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Research article

Revision hip arthroscopy: findings and outcomes

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ABSTRACT

The purpose of this study is to report on the operative findings and the outcomes of revision hip arthroscopy. All hip arthroscopy cases are prospectively assessed with a modified Harris Hip Score (mHHS) preoperatively and postoperatively. This study consists of 190 consecutive hips (186 patients) who underwent revision arthroscopy with minimum 2-year follow-up. There were 69 males and 117 females with a mean age of 32.7 (14–64). The mean time from index to revision procedure was 24.5 months (3–146). Common diagnoses included labral tears (102) and unaddressed or residual femoroacetabular impingement (FAI) (49 cam, 11 pincer, and 20 combined). In addition to FAI correction, there were 82 labral debridements, 28 repairs/refixations, and 6 excisions of labral calcifications. Ninety-three underwent various amounts of synovectomy and 21 underwent iliopsoas release/debridement. At a mean follow-up of 46.9 months, 84.5% of patients reported symptomatic improvement. Twenty patients underwent subsequent surgery at mean of 51 months (11 repeat arthroscopy and 9 THA). Among 166 patients who had no further surgery, the mHHS had improved 27.1.8 points from a preoperative mean of 54.5 to 81.6. Patients who underwent treatment of FAI demonstrated a mean mHHS improvement of 25.7 points. Complications included two cases of transient pudendal neurapraxia, one case of transient quadriceps weakness, one case of retroperitoneal extravasation, and one case of perioperative myocardial infarction. In conclusion, for properly selected patients with persistent or recurrent symptoms following previous hip arthroscopy, revision surgery can result in favorable outcomes with an acceptably low complication rate.

INTRODUCTION

Driven by evolving technology, expanding indications, and increasing popularity, hip arthroscopy is among the fastest growing fields in Orthopaedic Surgery. A recent study of a large national insurance database found a 365% increase in the rate of hip arthroscopy over the five year period between 2004 and 2009 [1]. An 18-fold increase in the number of hip arthroscopies performed was reported by newly trained surgeons taking Part II of the American Board of Orthopaedic Surgeons in 2009 compared with 1999 [2].

Within the ever-growing population of patients who have undergone hip arthroscopy is a concurrently growing population who will subsequently require additional intervention or revision procedures. The evolution of hip arthroscopy from a soft tissue procedure to a procedure that may incorporate a bony correction has resulted in an increasing need for revision to address impinging bony lesions that were previously left untreated. Patients with other conditions that have only recently been described or understood may undergo subsequent arthroscopy to address pathology that was overlooked or incompletely addressed at index surgery. Advances in techniques such as labral repair and reconstruction and capsular plication provide novel revision options in select patients who continue to have problems after prior arthroscopy. Revision may be needed to address post-operative complications such as adhesion formation or heterotopic ossification. Additionally, the steep learning curve combined with the exponential increase in newly trained surgeons performing hip arthroscopy further drives the need for revision hip arthroscopy [3].

Favorable outcomes have been widely reported after primary hip arthroscopy for a variety of diagnoses [4–11]. Nonetheless, poor outcomes do occur after hip arthroscopy and necessitate revision for a variety of reasons.

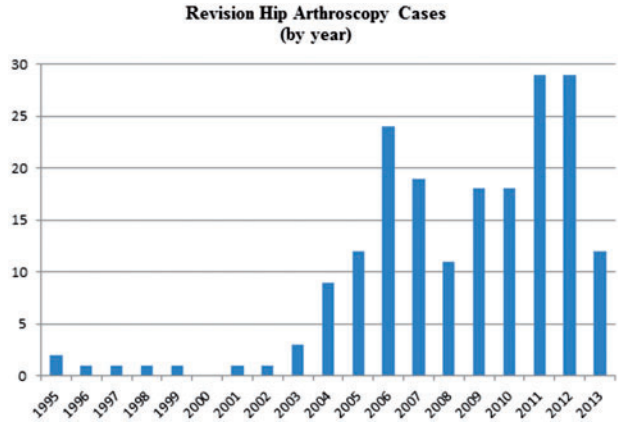

Fig. 1. Revision hip arthroscopy cases (by year). Note: Data for 2013 include cases from January to May.

There a paucity of literature reporting on findings at revision hip arthroscopy and outcomes. The purpose of this study is to report on the operative findings and the outcomes of revision hip arthroscopy.

MATERIALS AND METHODS

From a prospectively maintained database, we identified 190 revision hip arthroscopy cases performed upon 186 patients by the senior author (J.W.T.B.) between March 1995 and May 2013 (Fig. 1). There were 69 males and 117 females with a mean age of 32.7 years (range, 14–64 years) at the time of revision surgery. All patients had undergone at least one prior hip arthroscopy (range, 1–6), 80 of which were performed at an outside hospital by a different surgeon. The total number of prior arthroscopic procedures was 205. The average time from their most recent arthroscopic procedure to revision was 24.5 months (range, 3–146 months).

All patients were evaluated with history, examination, and relevant imaging by one surgeon (J.W.T.B.) and indicated for revision hip arthroscopy. While 137 patients had experienced an interval of symptomatic improvement after the index procedure, 53 patients never improved after the index procedure. All patients were prospectively assessed with a modified Harris hip scope (mHHS) at their preoperative evaluation.

Revision hip arthroscopy was carried out by the senior author using the standard supine method with anterolateral, posterolateral, and direct anterior portals as described previously [12]. Accessory portals were made as indicated by the pathology. Fluoroscopy was utilized to guide entry into the joint and direct bony correction when performed. Approximately 50 pounds of traction was applied to operative leg to access the central compartment and both the 70° and 30° arthroscope were used to document pathology and plan correction. An interportal capsulotomy with further extension medially and/or posteriorly was created as needed to adequately visualize and address all pathology. The peripheral compartment was accessed by flexion of the hip to about 30°–45°. Distal expansion of the capsulotomy was performed if needed to access the femoral neck.

Arthroscopic findings were systematically documented and were correlated with the preoperative evaluation and imaging to guide intervention. Post-operatively, patients underwent a standardized rehabilitation protocol based on the procedures performed. All patients were prospectively assessed post-operatively with the mHHS at 3, 12, 24, and 60 months. All scoring was performed by the second author (K.J.) either at the time of clinical follow-up or by telephone at the appropriate post-operative time point. Complications were documented. Minimum follow-up was 2 years.

RESULTS

An average of 4.0 diagnoses (range, 1–9) were documented at revision surgery (Table I). Significant chondral pathology was the most commonly observed pathology documented in 112 of 190 cases (58.9%). Acetabular chondral damage was seen in 105 cases of which 86 were grade III or grade IV lesions, while femoral damage was seen in 27 cases of which 25 were grade III or IV lesions. Twenty hips had high-grade cartilage damage on both the acetabular and femoral articular surfaces.

Labral tears were seen in 102 hips at revision. Labral calcifications were seen in 51 hips of which 18 had previously undergone a labral repair and 29 a labral debridement. Ligamentum teres injury was seen in 43 cases.

Unaddressed or residual impingement pathology was observed in 80 of 190 hips (42.1%). Cam deformities (69 cases) were more than twice more common than pincer (31 cases). Mixed femoroacetabular impingement (FAI) was seen in 20 cases. Of those cases with residual cam impingement, 53 (76.8%) had grade III or IV acetabular cartilage damage and recurrent labral tears were seen in 49 cases. Forty-two cam deformities had not been addressed at the index procedure while 27 cases were recurrent or incompletely addressed. Of pincer lesions seen at revision arthroscopy, 26 had not been addressed at the index procedure, while a prior pincer correction had been attempted in five cases. Two cases of ischiofemoral impingement were identified and addressed by decompression of the ischiofemoral space.

Synovitis was reported in 79 of 190 (41.6%) cases and pathological capsular adhesions in 16. Symptomatic recurrent synovial chondromatosis occurred in eight cases.

Table I. Findings at revision arthroscopy

Mean no. of documented diagnoses	*4.0 (range, 1–9)*
Femoroacetabular impingement	**80**
Pincer	11
Cam	49
Mixed	20
Chondral damage: acetabulum (grade)	105
I	14
II	5
III	55
IV	31
Chondral damage: femoral head (grade)	27
I	1
II	1
III	15
IV	10
Labral tearing	102
Labral calcification	51
Synovitis	79
Adhesive capsulitis	6
Ligamentum teres pathology	43
Loose bodies	15
Bone fragments	10
Recurrent synovial chondromatosis	8
Iliopsoas pathology	22
Iliotibial band pathology	2
Trochanteric bursitis	4
Piriformis syndrome	2
Ischiofemoral impingement	2
Heterotopic ossification	3

Six patients had developed adhesive capsulitis after their index arthroscopy. Symptomatic heterotopic ossification was reported in three patients. Extraarticular pathology documented at revision surgery included 22 cases of iliopsoas snapping or scarring, 4 cases of trochanteric bursitis, 2 cases of iliotibial band snapping, and 2 cases of piriformis syndrome.

On average, 3.4 procedures (range, 1–7) were performed at revision arthroscopy (Table II). The most commonly documented procedure was synovectomy reported in 93 of 190 cases (48.9%). Chondroplasty of the acetabulum was performed in 74 cases while chondroplasty of the femoral head was performed in 18 cases. Microfracture was performed in 11 cases. Isolated labral repair without acetabuloplasty was performed in eight cases while labral debridement was performed in 73. Excision of labral calcifications was performed in 34 cases.

Femoroacetabular impingement was addressed in 79 revision cases. Sixty-six hips underwent femoroplasty of which 26 were revision corrections, while 31 underwent acetabuloplasty, 5 of which were revisions. Twenty hips underwent combined femoroplasty and acetabuloplasty. Of the 31 acetabuloplasty cases, 20 underwent labral refixation, labral debridement was performed in 9, and labral calcifications were excised in 6.

Debridement of the ligamentum teres was performed in 34 cases. Bone fragments or loose bodies were removed in 21 cases. The iliopsoas tendon was released or debrided in 21 cases. The piriformis tendon was released in 2 cases. Pathology within the peritrochanteric space was addressed in 8 revision cases: two cases of iliotibial band release with trochanteric bursectomy; one case of gluteus medius repair with trochanteric bursectomy; and five cases of isolated trochanteric bursectomy.

Of the 190 cases, 188 had at least 2-year follow-up while three were lost to follow-up after 1 year. Mean follow-up for the remaining 188 cases was 46.9 months (range, 24–60 mHHS at each time point are reported in Table III. At 2-year follow-up, the mean mHHS was 81.2 for 175 patients who had not undergone any subsequent surgery, an improvement of 26.7 points for this cohort. Thirteen patients had undergone subsequent ipsilateral surgery by 2 years post-operatively, of whom six had undergone total hip arthroplasty. Five-year follow-up was available for 104 patients. These patients had a mean mHHS of 80.6, a 28.1-point improvement from the preoperative score of 52.5 for this cohort.

When FAI was addressed at the time of revision arthroscopy, mean improvement was 25.7 points at final follow-up (Table IV). If the correction was a primary correction for previously unaddressed FAI, the mean improvement was 27.4 points. Scores for revision FAI correction were lower with an overall mean improvement of 21.9 points.

In all, 84.5% of patients reported symptomatic improvement after revision hip arthroscopy. Of the 53 patients who reported no symptomatic improvement from their

Table II. Procedures performed at revision arthroscopy

Mean no. of procedures performed	*3.4 (range 1–7)*
Acetabuloplasty	31
Primary	26
Revision	5
Femoroplasty	69
Primary	42
Revision	27
Labral repair/refixation	27
Labral debridement	73
Excision labral calcification	34
Chondroplasty	92
Acetabulum	*74*
Femoral head	*18*
Microfracture	11
Synovectomy	93
Excision capsular adhesions	11
Debridement ligamentum teres	34
Iliopsoas release/debridement	21
Loose body/bone fragment removal	21
Excision heterotopic ossification	3
Piriformis release	2
Trochanteric bursectomy	8
Iliotibial band release	2
Gluteus medius repair	1
Manipulation under anesthesia	6

index procedure, the mean improvement in mHHS was 23.3 points compared a mean improvement of 26.0 points in those patients who experienced a period of interval improvement after their first procedure. However, 88% of patients who did not improve after the index surgery reported improvement after revision arthroscopy at final follow-up.

Twenty patients underwent a subsequent ipsilateral hip procedure at a mean of 51.0 months after revision hip arthroscopy (range, 3–60 months). Nine of these patients underwent total hip arthroplasty at 46.5 months postoperatively on average (range, 24–60 months).

Complications included two cases of transient pudendal neurapraxias, one case of transient quadriceps weakness, one case of retroperitoneal extravasation, and one case of perioperative myocardial infarction.

DISCUSSION

The utilization of revision hip arthroscopy will continue to expand to keep pace with the growing rate of hip arthroscopic procedures performed. The considerable increase in the number of newly trained surgeons performing this procedure will also drive a higher volume of revisions. New modes of failure and mores reasons for revision are expected consequences of the proliferation of indications and techniques for hip arthroscopy.

The current study demonstrates the importance of recognizing and adequately treating FAI at the time of index hip arthroscopy. Impinging bony lesions were present in 42.1% of hips in this series and in almost 70% of these cases, no bony correction had been attempted at the initial surgery. Persistent impingement appears to be a leading cause of poor outcomes after hip arthroscopy. Additionally, high-grade chondral damage was seen in the majority of cases of persistent impingement reflecting the potential ongoing damage that may occur without adequate bony correction.

Previous studies of revision hip arthroscopy have also found a high rate of unaddressed or residual impingement lesions. Bogunovic *et al.* [13] found residual FAI in 68% of cases of failed hip arthroscopy. In this series, 38% of the residual FAI cases required arthroplasty due to the severity of the resulting osteoarthritis after the index hip arthroscopy. Heyworth *et al.* [14] reviewed the radiologic and intraoperative findings at revision hip arthroscopy and found unaddressed or undertreated bony impingement lesions in 19 of 24 cases (79.2%). After finding residual FAI in 36 of 37 revision cases, Philippon *et al.* [15] concluded that persistent impingement was the most common indication for revision hip arthroscopy.

In addition to FAI, the numerous other diagnoses observed in the current study demonstrate the heterogeneity in the indications for revision hip arthroscopy and provide insight into the reasons why hip arthroscopy may fail. An average of 4 and as many as 9 diagnoses were documented at revision arthroscopy. Chondral damage, labral tears and calcifications, and/or synovitis were seen in many of the revision cases reflecting the degree of damage that may be responsible for persistent or recurrent symptoms. Previous studies have showed chondral damage in 70–88% and labral pathology in 86–87% of revision cases [13, 15]. This series also demonstrates the importance of

Table III. Clinical outcomes: all cases (mHHS)

	Pre-op	*3 mo*	*12 mo*	*24 mo*	*60 mo*
mHHS (n)	54.2 (188)	72.5 (188)	79.9 (181)	81.2 (175)	80.5 (104)

Table IV. Clinical outcomes: FAI

	n	*Pre-op mHHS*	*Final follow-up mHHS*	*Change mHHS*	*Follow-up (mo)*
All FAI cases	78	56.9	82.7	25.7	44.3
Primary FAI correction	54	56.1	83.5	27.4	44.7
Revision FAI correction	24	58.8	80.8	21.9	43.5
Non-FAI cases	110	52.3	77.2	24.9	48.5

considering lesions outside the hip joint as pathology involving the iliopsoas tendon, trochanteric bursa, gluteus medius, and iliotibial band was encountered in numerous cases.

While the outcomes after revision hip arthroscopy in this series were highly variable, the vast majority of patients improved after the procedure. On average, the patients in our series reported a 25.3 improvement in mHHS. In select patients, there is a potential to make a dramatic improvement with revision hip arthroscopy. Fourteen patients in our series experienced an improvement in mHHS of at least 50 points from their pre-revision score. Thirty-three patients achieved a post-revision mHHS of 96 or higher signifying a normal or near normal hip. Patients who experienced transient improvement following their index hip arthroscopy tended to have better outcomes although revision arthroscopy was beneficial for the majority of patients who experienced no benefit from their index surgery. Correcting previously unaddressed FAI appears to portend the most favorable prognosis. Revision of a prior FAI correction was not as beneficial on average.

Despite the benefit that the majority of the patients in this series received from revision hip arthroscopy, further procedures were performed in 20 of 190 cases (10.5%) including total hip arthroplasty in nine patients. Revision hip arthroscopy does not appear to present increased risk as we found an overall complication rate of 2.6%.

Previous case series have reported on outcomes after revision hip arthroscopy. Philippon *et al.* [15] reviewed 37 cases of revision hip arthroscopy performed at 20.5 months after the index procedure on average Five cases subsequently required additional surgery, two of which were total hip arthroplasty. Of the remaining 32 cases, follow-up was obtained on 27 at an average of 12.7 months and improvement in mHHS of 24 points from a pre-revision score of 53 points to a post-revision score of 77 points. A more modest benefit of revision hip arthroscopy was reported by Aprato *et al.* [16] in their study of 63 cases. While 63.4% of patients reported a benefit at 1 year after revision hip arthroscopy, that number fell to 55.6% at 3 years. In this series, the mean mHHS improvement was nine points at 1 year and five points at 3 years from a mean pre-revision score of 54. Gupta *et al.* [17] reported on 70 patients who underwent revision hip arthroscopy finding an overall success rate of 75% with mHHS improvement of 15.8 points at a mean of 28-month follow-up. However, 10 patients (14.3%) underwent total hip arthroplasty and 5 (7.1%) underwent additional hip arthroscopy.

Two case–control studies have evaluated revision hip arthroscopy in comparison to primary hip arthroscopy. Newman *et al.* [18] recently performed a matched-cohort study of 246 revision hip arthroscopy patients compared with 492 primary arthroscopy patients at mean follow-up of 43 months. Both groups reported similar significant improvement in outcome scores with the revision cohort seeing a 17-point increase compared with an 18.7-point increase in the primary cohort. They further broke down the revision cohort and found that those with greater joint space, those who had a prior labral repair, and those in which the capsule was plicated at the time of revision achieved more benefit from revision arthroscopy. Patients with more than two revisions had lower outcomes. Larson *et al.* [19] studied revision surgery in 85 cases of residual FAI compared with a primary FAI correction cohort of 237 cases. While both cohorts demonstrated significant improvement at mean follow-up of 26 months, the benefit was less in revisions. In the revision cohort, good or excellent results were achieved in 62.7% (mean mHHS

improvement of 17.8) compared with 81.7% in primary cases (mean mHHS improvement of 23.4). Predictors of better outcomes with revision surgery included greater post-operative head-neck offset, subspine decompression, labral repair/reconstruction, and capsular plication.

Limitations of this study include the retrospective design although all outcomes data was collected in a prospective manner. Additionally, the lengthy duration of data collection presents a natural limitation as the technique of hip arthroscopy has evolved substantially over that time period. Many of the primary procedures and several of the revision procedures studied in this series were performed prior to the development of the concept of FAI. Additionally, treatment of labral pathology has progressed over the duration of the study. Advances in technique allow repair of labral tears that were routinely debrided or excised early in the study period. Nonetheless, we believe that it is important to report on the entire experience of revision hip arthroscopy to portray the most accurate representation of the procedure. This is one of the largest series of revision hip arthroscopies yet reported.

CONCLUSION

Revision hip arthroscopy will continue to expand in utilization. The diagnoses, and consequently, the procedures performed are quite heterogeneous. A high index of suspicion for residual FAI should be maintained when evaluating and treating a patient who continues to have symptoms or develops new symptoms after a prior hip arthroscopy. Additionally, extraarticular and peritrochanteric etiologies should be considered. There does not appear to be increased risk of complications with revision, and while the outcomes can be variable, the majority of patients may experience meaningful benefit after revision hip arthroscopy.

IRB STATUS

The data in this study received exemption status from the Institutional Review Board.

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CONFLICT OF INTEREST STATEMENT

F. Winston Gwathmey receives research support from Depuy-Mitek and Ceterix. J. W. Thomas Byrd is a consultant for Smith & Nephew; he is a non-paid consultant and has stock in A3 Surgical.

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