

REVIEW ARTICLE

Can hip arthroscopy in the presence of arthritis delay the need for hip arthroplasty?

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ABSTRACT

Hip arthroscopy for joint preservation surgery has grown immensely over the last two decades. There is now an increasing trend to try and expand the role of hip arthroscopy to include patients of an older age or perhaps even with signs of arthritis, instead of the established patient group of young adults with mechanical symptoms or serious athletes. But how much of this growth is really justified? Once arthritis is apparent, the arthroscopic procedures needed to try and limit progression of the disease are likely to be different to those needed in young adult non-arthritic hips. Similarly, the expectation of results following an arthroscopic procedure in an older adult with arthritis must also be different. With an almost 5-fold increase in conversion rate from arthroscopy to arthroplasty in the over 50s population, arthroscopy in arthritis is a different procedure, with a different outcome, to arthroscopy in young adults with no evidence of osteoarthritis. This article takes a closer inspection at outcomes following hip arthroscopy in the older population particularly in those with evidence of early arthritis. This paper does not attempt to make recommendations in other diagnoses such as inflammatory arthritis or other secondary arthritides. It must be considered that hip arthroscopy is not a benign intervention: as well as the surgical risks, the lengthy rehabilitation period should be factored into the equation. Although the nature of surgeons is to find new techniques and push boundaries, we highlight the need for caution in undertaking arthroscopic intervention when arthritis is already apparent at presentation.

INTRODUCTION

For any condition diagnosed early in medicine, the goal of treatment is either to cure the disease or to prevent further damage. The same is true for disease of the hip joint. If caught early, the goal of surgery is joint preservation. Joint preservation surgery is largely built on the principles of improving joint biomechanics and then addressing the resultant soft tissue damage. A good example of this is in patients with femoroacetabular impingement (FAI). Joint preservation surgery is aimed at correcting the head/neck ratio in a cam type of impingement and or acetabular overcoverage in a pincer or mixed type of impingement thereby correcting the mechanics of the joint. It should then address the resultant soft tissue

damage by repairing or debriding the acetabular labrum and/or performing a microfracture or chondroplasty in the area of damaged articular cartilage. In theory, by correcting these abnormalities, we may be able to at least delay the need for hip arthroplasty if not totally circumvent it.

But what if degenerative changes in the hip have already manifested? Is it too late to consider arthroscopic intervention? Do the goalposts of surgery change? What should now be considered as success? When should arthroscopy not be undertaken? What is the role of arthroscopy in the presence of arthritis? How much arthritis is too much? There are many questions to be answered. In this short review, we aim to answer these questions and look at the

possible role for hip arthroscopy in patients with evidence of early arthritis.

FAI AND THE ROLE OF HIP ARTHROSCOPY

The theory of FAI as a possible cause for ‘idiopathic’ arthritis of the hip joint was one first put forward by Professor Ganz and his colleagues over a decade ago [1]. The theory showed that a morphological abnormality on either the femoral side (cam) or acetabular side (pincer) could lead to abutment of the femoral head-neck junction against the acetabular rim. This repeated mechanical abutment could further lead to acetabular labral damage and progressive breakdown of the chondro-labral junction, thereby leading to chondral defects and the eventual onset of osteoarthritis (OA) [2, 3]. In fact similar deformities were noted earlier by Murray [4] and Harris [5], but the possible direct linkage to arthritis was not investigated.

This theory serves as a good mechanical model, except that there is a significant proportion of the asymptomatic population who have radiological features suggestive of FAI [6–8]. The diagnosis of FAI and the decision to treat patients with a morphological abnormality is therefore made very carefully based on the symptomatic patient’s complaints, a thorough clinical evaluation, and radiological evidence to support it.

At the same time as the description of FAI, hip arthroscopy has been expanding rapidly as a treatment modality particularly for young adults with intractable hip or groin pain. Recent studies have shown that in UK NHS hospitals alone an average of 77 hip arthroscopies are being performed every month [9]. This figure is extrapolated from an 8-year study performed a couple of years ago, and it is likely that this figure is much higher now. Until recently though, hip arthroscopy had been an intervention, which was considered only for the young adult (usually considered as under the age of 40) or the serious athlete (based on a semi-professional or professional career). Its role in the over 40s, let alone the over 50s, had not been established [10–12]. And its significance in allaying the progression of disease in those with features of arthritis is certainly a relatively new concept.

DOES FAI CONTRIBUTE TO THE DEVELOPMENT OF HIP OSTEOARTHRITIS (OA)?

This key question underpins our current practice in joint preservation surgery. It is essentially posing the question: were Ganz and his colleagues correct about their mechanical theory of development of OA? Over the last 15 years there has been an exponential growth in the arena of hip

preservation surgery (both open and arthroscopic) in young adults in an attempt to prevent degenerative changes and perhaps delay or abort the need for arthroplasty in these patients. The evidence to support this theory has been growing steadily with a recent systematic review looking at 35 studies published between 2003 and 2014 investigating the relationship between FAI and OA [13]. The authors’ looked at all the human studies with more than five patients published since 2000. They found 35 eligible studies, only 3 of which had a power calculation performed. This in itself shows that although the number of procedures and even numbers of studies are increasing, there is still a lack of high-quality evidence in order to support or refute the mechanical theory. In this systematic review, the majority of studies used radiological criteria alone to make the diagnosis of FAI [13]. The authors’ concluded that there was a correlation found between FAI and OA, and an alpha angle of $>60^\circ$ was a predisposing factor to the development of significant OA which may then require a THR.

Leading on from this, Collins *et al.* aimed to answer a similar question: Was prophylactic surgery indicated for FAI? In their search, they did not find a single study that met their criteria to compare a cohort of asymptomatic patients with evidence of FAI treated with hip arthroscopy with a cohort treated non-operatively [14]. The premise of their study seemed to be the evidence that 10–74% of the asymptomatic population had radiological signs of FAI [15–17] and that the literature was not clear as to whether asymptomatic individuals with radiological evidence of FAI are at risk of premature OA. Finding patients having undergone prophylactic arthroscopy may have been their limiting factor, but from this they do show that prophylactic surgery is unlikely to be indicated and may result in 80% of patients with asymptomatic FAI undergoing an unnecessary procedure [14]. And as stated previously, it is not a procedure without risks. Malviya *et al.* aimed to identify complications of hip arthroscopy and showed that there is a 30-day re-admission rate of 0.5% [9].

It should also be mentioned that FAI is considered to be either a cam-type deformity (asphericity of the femoral head), or a pincer-type deformity (overcoverage of the femoral head) or, commonly, a combination of the two. A nationwide prospective cohort study has shown, however, that by using centre-edge angle measurements to quantify dysplasia or overcoverage, pincer deformity is protective of OA [18]. This study showed that there was a correlation between pincer-type deformity and joint space narrowing, but that with long term follow up, this narrowing was in fact not progressive.

WHAT ARE THE PREDICTORS FOR PROGRESSION TO OA IN FAI?

Bardakos and Villar performed a longitudinal radiological study with a 10-year follow-up and looked specifically at which radiological parameters in patients with FAI suggested a worse prognosis [19]. They looked at 43 hips, in which no surgical intervention was undertaken, and took various radiological measurements. They found a progression to OA in 65% of these patients. Radiological features reaching a level of significance were the presence of posterior wall sign and/or the reduction of the modified anatomical medial proximal femoral angle (to 81°) as seen on AP pelvis radiographs. In fact, this latter morphological abnormality was shown to have a 20 times higher risk of progression to OA per degree of reduction in the medial proximal femoral angle from normal.

This finding was supported by Ng *et al.* [20] who looked at patients with bilateral cam-type deformity and unilateral symptoms. They used CT to measure a range of angles and found that the femoral neck-shaft angle and the medial proximal femoral angle were the only significant parameters that distinguished the symptomatic from the unaffected side.

The Bardakos and Villar study looked at a subset of patients aged under 55 years. A recent study looking at the overall rate of complications following hip arthroscopy nationally [9] showed that patients over the age of 50 had a 4.65 times greater risk of requiring a hip arthroplasty following hip arthroscopy. They looked at survivorship of hip arthroscopies with THR as an end-point. After stratifying for age, the lowest survivorship was found to be in the 50–75 year age group, with a 38% risk of requiring a THR within 8 years of hip preservation surgery. This is corroborated by work by Philippon *et al.* [21] who looked at 153 patients with a mean age of 57 and investigated their outcomes. The survivorship was 80% at 3 years. In their study, they concluded patients with a joint space of 2 mm or less on plain film radiographs were 9.9 times more likely to require a THR. The same group looked at Tönnis grade, Kellgren and Lawrence scores and joint space narrowing in a subgroup of 96 patients who were all referred for hip arthroscopy, and found that patients with 2 mm or less joint space were 12 times more likely to undergo THR than those with a wider joint space [22]. This was an accurate prediction in 81% of their patient cohort. The joint space was measured using digital calipers at the lateral edge of the sourcil, middle of the sourcil, and in line with the fovea.

So along with morphological features, which affect the biomechanics of the hip (i.e. medial proximal femoral angle) and known signs of arthritis on radiographs, age is

certainly also a predictor of rapid progression to arthritis requiring a joint replacement following a hip arthroscopy. These measurements have been shown to have good inter-observer reliability with radiologists assessing plain films [17]; however, the reliability of using plain film radiographs was brought into question by Barton *et al.* [23], who felt that measurements on plain films were not adequately validated to 3D MRI. A pilot study using a single cadaveric specimen, looked at X-ray images taken at seven different degrees of hip rotation and found that each additional degree of internal rotation produced a reciprocal reduction in the medial proximal femoral angle by 0.36° and the α angle by 0.18° [24]. This suggests that care should be exercised while designing protocols for obtaining radiographs in each department to ensure rotation of the hip is kept as constant as possible.

ARTHROSCOPY IN THE OVER 50s

Until recently arthroscopy had been reserved for the younger adult. The main goal has been to provide pain relief, maintain a pre-morbid level of activity and curb the progression of arthritis in the longer term. But what about the older adult with hip or groin pain affecting his/her daily life? In some studies, the outcome measure in the older age group (over the age of 50) has been conversion to total hip replacement. Just as we know 'a hip with cam impingement is not always destined for end-stage arthritic degeneration' [19], not all middle-aged patients presenting with hip pain have established OA.

Studies have shown that acetabular labral tears, which we now know are a direct result of the cam-type deformity, are the most common pathology in patients undergoing hip arthroscopy [25, 26], and the likely cause of mechanical symptoms. Therefore, if a patient over the age of 50 years with little or no evidence of arthritis on their plain film radiographs, presents with mechanical features suggestive of a labral tear, one might presume it should be reasonable to offer them a hip arthroscopy. However, a prospective study looking at 153 patients over the age of 50 undergoing hip arthroscopy for FAI, showed that 20% required a total hip replacement at a mean time of 1.6 years following arthroscopy [21]. In an age-matched study using under 30-year olds as a control, progression to THR was seen in 17.3% within the 2-year follow-up period [27]. Another study showed that in patients over the age of 50, even with no pre-operative radiological signs of arthritis, hip arthroscopy did not significantly improve their range of movement [28]. Interestingly, in this study 55% of the 20 patients had acetabular chondral lesions found at the time of arthroscopy. This shows that a sizeable proportion of the over 50 population with no radiological signs may

indeed have arthroscopic signs of early arthritis, which brings into question whether or not a surgeon can realistically separate the older patient from the older patient with early signs of arthritis. And if they can, is this purely academic?

A single-surgeon cohort of 176 patients who had arthroscopy for labral pathology, was followed up for a minimum of 2 years to assess the influence of age and arthritis on outcomes [29]. The finding was that the presence of Outerbridge [30] Grade IV changes at arthroscopy were predictive of a worse outcome compared with the non-arthritic cohorts. It was also shown that patients over the age of 40 had worse outcomes ($P < 0.0001$). This looked at age only, not patients with signs of arthritis, and still found poor outcomes. Age therefore plays a significant factor in the decision of whether or not to offer a patient hip arthroscopy.

HOW MUCH ARTHRITIS IS TOO MUCH?

A recent systematic review undertaken by Domb *et al.* [31] looked at 13 articles with data on 2051 hips. The outcome measure used was the need for a joint replacement. They recognized the differences in measurement and grading of arthritis between the studies as a potential limitation, however found seven factors that negatively correlated with post-arthroscopy outcomes. These included pre-operative evidence of OA (Tönnis Grade ≥ 2 or joint space < 2 mm), increasing age, chondral damage and the time of arthroscopy, presence of FAI, long duration of symptoms, the poor pre-operative non-arthritic hip score, and secondary gain. In the non-arthritic cohort, 8.3% had a conversion to THR at a mean of 26.1 months post-arthroscopy. In the arthritic group, out of 1195 hips, 23% proceeded to a hip replacement at a mean time of 17.1 months ($P < 0.001$).

In another study, the mean time of progression to THR was between 7 months and 4.8 years in those patients with recognized arthritis [32]. This systematic review used 22 studies and looked at progression to arthroplasty as an outcome. They also show that femoral chondral disease as seen at the time of arthroscopy was associated with a 58 times greater risk of progression to THR than those without; compared with a 20 times greater risk in those with acetabular chondral damage. In fact, in this study, for patients over the age of 40, who had an arthroscopy and had an Outerbridge Grade of III or IV in both the femoral head and acetabulum, the probability of needing a THR within 10 years was 99%.

Again, Clohisy's team showed similar findings when they reviewed the failures (as denoted by revision arthroscopy or conversion to THR) of 1724 consecutive hip surgeries. They found that either underlying OA or residual/

unaddressed structural abnormalities were associated with failure of hip arthroscopy. In another series, 16% of patients with severe OA (as defined by Outerbridge Grade III/IV on the acetabular and femoral aspect) proceeded to THR within the 7-year time-frame of the study [33]. They found that the limiting factor in treatment outcome was the amount of cartilage damage that had occurred prior to surgery.

Safran and Epstein, in a small case series, showed that there may be a role of arthroscopy in protrusio acetabuli, but admitted that it could only partially tackle the problem [34]. However, McCarthy and Lee strongly suggested that protrusio was a contra-indication to hip arthroscopy as there was limited potential for joint distraction [35].

When looking at a series of patients undergoing arthroscopy with OA evident as Tönnis Grade 2 or 3, 44% required arthroplasty at a mean of 18 months [36]. In fact, although this study aimed to promote arthroscopy in advanced arthritis, 4% of their patient set went on to have a THR within 6 months of arthroscopy, and 12% within 12 months. This clearly shows that hip arthroscopy, which in itself has a significant recovery and rehabilitation period, is not the treatment option of choice when arthritis is evident.

The question of how much arthritis is too much is a complex one to fully answer, but many factors must be taken into consideration. Firstly, those studies using Outerbridge scores have not correlated their findings with pre-operative radiographic signs. Tönnis grade of 2 or more has been associated with a lack of success of arthroscopic hip preservation surgery [37, 38], and more recently studies have shown that joint space narrowing is a better predictor of progression to arthritis [22]. This measurement should be taken alongside the overall deformity profile however, as was discussed earlier, the pincer-type deformity without cam presence may in fact be protective of OA, with narrow joint space not progressing beyond a certain threshold [18, 39]. There also seems to be agreement that reduction in the medial proximal femoral angle is a reliable marker of progression to arthritis, with a reduction of 1° increasing the odds ratio of progression by 20.6 times [19].

WHAT ARE THE GOALPOSTS IN THE MILDLY ARTHRITIC HIP?

The goal in young adult hip preservation surgery is to provide pain relief, maintain the level of pre-morbid activity and prevent progression to OA requiring a joint replacement. The goals are surely different in the middle-aged adult with signs of early arthritis. Although Lubowitz *et al.* state in their editorial, that 'even buying 5 or 10 years may

be a win' [40], if 23% required arthroplasty in under 18 months post-arthroscopy, the number of patients getting that '5 or 10 years' is relatively small. It stands to reason that if a patient is in their 50s and leads a moderately active lifestyle, hip arthroscopy may provide the relief they require to continue those activities for a few years longer [35], but they must understand the significant risk of their decision.

All the recent work into outcomes of hip arthroscopy has shown us when to use caution. An increased alpha angle of greater than 60° in the presence of FAI has a correlation with OA [13]. Patients with signs on AP radiographs of morphological abnormalities, particularly the presence of posterior wall sign and reduced medial proximal femoral angle, also have increased odds of arthritic progression [19]. And in the 50–75 age group, there is a 38% risk of conversion to THR within 8 years [9]. These factors serve to help with deciding surgical treatment options and curb patient expectations. There are studies that support the use of arthroscopy even in the face of OA, but even some of these show a high reoperation rate and progression to THR [25, 27, 33, 36].

The basis of decision-making should be formed upon a discussion with the patient regarding their expectation of hip arthroscopy and their understanding of the lengthy rehabilitation process that may ensue following arthroscopic intervention. They should be consented for the risk of conversion to total hip replacement, and those between the ages of 50 and 75 should understand that this risk may be as high as 38% [9] within 8 years. Discussion must also emphasize the possible finding of arthritis at the time of procedure even if there are minimal radiographic signs preoperatively. The goals of treatment do change in the over 40s and in those with recognizable OA. With many studies showing a high conversion rate within a short period following arthroscopy, perhaps in the face of moderate arthritis, arthroscopy cannot delay the need for hip arthroplasty.

CONFLICT OF INTEREST STATEMENT

None declared.

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