



■ INSTRUCTIONAL REVIEW: HIP

Extra-articular hip endoscopy

A REVIEW OF THE LITERATURE

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The aim of this review is to evaluate the current available literature evidencing on peri-articular hip endoscopy (the third compartment). A comprehensive approach has been set on reports dealing with endoscopic surgery for recalcitrant trochanteric bursitis, snapping hip (or coxa-saltans; external and internal), gluteus medius and minimus tears and endoscopy (or arthroscopy) after total hip arthroplasty. This information can be used to trigger further research, innovation and education in extra-articular hip endoscopy.

Keywords: Hip endoscopy, Peritrochanteric space, Third compartment, Gluteus tears, Snapping hip, Bursitis, Piriformis, Arthroscopy after arthroplasty

Introduction

During the last decade, novel endoscopic techniques for the treatment of extra-articular abnormalities of the hip have been increasingly reported. As more centres and surgeons adopt practices for peri-articular hip endoscopy, it is important to understand the proper indications, technical variations, limitations and outcome expectations of these procedures. As such, we have performed a thorough review of the literature with a specific focus on evidence-supported ethical and surgical guidelines related to clinical decision-making.

Burman¹ first reported in 1931 on an early arthroscopy of the hip. It was his impression that ‘it would be impossible to insert a needle between the femoral head and the acetabulum’ and that ‘visualisation was limited to the articular surface of the femoral head and the femoral neck’.¹ In the following decades, arthroscopy of the knee and shoulder flourished. However, hip arthroscopy seemed of no value to clinical practice at that time.

It was not until the late 80s and early 90s that Glick et al² and Byrd³ published their results using the lateral and supine approaches. Keene and Villar⁴ were among the first to publish detailed reports on *in vivo* arthroscopic hip anatomy. The introduction of ‘hip arthroscopy-specific’ instruments and hip distraction techniques further allowed other pioneering surgeons to move forward.^{5,6} At that time, several reports were published linking labral pathology to hip and groin pain and reports on therapeutic procedures soon followed.^{2,7,8} Ganz et al⁹ more

recently introduced the concept of femoro-acetabular impingement (FAI) as the major cause for early osteoarthritis (OA) of the hip, which resulted in an exponential growth of arthroscopic procedures of the hip. So far, however, hip arthroscopy had contained itself within the intra-articular space of the hip. The expansion of hip ‘endoscopy’ to an alternative extra-articular use, however, was only gradually introduced.

Peri-articular hip endoscopy started to appear in 2005 and this relatively new concept has not been studied as extensively as intra-articular hip arthroscopy.¹⁰⁻¹⁵ Recently, and with improved understanding of greater trochanteric pain syndrome (GTPS), external snapping iliotibial band and gluteus medius and minimus tears, peri-articular hip endoscopy has become an exciting new treatment tool for hip arthroscopy surgeons.¹⁶⁻¹⁹ In order to allow for comparison of the various concepts and their results, to understand failure mechanisms and thereby hopefully improve future developments, scientifically sound clinical studies are crucial. The aim of our review is to evaluate the current evidence and available literature on peri-articular hip endoscopy and to provide directions for further research, innovation and education in hip surgery.

Hip anatomy from an endoscopic perspective

The peri-articular anatomy can be defined as the area around the hip that is accessible by means of a hip scope and not necessarily requiring capsular breaching. The structures

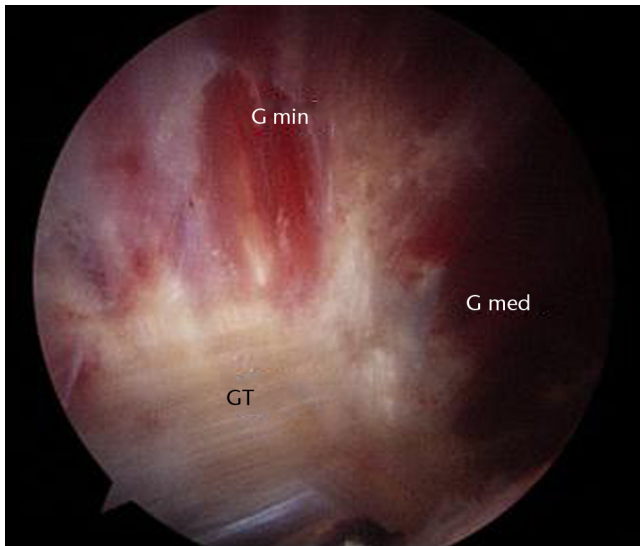


Fig. 1

Endoscopic anatomy of the peritrochanteric space (GT, greater trochanter; G med, gluteus medius; G min, gluteus minimus).

Table 1. Reported indications for peri-articular hip endoscopy

Category	Affection associated	Procedures described	Considerations
Greater trochanteric pain syndrome (GTPS)	Tendinous tears (gluteus medius/minimus)	Suture-anchor repair to greater trochanter ^{12,20}	Direct peritrochanteric ¹² vs transtendinous ²⁴
	Recalcitrant trochanteric bursitis	Bursectomy ²¹⁻²³	Along with iliotal band release ²⁵
	External snapping	Iliotibial band release ¹¹ (suture-anchor) ²²	Diamond shape resection ¹¹
Internal snapping	Iliopsoas snapping	Tendon release	Transcapsular or at lesser trochanter area, treat intra-articular pathology ²⁶
Piriformis syndrome (entrapment of sciatic nerve)	Fibrous bands, gluteal, piriformis, or hamstring muscles	Tendon release	Consider under local anaesthesia ²⁷
Post-arthroplasty	Iliopsoas friction, diagnostic miscellaneous	Diagnostic arthroscopy	Consider synovial samples for culture and anatomopathology

comprising the lateral or third compartment therefore comprise the greater trochanter, the iliotibial band, trochanteric bursa and the gluteus medius and minimus muscle (direct peritrochanteric structures), the sciatic nerve and short external-rotator muscles and its insertions (posterior structures) and the iliopsoas tendon (anteromedial structures) (Fig. 1).¹²

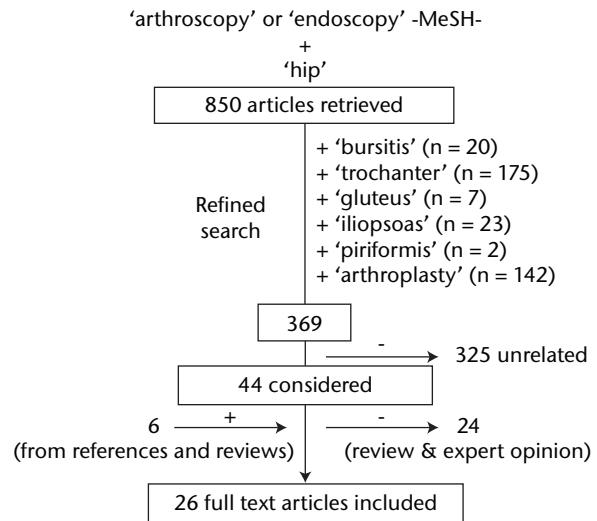


Fig. 2

Applied search strategy using PubMed database.

Indications

Indications for peri-articular hip endoscopy can be classified into four categories. Details are shown in Table 1.^{11,12,20-27} These categories consist of treatment for greater trochanteric pain syndrome (GTPS) and associated lesions, internal snapping of the iliopsoas tendon, piriformis syndrome and endoscopic surgery following hip arthroplasty. All categories will be addressed separately below.

Search strategy, selection criteria and results

A comprehensive MEDLINE database via Pubmed search was performed. All publications from inception to July 2012 (including online format only) were accounted. Advanced search was based on the MeSH terms “arthroscopy” or “endoscopy” in combination with “hip”. These results were then searched along with separated terms “gluteus”, “bursitis”, “trochanter”, “iliopsoas”, “piriformis”, and “arthroplasty”. Only manuscripts specifically dealing with endoscopic procedures and presenting clinical or surgical findings were considered for inclusion. We examined the references of all papers to identify any additional articles of interest. Articles were excluded from the review as per following exclusion criteria: review articles, duplicate series and expert opinions (Fig. 2).

1. Greater trochanter pain syndrome – endoscopy

Greater trochanteric pain syndrome (GTPS) is the term used to describe chronic pain overlying the lateral aspect of the hip. This relatively new term includes gluteus medius, and minimus pathology, greater trochanteric bursitis, and external snapping hip, all of which have been reported as responsive to endoscopic treatment.^{11,20,22,28} For technical

Table II. Literature reports on endoscopic bursectomy after recalcitrant trochanteric bursitis

Author/s	Study type	Level of evidence	Sample size	Mean follow-up (months)	Outcome	Complications
Fox ²¹	Retrospective case series	IV	27	60	Good	Two recurrences
Wiese et al ²²	Retrospective case series	IV	45	30	Good	Haematoma in four cases
Baker et al ²³	Prospective case series	IV	25	26 (SD 13)	Good	One seroma, one recurrence
Farr et al ²⁵	Case report	V	2	32 and 50	Good	None

Table III. Literature reports on endoscopic release for external-snapping hips

Authors	Study type	Level of evidence	Sample size	Follow-up (mths)	Outcome	Complications
Ilizaliturri et al ¹¹	Retrospective case series	IV	10	25	Good	One recurrence

details regarding surgical access to the peritrochanteric space or 'third compartment', we refer to the paper by Voos et al.¹² Alternatively, a direct lateral approach can be used either by blunt dissection of the fat overlaying the fascia either by use of an endoscopic dissection balloon. This particular technique, developed by Audenaert and Pattyn,¹⁵ has been suggested to avoid post-operative bleeding and reduce operating time.

Recalcitrant trochanteric bursitis (RTB). Isolated RTB should be suspected in cases of persistent lateral peritrochanteric pain whenever the abductor mechanism remains unaffected. Literature tends to overlap endoscopic treatment of gluteus medius and minimus tears (GMMT), RTB and external coxa-saltans. Only four consistent articles are currently available in the literature focusing on the endoscopic treatment of RTB (Table II).^{21-23,25} Additionally, there is a case-report by Bradley and Dillingham²⁹ in which a professional basketball player underwent bilateral bursectomy. The patient was followed for seven months and returned to the same professional level with no residual weakness or 'catching'.²⁰

Fox²¹ first reported on his series of 27 patients with a maximum follow-up of five years. A bursectomy with the aid of a shaver was performed in all cases. No complications were reported and the procedure was described as 'safe' and 'efficient'.²¹ Although the number of cases is considerable, no further controlled strategy of comparison between their technique and other open or endoscopic procedures was actually performed.

Wiese et al²² published their results of 45 procedures. They were able to review 37 patients at a follow-up of 30 months. The best outcomes developed in those patients who had osteophytes of the greater trochanter or an exudate overlaying the bursa. The subjective possibility of 'lying on the affected side' was evaluated in the patients, observing an improvement from a mean of 15% pre-operatively to 75% post-operatively. Only four cases developed a focal haematoma, which did not complicate any further. As with the study by Fox,²¹ no randomisation against open procedures was performed. Interestingly, Wiese et al²² also described having resected the bursa in

six post-arthroplasty patients, and to have had anchored the iliotibial band (ITB) instead of releasing it in four cases.

Baker et al²³ described a series of 25 patients with a mean follow-up of 26 months. They prospectively set clinical hip scores that showed lasting improvement in function and pain usually evident by one to three months after endoscopic bursectomy. One seroma was observed that needed open debridement.²³

Farr et al²⁵ reported a case-series of RTB endoscopic bursectomy in 2007. A different approach for isolated bursitis was proposed: they performed bursectomy plus ITB release without evidence of external coxa-saltans, arguing that spasm of the overlying iliotibial band may lead to a contracted state, which further contributes to the chronicity of the RTB.²⁵ Unfortunately only two cases were described and no further report of this technique can be found.

In summary, several techniques have been described for the endoscopic treatment of RTB: isolated bursectomy, either with concomitant ITB release or tenodesis. Only small, single-surgeon case series are available. None of these reports use control groups and there is no comparison to open surgery. Studies investigating the added value of endoscopy in the treatment of RTB are needed.

External snapping hip-endoscopy (ESH). Although open procedures for the treatment of ESH have been described,³⁰⁻³³ only one clinical series regarding endoscopic ESH release was found (Table III).¹¹ Ilizaliturri et al¹¹ performed a diamond-shaped cut as a release of the stressed ITB overlaying the greater trochanter. They report results on ten patients with a follow-up of 25 months. Pain was eliminated in all cases, although one patient had a recurrence. The mean operating time was 80 minutes, which emphasises the importance of dissecting the subcutaneous tissue and performing adequate haemostasis, as has been reported by Audenaert and Pattyn.¹⁵ Comparative studies with open surgery are currently lacking, and despite the minimal invasive nature of the endoscopic techniques, these will be mandatory to evidence equal clinical outcome.

Gluteus medius and minimus tears (GMMT). Tendinous lesions of the gluteal muscles have been compared to

Table IV. Literature reports on endoscopic repair of gluteus medius/minimus tears

Authors	Study type	Level of evidence	Sample size	Follow-up (mths)	Outcome	Complications
Kandemir et al ²⁸	Case report	IV	1	3	Good	None
Voos et al ²⁰	Prospective case series	IV	10	25 (SD 9.5)	Good	None

shoulder rotator-cuff lesions.^{34,35} Partial or full thickness tears have been suggested to be part of the problem of recalcitrant trochanteric bursitis with a positive Trendelenburg sign.²⁴ Despite the fact that GMMT are present in 10% of elderly patients, it may be 'severely' underdiagnosed.³⁶ The discussion on the necessity and the type of surgery for the treatment of gluteal tears is beyond the scope of this article, but there is a recent and thorough review by Lachiewicz.³⁷

There are only few publications available regarding the endoscopic treatment of 'cuff' pathology around the hip (Table IV). Kandemir et al²⁸ first reported on a case of calcific tendinitis of the gluteus medius and minimus associated with trochanteric bursitis. The lesion was successfully treated by endoscopic tendinous debridement and bursectomy. At three months' follow-up, normal strength and pain-free motion were observed.²⁸ No further follow-up is documented. Following the publication of their surgical technique,¹² Voos et al²⁰ reported on a clinical series in 2009. Physical examination and MRI were the tools upon which diagnosis and indication for surgery were based. Ten patients were prospectively reviewed at a mean follow-up of 25 months. Pain was resolved and strength fully recovered in all.²⁰ They also stated that out of 482 consecutive arthroscopies, a total of only ten (2%) were diagnosed with gluteal tendinous lesions amenable to repair, evidencing the difficulty and paucity for its diagnosis and case isolation.

In view of the fact that deeper partial gluteal lesions may be misdiagnosed and therefore treated as chronic bursitis, Domb et al²⁴ have proposed a trans-tendinous technique for the endoscopic treatment of gluteal cuff lesions. Although it seems a very promising technique, clinical data are still pending.

Even though the repair of gluteus muscle tears is currently a hot topic among hip arthroscopists, scientific evidence supporting these techniques is lacking. Only small, single-surgeon case series are available, no control groups are presented and comparison with open surgery is missing. Furthermore, it remains unclear as to the extent to which muscle atrophy, dysfunction and imbalance are reversible, and what variables are important in surgical decision-making and related prognosis.

2. Snapping of the iliopsoas tendon (SIT) – internal snapping hip

Snapping of the iliopsoas tendon (SIT) is defined as an audible click and/or pain caused by the iliopsoas tendon moving over the femoral head, the iliofemoral ligament, the iliopectineal ridge, or other structures on the anterior

aspect of the hip joint.³⁸ Conservative management is the mainstay of treatment and injections of the iliopsoas bursa have been shown to be beneficial in 50% of the cases.³⁹

Painful internal snapping, unresponsive to conservative treatment, has been addressed through open surgery. However, it is considered invasive and fraught with complications.^{40,41} The current tendency is towards endoscopic treatment of this pathology, as it allows for minimally invasive and controlled release under direct visualisation. However, objective data supporting any statements from comparative studies assessing open and endoscopic approaches are not available.

Concomitant intra-articular pathology in up to 50% of cases has been reported.^{19,42} Therefore, the exact source of the complaints could either come from intra-articular lesions, the psoas tendon or a combination of both. Yamamoto et al⁴³ successfully operated on 32 hips for internal snapping of the hip by exclusive treatment of intra-articular pathology. They concluded that the iliopsoas tendon was not necessarily the cause of the snapping and a labral tear was causing the snapping in 80% of the cases.⁴³ This report supports the need to perform simultaneous inspection of the intra- and extra-articular compartments but also addresses that 'intra-articular snapping aetiologies' may be different to the snapping nature of SIT. Further research on the exact source of complaints in these cases is therefore advisable.

From a technical point of view, there are two techniques reported to release the iliopsoas endoscopically: 1) a trans-capsular release and 2) a direct release at the lesser trochanter.¹⁰ Byrd⁴⁴ and Ilizaliturri et al¹⁰ were the first to publish on the endoscopic treatment for SIT in 2005 (Table V). Both independently describe a release at the level of the lesser trochanter. Byrd⁴⁴ reported his experience in nine cases in which the results were 'quite good', without complications or recurrences. Ilizaliturri et al¹⁰ described another seven cases and found 'good' results at 21 months, also without complications or recurrence. Concomitant intra-articular pathology was addressed in four cases (57%).¹⁰ Both studies reported temporary and subjective reduction of flexor strength, which seemed fully recovered at final follow-up. Quantitative and objective data on post-operative muscle weakness and its evolution are not available to date.

Wettstein, Jung and Dienst⁴⁵ confirmed good outcome in nine cases using a trans-capsular release of the iliopsoas tendon. They suggested that the release should be performed at the end of the procedure to avoid excessive extracapsular flow. Flanum et al⁴⁶ reported on

Table V. Literature reports on endoscopic iliopsoas release for internal-snapping hips

Author/s	Study type	Level of evidence	Sample size	Follow-up (mths)	Outcome	Complications
Byrd ⁴⁴	Retrospective case series	IV	9	-	Good	None
Ilizaliturri et al ¹⁰	Prospective case series	IV	7	21 (SD 8.5)	Good	One recurrence
Wettstein et al ⁴⁵	Retrospective case series	IV	9	9	Good	None
Flanum et al ⁴⁶	Retrospective case series	IV	6	12	Good	None
Anderson and Keene ⁴⁸	Prospective case series	IV	15	12	Good	None
Ilizaliturri et al ⁴⁷	Randomised controlled trial	I	19	24	Good	None
Contreras et al ⁴⁹	Prospective case series	IV	7	24	Good	None
Fabricant et al ⁵⁰	Prospective case series	IV	67	6	Good	None

Table VI. Literature reports on endoscopic release of piriformis syndrome

Authors	Study type	Level of evidence	Sample size	Follow-up (mths)	Outcome	Complications
Dezawa et al ²⁷	Prospective clinical series	IV	8	-	Good	None
Hwang et al ⁵³	Case report	IV	1	20	Good	None
Martin et al ⁵¹	Retrospective case series	IV	35	12 (SD 9)	Good	One recurrence

six cases with good outcome after endoscopic release in 2007. Although flexor strength reduction was initially observed, this recovered fully at 12 months follow-up.

In 2009, Ilizaliturri et al⁴⁷ presented a comparative study of 19 patients. Ten were operated using a release at the level of the lesser trochanter, and nine were operated by a trans-capsular release. They found excellent results in all patients and no clinical difference between the results of both techniques. In both groups almost all patients were concomitantly treated for intra-articular pathology.⁴⁷ Anderson and Keene⁴⁸ demonstrated similar results in 15 athletic patients using a release at the lesser trochanter. Patients were able to continue their sports at a mean of nine months post-operatively. Contreras et al⁴⁹ also reported full recovery of strength and good outcomes after 24 months of follow-up in seven patients using a transcapsular release. No complications were reported.⁴⁹

Recently, Fabricant et al⁵⁰ considered femoral anteversion (FAV) as a predictor of severity and outcome after SIT release. A total of 67 patients were treated using a trans-capsular release and divided into two groups: those who had normal femoral anteversion and those who had increased femoral anteversion of > 25°. Patients with increased anteversion did significantly worse than patients with normal anteversion. They concluded that for patients with increased anteversion, the iliopsoas is most likely an important secondary stabiliser for the anterior structures. These results suggest that surgeons should screen for increased FAV prior to surgery.⁵⁰

3. Piriformis syndrome (PS)

Under normal conditions, the sciatic nerve is able to stretch and glide to accommodate moderate strain or compression associated with joint movement.⁵¹ PS may

be considered as part of a broader group of sciatic nerve entrapment causes termed as the deep gluteal syndrome (DGS). PS proper diagnosis is difficult and therefore relies on precise clinical examination. Robinson⁵² first established the PS manifestation criteria: 1) a history of trauma to the sacroiliac and gluteal region; 2) pain in the sacroiliac joint, greater sciatic notch and the piriformis muscle, extending down the leg and causing difficulty walking; 3) acute exacerbations brought on by stooping or lifting and relieved by traction on the affected leg; 4) presence of a tender, palpable, sausage-shaped mass over the piriformis muscle; 5) a positive Lasegue sign⁵²; and 6) gluteal atrophy. The sciatic nerve, the external rotators, the piriformis tendon and the quadratus femoris are all included in the posterior compartment of the hip. The diversity of anatomic structures along with the difficulty of clinical signs makes this an exceptional diagnosis and carries the danger of mis-, under- or overdiagnosis. According to the literature there is slight evidence supporting the benefit of open sciatic nerve decompression and debridement after failed conservative modalities. According to our search, three reports were found dealing with clinical outcome after endoscopic treatment for piriformis syndrome (Table VI).^{27,51,53} Figure 3 provides an illustration of the procedure and its relevant anatomy.

Dezawa et al²⁷ were the first to report on the arthroscopic release of the piriformis tendon for entrapment neuropathy of the sciatic nerve. They performed the procedure in six patients (eight limbs), and achieved 'good results'. The release was performed under local anaesthesia in order to rely on the patients' ability to help locate sciatic pain. Although no clinical data is presented, the patients confirmed relief of symptoms intra-operatively.²⁷ Hwang et al⁵³ reported a case of successful

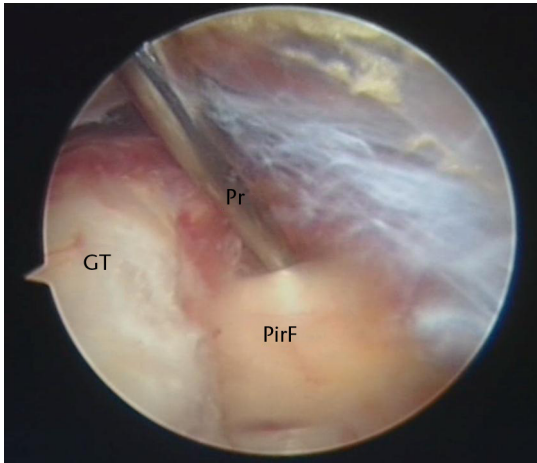


Fig. 3a

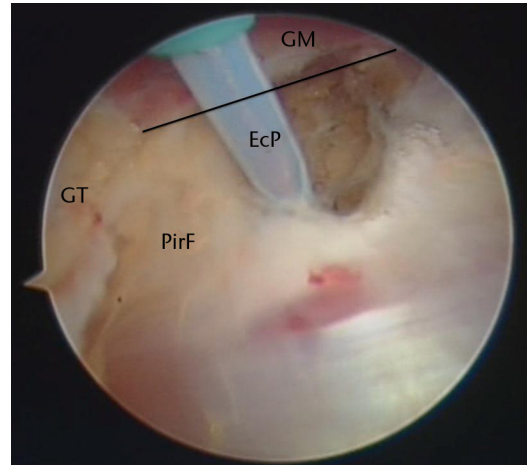


Fig. 3b

Endoscopic release of the piriformis tendon and posterior hip capsule (GT, greater trochanter; Pr, endoscopic probe; PirF, piriformis tendon; EcP, hooked coagulation probe).

Table VII. Literature reports on arthroscopy after total hip arthroplasty (THA)

Authors	Study type	Level of evidence	Sample size	Follow-up (mths)	Indication	Findings	Complications
Hyman et al ⁶¹	Retrospective case series	IV	8	70 (SD 37)	Lavage for late THA infection	No recurrence	None
Fontana et al ⁵⁴	Case report	V	1	-	Pain, radiological narrowing	Polyethylene breakage	None
Khanduja and Villar ⁵⁵	Case report	V	1	-	Persistent pain	Acetabular component loosening	None
McCarthy et al ⁵⁶	Retrospective case series	IV	16	-	Persistent pain	Added value in 75%	None
Cuellar et al ⁵⁷	Case report	V	2	15 to 12	Capsulorrhaphy for instability	No recurrence	None
Van Riet et al ⁵⁸	Retrospective case series	IV	9	11 (SD 8)	Iliopsoas release after groin pain	Good results	None
Pattyn et al ⁵⁹	Retrospective case series	IV	15	-	Diagnostic and therapeutic for groin pain	Low incidence of iliopsoas tendinitis	None
Bajwa and Villar ⁶⁰	Prospective case series	IV	24	-	Diagnostic and therapeutic	Added value in 70%	None

arthroscopic treatment of a perineural cyst on the sciatic nerve at the site of the piriformis tendon in 2010. Post-operative MRI imaging was performed providing evidence of surgical success in removing the cyst.

Martin et al⁵¹ published the largest series of cases available to date. They reported on the treatment of 35 patients with sciatic nerve entrapment. All cases were confirmed endoscopically. The mean modified Harris hip score improved from 54.4 to 78.0 at a follow-up of 12 months.

Comparison between the endoscopic treatment and either conservative or open surgical measures are currently not available in the literature. The endoscopic treatment of piriformis syndrome is therefore still experimental in nature and further research is mandatory to provide scientific evidence on these techniques.

4. Endoscopic surgery following hip arthroplasty

Iliopsoas tendinitis (IT) and peri-prosthetic abnormalities (including impingements) are currently all being addressed arthroscopically (Table VII).⁵⁴⁻⁶¹ Interestingly, no post-arthroplasty endoscopic reports involving GTPS or PS were found in the literature. Figure 4 illustrates endoscopic psoas tendon release in total and resurfacing hip arthroplasty.

Fontana et al⁵⁴ and Khanduja and Villar⁵⁵ first reported on isolated arthroscopic findings of polyethylene wear and acetabular loosening. McCarthy et al⁵⁶ published their series of 16 painful total hip arthroplasties treated arthroscopically. They treated cases of infection, migration of hardware, a loose acetabular component,

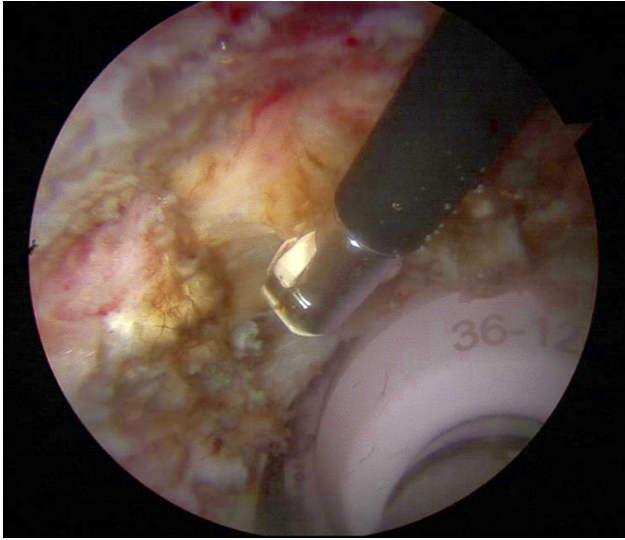


Fig. 4a

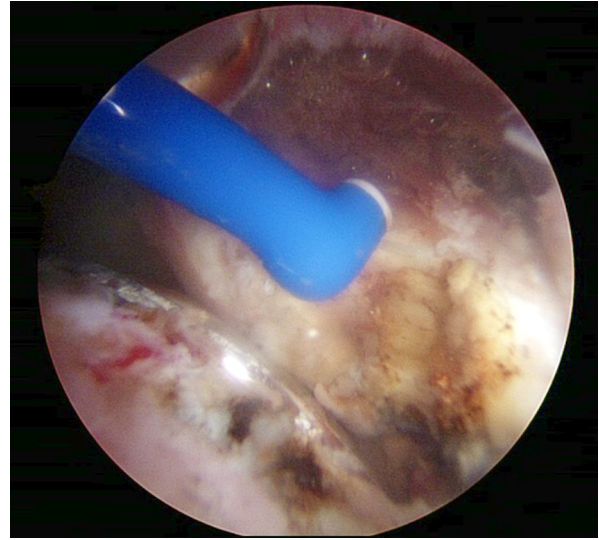


Fig. 4b

Arthroscopic psoas release for iliopsoas impingement after a) total and b) resurfacing hip replacement.

corrosion at the head–neck junction of a metal-on-metal articulation, soft-tissue–scar impingement at the head/cup interface, synovitis with associated scar tissue and capsular scarring with adhesions. They concluded that hip arthroscopy was beneficial in 12 of 16 cases (75%), and that it did not cause any further complications.⁵⁶ Cuellar et al⁵⁷ reported two cases of successful stabilisation by arthroscopic capsulorrhaphy. No recurrences or complications were reported.

Endoscopic tendinous release in the setting of residual groin pain as a result of iliopsoas tendinitis (IT) has also been reported. This impingement phenomenon has been well described^{62,63}; its higher incidence in post-resurfacing hips is presumably related to the increased overhang of the acetabular component and the insufficient restoration of anterior head offset.⁶² Van Riet et al⁵⁸ published a clinical series of this residual groin pain secondary to IT in nine patients (three hip resurfacing arthroplasty, five total hip arthroplasty and one revision). Endoscopic iliopsoas tenotomy through the trans-capsular approach was performed. None of the patients had anterior cup overhang as this was considered a contraindication prior to surgery. At a mean follow-up of 11 months all patients showed improvement and no complications were reported.⁵⁸ Pattyn et al⁵⁹ published their experience with arthroscopy after hip resurfacing arthroplasty in 15 cases. They concluded that arthroscopy was beneficial in cases of unexplained residual groin pain. However, the results were surprising because infection or an adverse reaction to metal debris (ARMD) was found in seven of 15 cases; they could only confirm and treat IT by tendon release in three of 15 patients (20%). The last

report of Bajwa and Villar⁶⁰ compared arthroscopy of painful post-arthroplasty hips (study group) with painful native hips (control group). Each study arm comprised of 24 patients. For the post-arthroplasty cases, arthroscopy aided in confirming diagnosis in 96% of the cases, and was also therapeutically successful in 43%. In the native hips, the diagnosis was confirmed and a therapeutic procedure performed in all of the cases. This provided relief of symptoms in 87%.⁶⁰ In conclusion, several reviews have been published tackling the complex problem of the painful hip replacement. Hip arthroscopy has shown to provide a valuable diagnostic tool to elucidate the origin of complaints, especially when non-invasive investigations fail to explain the symptoms.

Conclusions

Evidence-based surgery describes the consistent and judicious use of the best available scientific evidence in making decisions about the care of surgical patients. When reflecting on the literature dealing with hip endoscopy, we unfortunately need to conclude that scientific evidence on these procedures remains poor. Retrospective, single-surgeon case series and ‘expert opinions’ based on empirical impressions currently make up the majority of reports available on the topic. This does not necessarily mean hip endoscopy should not be performed as undoubtedly, hip endoscopy provides a minimally invasive alternative to a large number of open surgical procedures. Nevertheless, sound qualitative prospective, randomised controlled trials on extra-articular hip arthroscopy, its indications and its techniques, are lacking completely to date.

Since extra-articular hip arthroscopy seems to gain broad popularity, new indications, techniques and innovations become increasingly reported. We need to work to provide qualitatively sound and reliable studies if we want to lift hip endoscopy from its experimental status to an evidence-based practice of care in the future.

Based on this information, we believe that the treatment of ISH is the only indications to date where extra-articular endoscopy appears to be equivalent and even superior to the open treatment. Endoscopic surgery offers a safe option with minimal risk of complications. However, again there is no direct comparison available between open and endoscopic surgery.

References

- Burman MS. Arthroscopy or the direct visualization of joints: an experimental cadaver study, 1931. *Clin Orthop Relat Res* 2001;390:5–9.
- Glick JM, Sampson TG, Gordon RB, Behr JT, Schmidt E. Hip arthroscopy by the lateral approach. *Arthroscopy* 1987;3:4–12.
- Byrd JW. Hip arthroscopy utilizing the supine position. *Arthroscopy* 1994;10:275–280.
- Keene GS, Villar RN. Arthroscopic anatomy of the hip: an in vivo study. *Arthroscopy* 1994;10:392–399.
- Altenberg AR. Acetabular labrum tears: a cause of hip pain and degenerative arthritis. *South Med J* 1977;70:174–175.
- Suzuki S, Awaya G, Okada Y, et al. Arthroscopic diagnosis of ruptured acetabular labrum. *Acta Orthop Scand* 1986;57:513–515.
- Byrd JW, Chern KY. Traction versus distension for distraction of the joint during hip arthroscopy. *Arthroscopy* 1997;13:346–349.
- Dienst M, Seil R, Gödde S, et al. Effects of traction, distension, and joint position on distraction of the hip joint: an experimental study in cadavers. *Arthroscopy* 2002;18:865–871.
- Ganz R, Parvizi J, Beck M, et al. Femoroacetabular impingement: a cause for osteoarthritis of the hip. *Clin Orthop Relat Res* 2003;417:112–120.
- Ilizaliturri VM, Villalobos FE, Chaidez PA, Valero FS, Aguilera JM. Internal snapping hip syndrome: treatment by endoscopic release of the iliopsoas tendon. *Arthroscopy* 2005;21:1375–1380.
- Ilizaliturri VM, Martinez-Escalante FA, Chaidez PA, Camacho-Galindo J. Endoscopic iliotibial band release for external snapping hip syndrome. *Arthroscopy* 2006;22:505–510.
- Voos JE, Rudzki JR, Shindle MK, Martin H, Kelly BT. Arthroscopic anatomy and surgical techniques for peritrochanteric space disorders in the hip. *Arthroscopy* 2007;23:1246–1241.
- Tibor LM, Sekiya JK. Differential diagnosis of pain around the hip joint. *Arthroscopy* 2008;24:1407–1421.
- Larson CM, Guanache CA, Kelly BT, Clohisy JC, Ranawat AS. Advanced techniques in hip arthroscopy. *Instr Course Lect* 2009;58:423–436.
- Audenaert E, Pattyn C. Balloon dissection for improved access to the peritrochanteric compartment. *Arthroscopy* 2009;25:1349–1353.
- Segal NA, Felson DT, Torner JC, et al. Greater trochanteric pain syndrome: epidemiology and associated factors. *Arch Phys Med Rehabil* 2007;88:988–992.
- Lequesne M. From “peri-arthritis” to hip “rotator cuff” tears: trochanteric tendinobursitis. *Joint Bone Spine* 2006;73:344–348.
- Strauss EJ, Nho SJ, Kelly BT. Greater trochanteric pain syndrome. *Sports Med Arthrosc* 2010;18:113–119.
- Ilizaliturri VM, Camacho-Galindo J, Evia Ramirez AN, et al. Soft tissue pathology around the hip. *Clin Sports Med* 2011;30:391–415.
- Voos JE, Shindle MK, Pruett A, Asnis PD, Kelly BT. Endoscopic repair of gluteus medius tendon tears of the hip. *Am J Sports Med* 2009;37:743–747.
- Fox JL. The role of arthroscopic bursectomy in the treatment of trochanteric bursitis. *Arthroscopy* 2002;18:E34.
- Wiese M, Rubenthaler F, Willburger RE, Fennes S, Haaker R. Early results of endoscopic trochanter bursectomy. *Int Orthop* 2004;28:218–221.
- Baker CL, Massie RV, Hurt WG, Savory CG. Arthroscopic bursectomy for recalcitrant trochanteric bursitis. *Arthroscopy* 2007;23:827–832.
- Domb BG, Nasser RM, Botser IB. Partial-thickness tears of the gluteus medius: rationale and technique for trans-tendinous endoscopic repair. *Arthroscopy* 2010;26:1697–1705.
- Farr D, Selesnick H, Janecki C, Cordas D. Arthroscopic bursectomy with concomitant iliotibial band release for the treatment of recalcitrant trochanteric bursitis. *Arthroscopy* 2007;23:905–901.
- Ilizaliturri VM, Camacho-Galindo J. Endoscopic treatment of snapping hips, iliotibial band, and iliopsoas tendon. *Sports Med Arthrosc* 2010;18:120–127.
- Dezawa A, Kusano S, Miki H. Arthroscopic release of the piriformis muscle under local anesthesia for piriformis syndrome. *Arthroscopy* 2003;19:554–557.
- Kandemir U, Bharam S, Philippon MJ, Fu FH. Endoscopic treatment of calcific tendinitis of gluteus medius and minimus. *Arthroscopy* 2003;19:E4.
- Bradley DM, Dillingham MF. Bursoscopy of the trochanteric bursa. *Arthroscopy* 1998;14:884–887.
- Féry A, Sommelet J. The snapping hip: late results of 24 surgical cases. *Int Orthop* 1988;12:277–282 (in French).
- Kim DH, Baechler MF, Berkowitz MJ, Rooney RC, Judd DB. Coxa saltans externa treated with Z-plasty of the iliotibial tract in a military population. *Mil Med* 2002;167:172–173.
- Provencher MT, Hofmeister EP, Muldoon MP. The surgical treatment of external coxa saltans (the snapping hip) by Z-plasty of the iliotibial band. *Am J Sports Med* 2004;32:470–476.
- White RA, Hughes MS, Burd T, Hamann J, Allen WC. A new operative approach in the correction of external coxa saltans: the snapping hip. *Am J Sports Med* 2004;32:1504–1508.
- Bunker TD, Esler CN, Leach WJ. Rotator-cuff tear of the hip. *J Bone Joint Surg [Br]* 1987;79-B:618–620.
- Kagan A. Rotator-cuff tear of the hip. *J Bone Joint Surg [Br]* 1998;80-B:182–183.
- Cormier G, Berthelot JM, Maugars Y. Gluteus tendon rupture is underrecognized by French orthopedic surgeons: results of a mail survey. *Joint Bone Spine* 2006;73:411–413.
- Lachiewicz PF. Abductor tendon tears of the hip: evaluation and management. *J Am Acad Orthop Surg* 2011;19:385–391.
- Shu B, Safran MR. Case report: bifid iliopsoas tendon causing refractory internal snapping hip. *Clin Orthop Relat Res* 2011;469:289–293.
- Blankenbaker DG, De Smet AA, Keene JS. Sonography of the iliopsoas tendon and injection of the iliopsoas bursa for diagnosis and management of the painful snapping hip. *Skeletal Radiol* 2006;35:565–571.
- Grøn GS, Scioscia TN, Lowenstein JE. The surgical treatment of internal snapping hip. *Am J Sports Med* 2002;30:607–613.
- Hoskins JS, Burd TA, Allen WC. Surgical correction of internal coxa saltans: a 20-year consecutive study. *Am J Sports Med* 2004;32:998–1001.
- Byrd JW. Evaluation and management of the snapping iliopsoas tendon. *Instr Course Lect* 2006;55:347–355.
- Yamamoto Y, Hamada Y, Ide T, Usui I. Arthroscopic surgery to treat intra-articular type snapping hip. *Arthroscopy* 2005;21:1120–1125.
- Byrd J. Evaluation and management of the snapping iliopsoas tendon. *Techniques in Orthopaedics* 2005;20:45–51.
- Wettstein M, Jung J, Dienst M. Arthroscopic psoas tenotomy. *Arthroscopy* 2006;22:907–901.
- Flanum ME, Keene JS, Blankenbaker DG, Desmet AA. Arthroscopic treatment of the painful “internal” snapping hip: results of a new endoscopic technique and imaging protocol. *Am J Sports Med* 2007;35:770–779.
- Ilizaliturri VM, Chaidez C, Villegas P, Briseño A, Camacho-Galindo J. Prospective randomized study of 2 different techniques for endoscopic iliopsoas tendon release in the treatment of internal snapping hip syndrome. *Arthroscopy* 2009;25:159–163.
- Anderson SA, Keene JS. Results of arthroscopic iliopsoas tendon release in competitive and recreational athletes. *Am J Sports Med* 2008;36:2363–2371.
- Contreras ME, Dani WS, Endges WK, De Araujo LC, Berral FJ. Arthroscopic treatment of the snapping iliopsoas tendon through the central compartment of the hip: a pilot study. *J Bone Joint Surg [Br]* 2010;92-B:777–780.
- Fabricant PD, Bedi A, De La Torre K, Kelly BT. Clinical outcomes after arthroscopic psoas lengthening: the effect of femoral version. *Arthroscopy* 2012;28:965–971.
- Martin HD, Shears SA, Johnson JC, Smathers AM, Palmer IJ. The endoscopic treatment of sciatic nerve entrapment/deep gluteal syndrome. *Arthroscopy* 2011;27:172–181.
- Robinson DR. Piriformis syndrome in relation to sciatic pain. *Am J Surg* 1947;73:355–358.
- Hwang DS, Kang C, Lee JB, Cha SM, Yeon KW. Arthroscopic treatment of piriformis syndrome by perineural cyst on the sciatic nerve: a case report. *Knee Surg Sports Traumatol Arthrosc* 2010;18:681–684.
- Fontana A, Zecca M, Sala C. Arthroscopic assessment of total hip replacement and polyethylene wear: a case report. *Knee Surg Sports Traumatol Arthrosc* 2000;8:244–245.

55. **Khanduja V, Villar RN.** The role of arthroscopy in resurfacing arthroplasty of the hip. *Arthroscopy* 2008;24:122–121.
56. **McCarthy JC, Jibodh SR, Lee JA.** The role of arthroscopy in evaluation of painful hip arthroplasty. *Clin Orthop Relat Res* 2009;467:174–180.
57. **Cuellar R, Aguinaga I, Corcuera I, Ponte J, Usabiaga J.** Arthroscopic treatment of unstable total hip replacement. *Arthroscopy* 2010;26:861–865.
58. **Van Riet A, De Schepper J, Delpont HP.** Arthroscopic psoas release for iliopsoas impingement after total hip replacement. *Acta Orthop Belg* 2011;77:41–46.
59. **Pattyn C, Verdonk R, Audenaert E.** Hip arthroscopy in patients with painful hip following resurfacing arthroplasty. *Knee Surg Sports Traumatol Arthrosc* 2011;19:1514–1520.
60. **Bajwa AS, Villar RN.** Arthroscopy of the hip in patients following joint replacement. *J Bone Joint Surg [Br]* 2011;93-B:890–896.
61. **Hyman JL, Salvati EA, Laurencin CT, et al.** The arthroscopic drainage, irrigation, and debridement of late, acute total hip arthroplasty infections: average 6-year follow-up. *J Arthroplasty* 1999;14:903–910.
62. **Bin Nasser A, Beaulé PE, O'Neill M, Kim PR, Fazekas A.** Incidence of groin pain after metal-on-metal hip resurfacing. *Clin Orthop Relat Res* 2010;468:392–399.
63. **Bartelt RB, Yuan BJ, Trousdale RT, Sierra RJ.** The prevalence of groin pain after metal-on-metal total hip arthroplasty and total hip resurfacing. *Clin Orthop Relat Res* 2010;468:2346–2356.

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