular side of the labrum and capsule after labral repair or in the peripheral compartment between femoral neck and capsule after osteoplasty [44].
3. **Heterotopic Ossification** (HO). Randelli, et al. [45] 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. [46] showed the incidence of HO with NSAID prophylaxis was 5.6% as opposed to 25% for those patients who did not.
4. **Femoral neck fractures**, as much as 30% of the femoral neck diameter can be resected without adversely risking neck of femur fracture [43], this is beyond normal neck resection for cam lesions. Zingg, et al. [47] reported on 7 fractures (1.9%) in a series of 376 consecutive osteochondroplasties for FAI.
5. **Trochanteric bursitis** and **iliopsoas tendinitis** may occur post-operatively [48].

Conclusion

Hip arthroscopy is a useful and effective minimally invasive procedure for the diagnosis and management of selected patients. Arthroscopic treatment for FAI and Labral tear repair resulted in statistically and clinically significant improvements in outcome parameters. Important considerations should be taken in patient selection for improved outcomes. Identifying these features pre-operatively will aim to improve the results of hip arthroscopy as joint preserving surgery. Future of hip arthroscopy should be balanced with adequate training to avoid complication.

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