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Technique and results of endoscopic tenotomy in iliopsoas muscle tendinopathy secondary to total hip replacement: A series of 10 cases

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KEYWORDS
Hip arthroscopy; Iliopsoas tendinopathy; Endoscopic tenotomy; Total hip replacement; Groin pain; Complications

Summary

Introduction: There have been numerous recommendations for management of iliopsoas tendinopathy secondary to hip replacement: medical treatment, cup replacement, and open or arthroscopic tenotomy.

Material and method: We report on a series of 10 endoscopic iliopsoas tenotomies. Arthroplasty comprised five primary conventional total prostheses, two large head diameter metal-metal models, one resurfacing and one revision arthroplasty. All patients underwent clinical (PMA, WOMAC), imaging (X-ray, CT, scintigraphy) and biological assessment. Seven cases showed mechanical impingement (six involving the anterior edge of the cup, and one a cement fragment); the other three involved large femoral components (two large head diameter models, one resurfacing). Infiltration test was positive in eight cases out of nine. Endoscopic iliopsoas tenotomy for recurrence was performed in dorsal decubitus on an ordinary table, under fluoroscopy, using two approaches (inferior for the endoscope, superior for the instruments) converging on the lesser trochanter.

Discussion: There were no complications. At a mean 20 months’ follow-up (range, 12–60 months), mean pain grade was 5.5 (4–6). Eight patients showed complete relief, and two partial relief (two atypical cases). Mean PMA score was 16.9 (15–18) and mean WOMAC score 84 (60–95). Muscle force was recovered at a mean 3.25 months (0.5–6). Eight patients were very satisfied, one satisfied and one moderately satisfied.

Conclusion: This technique is much less heavy than implant replacement; postoperative course is shorter than for open tenotomy and the technique is simpler than arthroscopic tenotomy, with lower risk. Subsequent cup change, where necessary, is not compromised.

Level of evidence: IV, retrospective, case series.

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Introduction

Iliopsoas tendinopathy may compromise the result of otherwise satisfactory total hip replacement (THR). It was first reported by Postel in 1975 [1], then fully described by Lequesne et al. [2] in 1991, in a series of nine cases.

Incidence was estimated at 4.3% in both a series of 206 THRs from Lille, France (n = 9/206) [3] and a series of 280 from St-Etienne, France (n = 12/280) [4]. The most frequent causes are either mechanical impingement between the tendon and the anterior edge of the acetabular cup, due to insufficient anteversion, excessive volume and/or lateralization, notably in case of dysplasia [2,4], or to a cement fragment [1,2,5,6], a reinforcement ring [7], too long a fixation screw (for the cup or reinforcement ring), or an osteophyte [8]. Too long a screw in the iliac muscle body may also be involved [4] and, more recently, large-diameter heads in metal-metal prostheses have also been implicated [9]. Where there is no such mechanical impingement, the cause may be more than 1 cm limb lengthening and/or femoral lateralization [10]. In some cases, no cause can be identified, as in the series reported by O’Sullivan et al., who suggested the involvement of changed muscle trajectory following resection of the femoral head; they therefore advised against resecting the anterior capsule and recommended trimming the anterior edge of the femoral neck cut [11].

When pain fails to resolve in a few months under analgesics, anti-inflammatory and stretching exercises, local treatment seems indicated. Various types of infiltration have been recommended: infiltration(s) of the tendon and of the serous bursa between the tendon and the anterior edge of the cup, using a local anesthetic and a cortisone derivative [8], or else botulinum toxin injection(s) to the muscle itself [12]. Infiltration may be repeated [8,12]. Efficacy and duration of relief are very variable; therefore, resolving the impingement (cup replacement, screw extraction, cement fragment resection, etc.) or tenotomy are indicated in case of failure (six out of six cases for Bricteux [4] or recurrence [2,8] or, for some authors, in first intention [5]. Tenotomy is much less heavy and provides satisfactory results without significant loss of hip flexion force [3,5,6,13,14].

Tenotomy was initially performed in open surgery. It consists in sectioning only the tendon fibers, at their insertion on the lesser trochanter [3,5,10]. Tenotomy may also be performed under arthroscopy [13], enabling the impingement to be visualized and the tendon to be sectioned at that precise point; there is, however, a risk of infection and of bearing surface deterioration. Here we describe a technique of extra-articular endoscopic tenotomy at the insertion, as performed for iliopsoas snapping in non-operated hips [15]. It is simpler, quicker and involves less risk. We describe the procedure and report results on a retrospective series of 10 cases.

Material and method

The series comprised 10 extra-articular endoscopic tenotomies in 10 patients: five males, five females; mean age, 58 years (range, 45–80 yrs).

Tendinopathy was secondary to primary THR (n = 8), resurfacing (n = 1), or revision arthroplasty (n = 1).

The eight primary implants were:

- five implants with metal-polyethylene bearing couple, various models of impacted cup (one with screw) and 28 mm head, and one cemented Chamley-Kerboull implant with 22.2 mm head;
- one alumina-alumina model with impacted Pinnacle® cup and 36 mm head (DePuy Inc.);
- large head diameter metal-metal implants, including one Durom® cup (Zimmer Inc.) with 46 mm head and one BHR (Birmingham Hip Resurfacing®) cup (Smith and Nephew Inc.) with 50 mm head;
- also, one resurfacing, with metal-metal bearing couple, BHR® cup and 50 mm head;
- and one revision of a metal-polyethylene implant with impacted cup and 28 mm head.

I.e., head diameters were: 28 mm (n = 6), 36 mm (n = 1), 46 mm (n = 1) and 50 mm (n = 2).

All patients had been previously operated on in other centers, except for the case of resurfacing.

Function was assessed pre- and postoperatively on PMA and WOMAC scores. Patient satisfaction was recorded post-operatively.

Postoperative active flexion force was graded clinically as 1 to 5 (only postoperatively as pain precluded preoperative assessment).

Assessment systematically included:

- plain X-ray (AP pelvic, AP and Lequesne lateral hip views);
- CT to explore for mechanical impingement (anterior protrusion of the cup, in mm, large implant head, cement fragment, intramuscular screw, ossification);
- inflammation work-up (VS, CRP);
- bone scintigraphy;
- plus systematic serum chromium and cobalt ion assay in metal-metal models.

Once diagnosis was established, therapeutic and/or diagnostic infiltration was performed, using an anesthetic (xylocaine) and a delayed-release cortisone derivative (Altim) under CT (n = 8) or ultrasound (n = 1) guidance; one patient refused infiltration. Eight of the nine reported relief, complete in six cases and partial in two, although pain quickly recurred except in one patient who experienced relief for 4 months.

At this point, extra-articular endoscopic tenotomy was suggested, and accepted by all 10 patients.

The surgical technique was inspired by that of Ilizaliturri et al. [15] in iliopsoas snapping in non-operated hips, but with an inferior endoscopic approach and a superior instrumental approach for the radiofrequency electrode used for the tenotomy up against the lesser trochanter. All patients were operated on by the first author (JEG).

The patients were positioned in dorsal decubitus on a standard table. The surgeon stood next to the hip to be operated on, with the hip in extension and in external rotation to release the lesser trochanter. The fluoroscope was positioned facing the surgeon, with an anteroposterior view, perpendicular to the table; displacing the table distally...
facilitated positioning. The arthroscope column and the fluoroscope screen were on the same side as the fluoroscope, but more distally.

Two approaches were used, both aligned on a vertical line, one on the anterolateral side of the hip and the other sufficiently distally to allow good instrument triangulation toward the lesser trochanter (Fig. 1).

The more distal approach was performed first, using a cannulated needle, a flexible metal guide (Nitinol) and dilators as used in hip arthroscopy. The needle passed through the quadriceps at an oblique ascending angle, inward and backward. Bone contact with the needle tip was sought on the anterior side of the femur, then the needle slid along the anteromedial side of the shaft toward the lesser trochanter. This step was performed under radioscopic control (Fig. 2). A standard arthroscopic sleeve was slid along the cannulated dilator and the 30° scope was set up. Rotational movements created a visualization chamber in the fatty tissue.

The second, more proximal, approach was performed on the same principles. Needle positioning was controlled first radioscopically and then endoscopically. A shaver was slid along the metal guide positioned via the needle. It enabled good visualization of the distal iliopsoas tendon insertion after resection of the covering fatty tissue (Fig. 3). The shaver was then replaced by a working cannula, through which an arthroscopic sectioning/coagulation probe was introduced. The tendon was then sectioned at its bone insertion on the lesser trochanter (Fig. 4). Stump retraction was performed under visual control (Fig. 5) and the tendon remaining on the insertion surface was coagulated.

All patients could be discharged the following day, with a prescription of indometacin for 1 week, with complete weight-bearing allowed, with two canes for support for 3 weeks.

**Results**

Preoperative (Table 1):

- onset of pain after THR was early in eight cases, at 6 weeks in one and at 3 months in one. Mean grade following Postel et al. [16] was 3.3 (range, 2–4). Pain was typical in eight cases: groin pain on active flexion and deflexion, with weight-bearing and passive mobilization remaining painless; the other two cases were atypical, with anterolateral pain also on flat-ground walking. Mean evolution was 43 months (range, 14–72 months);
- mean PMA score was 13.1 (range, 11–15) and mean WOMAC score 34 (24–46);
- one large head diameter implant (BHR) showed Brooker type-2 ossifications [17], although remote from the usual site of impingement;
<table>
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<tr>
<th>Age</th>
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• there were no cases of significant lengthening or femoral lateralization;
• aork-up implicated mechanical impingement in seven cases (>10 mm anterior protrusion of the cup in six cases and a cement fragment in one case); in the other three cases (the two large head diameter implants and the one case of resurfacing), no cause could be identified;
• other causes of postoperative pain could be ruled out: notably, infection or non-fixation of an implant component. Chrome-cobalt ion assay values in metal-metal friction-couple implants were not abnormal for this type of arthroplasty.

Postoperative:
• there were no complications;
• at a mean 20 months’ follow-up (range, 12–60), mean pain score was 5.5 (4–6). Relief was total or almost total (pain score, 5 or 6) in eight cases and partial (pain score, 6–5) in four cases.

Figure 4  Sectioning the tendon by the hooked radiofrequency probe.

Figure 5  Complete disinsertion and stump release.
score, 4) in two. It is noteworthy that the two cases of merely partial relief were those of atypical pain, incompletely relieved by infiltration; in one of these cases (with periprosthetic ossification), no cause of impingement could be identified; • mean postoperative PMA score was 16.9 (15–18), with four patients scoring 17, four scoring 18, one scoring 15 (partial relief, but very satisfied given a preoperative PMA score of 11) and one scoring 16 (partial relief and moderate satisfaction, with a pre-operative PMA score of 13); • mean postoperative WOMAC score was 84 (60–95); • one patient showed ossifications at the lesser trochanter.

Grade-5 muscle force was recovered in a mean 3.25 months (0.5–6).
Subjective satisfaction ratings were:

• very satisfied: eight patients (including one with only partial relief);
• satisfied: one patient;
• moderately satisfied: one patient (with partial relief, or at least onset of new pain).

Discussion
The present series was small, but most published series, and especially those using a single surgical technique, were not much bigger. The largest were those of Dora (16 cup replacements) [5] and O’Sullivan (16 tenotomies) [11]. Diagnosis used the Lequesne lateral view, whereas Arcelin’s surgical lateral view is more often recommended for visualizing anterior cup protrusion [5,8,9,11,18]. CT, however, was available in all cases and is also recommended for detecting and measuring anterior cup protrusion [19]. All six protrusions exceeded 10 mm, in agreement with Cytéval et al. (>12 mm protrusion in case of impingement). Probably wrongly, we made little use of ultrasound [20,21], and notably of dynamic ultrasonography, which is recommended in iliopsoas snapping [22,23] and can also be used in post-implantation tendinopathy. It provides artifact-free visualization of the tendon and can visualize the actual impingement and the bursitis that is associated in about half of cases [4,13]; mobilizing the thigh can disclose the position in which impingement occurs, and passing the probe in the impingement area can evoke the spontaneously experienced pain.

At all events, we implicated tendinopathy too often. Two patients showed atypical pain, partially relieved by infiltration, and were not fully relieved by tenotomy, suggesting that tendinopathy was not the real underlying cause or that some other cause may have been involved. The present findings thus confirm the interest of the infiltration test recommended by Ala Eddine et al. [3].

It was also noteworthy that, in the three cases of large implant heads, there was no anterior cup protrusion, confirming the notion that a large-diameter head may in itself induce impingement. This is in agreement with Browne et al. [9] who, in a series of three cases, associated reduced head diameter (and thus cup replacement) to total tenotomy in two cases and partial tenotomy in one, with good results. In the present three cases, two experienced complete relief following tenotomy alone, while the third was only partially relieved (this was the patient with postoperative ossifications and atypical pain incompletely relieved by infiltration).

Unlike Heaton and Dorr [10], we observed no lower-limb lengthening or femoral lateralization, although our X-ray views would not enable reliable measurements of these. O’Sullivan et al. found no difference here between a group of patients with tendinopathy and a control group [11].

Pre- and postoperative pain was assessed by PMA score, which was poorly suited as it takes account only of pain on walking. It would have been preferable to use a visual analog scale and to study pre- and postoperative impact of pain on certain target activities, as done by Nunley et al. [8]. We did, however, use the WOMAC quality-of-life score and collected patients’ satisfaction ratings. That eight out of 10 patients reported complete pain relief was very satisfactory.

Finally, we, like other authors [3,5,6,13,14], found that patients did not complain of flexion force loss following tenotomy. This is because the iliopsoas tendon insertion on the lesser trochanter is not its only distal insertion, as radiographic views have shown [22,24]: the iliopsoas tendon corresponds to the psoas muscle and the medial part of the iliac muscle; the rest of the iliac muscle is inserted on the proximal femur by fleshy fibers that are conserved in tenotomy (Fig. 6).

As reports in the literature are few and varied, it is difficult to specify the optimal treatment for post-THR iliopsoas tendinopathy: there is no consensus concerning infiltration.

In the present series, only one patient experienced lasting relief (4 months). Several authors conclude that infiltration lacks efficacy [4], or more often or shows only transient efficacy, whether guided by radiocopy [8], ultrasound [20,25] or CT [6].

Ala Eddine et al. [3], using two injections, achieved total or partial relief at 3 months in five out of nine non-operated patients; three did not show anterior cup protrusion and the

Figure 6 Iliopsoas anatomy.
cause of their tendinopathy was unidentified; only two of the other six showed improvement with iterative injection.

Dora et al., in a series of 30 cases [5], reported systematic transient improvement (of 2 weeks to 17 months); after recurrence of pain, none of the eight patients who refused surgery were pain-free at 24 months. Adler et al. [20] reported only improvement at 1 year in only half of a series of 10 patients.

In a series of nine cases, Jasani et al. [6] found benefit from injection, but with recurrence of pain in a mean 3.6 months, except in one case.

O’Sullivan et al. [11] performed infiltration in 13 out of 16 cases, with clear immediate benefit, but which was not lasting (recurrence within a month).

The best assessment of infiltration efficacy was made by Nunley et al. [8] in a series of 27 cases managed by radioscopy-guided serous bursa infiltration. Mean follow-up was 44.6 months (range, 25–68) after first injection. Nineteen patients were followed up and all showed significant improvement, but to varying degrees. Eight patients (30%) had a second injection at a mean 8.2 months (1–35) later. Six patients required surgery. Injection should be repeated when the first has proved effective (only one of the eight patients receiving repeated injection went on to require surgery).

Infiltration thus shows good diagnostic but limited therapeutic value.

Iliopsoas tenotomy is a simple procedure, well described in open surgery by Heaton and Dorr [10]. Reusing a short segment of the distal part of the incision, the lower limb is put in internal rotation and the quadratus femoris muscle is partly released, until the lesser trochanter is encountered. The iliopsoas tendon fibers are then located and released. Other approaches, however, have been used [5] and a medial approach has even been recommended [14]. Tenotomy was generally associated with good results at a mean 6.8 years’ follow-up (range, 5–9 yrs) in Dora et al.’s series [5], where it was applied in over-65 year-olds; benefit was acquired in 3 months and improved over time. Al Aeddine et al. [3], Heaton and Dorr [10], Della Valle et al. [26] and Taher and Power [14] also reported good results. The largest series was O’Sullivan et al.’s, with 15 good results out of 16 (one failure, revised by cup replacement) at a mean 36.4 months’ follow-up (range, 5–63 months) [11].

Eliminating the cause of the impingement is logical [4,5,8,9,18], but cup replacement or removing a screw that is too long are much heavier procedures than tenotomy. Bricteux et al. (six cases) [4], Browne et al. (three cases) [9] and Trousdale et al. (two cases) [18] reported no complications. Nunley et al. (4 cases) [8] reported one late dislocation. In contrast, Dora (16 cases) [5] reported a high complications rate: one superficial superinfection, one trochanteric non-union, one anterior dislocation, five trochanteric bursites on cerclage wires, and one unexplained neuropathy; seven redo opera procedures were necessary. Risk is clearly greater in implant replacement than in tenotomy. Simply eliminating the impingement, however, may fail to resolve pain in established tendinopathy, and associating tenotomy to cup replacement is to be considered. Both Dora et al. [5] and Trousdale et al. [18] associated tendon debridement to implant replacement, and Browne et al. associated two total and one partial tenotomy to implant replacement. That changing the cup (or removing a screw) does not avoid the need or recommendation for tenotomy [27] is a further argument for beginning by tenotomy. If the cause of impingement is an intramuscular screw, isolated tenotomy does not seem a reasonable attitude, as it is not impingement between tendon and screw that is implicated.

Open tenotomy is a simple and quick procedure but is more invasive, requiring a longer hospital stay and recovery period than an arthroscopic or endoscopic technique.

There are advantages to arthroscopic tenotomy [13]:

- it enables sampling of articular and synovial fluid;
- the impingement is visualized and can be eliminated on site; also certain implant malfunctions (absence of cup fixation, deteriorated friction surface) can be detected.

However, it entails risk of infection and of bearing surface damage. It also requires anterior arthroscopic capsulotomy to expose the iliopsoas, the tendon fibers of which are sectioned at the myotendinous junction, conserving the muscle fibers, which are more anterior. Results are satisfactory, with no complications in Van Riet et al.’s series of nine cases [13].

The present endoscopic tenotomy technique shows a very low risk of implant infection or bearing surface damage. It does not require sectioning the anterior capsule, which can be difficult when it is very thick, as is often the case, especially with small-head implants [13]; moreover, the tendon is sectioned more remotely from the vessels.

Ilizarov compared endoscopic and arthroscopic procedures, in respectively 10 and nine patients, and reported no complications and no difference in results [28]. However, these were tenotomies for iliopsoas snapping in non-operated hips, where capsulotomy and arthroscopic tenotomy are easier. We would suggest, only in case of diagnostic doubt, performing an initial arthroscopy (fluid sampling, synovial biopsy, direct visualization of any impingement, checking friction surfaces) ahead of endoscopic tenotomy as a second step.

Conclusion

The endoscopic iliopsoas tenotomy recommended here is simple, relatively non-invasive, with very low risk of complications, and very often provides the desired pain relief when the diagnosis of tendinopathy is well confirmed (typical symptomatology, positive infiltration test).

Should it prove insufficient, a confirmed impingement susceptible of surgical management may be treated directly (cup replacement, replacement of a large head diameter implant, etc.). This situation never arose in this small series, but has been reported elsewhere. This attitude is especially justified as tenotomy is frequently associated to revision arthroplasty, so that iliopsoas tendon conservation is not an argument for implant replacement. Tendinopathy caused by an intramuscular screw may be an exception to this rule, as it is not the iliopsoas tendon that is implicated.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.
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