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ARTHROSCOPY AND SPORTS MEDICINE

An operative technique for psoas impingement following total hip arthroplasty: a case series of day case, extra articular, arthroscopic psoas tenotomy

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Abstract

Purpose We present a prospective case series of patients undergoing an arthroscopic, extra-articular psoas tenotomy.

Methods From February 2009 to February 2017, 13 consecutive patients underwent day case, arthroscopic tenotomy. Patients were selected following clinical evidence of impingement and a diagnostic ultra-sound-guided steroid injection of the psoas bursa. The patient's mean age was 52.8 years ± 13.7 (29.1–82.7), mean ASA 1.8 and mean BMI 30.6 ± 8.5 kg/m^2. We detail the technique employed and patient outcomes to include FABER testing, manual hip flexion strength assessment and pain improvements.

Results The typical onset of impingement symptoms following THA was 4 months (2–24 months). 9 patients tested FABER negative and 62% ($n=8$) were pain-free within 6–12 weeks. An average 20% (5–30%) reduction in hip flexion strength was seen post-arthroscopy. The mean follow-up was 2 years, (0.5–7 years). Regarding complications, one patient required revision surgery due to recurrence prompting a technique adaptation.

Conclusion For psoas impingement following THA where non-operative measures are ineffective, we recommend extra-articular arthroscopic psoas tenotomy as a feasible operative strategy. This minimally invasive, day case, low-risk treatment option is beneficial in relieving impingement symptoms.

Keywords Hip arthroscopy · Psoas tenotomy · Extracapsular tenotomy · Total hip replacement

Introduction

Although ongoing pain after total hip arthroplasty (THA) is unusual, there is an increasing recognition that psoas impingement is one cause of such pain [1]. Psoas impingement is one of many causes of hip pain following THA, accounting for 4.3% of cases in some series [2, 3]. Psoas impingement as a cause of hip pain following THA was first described by Postel in 1975 [4]. Subsequently two clinical cases were reported by Kolmert et al. in 1984 [5]. Treatment options have included non operative management with physiotherapy and analgesia, psoas bursa cortisone injection, open psoas tenotomy or revision of the acetabular component.

Whilst arthroscopic iliopsoas tenotomy techniques have been reported, most series describe trans-capsular approaches [6, 7], intracapsular [8] and a single series of an extra capsular approach [9]. We present a prospective case series of patients undergoing an arthroscopic, extra-articular psoas tenotomy technique; the earliest extra-capsular technique case series reported. We hypothesis it is an effective and safe treatment option in selective patients.

Patients and methods

Patients

We present the cases of 13 consecutive patients who required surgery for psoas impingement following THA (13 primary and one revision arthroscopy) between February 2009 and February 2017. At arthroscopy, the patient's mean age was

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52.8 years ± 13.7 (range 29.1–82.7 years), mean ASA 1.8 and mean BMI 30.6 ± 8.5 kg/m^2, comprising two males and 11 females, with three left and 10 right-sided procedures. Table 1 outlines the stem and acetabular components used in each of the patient's THA.

The mode onset of impingement symptoms started 2 months (range 1.5–24 months) following the THA. Each had symptoms of groin pain on active and resisted hip flexion and pain as the hip came from flexion into full extension. On examination, all patient had a positive FABER test (pain on hip Flexion Abduction and External Rotation). On supine hip examination, as the hip was actively moved from flexion to extension, pain was typically noted between 30° and full extension. The mean interval from the THA to arthroscopic tenotomy was 2.9 ± 2.2 years (range 0.4–10.1 years).

All patient's C-reactive protein and white cell counts were within the normal range and plain radiography (AP pelvis and lateral) showed no signs of implant loosening. Plain radiographs were used to gauge acetabular positioning and computerised tomography not performed for our patients. 12 of the patients had a diagnostic ultra-sound-guided injection (Kenalog 40 mg and Bupivacaine 0.5%) of the psoas bursa which gave complete, but temporary, pain relief. One patient had an MRI confirming inflammation of the psoas tendon prior to referral to our service. Inclusion criteria included a positive provocation testing and a positive response to psoas bursa ultrasound-guided injection. Arthroscopic tenotomy was offered to patients with findings consistent with iliopsoas impingement in whom non-operative measures failed to deliver sustained pain relief. Furthermore, in each case the decision to operate was based on the longevity of impingement symptoms and failure to respond to extensive specialist physiotherapy aimed at psoas stretching. All patients were felt to have isolated iliopsoas impingement.

Patient data were prospectively collected by the operating surgeon immediately following patient encounters in the outpatient department. We detail the reported onset of impingement symptoms following their THA and post arthroscopy FABER testing. Patients were asked to state their pain levels (with 0% indicating no improvement and 100% indicating pain-free). In addition, manual hip flexion power on clinical examination 6 or 12 weeks post-arthroscopy compared with the contralateral limb and complications were recorded. All patients who had surgery were followed up.

Operative technique

Prior to surgery all patients were consented for the risks of surgery, including permanent weakness of hip flexion due to loss of psoas hip flexion power (30% weaker being the figure given). Under spinal anaesthesia with sedation, each patient was placed supine on either a standard orthopaedic traction table or dedicated hip arthroscopy traction table. This allowed positioning of the limb for optimum imaging, no traction was used. The hip was placed in 20° flexion, 20° abduction and 50° external rotation, to place the lesser trochanter in full profile.

Superior lateral and inferior lateral arthroscopic portals were used (these were more anterior than the usual hip arthroscopy portals). The insertion of the initial needles/guide wires involved AP image intensification and 'feeling the way' over the front of the femur to the region of the lesser trochanter (Fig. 1a). The trochar and cannulae were

Table 1 Demographics and characteristics of patients undergoing psoas tendon release

Case #	Stem	Acetabulum	Age gender	Impingement symptom onset following THA (months)	THA to arthroscopy interval (years)
1	ABG	ABG (U)	49.4 F	6	3.4
2	Exeter	TM monoblock (U)	82.7 F	2	1.2
3	BHR	BHR (U)	47.3 F	Pre-existing	1.5
4	Exeter	Trident ceramic (U)	60.5 F	3	1.4
5	Muller	Muller (U)	38.9 M	n/a	10.1
6	Exeter	TM monoblock (U)	65.1 F	2	2.8
7	Exeter	Ogee (C)	60.5 F	5	0.8
8	Exeter	Trident ceramic (U)	41.1 M	24	5.3
9	CORAIL	PINNACLE (DePuy Inc.) (U)	54.1 F	2	3.8
10	Exeter	Trident poly (U)	54.8 F	2	1.9
11	Exeter	Trident ceramic (U)	43.3 F	6	2.9
12	Exeter	Ogee (C)	60.2 F	1.5	0.4
13	Exeter	Trident poly (U)	29.1 F	12	3.1

U uncemented, *C* cemented, *BHR* Birmingham Hip Resurfacing

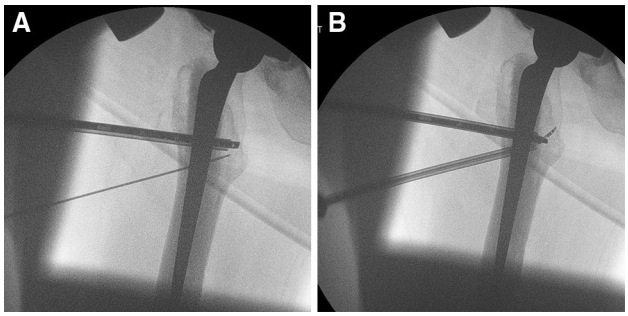

Fig. 1 **a, b** On-table image intensifier view of positioning the cannulae and sweeping soft tissue away from the psoas tendon

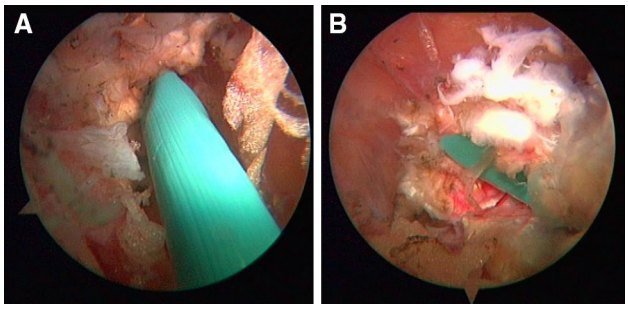

Fig. 3 **a, b** Arthroscopic views of probing the divided proximal and distal psoas tendon

then inserted over the guide wires, converging just proximal to the lesser trochanter.

With a right hip, for a right-handed surgeon, we place the 70° arthroscope through the superior lateral portal. Once in the region of the lesser trochanter, visualization of the psoas tendon was initially achieved by sweeping the soft tissue away using the inferior trochar and cannula. Further clearance was achieved, under arthroscopic vision, using a hooked arthroscopy probe placed through the inferior cannula then using a radiofrequency probe, the rigid cannula permits more accurate positioning of the flexible radiofrequency probe (Fig. 1b). The flexible ligament chisel is more manoeuvrable than the more rigid 90° devices (although the latter is better at clearing soft tissue to visualise the tendon).

The arthroscopic fluid pump pressure was set at 50 mmHg. Once clear visualisation of the psoas tendon was achieved (Fig. 2a) the radiofrequency probe was used to divide the psoas tendon approximately 1–2cm from its attachment to the lesser trochanter (Fig. 2b). Both the proximal and distal divided ends of the released tendon were probed to confirm the complete release (Fig. 3a, c, respectively). More recently, the distal tendon stump (approximately 1 cm) has been removed after division.

The post-operative instruction was for full weight bearing, with the use of crutches if necessary. Discharge was on the day of surgery. Physiotherapy advice was given to perform regular hip extension/stretching exercises and hip flexion/strengthening exercises.

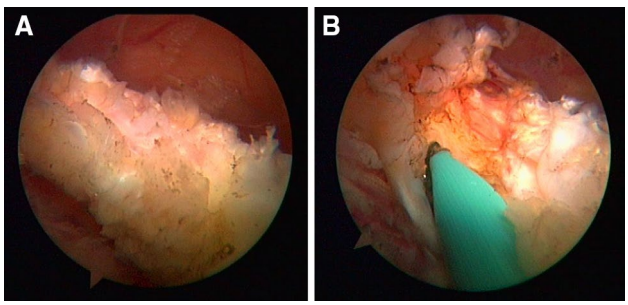

Fig. 2 **a** Arthroscopic view of psoas after sweeping soft tissue away. **b** The division of the psoas tendon

Results

All patients noted impingement symptom improvement 6–12 weeks post operatively. Nine patients became FABER negative post-operatively (2 were unable to perform FABER test due to weakness and 2 remained FABER positive). A subjective flexion weakness of on average 20% (range 0–30%) when assessed at 12 weeks post arthroscopy. The majority of patients reported they were pain-free (62% $n=8$) with the remaining reporting 50%, and 70 and 90% pain improvements (see Table 2). All patients were discharged on the day of surgery and none reported early post-operative complications.

One patient (Case 1) had recurrence of symptoms 5 years after the arthroscopic tenotomy. FABER testing was positive and a diagnostic ultrasound-guided steroid and anesthetic injection gave complete but temporary impingement symptom relief. A revision arthroscopy was performed demonstrating an intact psoas tendon managed with division and coblation of the distal stump. Six weeks following the revision procedure, the patient was FABER negative, had 5% weakness of hip flexion and reported a 95% pain improvement. Patients operated upon following this revision in November 2014, (Cases 6–12) underwent the adapted technique; division of the tendon and distal stump coblation removal. The outcomes seen for the other patients (Cases 2–13) were sustained until their discharge from outpatient follow-up. The mean follow-up following the primary arthroscopy tenotomy was 2 years (range 0.5–7 years).

Discussion

Psoas impingement is one of many causes of hip pain following THA, accounting for 4.3% of cases in some series [2, 3]. We report a case series of 13 patients with symptomatic

Table 2 Outcomes of patients following arthroscopic extra-capsular psoas tenotomy

Case #	Time to symptom improvement (weeks)	FABER test	Hip flexion weakness at 12 weeks (%)	Pain improvement (%)
1	12	Negative	30	100
2	12	Not assessed[a]	20–30	100
3	10	Not assessed[a]	30	100
4	6	Positive	20	100
5	6	Negative	5–10	100
6	6	Negative	20	100
7	6	Negative	0	100
8	12	Negative	25	70
9	12	Negative	20	90
10	6	Negative	5–10	100
11	6	Negative	5–10	50
12	6	Negative	15	50
13	6	Positive	20	50

[a]FABER test not assessed as patient weakness precluded test

psoas impingement following hip arthroplasty undergoing arthroscopic distal tenotomy of the psoas tendon. 62% ($n=8$) become pain-free and nine patients had negative provocation testing (FABER) post procedure.

Ala Eddine et al. discussed several abnormalities associated with psoas impingement noting anterior prominence of the acetabular component in 60% of cases [2]. Dora et al. showed no improvement in eight cases managed conservatively, but good improvement with surgical management in 18 out of 22 cases, (12/15 having acetabular component revision with tenotomy and 6/7 having tenotomy alone) [10]. They also found the same functional outcome for both psoas tenotomy and acetabular revision. Ala Eddine et al. reported complete recovery in 7 out of 9 patients (4 after repeated injections and 3 after tenotomy) and partial recovery in the remaining 2 (1 after injection and 1 after tenotomy) [2]. Jasani et al. described 100% improvement (9/9) following open psoas tenotomy/lengthening with no acetabular revision [11].

Lequesne et al. showed that removal of any acetabular prominence causing psoas impingement gave a good result and partial removal led to residual symptoms [12]. Schuh et al. report a case of pain following a revision THA with an acetabular reinforcement ring. This patient underwent a further operation where bone cement was used on the anterior edge of the acetabular reconstruction ring to create a smooth rim for the ilio psoas tendon [13]. Bricteux et al. report that, of the 6 out of 12 patients in their series who accepted revision surgery, all improved [3]. Trousdale et al. reported 2 out of 2 cases improved following revision of the acetabular component [14].

Lachiewicz and Kauk in their 2009 review article detail the reports on a total of 112 painful hips following arthroplasty, with 68 having definite psoas impingement [1]. They found that with non-operative management 39% improved, whereas 91.5% of operatively managed cases improved. Analysis of their results appears to indicate that psoas tenotomy had a higher success rate than acetabular revision ± psoas tenotomy.

Whilst arthroscopic psoas tendon division is not a new technique, prior to our technique (devised in early 2009), reports primarily relate to the un-replaced/native joint. The tendon can be divided either at the level of the lesser trochanter [15, 16], or by a trans-capsular release from the peripheral compartment [17]. Blomberg et al. on a cadaveric study demonstrated that iliopsoas muscle tendon unit at the level of the lesser trochanter comprised of 60% tendon and 40% muscle. More proximally, such as at the transcapsular release sites, tendon accounts for a smaller proportion of the muscle tendon unit. Releasing the iliopsoas at the level of the lesser trochanter does not result in complete release of the muscular tendinous unit. However, Ilizaliturri showed no significant difference in the effectiveness of either option, in the native joint [18]. Both Dora et al. and Wettstein et al. document recovery of hip flexion power at or around 3 months post surgery [10, 17].

Whilst arthroscopic iliopsoas tenotomy techniques have been reported, most series describe trans-capsular approaches. Van Reit et al. describe arthroscopic iliopsoas tenotomy through a trans-capsular approach and one night hospital stay; a case series of 9 patients and mean follow-up of 11 months (5 total hip arthroplasty patients) [6]. They report 5 out of 9 patients (55%) described complete resolution of pain, comparable with our series where 69% of patients were pain-free, Jerosch et al. described a higher 91% (32/35 patients) rate of complete pain relief following

a intra-capsular iliopsoas tenotomy [8]. Filanti et al. claim arthroscopic trans-capsular superiority to open tenotomy techniques. They report Harris Hip Scores pre vs. 24 month post-arthroscopy tenotomy of 44.1 (range 32–56) vs. 83.28 (range 61–91), in 35 patients [7]. All report full return of strength, at 4 weeks and 6 weeks post operatively, whereas this occurred in only one of our patients (Case 7). None of the above series report complications with the intra-capsular techniques.

Gedouin et al. describe an extra-capsular technique with a 80% complete pain relief (8/10), high patient satisfaction levels and a return of power 3.25 months (range 0.5–6) following surgery [9]. This is in contrast to our series where a 20% weakness of hip flexion typically occurred. Extra-capsular techniques theoretically have a low risk of implant infection or bearing surface damage. Furthermore, they avoid sectioning a possibly thickened anterior capsule. We were also concerned, given post-operative THA scarring affecting the anatomy over the front of the hip joint, to avoid inadvertent division of structures other than the psoas tendon. The angulation of the 70° arthroscope gave an excellent view across the front of the femur onto the lesser trochanter and psoas tendon. We found the flexible radiofrequency probe to be more efficient at reaching the tendon than the 90° device, but note that it was easier to position and more effective when placed through the arthroscopic cannula. The 90° device cleared the soft tissue more effectively than the flexible probe but required more careful positioning of the entry portal to easily reach the tendon.

Our inclusion criteria required patients to have complete but transient pain relief following the diagnostic injection. Nunley et al. present a series of 19 patients, who saw significant improvement in pain with psoas bursa injection. Eight patients (30%) required a second injection at an average of 8.2 months after the first injection. And only six patients (22%) had an additional surgical procedure to address the underlying cause of the iliopsoas irritation. They conclude that repeated injection should be considered as part of conservative treatment [19].

Chalmers et al. present a retrospective series of 49 patients with iliopsoas impingement after total hip arthroplasty. Twenty one patients underwent acetabular revision and 8 patients underwent open tenotomy. No significant differences in Harris hip scores were found between acetabular revision and tenotomy. Acetabular revision was more predictable for groin pain resolution in patients with ≥ 8 mm of component prominence; 92% (12 of 13) of patients with < 8 mm of component prominence vs. 50% (4 out of 8) of patients with ≥ 8 mm of component prominence. Subsequently, they propose a retrospective algorithm based on component prominence [20]. However, given the strength of evidence presented, we feel the low risk option of arthroscopic tenotomy remains a reasonable first-line surgical treatment strategy.

Limitations

We concede there are limitations to this study including the small sample size originating from a single surgeon. Measurements of hip flexion power were performed manually by the operating surgeon, introducing potential bias. Furthermore, patient-reported outcomes were not collected. The authors are aware that psoas bursa and hip joint communication can occur in patients, giving rise to false positive diagnostic injections. We discuss this issue of false-positive results with patients, but we are unaware of any more accurate diagnsotic tests to support our clinical testing. Thus, we rely on clinical testing (backed up by abolition of pain with psoas bursa injections) to select patients.

This single centre study has small case numbers of extra-articular tenotomy, which we publish to add to the collective data in an area with a current paucity of evidence.

Conclusions

Following THA, clinical examination and investigations (such as ultrasound-guided psoas bursa cortisone injection) can support that pain is originating as a result of psoas impingement. Where non-operative measures fail to deliver sustained pain relief, we recommend extra-articular arthroscopic psoas tenotomy at the level of the lesser trochanter as a feasible operative stratagy. This minimally invasive, day case, low-risk treatment option, is beneficial in relieving impingement symptoms, with typically a 20% reduction in hip flexor strength and appears safe.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval This article was a retrospective review of prospective collected data on our routine clinical practice, no ethical approval was required.

Informed consent Informed consent was obtained from all individual participants included in the study.

References

1. Lachiewicz PF, Kauk JR (2009) Anterior iliopsoas impingement and tendinitis after total hip arthroplasty. J Am Acad Orthop Surg 17(6):337–344

2. Ala Eddine T, Remy F, Chantelot C, Giraud F, Migaud H, Duquennoy A (2001) Anterior iliopsoas impingement after total hip arthroplasty: diagnosis and conservative treatment in 9 cases. Rev Chir Orthop Reparatrice Appar Mot 87(8):815–819
3. Bricteux S, Beguin L, Fessy MH (2001) Iliopsoas impingement in 12 patients with a total hip arthroplasty. Rev Chir Orthop Reparatrice Appar Mot 87(8):820–825
4. Postel M (1975) Painful prosthesis. I. Possible causes. Rev Chir Orthop Reparatrice Appar Mot 61(Suppl 2):57–61
5. Kolmert L, Persson BM, Herrlin K, Ekelund L (1984) Ileopectineal bursitis following total hip replacement. Acta Orthop Scand 55(1):63–65
6. Van Riet A, De Schepper J, Delport HP (2011) Arthroscopic psoas release for iliopsoas impingement after total hip replacement. Acta Orthop Belg 77(1):41–46
7. Filanti M, Carubbi C, Del Piccolo N, Rani N, Mazzotta A, Dallari D (2016) The role of arthroscopy in the treatment of groin pain after total hip arthroplasty: our experience. Hip Int 26(Suppl 1):28–33
8. Jerosch J, Neuhäuser C, Sokkar SM (2013) Arthroscopic treatment of iliopsoas impingement (IPI) after total hip replacement. Arch Orthop Trauma Surg 133(10):1447–1454
9. Gédouin JE, Huten D (2012) Technique and results of endoscopic tenotomy in iliopsoas muscle tendinopathy secondary to total hip replacement: a series of 10 cases. Orthop Traumatol Surg Res 98(4 Suppl):S19–S25
10. Dora C, Houweling M, Koch P, Sierra RJ (2007) Iliopsoas impingement after total hip replacement: the results of non-operative management, tenotomy or acetabular revision. J Bone Jt Surg Br 89(8):1031–1035
11. Jasani V, Richards P, Wynn-Jones C (2002) Pain related to the psoas muscle after total hip replacement. J Bone Jt Surg Br 84(7):991–993
12. Lequesne M, Dang N, Montagne P, Lemoine A, Witvoet J (1991) Conflict between psoas and total hip prosthesis. Rev Rhum Mal Osteoartic 58(9):559–564
13. Schuh A, Schraml A, Zeiler G (2003) [Impingement of the iliopsoas muscle after revision of a loosened acetabular cup with an acetabular reinforcement ring]. Zentralbl Chir 128(3):209–211
14. Trousdale RT, Cabanela ME, Berry DJ (1995) Anterior iliopsoas impingement after total hip arthroplasty. J Arthroplasty 10(4):546–549
15. Ilizaliturri VM, Villalobos FE, Chaidez PA, Valero FS, Aguilera JM (2005) Internal snapping hip syndrome: treatment by endoscopic release of the iliopsoas tendon. Arthroscopy 21(11):1375–1380
16. Byrd JW (2006) Evaluation and management of the snapping iliopsoas tendon. Instr Course Lect 55:347–355
17. Wettstein M, Jung J, Dienst M (2006) Arthroscopic psoas tenotomy. Arthroscopy 22(8):907.e1–907.e4
18. Ilizaliturri VM, Chaidez C, Villegas P, Briseño A, Camacho-Galindo J (2009) Prospective randomized study of 2 different techniques for endoscopic iliopsoas tendon release in the treatment of internal snapping hip syndrome. Arthroscopy 25(2):159–163
19. Nunley RM, Wilson JM, Gilula L, Clohisy JC, Barrack RL, Maloney WJ (2010) Iliopsoas bursa injections can be beneficial for pain after total hip arthroplasty. Clin Orthop Relat Res 468(2):519–526
20. Chalmers BP, Sculco PK, Sierra RJ, Trousdale RT, Berry DJ (2017) Iliopsoas impingement after primary total hip arthroplasty: operative and nonoperative treatment outcomes. J Bone Jt Surg Am 99(7):557–564