



## Hip arthroscopy current advances

Andrea VOLPIN, Carla MADEN, Carlo BIZ, Fahad HOSSAIN, Luigi ZAGRA, Sujith KONAN

*From Dr Gray's Hospital, Elgin, NHS Grampian, United Kingdom*

This review summarizes current concepts and advances in the arthroscopic surgery of the hip joint. The number of hip arthroscopies performed in the UK is rising exponentially, and surgeons are expanding the applications in both intra-articular and extra-articular surgery. This procedure has showed satisfactory results in the treatment of labral pathology in young adults and recently its indications are extended to older patients. Current literature suggests good short-term results from arthroscopy in the management of labral tears, capsular closure, and assisting with the repair of hip fractures. Following the better understanding of the role and function of hip capsule, variable treatment options have been reported with satisfactory results about its repair. Finally, new biological and surgical approaches have also been presented for the treatment of chondral acetabular lesions. The use of biological therapies in conjunction with hip arthroscopy are showing promising results in the short to medium term. However, as the majority of studies focus on early outcomes, further work is needed to be able to appreciate the wide potential of hip arthroscopy in the diagnosis and management of pathologies around the hip joint.

**Keywords :** Hip ; arthroscopy ; advances ; labrum ; capsule.

### INTRODUCTION

Hip arthroscopic surgery is used for the treatment of intra-articular and extra-articular pathologies around the hip joint.

The incidence of arthroscopic hip procedures performed is increasing worldwide. In USA between 2004 and 2009 there has been an increase of incidence of hip arthroscopy by 365% (35) and a further increase of 250% between 2007 and 2011 (46).

In England the number of hip arthroscopies has increased by 727% between 2002 and 2013 and it is forecast to increase by 1388% in 2023 (39).

The therapeutic indications for hip arthroscopic surgery are several and include : CAM resection in femoro-acetabular impingement (49), repair or resection of labral tears (13), washout of septic hip (11) release of snapping iliopsoas tendon (22), release of snapping iliotibial band (58), treatment of hip

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- Andrea Volpin<sup>1</sup>,
  - Carla Maiden<sup>2</sup>,
  - Carlo Biz<sup>3</sup>,
  - Fahad Hossain<sup>4</sup>,
  - Luigi Zagra<sup>5</sup>,
  - Sujith Konan<sup>6</sup>

<sup>1</sup>*Dr Gray's Hospital, Elgin, NHS Grampian, United Kingdom.*

<sup>2</sup>*UCL Medical School, University College London, London, United Kingdom.*

<sup>3</sup>*Orthopaedic Clinic, Department of Surgery, Oncology and Gastroenterology DiSCOG, University of Padua, Italy.*

<sup>4</sup>*Walsall Hospitals NHS Trust, United Kingdom.*

<sup>5</sup>*Istituto Ortopedico Galeazzi IRCCS, Milan, Italy.*

<sup>6</sup>*Trauma and Orthopaedics Department, University College London Hospitals, London, United Kingdom.*

Correspondence : Andrea Volpin, Dr Gray's Hospital, Elgin, NHS Grampian, United Kingdom.

Email : volpinandrea@hotmail.com

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synovial chondromatosis (14), removal of loose or foreign bodies (38), repair of gluteus medius tendon tear (25), arthroscopic reduction and internal fixation of fracture of femur head (26), repair of ligamentum teres tear (1), management of chondral lesions (9), removal of loose bodies, and management of osteoarthritis.

The recent strides in hip arthroscopy include more focus on increasing range of movement and joint survival following extra and intra-articular operations. However, there is a paucity of long-term follow-ups and outcomes. The current evidence supports an improvement in functional outcome scores in the short term in the arthroscopic management of labral tears (17,20), osteoplasty (8) and microfracture (33).

This review article aims to summarise the evidence for the new advances in hip arthroscopic surgery with emphasis on the treatment options for labral tears and capsular repair; the biological and surgical therapies for cartilage lesions in the hip joint; and the indications and outcomes in adults over 40 years old.

### **Repair & reconstruction of labrum tear**

Over the past decade the treatment of the labral pathology has progressed from labral debridement (17) to labral repair (19) and reconstruction [50]. While labral tears are often missed by conventional imaging methods, arthroscopy provides an effective way to visualise the joint.

The integrity of the acetabular labrum is essential for the normal biomechanics of the hip joint. Several different labral stitch configurations have been described, with the most common being a mattress stitch passed through the labrum in its widest part with a simple loop surrounding it (2,18).

A recent study by Hapa et al. (18) analysed the strength of the various suture techniques and the impact of the suture passer size on a bovine hip labrum model, not incorporating suture anchor fixation into the acetabular rim. They concluded that vertical and oblique stitches are stronger compared to horizontal stitches, and that a 1.8 mm passing device showed a better loading performance than a 2.6 mm one.

Ye and Singh (57) described a double stranded single pass vertical mattress suture technique leaving the free margin of the labrum intact and continuous without eversion.

In a cadaveric biomechanical study Philippon et al. (40) has demonstrated that labral repair with a combined technique of looped technique and pierced technique produced a repair with mean 102% pressurization that is relatively close to the natural intact labrum.

Recently, Suarez-Ahedo et al. (48) described a new technique for labrum repair with a knotless suture anchor and a looped suture configuration, although no long-term clinical outcomes were reported.

Evidence challenging these findings was published by Sawyer et al. (43) who showed that there were no statistical clinical (HOS-ADL score) difference between patients who underwent a labrum repair using looped, pierced or combined technique at a minimum follow-up of 2 years.

Another study by Jackson et al. (24) reviewing 110 patients, who underwent circumferential suture repair, with a follow-up period of 30 months, failed to find any difference in outcome scores based on the type of labral repair performed.

Since the first description in 2009 (28), labral reconstruction, that uses a graft to reconstruct the damaged labrum, has become a valid option in the treatment of the labrum pathology, in selected patients with an irreparable labral tear or insufficient labral tissue (51).

White et al. (50) described a modified technique using iliotibial band for allograft and a front-to-back fixation that has the advantage of eliminating any mismatch between the graft length and the labral defect creating a more appropriate graft.

In a recent study, White et al. (53) reported promising significant improvement in patient reported outcomes (MHHS, LEFS and VAS scores) in 131 hips with a minimum follow-up of 2 years, who underwent arthroscopic labrum reconstruction with allograft using their modified technique. They reported 18 (13.7%) failures (13 conversions to total hip arthroplasty & 5 revision hip arthroscopy) at mean follow-up of 28 months.

White et al. (32) showed that in patients undergoing revision arthroscopy following previous

labral resection or repairs, revision surgery with labral reconstruction has 2.6 times reduced failure rate compared to revision labral repair.

Chahla et al. (5) reported on the benefits of using a iliotibial band autograft for labrum reconstruction, in particular the proximity to the portals and the possibility of adjusting the graft's diameter during tubularization.

Zachary T. Sharfman et al. (44) described a new procedure for labral reconstruction using the indirect head of the rectus femoris tendon, that doesn't need tubularization and the complete sacrifice of the tendon. They argued that the surgeon could choose the width of the graft while preserving native blood supply after grafting.

Current evidence is not conclusive for which technique or type of graft is ideal necessary for treatment.

### Targeting the hip capsule at hip arthroscopy

Targeting the hip capsule during hip arthroscopy is an area of new interest (10,34). Capsulotomies ranging from aggressive ones to gain a better exposure to more limited t-shaped capsulotomies have been described (12).

The main options for capsular management after hip arthroscopy are : leaving the capsule open & unrepaired, partial closure, complete closure or capsular plication (37).

A systematic review including 82 studies and 4504 patients (37), demonstrated that the available data does not routinely support capsular closure as providing better functional outcome or as a protective factor against postoperative instability. The most commonly performed capsulotomies were interportal for addressing central compartment pathology and T-capsulotomies for per peripheral compartment pathology (37).

An interportal capsulotomy involves incising the capsule between the antero-lateral and the mid anterior portal and occasionally to the postero-lateral portal. In case additional exposure is needed for treating a cam deformity, a T capsulotomy ; with the vertical incision parallel to the femoral neck, can be performed (38).

Although to date there are no literature evidence from level 1 or 2 studies comparing outcomes in

patients, who underwent capsular closure to those without it, there is a growing trend among the hip arthroscopy surgeons to restore the native hip anatomy (38).

Nepple et Smith (37) identified that the main indications for capsule closure are : I) patients with underlying soft tissue laxity those hips distract easily intra-operatively, II) patients with subtle hip dysplasia, including borderline acetabular dysplasia (lateral centre edge angle 20 to 25 degrees or acetabular inclination 10 to 15 degrees) or increased femoral anteversion (>25 degrees), III) patients participating in activities requiring extreme hip range of motion and IV) patients with persistent pain after a previous unrepaired capsulotomy with no other underlying pathologies.

Harris (19) described two absolute contraindications to capsular repair : I) patients with a significant dysplasia (more than borderline or mild dysplasia : break in the Shenton line, femoral head extrusion index >25%, lateral centre edge angle less than 20°, anterior centre edge angle less than 20°, and Tonnis angle >15°) and II) patients with significant osteoarthritis, Tonnis grade 2 or 3 or in patients with less than 2 mm of joint space.

Wuerz et al. (54) evaluated the effect of capsulotomy size and subsequent repair on the biomechanical stability of hip joint in eight fresh-frozen cadavers. They demonstrated that wide capsulotomies increased the range of motion of the hip joint, hysteresis area and neutral zone compared to the ones recorded at time zero with capsule intact. After a complete capsular closure all these measures were effectively restored to intact states.

In particular, in a recent study Levy et al. (29) reported that 48 patients (94%) returned to running after hip arthroscopy for FAI, all of the cohort underwent capsular plication to the iliofemoral ligament and also the interportal capsulotomy was closed with 2-3 sutures

Wylie et al (55) reported that in a cohort of 33 patients, who were diagnosed with symptomatic instability after hip arthroscopic surgery, all who underwent to revision hip arthroscopic surgery for capsular repair had improved outcomes.

## Hip fracture

The application of arthroscopy in the removal of post-fracture intra-articular loose bodies has been successful in multiple case reports (47). Furthermore, arthroscopic surgery has been used to repair tears of the anterior labrum, which are often associated with fracture and dislocation of the hip (23).

The most recent advancements in the application of arthroscopy involve the direct reduction of fractures. The use of arthroscopy has the advantage of allowing the surgeon to simultaneously visualise the appearance of the articular surface and manage intra-articular lesions. Yang et al. described a case report of 2 female athletes who underwent successful arthroscopic fixation of acetabular fractures (56). A percutaneous screw was used to fix the anterior column, with the arthroscopy as an assisting tool.

## Hip arthroscopy in patients over 40 years of age

A recent analysis of demographic data (7) suggested that in the United States, the highest incidence (28%) of hip arthroscopy was in 40 to 49-year-olds and that patients older than 60-years-old saw a 200% increase in the procedure from 2007 to 2011.

The presence of osteoarthritis and obesity have been shown in many studies to be a poor prognostic factor in hip arthroscopy (7), and extended indications need a closer look.

In a recent review, of seventeen studies that included 9954 patients over the age of 40 years, Horner et al. (21) reported a significant improvement of standardized hip scores following hip arthroscopy surgery for labral pathology, femoral osteochondroplasty or for unspecified indications with a low rate of complications. In the studies that directly compared outcomes of patients 40 years or older with those under 40, there was a significantly higher rate of conversion to total hip replacement.

Another systematic review (16) analysing eight studies with 401 patients who underwent hip arthroscopy for femoroacetabular impingement or labral tears demonstrated a higher patient-reported outcome scores including an increasing trend for labral repair compared to isolated labral debridement.

The overall rate of conversion to total hip replacement was 18.5% at a mean of 17.5 months following the surgery. The major risk factor for failure in hip arthroscopy was noted as advanced osteoarthritis with severe chondral damage and low pre-operative outcome scores.

Moriya et al. (36) reviewed a series of 23 patients with a mean age of 59 years, who underwent hip arthroscopy for femoral-acetabular impingement, labral lesions or chondral lesions, showing a significant increase in the Japan Orthopedic Association hip score, especially in terms of pain relief at a mean follow-up of 28 months. However it was noted that there was a progression of arthritis in 34.8% of the patients and one of them was converted to a total hip replacement.

Similarly, Mardores et al. (32) found that hip arthroscopic for femoro-acetabular impingement in well-selected patients older than 60 years improved the baseline preoperative modified Harris Hip Scores mHHS and VAS scores at a mean follow-up of 4.4 years in the 87% cases. In this cohort twenty-three patients (28 hips) with a mean age of 63.4 years, with symptomatic femoro-acetabular impingement ; hip joint space greater than 2 mm and a grade I and II arthritis (Tonnis scale), was treated with acetabularplasty and osteoplasty. Platelet rich plasma was positioned on the head-neck junction in all the cases.

Finally Capogna et al. (3) reported that in forty-two patients aged 60 years or older who underwent hip arthroscopy, the preoperative modified Harris Hip Scores and non-arthritic Hip Scores increased significantly with surgery at 2 year follow-up. In this case series 7.1% of patients underwent conversion to total hip replacement and there were 2 arthroscopic revision surgeries for recurrence of symptoms.

## Biological and uurgical therapies for cartilage lesions in the hip joint

Imaging modalities continue to evolve, providing early diagnosis and evaluation of the chondral damages. In a recent study Linda et al. [30] demonstrated that non arthrographic 3-T MRI had a sensitivity of 94% and 85% in evaluating acetabular and femoral head articular cartilage pathologies

respectively. It also averts potential drawbacks or complications associated with magnetic resonance arthrography.

Different biological agents have been proposed by authors for treating chondral lesion and early osteoarthritis in the hip joint. Platelet-rich plasma (PRP) has gained popularity albeit with limited evidence for its efficacy in healing the intra-articular pathologies of the hip joint. In a recent review Kraeutler et al. (27) described PRP's beneficial effects, in cases of osteoarthritis as well as in high level athletes who present with acute hip inflammation due to intra-articular pathology such as FAI-induced labral tear or ligamentum teres (LT) strain.

Redmond et al. (42) conducted a prospective cohort study to compare outcomes of intraoperative PRP versus bupivacaine injection for patients undergoing hip arthroscopy for labral tears; they found that patients receiving intraoperative PRP injections had better pain scores and significantly lower modified Harris Hip Scores at 2 years post-operatively.

Another biological treatment for the intra-articular pathologies of the hip that has become popular is hyaluronic acid; Piccirilli et al. (41) conducted a review that showed that despite lack of general consensus about its use, it may be the best conservative therapy for mild osteoarthritis before surgical management due to its efficiency on pain relief without modifying the morphological structure of the pathological hip and natural history of the disease.

Similarly, stem cells or bone marrow aspirate concentration (BMAC) represent yet another promising and fascinating option, again with very limited case series reporting its use in treatment of hip pathologies. In a review article, Chahla et al. (4) reported that a current study has been conducted at their institution for the treatment of hip early osteoarthritis with injection of BMAC. They reported that due to the possible anti-inflammatory effect, patients responded during the first two weeks after the injection and no adverse effects have been found so far.

Mardones et al. (31) reported excellent outcomes in a cohort of twenty patients (29 hips), treated

with hip arthroscopy for femoral-acetabular impingement and focal chondral damages or mild osteoarthritis, who received intra-articular injections of bone marrow mesenchymal stem cells from 4 to 6 weeks post-operatively. No major complications or infection were found in this case series.

Regarding the surgical techniques for managing focal chondral lesions, autologous matrix-induced chondrogenesis has been used as a novel approach in which the microfracture is enhanced with a type I/II collagen matrix membrane.

Fontana (15) reported improved parameters in 201 patients that were treated with this single stage surgical procedure and with a mean follow-up of 5 years. Patients included in this study had a mean chondral lesion of 2.9+/- 0.8 cm<sup>2</sup> measured arthroscopically and the author did not find any significant complications following the procedure.

## CONCLUSION

The present review focuses on some of the current trends as well as novel therapies in arthroscopic surgery of the hip joint for labral treatment, capsule management, indications and outcomes in patients aged over 40 years and the biological therapies for cartilage lesions in the hip joint.

The clinical applications for hip arthroscopy have grown in response to new technological developments and the increasing experience of surgeons. It is clear that surgeons will continue to expand the indications for hip arthroscopy and as skills and technology develop, there will be more literature on the use of hip arthroscopy for expanding indications as well as outcomes. This technology is not without complications, however, which occur at a rate of 0.5-5% (11), the most common of which are palsies of the surrounding nerves, labral damage, chondral damage, and fluid extravasation. Rare complications include infection of the joint, osteonecrosis, and occasionally tears of the vagina or anus due to aggressive traction. Most of the currently available literature focuses on early outcomes and simple functional measures, making it less useful to counsel patients. However, in the coming years hip arthroscopy is well on the way to becoming an incredibly useful tool for the diagnosis



and management of both extra- and intra-articular conditions.

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