Radiologic and Intraoperative Findings in Revision Hip Arthroscopy

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Purpose: The purpose of this study was to identify possible causes of failure of hip arthroscopy by reviewing the intraoperative and radiologic findings in a series of patients requiring revision hip arthroscopy. **Methods:** We retrospectively reviewed 24 revision hip arthroscopy cases performed in 23 patients (14 female and 9 male; mean age, 33.6 years; 1 bilateral). The review included indications for surgery, intraoperative findings, and arthroscopic interventions for both the primary and revision surgeries. Imaging studies, including radiography, magnetic resonance imaging, and 3-dimensionally reconstructed computed tomography scans, were analyzed for the presence of preoperative bony impingement lesions (e.g., femoral head-neck junction "cam" lesions or anterosuperior acetabular "pincer" lesions). **Results:** The mean interval between previous hip arthroscopy and recurrence of symptoms was 6.1 months. In 13 of 24 cases (54%), patients had no significant improvement at any point after the primary hip arthroscopy. The mean interval between the previous hip arthroscopy and revision surgery was 25.6 months. Unaddressed or undertreated bony impingement lesions were found in 19 of 24 cases (79%) and were identified on imaging studies before revision hip arthroscopy. A tight psoas tendon and corresponding labral impingement lesion were identified by arthroscopic visualization in 7 of 24 cases, for which partial psoas tendon release was performed. Eight cases of failed labral repair were addressed with labral debridement and removal of suture material. Of these 8 cases, 6 also had bony impingement, which was also addressed at the time of the revision surgery. **Conclusions:** Failure to address bony impingement lesions of the hip and a tight psoas tendon are key factors in unsuccessful hip arthroscopy and may require revision surgery. Furthermore, failure of labral repairs may be the result of unrecognized bony impingement at the time of initial surgery. **Level of Evidence:** Level IV, prognostic case series. **Key Words:** Hip arthroscopy—Revision surgery—Acetabular labral tears—Femoroacetabular impingement.

Hip arthroscopy has been successfully used to treat symptomatic acetabular labral tears, femoroacetabular impingement, hip capsular laxity and instability, chondral injuries, coxa saltans, ligamentum teres injuries, adhesive capsulitis, and extra-articular injuries.[1-10] Although complication rates are relatively low,[4,11-14] new literature suggests that short-term postoperative satisfaction rates are between only 60% and 70%.[15] These results are disappointing when compared with the results of other common arthroscopic procedures.[6,16,17]

Despite technically sound management of focal intra-articular lesions, such as acute and chronic labral tears, some patients continue to have pain and poor functional outcomes. The recent literature suggests that a large number of patients with acetabular labral tears may also have underlying structural hip abnormalities detectable by plain radiographs.[18] There is only one report in the literature regarding the cause of failure in primary hip arthroscopy or findings related to revision hip arthroscopy.[19] The purpose of this retrospective review is to identify possible causes of "failure" of hip arthroscopy and to report the radiographic and intraoperative findings

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in patients undergoing revision hip arthroscopy. It is hypothesized that patients with persistent symptoms after labral debridement or repair performed arthroscopically had bony impingement lesions that had not been adequately addressed.

METHODS

The medical records of 450 patients who underwent a hip arthroscopy procedure between 2003 and 2007 by the senior author were reviewed to identify those who had undergone 1 or more prior hip arthroscopy procedures on the ipsilateral side. This was the sole inclusion criterion, and none of the identified patients was excluded. Dictated operative notes for the prior procedures were obtained by the patients for our review, and details of each patient's clinical course between procedures was reviewed. The review included the time after the most recent prior procedure at which symptoms recurred and the time interval between the prior procedure and revision procedure. Indications for the revision procedure and the detailed operative interventions were recorded from the senior author's operative notes and clinic notes.

Demographic data analyzed included age at the time of the revision procedure, sex, athletic status (stratified into 4 categories: professional, high school/college, recreational, or nonathlete), and primary sport played, if any. Preoperative and postoperative radiographs, preoperative magnetic resonance imaging scans, preoperative 3-dimensionally reconstructed computed tomography scans, and intraoperative arthroscopic digital photographs from the revision procedure were analyzed, with particular attention paid toward the presence of a bony "cam" lesion or "pincer" lesion, as well as the effectiveness of debridement interventions in removing such lesions in the revision procedure, based on the images obtained before and after arthroscopy. For assessment of the presence of impingement lesions, all primary measurements and determinations were performed by the senior author. A cam lesion was defined as a femoral head-neck relation that was nonspherical or not perfectly round. The loss of roundness contributes to abnormal contact between the femoral head and acetabular socket, thereby causing impingement of both structures, as reported by Lavigne et al.[20] Identification of a cam lesion was made based on an α angle measuring greater than 50° on an oblique axial magnetic resonance image, as described by Notzli et al.[21] A pincer lesion was defined as an abnormal bony prominence at the anterosuperior aspect of the acetabulum, seen as a positive crossover sign on a true pelvis radiograph, as described by Siebenrock et al.[22] To assess the radiologic interpretations of the senior author, the official radiology readings, performed by several different musculoskeletal radiologists at the institution at which this study was performed, were reviewed. In each case in which the senior author identified an impingement lesion, the reading for one or more radiologic modality included the diagnosis of an impingement lesion.

RESULTS

We identified 24 cases of revision hip arthroscopy in 23 patients, with 1 patient requiring bilateral hip arthroscopy for resection of pigmented villonodular synovitis lesions, performed in a staged fashion. Of the patients, 6 had prior surgeries performed by the senior author himself. There were 14 female patients (61%) and 9 male patients (39%), with a mean age of 33.6 years (range, 16 to 54 years). One patient was a professional golfer, four were competitive high school or college athletes, and eight were recreational athletes, with various sports being played, including golf, soccer, skiing, cross-country running, triathlon, snowboarding, and basketball.

The mean interval between the primary hip arthroscopy and recurrence of symptoms was 6.1 months (range, 0 to 39 months). Although a variety of symptoms were reported, all 23 patients (100%) reported groin pain, had pain that became worse with activity, and had no significant improvement with conservative measures, which included anti-inflammatory medications and physical therapy. In 13 of 24 procedures (54%) there was no improvement in symptoms at any time point after the primary surgery. The mean interval between the prior and revision surgery was 25.6 months (range, 7 to 43 months).

On the basis of a review of preoperative radiologic findings, bony impingement lesions were identified by the senior author in 19 cases (79%) (5 cam [21%], 11 pincer [46%], and 3 combined [13%]), which was supported by official radiologists' readings and further confirmed by the intraoperative arthroscopic findings observed by the senior author in each case (Figs 1-11). There were no false-positive diagnoses of impingement lesions based on preoperative radiographs, and intraoperative arthroscopic digital photographs and postoperative radiographs confirmed removal of the lesion(s) in each of the revision cases.

Both the primary and revision procedures performed are detailed in Table 1. Pincer debridement or femoral head-neck junction cam debridement had

FIGURE 1. Lateral radiograph of hip showing combined cam and pincer lesion and planned area of arthroscopic bony resection.

been performed during the primary procedure in 9 of 19 revision cases. Of these 9 cases, 1 involved under-resection of a pincer lesion, 4 involved failure to address 1 of the 2 bony lesions in patients with a combined cam-pincer lesion, and 2 involved both under-resection and failure to address a second lesion. In the other 2 of 9 cases in which bony debridement had been performed, it was judged to be adequate.

Of the 10 primary cases involving only soft-tissue procedures, 8 included arthroscopic labral repair, which in each case was found to have failed, in the form of either a loose suture anchor or retorn labrum. Re-repair was performed in 1 patient, and debridement of the torn labrum and removal of the suture/anchor material were performed in the other 7. Of the 8 labral repair cases, 6 were found to have bony impingement lesions, which were addressed with debridement in each of the revision cases.

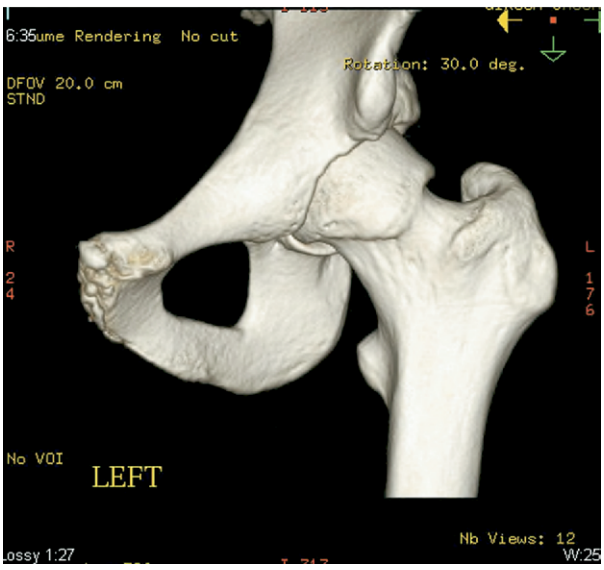

FIGURE 2. Anterior view of 3-dimensional computed tomography scan of left hip with prominent femoral head-neck junction impingement lesion.

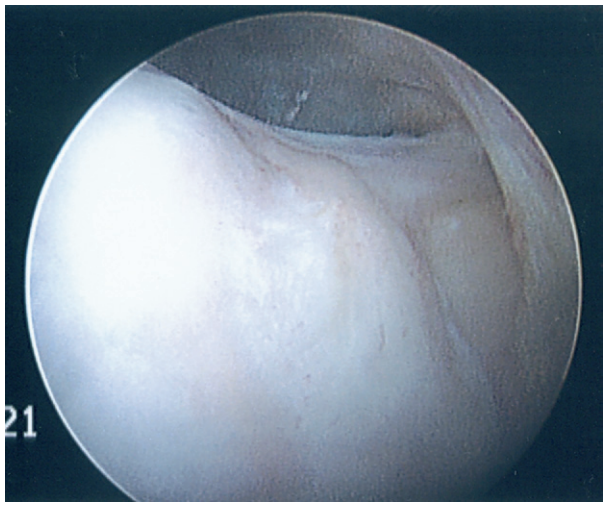

FIGURE 3. Arthroscopic view of femoral head-neck junction cam impingement lesion.

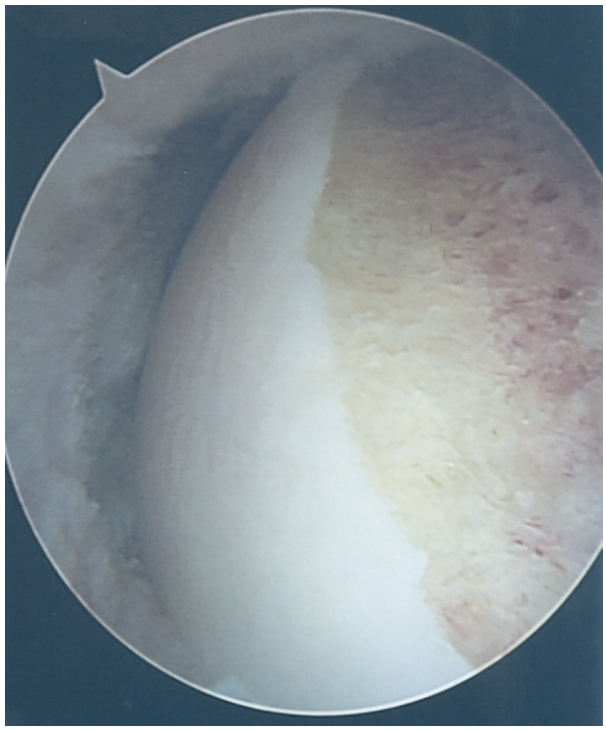

FIGURE 4. Arthroscopic view of femoral head-neck junction after debridement of cam lesion.

FIGURE 5. Coronal view of magnetic resonance imaging study showing acetabular pincer impingement lesion with associated labral tear.

A partial psoas tendon release was performed in 7 of 24 cases, usually in conjunction with another procedure. In 6 of these cases, both a pincer lesion and labral tear were also identified and debrided, whereas only 1 case involved only a labral tear. In each case, however, the labral tear corresponded to the location of the psoas tendon on the acetabulum, which was found to be tight over the acetabulum with the hip in extension. In the 5 cases in which bony debridement was not performed, a variety of other soft-tissue procedures were performed, which are detailed in Table 1.

FIGURE 6. Arthroscopic view of acetabular pincer impingement lesion with associated labral lesion.

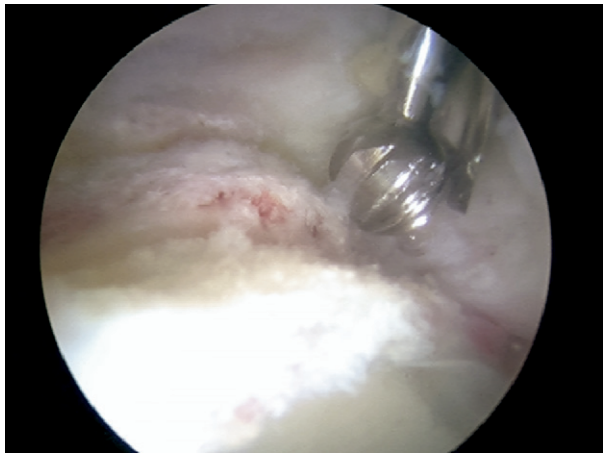

FIGURE 7. Arthroscopic view of debridement of anterosuperior acetabular rim pincer impingement lesion with high-speed bur.

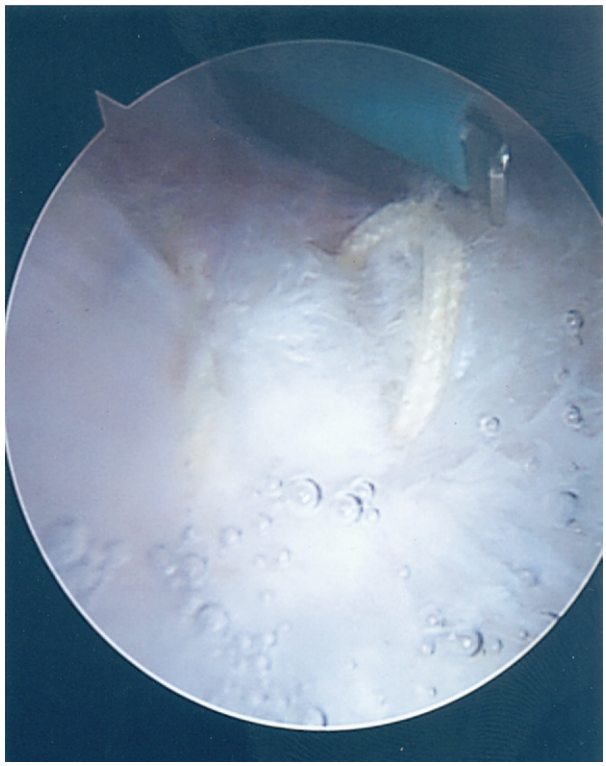

FIGURE 8. Arthroscopic view of failed labral repair associated with labral tear and loose suture.

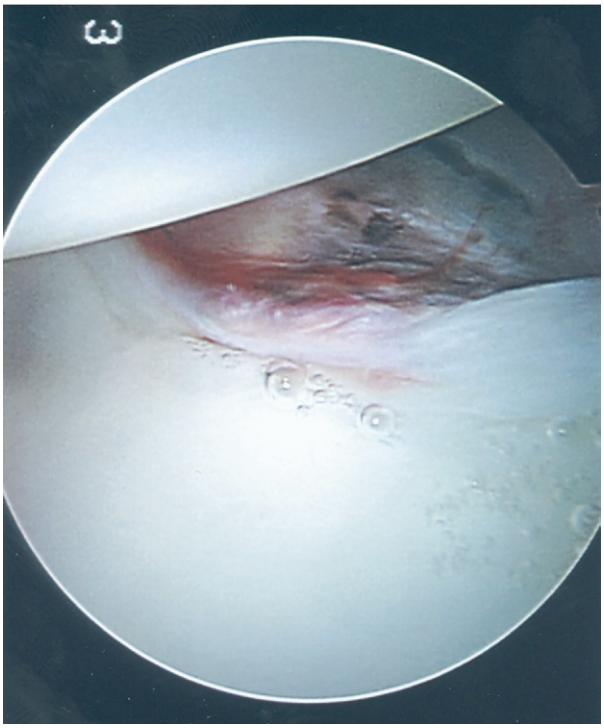

FIGURE 9. Arthroscopic view of anterior labral lesion associated with overlying psoas tendon impingement.

DISCUSSION

Recognition of a widening spectrum of debilitating intra-articular injuries within the hip joint is increasing, as new imaging techniques are enhanced and diagnostic approaches evolve. As a result, hip arthroscopy is a rapidly advancing area of orthopaedic surgery, with expanding indications. Various studies suggest that complication rates remain low, ranging from 0.5% to 5%, with transient neurapraxia being the most common.[1,4,11-14,23] However, there is a paucity of data in the literature regarding patient outcomes after these procedures.

In this retrospective series the hypothesis was effectively proven that patients with persistent symptoms after labral debridement or repair performed arthroscopically had bony impingement lesions that had not been adequately addressed. Most cases (79%) showed underlying bony hip pathology, in the form of femoroacetabular impingement lesions, specifically either femoral head-neck junction cam lesions, anterosuperior acetabular pincer lesions, or both. These lesions were identified at the time of presentation after primary or previous hip arthroscopy procedures and before revision surgery. Any evidence of attempts to surgically address bony pathology was reported in less than half of the primary cases. These data suggest that although there are a variety of indications for primary hip arthroscopy, a significant cause of failure after such cases may be inadequate preoperative identification of such bony lesions. Interestingly, 6 patients in this series underwent either a cam resection, only to require a pincer resection at the time of revision, or a pincer resection, only to require a cam resection at the time of revision. Such a finding may lend support to work performed by Beck et al.,[24] who found combined femoroacetabular impingement lesions to be significantly more common that either isolated cam or pincer lesions alone. In addition, 3 patients in this series who underwent cam or pincer resection in the primary case had persistent radiographic and clinical signs of impingement, requiring more aggressive resection at the time of revision. Thus, even when bony lesions are fully recognized, there may be a tendency to insufficiently address them surgically.

The significant number of concomitant pathologic findings, particularly labral tears, that were appreciated intraoperatively in this subpopulation of revision hip arthroscopy patients also suggests that although bony pathology may be a common cause of hip pathology amenable to hip arthroscopy, by the time patients are symptomatic, cam and pincer lesions can lead to a cas-

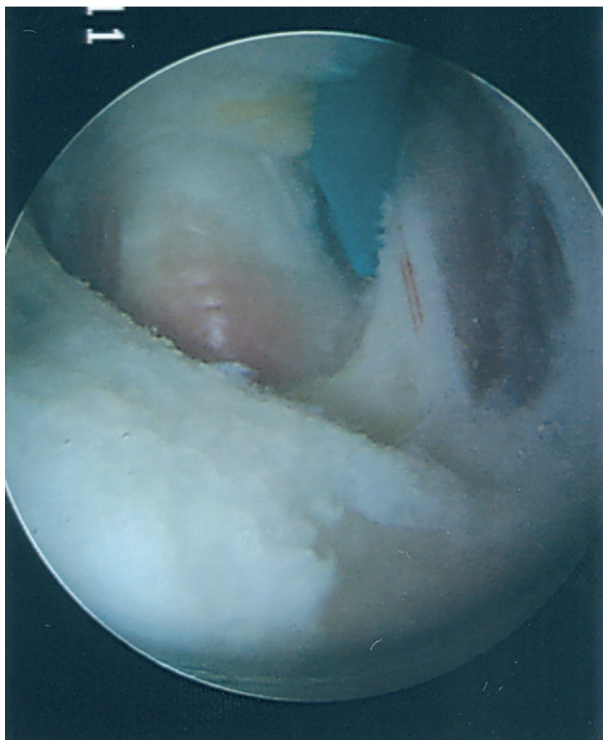

FIGURE 10. Arthroscopic view of underside of psoas tendon with characteristic tendon sheath lesion, after capsular debridement for exposure.

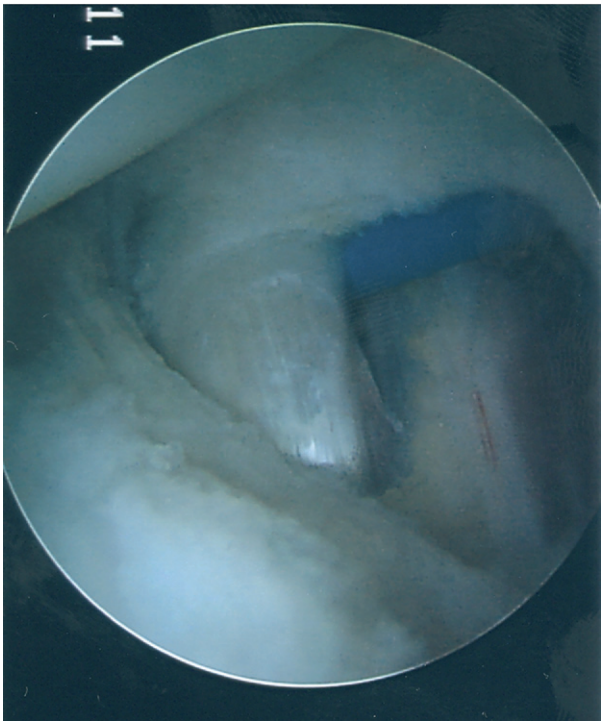

Figure 11. Arthroscopic view of tight psoas tendon, associated with labral impingement lesion, just before release of tendon.

cade of degenerative or inflammatory processes. This may explain why labral fraying or frank detachment and generalized synovitis were seen in most of our cases. As a result, a large number of concomitant surgical interventions were performed in the revision setting, making isolation of the primary symptomatic or etiologic lesions difficult. Ultimately, however, debridement of these bony lesions may be a critical factor in the success of hip arthroscopy in a large percentage of patients. Interestingly, in most cases (54%), patients reported no relief of symptoms at any time after their prior arthroscopic surgery. Those who did report relief of symptoms had a mean of only 6 months of relief before recurrence of symptoms. Overall, this series of patients required revision surgical intervention within a mean of approximately 2 years.

Robertson et al.[15] performed a systematic review of the literature regarding patients with symptomatic acetabular labral tears who did not have severe arthritis or severe acetabular dysplasia and in whom conservative management had failed. They concluded that patients undergoing labral debridement can expect a satisfaction rate of 67% at a mean follow-up of 3.5 years. When compared with the short-term results of knee meniscectomy,[6,16,17] these results suggest the need for further improvement in the application of diagnostic tools,[25,26] the honing of surgical indications, or the execution of surgical techniques.

One emerging concept is the emphasis on underlying bony deformity as a possible cause of soft-tissue pathology. Wenger et al.[18] performed a retrospective review of all patients with acetabular labral tears and found that 87% had a structural hip abnormality detectable by plain radiographs, including coxa valga, a retroverted acetabulum, an abnormal femoral head-neck offset, or osteophytes. Labral debridement is becoming a more commonly performed procedure, but failure to address underlying bony abnormalities such as femoroacetabular impingement may lead to continued pain, poor patient satisfaction, and functional limitations. Many institutions are now performing concurrent procedures such as osteoplasty for bony impingement or capsular plication for hip instability to address the underlying causes of labral tears.[27] A recent study by Philippon et al.[19] looked at 37 revision hip arthroscopy cases and reported findings similar to those in our study. Approximately 95% of the revision surgeries in their series included procedures for femoroacetabular impingement. Although they reported 5 failures of revision surgery requiring total hip replacement or a second revision hip arthroscopy procedure, 1-year follow-up on 27 of 32 patients in whom revision did not fail revealed improvement in functional outcomes.

Notably, in the current study primary cases in which labral repairs had been performed represented one third of the total number of revision cases. In each case the labral repair had failed, and in 75% of these failures, there was also a bony impingement lesion that had been either missed or inadequately addressed. It is unclear from the limited data available in the literature whether arthroscopic labral repair is a consistently efficacious procedure, and more research into this specific question is clearly needed. The data from this study suggest that one factor that is likely to limit the success of labral repair is bony impingement.

In addition, there is growing recognition that the psoas tendon, as it crosses the anterior aspect of the hip joint, can play a role in the pathophysiology of acetabular labral impingement, even in patients without a formal diagnosis of "snapping hip." In this series of revision hip arthroscopy procedures, 7 patients were seen to have a tight psoas tendon overlying and impinging upon a torn or inflamed anterior labrum. In each case a partial psoas release of the tendinous portion of the musculotendinous unit at that level was performed, and the labrum was observed, arthroscopically, to be free of impingement from the tendon when the hip was taken through its

TABLE 1. *Primary and Revision Procedures*

	Primary Procedures						Revision Procedures						
	CD	PD	LD	LR	LTD	Other	CD	PD	C&PD	LD	LR	PTR	Other
Case No.													
1				+				+		+			Partial synovectomy
2				+			+			+			
3			+			Partial synovectomy	+			+			Partial synovectomy
4	+		+		+			+					Partial synovectomy, capsular release
5			+						+	+			Partial synovectomy, capsular release
6				+			+						Partial synovectomy
7	+		+		+	Partial synovectomy			+				Removal of loose body
8	+			+		Partial synovectomy		+		+		+	
9				+		Capsular plication					+		Thermal capsulorrhaphy
10				+						+			Partial synovectomy
11			+			PVNS resection, psoas tendon release, capsular release	+			+			PVNS resection, capsular release
12			+			PVNS resection, capsular release	+						PVNS resection, trochanteric bursectomy
13		+	+					+		+			Partial synovectomy
14		+	+							+		+	Partial synovectomy, removal of loose body
15			+					+		+			Ligamentum teres debridement
16						Iliotibial band release					+	+	Iliotibial band release, trochanteric bursectomy, synovectomy, capsular plication
17			+					+		+			Partial synovectomy
18			+					+		+			Partial synovectomy
19	+		+					+		+			Partial synovectomy
20	+			+				+		+		+	Partial synovectomy, removal of loose body
21				+		Partial synovectomy		+		+		+	Partial synovectomy, removal of loose body
22	+		+			Partial synovectomy				+			Partial synovectomy, removal of loose body
23	+		+		+	Partial synovectomy, thermal capsulorrhaphy			+	+			+	Partial synovectomy, removal of loose body
24			+		+			+		+		+	Partial synovectomy, removal of loose body
Total	7	2	16	8	4	Partial synovectomy in 6	5	11	3	19	2	7	Partial synovectomy in 16

Abbreviations: CD, cam debridement; PD, pincer debridement; LD, labral debridement, LR, labral repair; LTD, ligamentum teres debridement; C&PD, cam & pincer debridement; PTR, psoas tendon release; PVNS, pigmented villonodular synovitis.

range of motion. More research is needed to understand the spectrum of disease related to the psoas, but it may play an increasingly substantial role in failure of hip arthroscopy procedures.

Among the previously mentioned categories of conditions affecting the acetabular labrum, 2 that were notably absent from this series of revision hip arthroscopy cases were patients with dysplastic and degenerative hip pathology. Unlike patients with bony and tendinous impingement lesions affecting the labrum, these subsets of patients often have underlying conditions that are not reversible or correctable with arthroscopic techniques and are therefore rarely indicated for arthroscopic procedures. Although the indications of hip arthroscopy continue to expand, recognition of the limitations of the changing treatment modalities also remains a goal of both research efforts and clinical care.

Limitations of this study include a relatively small sample size, thereby precluding significant statistical analyses within any subgroups. Moreover, this was a retrospective observational study, rather than a prospective outcomes study. Therefore, patient satisfaction, functional outcome measures, and potential long-term complications related to the revision surgeries performed were not reported. In addition, because this was a single-surgeon study, patients who met the inclusion criteria were determined to be candidates for revision hip procedures based on only 1 person's clinical judgment, which introduces some level of bias into the study.

CONCLUSIONS

Failure to address bony impingement lesions of the hip and a tight psoas tendon are key factors in unsuccessful hip arthroscopy and may require revision surgery. Furthermore, failure of labral repairs may be the result of unrecognized bony impingement at the time of initial surgery.

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