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Role of Arthroscopy for Hip Osteoarthritis with Impingement

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Abstract

Purpose of review Femoroacetabular impingement (FAI), also known as hip impingement, has seen increasing attention over the last decade. This condition is being recognized as a cause hip pain and can lead to early degeneration within the joint. The purpose of this review is to examine the current literature related to the treatment of FAI combined with osteoarthritis (OA) with hip arthroscopy.
Recent findings FAI without degenerative changes is effectively treated with hip arthroscopy, osteoplasty, and labral repair. While there is still a role for hip arthroscopy in lower grades of OA, higher grades of OA or joint space of less than 2 mm have been shown in the literature to result in poor outcomes and early failure. OA has been shown to be a risk factor for failure of hip arthroscopy independent of age.
Summary There is limited role for hip arthroscopy in the presence of OA. Careful patient selection, stringent surgical indications, and selection criteria, as well as consideration for overall cost-benefit in older patients and patients with pre-existing OA are imperative. Future research should evaluate whether definitive total hip arthroplasty is more cost-effective than joint preserving surgeries in the presence of FAI with mild OA.

Introduction

Femoroacetabular impingement (FAI), also known as hip impingement, has seen increasing attention over the last decade. This condition is being recognized as a common cause of hip pain and restricted range of motion in young adults [1, 2]. Better awareness of this condition has led to earlier detection and improved management. As FAI is a newer concept; however, some cases were often initially mismanaged or missed in their early stages. As a result of this delay in diagnosis, impingement continued to occur leading to progressive chondral injuries in addition to labral pathology. Consequently, it is common to see combined cases of FAI with osteoarthritis (OA). Combined, these conditions are much more difficult to treat. The purpose of this review is to highlight available evidence to guide treatment of FAI with associated OA.

Etiology

FAI was first described by Ganz in 2003 [2, 3]. In this condition, abnormal contact occurs between the proximal femur and the acetabular rim during terminal motion of the hip. This results in early chondral damage and labral lesions. FAI can be subclassified into two types: cam type and pincer type [2–4]. Patients can also present with mixed pathology.

Cam impingement results from a femoral sided pathology. Cam lesions are more common in young active men [3, 4]. Cam lesions are described as a prominence, normally on the anterolateral head neck junction, which are associated with reduced femoral head-neck offset [3]. Radiographic assessment of these lesions is best done on Dunn lateral views of the hip (Fig. 1). On this view, the magnitude of this lesion can be quantified using a measurement known as the alpha angle. Greater than 42° indicates asphericity suggestive of

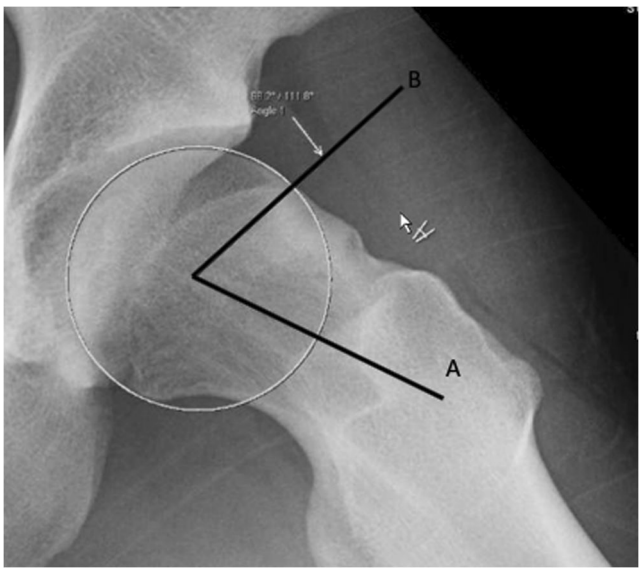

Fig. 1. Cam lesions can be quantified using the alpha angle. The alpha angle is the angle between a line drawn from the center of the femoral neck to the center of the femoral head (A) and a second line from the center of the femoral head to the point where the femoral head loses sphericity (B). Greater than 42° indicates asphericity and cam pathology.

cam pathology [4]. These lesions can be idiopathic or caused by conditions that reduce the head neck offset such as coxa vara, femoral neck fracture malunions, and childhood conditions including Legg-Calve-Perthes and slipped capital femoral epiphysis [4, 5]. This deformity leads to abnormal contact between the femoral head and the acetabular rim which results in excessive shear forces. This abnormal collision results in labral tears at the chondrolabral junction, while also causing outside-in abrasions, or delamination, of the acetabular cartilage [3]. Cam lesions are commonly bilateral [6]. In addition to the delamination of the anterosuperior acetabulum where the cam deformity enters the acetabulum, there can often be resultant joint subluxation secondary to the impingement, causing additional cartilage injuries to the posterior aspect of the joint (also referred to as contre-coup lesions).

Pincer impingement results from over coverage of the acetabular rim. These lesions are more common in middle-aged active women [4]. This can be idiopathic in nature or related to acetabular retroversion and/or coxa profunda (Fig. 2). Radiographically, retroversion can be noted on plain films of the pelvis. The lateral center edge angle (LCEA) can be used to quantify over coverage. LCEA greater than 40° indicates pincer pathology [7]. This over coverage results in abnormal contact between the acetabulum and a normal femoral head-neck junction. This tends to cause a crush-pattern of injury to the labrum, resulting in a complex labral tear. Continued contact results in degeneration of the labrum with intrasubstance tearing or ganglion formation. Damage to the labrum can also lead to ossification of the rim leading to additional deepening of the acetabulum and worsening of the pincer impingement. Pincer impingement is often anterior and continued impingement can cause similar levering within the hip resulting in the same "countre-coup" type injury to the posteroinferior acetabulum [3].

Of the two primary impingement patterns, several studies have identified that cam-type FAI leads to a greater degree of chondral damage [8, 9]. Natural progression studies have identified that cam-deformities with symptomatic impingement may contribute to the development of osteoarthritis [10–12].

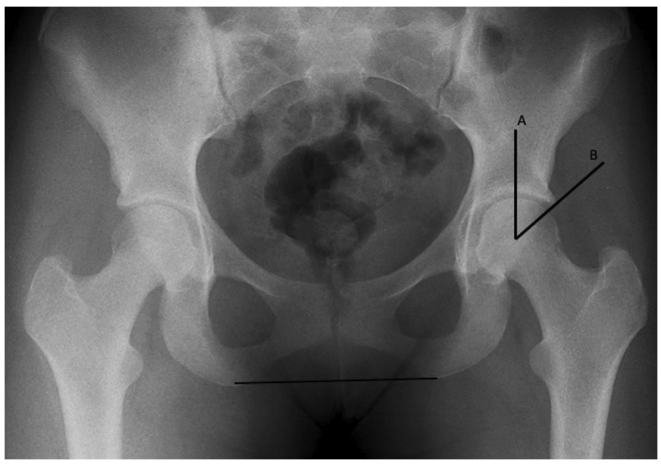

Fig. 2. Pincer lesions can be quantified using the LCEA. The LCEA is the angle between a line drawn vertically from the center of the femoral head (A) and the lateral edge of the acetabulum. Greater than 40° indicates pincer pathology.

Non-operative management

Initial non-operative measures can be attempted to improve symptoms and quality of life. Modification of activities, non-steroidal anti-inflammatories, intra-articular hip injections, and physiotherapy (PT) can be offered to patients with symptomatic FAI [13]. Patients with FAI have reduced range of motion and strength compared with patients without FAI [14]. PT aims to address these deficits and improve pain and function, by targeting core musculature and hip abductors. Studies have indicated that PT can improve patient reported outcomes and quality of life. A recent study by Griffin and colleagues (2018) examined the effects of best conservative measures versus surgery for FAI [15••]. Patients were randomized to either hip arthroscopy or personalized PT. While the arthroscopy group demonstrated greater improvement in outcomes measures, the non-operative group treated with PT demonstrated significant improvements in iHOT-33 score from 35.6 to 49.7 at 12 months after randomization, surpassing the threshold for a minimum clinically important difference. Mansell and colleagues also examined the roll of PT in the treatment of FAI [16]. Eighty patients with FAI were randomized to either a supervised PT program or surgical intervention. The PT consisted of a 12-week program with sessions twice weekly. Statistically significant improvements in patient reported outcomes were seen in both groups, with no difference between groups at 2 years of follow-up. Given the structural nature of this condition, frequently with impinging osseous lesions, non-operative management often fails and necessitates surgical intervention.

Surgical management

Multiple surgical interventions have been described in the treatment of FAI. The overall goals of the procedures are to repair chondral injuries including labral tears, reshape the femoral head and/or acetabulum and improve the clearance for hip motion and alleviation of the femoral abutment against the acetabular rim [3, 4]. Historically, FAI was treated with an open surgical procedure. Access to the hip was obtained through a surgical dislocation as described by Ganz [17]. This technique allowed for preservation of the blood supply to the femoral head while also gaining circumferential access to the hip. Once access is obtained, femoral and/or acetabular osteoplasty are completed to restore the "normal" contour of the femoral head-neck junction. The goal of the femoral osteoplasty is to remove any non-spherical portion of the femoral head and improve hip clearance to prevent further impingement. The goal of the acetabular osteoplasty is to remove the additional bone causing over-coverage and osseous impingement within a functional range of movement. Once the bony anatomy has been improved, any labral pathology can be addressed by debridement or repair [3].

Advances in technology and surgical techniques have made it possible for FAI to now be treated with arthroscopic osteoplasty. Multiple studies have shown comparable results between arthroscopic and open treatment of FAI [18–22]. In 2014, Botser and colleagues reviewed open surgical dislocation versus arthroscopic management of FAI [22]. Patient-reported outcomes,

including the modified Harris Hip Score and Non-Arthritic Hip Score, were improved in both groups at final follow-up (mean 14.7 months). Patients in the arthroscopic group had earlier improvements at 3 and 6 months, indicating faster recovery in this group. There was no statistically significant difference between the groups at final follow-up. A high-quality systematic review of 16 studies demonstrated similar positive results [20•]. The review used conversion to total hip arthroplasty (THA) as well as health-related quality of life measures as outcomes. Survival to THA was 90.5% for arthroscopic procedures (mean follow-up 4.2 years) and 93% for open procedures (mean follow-up 4.8 years) ($P = 0.06$). Health-related quality of life was higher in the arthroscopic group. Overall, hip arthroscopy is less invasive and has a shorter recovery time than does open surgery [20•, 21].

As a result, hip arthroscopy has become the gold standard for surgical management of FAI [23].

Surgical outcomes

The outcomes of hip arthroscopy for FAI may be attributed to multiple factors, including patient psychosocial well-being, patient demographics, disease pattern/condition, as well as operative technique [24–28].

Negative prognostic factors related to psychosocial factors include preoperative narcotic use and mental health disorders. Mental health disorders, such as depression, have not only been related to worse symptoms in patients with FAI preoperatively but can also lead to poorer outcomes following hip arthroscopy [24, 29]. Mental health disorders are such an important prognostic factor that preoperative symptoms in FAI patients have been reported to be related to mental health scores more than the severity of labral tear or magnitude of bony deformity [24]. A Multi-Centered Arthroscopic Study of the Hip (MASH) reported that those with symptoms of depression had lower self-reported function, higher pain levels, and less satisfaction on initial assessment and at 2-year follow-up than those without symptoms of depression [29]. Narcotic use in the 2 weeks preceding arthroscopic surgery for FAI has also been found to be a strong predictor of negative outcomes and higher opioid use post-operatively [30]. In light of these findings, surgeons who perform hip arthroscopy should exhibit caution in overprescribing opioids to patients pre- and post-surgery, titrating the prescriptions to individual patient needs. Care should also be taken to examine psychosocial health, specifically screening for symptoms of depression, narcotic use, and recognizing the potential negative impact that they can have on post-operative outcomes.

There is a logical expectation that a delay in treatment of FAI can result in progressive chondrolabral injury and long-term joint degeneration. This has been associated with inferior surgical outcomes for joint preservation surgery, leading to advocation for earlier surgeries. A prospective single surgeon series of 525 patients [31] and a recent series of 1049 patients [32] undergoing arthroscopy for FAI showed significantly better outcomes for patients who underwent surgery within 6 months of symptom onset compared with those who waited longer. Patients who had symptoms for over 3 years at the time of surgery had significantly poorer results as well as a higher rate of revision surgery [31]. A high-quality systematic review that looked at 13 articles with data on 2051 hip arthroscopies has also reported this positive correlation [33]. Although earlier

surgery can be beneficial for a selected group of patients, it is important to note that there can be confounding psychosocial and medical factors that lead to a delay in surgery and hence poorer outcomes in patients who have undergone surgery after prolonged duration in their symptoms. In contrast, patients with a shorter duration of symptoms may have met operative indications earlier due to a perceived better candidacy for surgery. In addition to these confounding factors and selection bias, it is also unknown whether the differences in outcome persist in the long term or if they normalize over time. Although these studies imply that delay in treatment may adversely affect outcome, caution should be taken not to abandon conservative measures prematurely and over treat FAI surgically.

Negative prognostic factors related to patients' demographics that have been reported include high body mass index (BMI) and advanced age. In a cohort study of 409 hips, Saltzman et al. reported lower satisfaction scores and poorer improvement in VAS pain scores for obese patients as compared to normal BMI patients at 2-years post-operatively [25]. Cvetanovich et al. [34] also alluded to this finding and reported that a lower BMI (< 24.5 kg/m^2) was associated with more successful arthroscopic procedures for FAI [34]. A systematic review of the literature in 2015 identified 3 studies that compared the outcome of hip arthroscopy between different BMI groups. Due to possible overlap in populations of two of the studies cited, a meta-analysis was not possible. The studies identified all reported poorer patient subjective outcomes scores, higher conversion to THA or resurfacing hip surgery, and higher rate of revision arthroscopy in the obese patient groups [35].

Although advanced age has been shown as an independent predictor of worse outcomes [36–38], we have noticed an increasing incidence of this procedure being performed in the older population. A large cross-sectional analysis of 8227 hip arthroscopies reported the highest incidence of hip arthroscopy being performed in patients aged 40 to 49 years old, with a twofold increase in the number of hip arthroscopies performed in patients older than 60 years old from 2007 to 2011 [26]. A major consideration in the older adult population is the presence of OA or progression of the OA after hip arthroscopy. With the incidence of OA being higher in the older population, it is not surprising that results of hip arthroscopy for FAI in patients older than 40 years old tend to be less consistent [37, 39•]. The 2-year rate of conversion to THA after hip arthroscopy has been found to increase significantly in patients aged 40 to 49 years (16%) compared with patients younger than 40 years (3%) and peaks at 35% in patients aged 60 to 69 years [39•]. A high-quality systematic review of literature in 2016 examined the role of hip arthroscopy in older adults (age > 40). Eight level 4 studies with a minimum of 1-year follow-up were included. Multiple patient-reported outcomes were used inconsistently within the studies, however reoperation rate, complications and conversion to THA was reported in seven of the eight studies in the review. The review revealed that the overall reoperation rate was 20.8% [37]. Despite having a higher reoperation rate, there are no reported increased complication rates [37]. Conversion to THA was similar to previously reported rates at 18.5% [37]. Despite these results, age is not an absolute contraindications to performing this procedure in older patients with FAI. However, this procedure should only be considered as a suitable option for labral tears and FAI in older patients who do not have significant underlying degenerative changes.

Although pre-existing OA is more commonly seen with older patients, OA has also been shown to be a risk factor for failure of hip arthroscopy independent of age [27, 38]. Despite that, reasonable outcomes can be obtained in arthroscopic hip surgery for FAI with preserved joint space or early OA [27, 40•, 41, 42]. In 2018, Byrd et al. [41] reported significant improvement in outcome scores for all patients group of Tönnis grades 0 to 3. The modified Harris Hip Score (mHHS) improvement for Tönnis grade 0 was 20.6 points, for Tönnis grade 1 was 22.2 points, for Tönnis grade 2 was 14.9 points, and for Tönnis grade 3 was 18.8 points. An improvement of greater than 8 points has been shown to be clinically significant. There was no difference in patient reported outcomes between Tönnis grade 0 and 1 versus grade 2 at 2 years postoperatively [41]. A longer follow-up study (5 years) performed by Domb et al. demonstrated improvement in patient reported outcome measures (PROM) and VAS for both Tönnis grade 1 and 2 patients [42]. Similarly, Chandrasekeran et al. demonstrated an improvement in mHHS of 15.5 for Tönnis grade-0, 23.8 for grade-1, and 18.5 for grade-2 groups [40•]. It can be argued that hip arthroscopy for FAI in OA has reasonable outcomes and can possibly delay the need for THA [43]. However, this comes at the expense of higher costs [43].

While there is still a role for hip arthroscopy in lower grade of OA, higher grades of OA or joint space of less than 2 mm are indisputably poor prognostic factors for hip arthroscopy. Patients with higher grade OA reported poorer outcomes measures [33, 37, 40•, 44, 45], and there is a higher conversion rate to THA, ranging from 9 to 50% [33, 36, 37, 40•, 44, 45]. Philippon et al. [46••] alluded to this correlation as well, showing that patients aged 50 years with less than 2 mm of joint space were 9.9 times more likely to require arthroplasty.

It is not uncommon to see only subtle or no radiographical changes of OA in a plain radiograph. Magnetic resonance imaging (MRI) can be useful in this regard. The presence of a subchondral edema with an acetabular cyst on MRI is indicative of a full-thickness cartilage lesion at the time of arthroscopy [47••]. Krych et al. have shown in their cohort study of 104 patients that patients with such MRI findings have inferior outcomes for arthroscopic treatment of FAI.

Conclusion

FAI has emerged as a frequent cause of hip pain and can lead to degenerative changes in the hip. FAI without degenerative changes is effectively treated with hip arthroscopy, osteoplasty and labral repair. The role for hip arthroscopy in patients who have FAI with degenerative changes has proven to be quite limited. This procedure should only be performed in patients with mild OA with few or no confounding negative prognostic factors as previously discussed in this study. Non-operative interventions such as activity modification, NSAIDs, PT, and intraarticular injections should be exhausted prior to any invasive surgical procedures. Surgery should include labral preservation where feasible.

Careful patient selection, stringent surgical indications, and selection criteria, as well as consideration for overall cost-benefit in older patients and patients with pre-existing OA are imperative. Prior to considering surgery, it is also important to discuss higher rate of failure and rates of conversion to THA in

order to set appropriate expectations with this group of patients. Future research should evaluate whether definitive THA is more cost-effective than joint preserving surgeries in the presence of FAI with mild OA.

Compliance with Ethical Standards

Conflict of Interest
Michelle E. Arakgi declares that she has no conflict of interest. Fucai Han declares that he has no conflict of interest. Ryan Degen declares that he has no conflict of interest

Human and Animal Rights and Informed Consent
This article does not contain any studies with human or animal subjects performed by any of the authors.

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- •• Of major importance

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