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Research article

How has arthroscopic management of the iliopsoas evolved, and why? A survey of high-volume arthroscopic hip surgeons

Austin W. Chen[1], Matthew J. Steffes[2], Joseph R. Laseter[3], David R. Maldonado[4], Victor Ortiz-Declet[5], Itay Perets[6] and Benjamin G. Domb [4,7]*

[1]Boulder Centre for Orthopaedics, 4740 Pearl Pkwy #200A, Boulder, CO 80301, USA,
[2]University of Illinois at Chicago, 1200 W Harrison St., Chicago, IL 60607, USA,
[3]Case Western Reserve University, 9501 Euclid Ave, Cleveland, OH 44106, USA,
[4]American Hip Institute Research Foundation, 999 E Touhy Ave. Ste. 450, Des Plaines, IL 66018, USA,
[5]Kayal Orthopedics, 260 Old Hook Rd #401, Westwood, NJ 07675, USA,
[6]Hasassah Hebrew University Hospital, Jersalem, Israel and
[7]American Hip Institute, 999 E Touhy Ste. 450, Des Plaines, IL 60018, USA.
*Correspondence to: B. G. Domb. E-mail: DrDomb@americanhipinstitute.org
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ABSTRACT

The rapid growth of hip preservation has left surgeons following trends based on limited, or even anecdotal, evidence in certain circumstances. A consensus as well as high-level research on how best to manage the iliopsoas is lacking. Arthroscopic treatment of the iliopsoas may be an example of how treatment patterns and trends can shift with limited evidence-based medicine. A cross-sectional survey of 16 high-volume hip preservation surgeons was conducted to gather perspectives and opinions on how and why the arthroscopic management of the iliopsoas has evolved. All participants completed the survey in person and anonymously. Of the surveyed surgeons, the mean career hip preservation volume was 1031.25 cases (250 to >3000) with an average annual volume of 162.08 cases (75–400). Of the surveyed surgeons' caseload, 16.1% involved an iliopsoas tenotomy or fractional lengthening mostly commonly (75%) for recalcitrant internal snapping. Labral repair/reconstruction is performed concomitantly 87.5% of the time. Seventy-five percent of surgeons indicated a decrease in frequency of iliopsoas tenotomy over the course of their practice most commonly (56.3%) because of hip flexion weakness; however, 0% of the surgeons could cite literature evidence to support their practices. *Perceived* poor outcomes in individual practices was the most common (56.3%) source of this complication. Surgeons were less inclined to perform tenotomy on patients with borderline dysplasia (75%) or ligamentous laxity (56.3%).

INTRODUCTION

The field of hip preservation has exploded in regards to awareness, understanding and treatment options in recent years. However, there are aspects of the field that continue to lag behind more than others. In these instances, anecdotal evidence and expert opinion at instructional courses may un-intentionally attempt to fill voids in the literature. The knowledge and management of iliopsoas pathology, including internal snapping hip, iliopsoas tendonitis and iliopsoas impingement, is one such deficit.

Internal snapping hip syndrome, or internal coxa saltans, as first described in 1951 by Nunziata and Blumenfeld [1], is characterized as a snap or audible pop due to the iliopsoas tendon translating medial to lateral over the iliopectineal eminence, femoral head or lesser trochanter. While it can be a common and asymptomatic phenomenon, it can also be painful, most notably with hip movement from flexion and abduction to extension and internal rotation [2].

Iliopsoas impingement involves the underlying acetabular labrum being damaged and compressed either by a tight

iliopsoas tendon or by an inflamed tendon adhered to the anterior capsulolabral complex causing a repetitive traction injury to the labrum. This leads to characteristic anterior labral tears at the 3 o'clock position (right hip) and occurs in isolation or concurrently with an internal snapping hip [3].

Failed conservative treatment of the iliopsoas pathology may necessitate surgical intervention. Surgery for iliopsoas pathology was originally managed through open procedures [4]. Currently, technologic advances allow for less invasive endo- or arthroscopic techniques for these conditions [5–7]. Techniques include endoscopically releasing the iliopsoas tendon directly from the lesser trochanter [2, 8, 9] or by an arthroscopic transcapsular approach at the level of the joint [3, 10].

The paucity of literature on this topic raises questions as to how treatment of these conditions can evolve and, if it does evolve, what are the instigating factors? The purpose of this study was to survey high-volume hip arthroscopists to assess for iliopsoas management trends in practice and the reasons behind those trends. Our hypothesis was that there is a great deal of variability and a lack of consensus among high-volume hip arthroscopists regarding the indications and techniques for performing iliopsoas tenotomies, and for their reasoning regarding their indications and choice of surgical technique.

MATERIALS AND METHODS

We conducted a cross-sectional survey of 16 high-volume surgeons, who specialize in hip arthroscopy (Supplementary Appendix 1). A high-volume surgeon is defined as an arthroscopist who performs >50 hip arthroscopy cases annually. The definition of high-volume surgeon was used based on previous similar studies [11–13]. This study group included surgeons who had case experience ranging from 75 to 400 hip arthroscopies performed annually and a total of 250–3000 cases performed in their careers. Surgical case volumes were reliant on recalled estimates as more accurate databases were not available.

This study was determined to be institutional review board exempt because the survey was confidential and anonymous, with no identifiers linked to individual responses. All participants completed the survey in person, hand-written in an anonymously and their completed questionnaires were collected at the end of an industry-sponsored hip arthroscopy meeting (Arthrex, Naples, FL, USA). Completion of the survey implies consent.

The survey consisted of 15 multiple-choice and short answer questions aimed to assess the current state of iliopsoas lengthening/tenotomy practices in hip arthroscopy and endoscopy. The questionnaire was structured to gauge opinions on the current indications for surgical management of the iliopsoas and techniques being utilized. The survey asked surgeons to provide their beliefs concerning (i) the frequency of iliopsoas tenotomy; (ii) techniques and best practices during a tenotomy, including anatomical location of tenotomy; (iii) common complications that may arise with tenotomy; (iv) indications and risk factors for tenotomy and (v) any adverse outcomes that have been noticed during their history of performing these procedures. It should be noted that this is not a validated questionnaire of outcome measure but a survey addressing common questions encountered at high-level hip arthroscopy meetings. For the sake of succinctness and because both procedures involve division of the tendinous portion of the iliopsoas muscle-tendon unit, 'iliopsoas tenotomy' refers to both complete iliopsoas release and iliopsoas fractional lengthening throughout the manuscript, unless otherwise specified.

Basic statistical analyses were performed using Microsoft Excel (Microsoft Corporation; Redmond, WA, USA) with the RealStatistics add-in package.

Data Availability

The data underlying this article will be shared on reasonable request to the corresponding author.

RESULTS

Sixteen high-volume arthroscopic hip surgeons participated in the survey. The mean annual number of hip arthroscopies performed was 162.1 (range, 75–400), while the mean number performed over their career was 1031.25 (range, 250–3000). All 16 surgeons, with extreme varying degrees of frequency, admitted to performing iliopsoas tenotomy.

Frequency of arthroscopic/endoscopic iliopsoas tenotomy

Surgeon experience with iliopsoas tenotomy/lengthening exposure in their own practices was assessed first (Table I). The responses indicated that, on average, iliopsoas tenotomy was performed in 12% (range, 0.5–90%) of the surgeons' hip arthroscopy cases.

Twelve surgeons (75%) admitted that the frequency in which they perform iliopsoas tenotomy has decreased over the course of their practice. At the time of the survey, 10 surgeons stated that they perform tenotomies in 10–20% of their cases. This is in contrast to the peak incidence of iliopsoas tenotomies in which six surgeons were performing tenotomies ≤5% of the time and eight surgeons ranged from 10 to 40%. The timing of the peak incidence or when the decline in frequency occurred was not recorded.

The surgeons who perform tenotomies were also asked what types of procedures they perform in combination (Table II). Most surgeons, 14 (87.5%), reported that they

Table I. Incidence of iliopsoas tenotomy cases

Frequency	*Mean ± SD (range)*
Current percentage of total annual hip arthroscopies	12.0 ± 21.7 (0.5–90.0)
Highest percentage of cases in a 1-year period during practice career	18.3 ± 22.1 (2.0–90.0)

Table II. Procedures typically performed in conjunction with tenotomies

Procedure	*No. of surgeons*	*Percentage of surgeons*
Labral repair or reconstruction	14	87.5
Labral debridement	4	25.0
Capsular plication/shift	4	25.0
Capsular release	0	0
Femoroplasty	11	68.8
Acetabuloplasty	11	68.8
Microfracture	2	12.5
Subspine de-compression	5	31.3

perform labral repairs or reconstructions whenever they perform an iliopsoas tenotomy. Capsular release was the least common procedures performed in conjunction with an iliopsoas tenotomy (0%) followed by microfracture (12.5%).

Techniques implemented

Fourteen surgeons reported that their standard technique for performing iliopsoas tenotomies is transcapsular at the level of the joint/labrum while one surgeon stated that he/she prefers to use an extracapsular technique in attempt to preserve the iliofemoral ligament. One surgeon abstained from answering the question. None of the surgeons reported performing iliopsoas tenotomies from the lesser trochanter. While performing tenotomies, surgeons believe a multi-fid iliopsoas tendon is present 26.0% of the time (range, 0–90.0%).

Complications

Those who reported that their volume of tenotomies had declined (12 surgeons, 75%), were asked their reasoning for avoiding or minimizing this procedure (Table III). Nine surgeons (56.3%), reported hip flexion weakness as the most common reason for avoiding iliopsoas tenotomy. Fluid extravasation, selected by 1 (6.3%) surgeon was the least common response.

To understand the evidence behind these reasons for avoiding iliopsoas tenotomy, surgeons were asked to specify their primary sources of information (Table IV). None of the surgeons was able to cite specific literature as reasoning for their practice changes; however, more than half of the surgeons (56.3%) reported that un-favorable/poor outcomes *perceived* in their own practice were the main reason for avoiding iliopsoas tenotomy.

Table III. Reasons for not performing/performing iliopsoas tenotomy less often

Symptom	*No. of surgeons*	*Percentage of surgeons*
Hip flexion weakness	9	56.3
Fluid extravasation	1	6.3
Hip instability	3	18.8
Pain	3	18.8
Poor outcomes	4	25

Indications

Surgeons were asked to select their current indications for tenotomy in native hips (i.e. non-arthroplasty; Table V). Most surgeons indicated that internal snapping (75%) and iliopsoas impingement (62.5%) were indications of tenotomy.

Surgeons who do not perform iliopsoas tenotomy for internal snapping or iliopsoas impingement were asked

Table IV. Primary source for complications from iliopsoas tenotomy

Option	*No. of surgeons*	*Percentage of surgeons*
Literature evidence	0	0
Unfavorable/poor outcomes perceived in own practice	9	56.3
Unfavorable/poor outcomes documented/studied in own practice	3	18.8
Expert opinion at a course or meeting	3	18.8

Table V. Current indications for tenotomy

Option	*No. of surgeons*	*Percentage of surgeons*
Internal snapping	12	75.0
Tendonitis	4	25.0
Iliopsoas impingement	10	62.5
Other	0	0

Table VI. Patients more likely to receive iliopsoas tenotomy

Option	*No. of surgeons*	*Percentage of surgeons*
Male	3	18.8
Female	8	50.0
Sufficient acetabular coverage	4	25.0
Borderline dysplasia	1	6.3
Coxa valga	0	0
Coxa vara	1	6.3
Ligamentous laxity	0	0

Table VII. Patients less likely to receive iliopsoas tenotomy

Option	*No. of surgeons*	*Percentage of surgeons*
Male	2	12.5
Female	4	25.0
Sufficient acetabular coverage	0	0
Borderline dysplasia	12	75.0
Coxa valga	6	37.5
Coxa vara	1	6.3
Ligamentous laxity	9	56.3

Table VIII. Consistent adverse outcomes observed with tenotomy

Outcomes	*No. of surgeons*	*Percentage of surgeons*
Hip flexion weakness	6	37.5
Intra-abdominal fluid extravasation	0	0
Hip instability	3	18.8
Pain	4	25.0

how they do treat these patients. Three reported that they prefer other treatment methods including labral repair at 3 o'clock with capsular plication, extracorporeal shockwave therapy and injections. One additional surgeon reported that he/she would perform a subspine de-compression instead of an iliopsoas tenotomy.

Patient population

Regarding risk factors that have been associated with requiring an iliopsoas tenotomy, eight surgeons (50.0%) selected female patients and four surgeons (25%) selected sufficient acetabular coverage as patients more likely to require tenotomies in their practice (Table VI).

Conversely, 12 surgeons (75.0%) reported that they were less inclined to perform iliopsoas tenotomy on patients with borderline dysplasia, followed by ligamentous laxity (56.3%) and coxa vara (37.5%) (Table VII).

Adverse outcomes

Surgeons were asked to report any *consistent* adverse outcomes that they have observed after performing

tenotomies (Table VIII). The most common (37.5%) observed adverse outcome was hip flexion weakness, although the persistence or duration of weakness was not quantified. The second most common adverse outcome was pain.

DISCUSSION

There was no consensus regarding management of the iliopsoas, confirming the study hypothesis. There remains high variability among expert hip arthroscopists regarding procedural technique, surgical indications and associated complications. Interestingly, 75% of surgeons indicated a decrease in frequency of iliopsoas tenotomy over the course of their practice most commonly (56.3%) because of hip flexion weakness. However, none (0%) of the surgeons could cite literature evidence. Most commonly (56.3%), surgeons referred to *perceived* poor outcomes in their own practice. There were other trends in surveyed responses: 75% of the surveyed physicians use internal snapping hip and 62.5% use ilipsoas impingement as indications for tenotomy when performed, 93.3% use a transcapsular technique to perform tenotomy at the hip joint level, 87.5% perform concomitant labral repair/reconstruction and surgeons were less inclined to perform tenotomy on patients with borderline dysplasia (75%) or ligamentous laxity (56.3%).

Ilizaliturri *et al.* [9] first reported good outcomes without recurrence after extracapsular endoscopic release of iliopsoas tendon at the level of the lesser trochanter. Further work from Ilizaliturri *et al.* and Contreras *et al.* [10, 14] showed comparable results with central compartment transcapsular release of the tendon at the level of the labrum when compared with the extracapsular release. These data, combined with fewer portal sites and operative time, likely provide the basis for the nearly unanimous opinion that tenotomy be performed transcapular at the level of the joint. By contrast, however, there is evidence stating that this technique carries a higher risk for recurrent internal snapping, if that is the indication for the iliopsoas tenotomy [15, 16].

The gold standard of care for both internal snapping hip syndrome and iliopsoas impingement is conservative treatment. These typically involve physical therapy and stretching exercises, use of non-steroidal anti-inflammatory drugs and/or corticosteroid injections [2]. If these do not relieve the pain, or other concomitant pathologies like femoroacetabular impingement or labral tears are present, then arthroscopy may be warranted. The respondents from the survey support this with a majority reporting iliopsoas impingement and snapping hip as indications for tenotomy. A majority also responded that labral repair or reconstruction, femoroplasty and acetabuloplasty were often done concurrently when indicated.

Fabricant *et al.* [17] reported inferior outcomes after arthroscopic transcapular iliopsoas lengthening with sparing of the iliacus muscle fibers in hips with high femoral anteversion. They hypothesized that iliopsoas plays a more crucial role as a dynamic stabilizer in hips with increased strain on the anterior aspect of the joint. These types of hips include borderline of frank anterior acetabular dysplasia as well as increased femoral anteversion. Based on this, worse outcomes and/or instability may arise when iliopsoas anatomy is altered or the function of the iliopsoas is reduced. Similarly, the experts in this study recommended avoiding iliopsoas release in borderline dysplastic hips and in individuals with general ligamentous laxity. A minority of surgeons responded with hip instability as an adverse outcome seen after tenotomy and also cited it as a reason to avoid tenotomy altogether.

It is the belief of the authors that the study published by Fabricant *et al.* may have been the initial stimulus for surgeons to begin decreasing the frequency in which they perform iliopsoas tenotomies. Our beliefs are based purely on anecdotal experience and the timing in which perceived change in iliopsoas occurred. However, the design of this study could have been improved to better achieve its purpose of 'examining an association between femoral anteversion and clinical outcomes after arthroscopic lengthening of a symptomatic, snapping psoas tendon in young patients'. The study groups consist of low/normal femoral version and high femoral version groups. In order to more accurately assess the impact of iliopsoas lengthening in the setting of high femoral anteversion, all patients would have high femoral anteversion while iliopsoas lengthening was performed in group one and a control group in which patients with high femoral anteversion underwent hip arthroscopy but without iliopsoas lengthening. In addition, labral treatment, femoroplasty and acetabuloplasty were performed concomitantly on an unknown number of patients.

An additional hypothesis for the low prevalence (both past and current) and decreasing incidence of lengthenings or tenotomies among the majority of high-volume surgeons in improved understanding of the iliopsoas' contribution to both dynamic and static stability of the hip, in addition to its role as the primary flexor of the hip. While many of the surgeons cited hip flexion weakness as an adverse outcome of iliopsoas tenotomy, none of the surveyed surgeons was able to cite specific literature as evidence of these complications. On review of the available literature, reporting of hip flexion weakness as an outcome following tenotomy is inconsistent. Several studies report hip initial

flexion weakness after surgery [9, 16, 18], while many others do not [10, 19, 20]. Márquez Arabia *et al.* and Hwang *et al.* [21, 22] reported on the initial loss of significant strength but the return of full strength over time. Brandenburg *et al.* [23] published the most precise quantification of hip flexion strength and noted hip flexion weakness when compared with the non-surgical extremity and with controls undergoing hip arthroscopy without tenotomy.

Limitations

This Level V expert opinion study contains several limitations. The small sample size of surgeons is underpowered and creates selection bias, though this study was given at an open meeting in an anonymous fashion. Our survey is not a standardized or validated questionnaire or outcome measure but a list of common questions encountered at high-level arthroscopy meetings. Because the questionnaire was administered to surgeons without access to their respective databases, it is very likely that recall bias affected the accuracy of the numbers provided by each surgeon. Response bias may also have played a role through surgeons favoring some responses while omitting others. Additionally, this study presents Level V evidence based on the opinions of a handful of hip arthroscopists rather than peer-reviewed data. In fact, some of the responses given were based on Level V evidence itself thus pointing to the need for prospective randomized trials to better evaluate this topic.

CONCLUSIONS

The use of iliopsoas tenotomy is a procedure most commonly indicated for internal snapping hip and iliopsoas impingement. When performed, tenotomy is most commonly performed at the level of the hip joint/labrum through a transcapsular technique and is often combined with labral treatment, femoroplasty and/or acetabuloplasty. Its implementation by hip arthroscopists is inconsistent and declining in utilization. The literature reporting adverse outcomes and complications associated with this procedure that should explain these trends are lacking consistency and quality of research. Based on this study, it is possible that surgeons are altering their practices without evidence-based medicine. Further high-level research regarding iliopsoas tenotomy/lengthening are desperately needed to better guide treatment tends.

SUPPLEMENTARY DATA

Supplementary data are available at *Journal of Hip Preservation Surgery* online.

CONFLICT OF INTEREST STATEMENT

Dr. Domb reports grants and other from American Orthopedic Foundation, during the conduct of the study; personal fees from Adventist Hinsdale Hospital, personal fees and non-financial support from Amplitude, grants, personal fees and non-financial support from Arthrex, personal fees and non-financial support from DJO Global, grants from Kaufman Foundation, grants, personal fees and non-financial support from Medacta, grants, personal fees, non-financial support and other from Pacira Pharmaceuticals, grants, personal fees, non-financial support and other from Stryker, grants from Breg, personal fees from Orthomerica, grants, personal fees, non-financial support and other from Mako Surgical Corp, grants and non-financial support from Medwest Associates, grants from ATI Physical Therapy, grants, personal fees and non-financial support from St. Alexius Medical Center, grants from Ossur, outside the submitted work; In addition, Dr. Domb has a patent 8920497 - Method and instrumentation for acetabular labrum reconstruction with royalties paid to Arthrex, a patent 8708941 - Adjustable multi-component hip orthosis with royalties paid to Orthomerica and DJO Global, and a patent 9737292 - Knotless suture anchors and methods of tissue repair with royalties paid to Arthrex and Dr. Domb is the Medical Director of Hip Preservation at St. Alexius Medical Center, a board member for the American Hip Institute Research Foundation, AANA Learning Center Committee, the Journal of Hip Preservation Surgery, the Journal of Arthroscopy; has HAD ownership interests in the American Hip Institute, Hinsdale Orthopedic Associates, Hinsdale Orthopedic Imaging, SCD#3, North Shore Surgical Suites, and Munster Specialty Surgery Center. Dr. Chen reports grants, personal fees and non-financial support from Arthrex, non-financial support from Smith & Nephew, non-financial support from Ceterix, non-financial support from DePuy Synthes Sales, non-financial support from Desert Mountain Medical, non-financial support from Horizon Pharma, non-financial support from Medacta USA, non-financial support from Medtronic Xomed, non-financial support from Orthogenrx, non-financial support from Stryker, non-financial support from Tornier, grants from DJO Global, non-financial support from Gemini Mountain Medical, outside the submitted work. Dr. Ortiz-Declet reports non-financial support from Abbvie, grants and non-financial support from Arthrex, non-financial support from Bioventus LLC, non-financial support from Ferring Pharmaceuticals, non-financial support from Horizon Pharma, non-financial support from Johnson and Johnson, non-financial support from Medacta USA, non-financial support from SeaPearl, non-financial support from Smith & Nephew, non-financial support

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ETHICAL APPROVAL

This study was performed in accordance with the ethical standards in the 1964 Declaration of Helsinki. This study was carried out in accordance with relevant regulations of the US Health Insurance Portability and Accountability Act (HIPAA). Details that might disclose the identity of the subjects under study have been omitted. This study was approved by the IRB (IRB ID: 5276). This study was performed at the American Hip Institute.

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