Persistent Structural Disease Is the Most Common Cause of Repeat Hip Preservation Surgery

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Abstract

Background Hip preservation surgery has become more commonplace, yet when it fails, it is unclear why it does so. Understanding failed procedures should lead to improved surgical results.

Questions/purposes The purposes of this study were to (1) characterize patients undergoing hip preservation

surgery after prior procedures; (2) compare demographics, hip pain, and function in patients with prior procedures with those undergoing primary surgery; (3) determine the types of previous procedures and the reasons for secondary surgery; and (4) report the procedure profile of the secondary surgeries.

Methods A prospective, multicenter hip preservation database of 2263 patients (2386 surgery cases) was reviewed to identify 352 patients (359 hips, 15% of the total) who had prior surgery. Patient demographics, type of previous surgery, diagnostic categories, clinical scores, and type of secondary procedure were recorded.

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Results For patients undergoing secondary surgery, the average age was 23 years and 70% were female. Hip pain and function were similar between patients undergoing primary and secondary surgery. The previous surgical approaches were open in 52% and hip arthroscopy in 48%. In the femoroacetabular impingement and adult acetabular dysplasia subgroups, hip arthroscopy was the most common previous surgical approach (86% and 64%, respectively). Inadequately corrected structural disease was the most common reason for secondary surgery. Femoral osteochondroplasty and acetabular reorientation were the most common secondary procedures.

Conclusions Inadequately corrected structural disease (femoroacetabular impingement or acetabular dysplasia) was commonly associated with the need for secondary hip preservation surgery. Although we do not have data to identify other technical failures, the available data suggest primary treatments should encompass comprehensive deformity correction when indicated.

Level of Evidence Level III, prognostic study. See Guidelines for Authors for a complete description of levels of evidence.

Introduction

The surgical treatment of young adult hip disease including femoroacetabular impingement (FAI) and acetabular dysplasia has rapidly expanded in the last decade [6, 18]. Surgical techniques to treat FAI and hip dysplasia [7, 8] provide symptomatic improvements in the majority of patients undergoing primary hip preservation surgery [4, 5]. Nevertheless, there is a complex subgroup of patients who present with continued or recurrent symptoms after previous hip preservation procedures. This subpopulation has not been well characterized in the literature and in general making a clear diagnosis of the causes of persistent pain and/or functional limitations difficult as is the choice of treatment. To improve clinical care for the expanding patient population undergoing both primary and secondary hip preservation surgery, there is a need to better understand the demographics, reasons for failed treatments, indications for additional surgery, and the best surgical strategies.

Hip pathology in the young adult population is diverse, including not only FAI and acetabular dysplasia, but also symptomatic residual deformities from pediatric hip disease. Symptomatic hips with previous treatment of developmental hip dysplasia, slipped capital femoral epiphysis (SCFE), and Legg-Calvé-Perthes (LCP) disease are not uncommon. The surgical treatment of these patients is particularly challenging as a result of the combination of underlying structural

deformities and secondary deformities created by surgery. A systematic evaluation of hip preservation surgery after prior procedures offers one method to better understand this patient population and to assist in the development of refinements in primary hip preservation treatments. For example, as the enthusiasm for hip arthroscopy grows, it is important to identify the limitations and contraindications for this surgical approach. Analysis of treatment failures is one method to define the limitations of a surgical approach and/or surgical procedure.

The purposes of this study were to (1) characterize patients undergoing hip preservation surgery after prior hip procedures; (2) compare demographics, hip pain, and function in patients with prior procedures with those undergoing primary surgery; (3) determine the types of previous procedures and the reasons for secondary surgery; and (4) report the procedure profile of the secondary surgeries.

Patients and Methods

The prospective, multicenter Academic Network of Conservation Hip Outcome Research (ANCHOR) joint preservation database was queried from January 1, 2007, to September 5, 2012. The prospective cohort included cases from 12 surgeons at nine institutions. A total of 2263 patients with 2386 hip preservation surgeries were queried to identify all 418 patients (424 procedures) with a history of previous hip surgery (Fig. 1). Of those we excluded 65 patients (65 hips) for one of the following reasons: previous fracture or traumatic dislocation, atypical congenital deformities, closed reductions and/or adductor tenotomy of a dysplastic hip, adductor tenotomy for LCP disease, infection/osteomyelitis, underlying neuromuscular disease, adult avascular necrosis, benign/malignant tumors, and incomplete records (Table 1). These exclusions left 353 patients with 359 previous procedures (15% of the total procedures). All patients had persistent or recurrent symptoms after their initial surgery. All 355 patients failed nonoperative treatment consisting of activity modification and physical therapy for a minimum of 3 months before the secondary surgery.

Patient demographics, type of previous surgery, baseline clinical scores, preoperative symptoms, and type of revision surgery performed were prospectively recorded. The number of previous surgeries was determined by patient report and review of available outside medical records. Isolated hardware removal was not included in the number of previous surgeries. Baseline clinical scores included modified Harris hip score (mHHS) [9], WOMAC [1, 12], and SF-12 [19] scores. Patients were subclassified into five categories based on surgeon-assigned diagnoses (at the

Fig. 1 The flow chart summarizes the ANCHOR hip preservation database cases and diagnostic categories for hips with previous surgery. DDH = developmental dysplasia of the hip.

Table 1. Reasons for exclusion of hips with previous surgery

Reason for exclusion	Number of hips (n = 62)
Previous fracture	16
Traumatic dislocation	3
Atypical congenital deformity*	6
Closed reduction and/or adductor tenotomy DDH	8
Adductor tenotomy LCP	8
Infection/osteomyelitis	4
Neuromuscular disease	7
Benign/malignant tumor	8
Incomplete records	2

* Proximal femoral focal deficiency (n = 4), multiple epiphyseal dysplasia (n = 1), achondroplasia (n = 1); DDH = developmental dysplasia of the hip; LCP = Legg-Calvé-Perthes.

time of secondary surgery) and type of previous and secondary surgery including (1) FAI/labral tears; (2) adult hip dysplasia; (3) pediatric hip dysplasia; (4) SCFE; and (5) LCP disease/residual Perthes-like deformities (Fig. 1). Acetabular dysplasia was subclassified as “pediatric” based on a history of previous surgical treatment (during childhood) of pediatric hip dysplasia or as “adult” when no history of childhood treatment was present. Complete data were present for all patients regarding the index (secondary) operative procedure for this study. Complete data were not available for the failed primary procedure because the majority of these were not in the ANCHOR database.

We compared the continuous variables (age, body mass index [BMI], mHHS, Hip Disability and Osteoarthritis Outcome Score [HOOS], WOMAC, SF-12 scores) between the primary and revision hip preservation cohorts using the Student’s t-test. A chi-square test was used to compare sexes.

Results

Of the 353 patients included in this study, 71% (n = 249) were female and 30% (n = 104) were male (Table 2). The average age of the group was 23 years (median, 20 years; range, 10–54 years) and average BMI was 26 kg/m² (median, 24 kg/m²). The mean number of previous surgeries in the study group was 1.1 with 12% of hips having more than one previous surgery. The most common diagnostic categories included FAI, SCFE, and adult acetabular dysplasia (Fig. 1). Baseline clinical scores were low for this young patient population as emphasized by an average mHHS of 59 and average total WOMAC score of 36 points (Table 2).

When compared with patients with no previous surgery, patients undergoing secondary surgery were more likely female and had a younger average age (Table 2). Hip pain and function were similar in these two patient groups; the mHHS, HOOS, and WOMAC scores were similar between these groups (Table 2).

For patients undergoing secondary surgery, previous surgical approaches were open in 52% and arthroscopic in 48%. Excluding known pediatric conditions, residual FAI

Table 2. Patient demographics and baseline clinical scores of patients with and without previous ipsilateral hip preservation surgery

Patient demographics and baseline clinical scores	All patients with secondary surgery (n = 359; 353 patients)	All patients with primary surgery (n = 1540; 1537 patients)	p value
Demographics			
Female	71%	65.1%	0.032
Age (years)	23	28	< 0.001
Body mass index (kg/m ²)	26	25	0.015
Preoperative outcome scores			
mHHS	59 (range, 8.8–100.1)	60 (range, 9.9–100.1)	0.429
HOOS pain	53 (range, 2.5–100)	55 (range, 5.0–100)	0.181
HOOS symptom	54 (range, 5.0–100)	55 (range, 5.0–100)	0.380
HOOS sports and recreation	42 (range, 6.25–100)	42 (range, 6.25–100)	0.463
WOMAC total	36 (range, 1.0–91)	35 (range, 1.0–9.6)	0.549
SF-12 physical	38 (range, 13.53–63.71)	38 (range, 10.29–68.5)	0.282
SF-12 mental	52 (range, 19.04–75.05)	52 (range, 7.52–76.68)	0.257

mHHS = modified Harris hip score; HOOS = Hip Disability and Osteoarthritis Outcome Score.

Table 3. Summary of prior surgical approaches for the study cohort and the FAI/adult dysplasia subgroups

Previous surgery	All cases (n = 359)	FAI (n = 109; 30%)	Adult dysplasia (n = 70; 19%)
Average number of previous surgeries (range)	1 (1–5)	1 (1–2)	1 (1–3)
Average age at primary surgery (years; range)	18.2 (1–52)	25 (1–52)	23 (7–48)
Previous hip arthroscopy*	48%	86%	64%
Previous open approach*	57%	19%	47%

* Excludes combined hip arthroscopy/periacetabular osteotomy (seven adult dysplasia, one pediatric dysplasia, one Legg-Calvé-Perthes); percent of open and arthroscopic approaches combined are > 100% as a result of patients with more than one prior surgery; FAI = femoro-acetabular impingement.

and adult acetabular dysplasia were the most common reasons for secondary surgery. For FAI, previous hip arthroscopy had been performed in 86% of cases (Table 3). Adult acetabular dysplasia was present in 19% (70 hips) with over half undergoing previous surgery with an arthroscopic approach only (64%). A previous pelvic osteotomy had been performed in 33% of patients. Hips with childhood hip disease were most commonly treated with previous open procedures (86%). Pediatric acetabular dysplasia was present in 11% (41 hips) with 28% undergoing more than one previous surgery. A history of previous pelvic osteotomy was present in 44% of hips and femoral osteotomy in 44% of hips. Deformity after a SCFE was present in 23% (82 hips) with 76% (n = 62) having previous in situ pinning. Symptomatic residual Perthes-like deformity was present in 12% (44 hips). Previous surgery most commonly included proximal femoral osteotomy (43%) or pelvic osteotomy (32%) for Perthes hips.

Secondary hip preservation procedures were performed with an arthroscopic approach in 18%, an open approach in 82%, and a combined arthroscopic/open approach in 6% (Table 4). In the FAI cohort, the revision surgical approach most commonly included surgical dislocation (52%) or hip arthroscopy (40%) (Table 5). Bony treatment with osteoplasty of the acetabular rim (30%) and/or femoral head-neck junction (73%) was performed in 75% (n = 82) of hips. Articular cartilage and labral treatments were also common in these cases (96%) (Table 5). In the adult acetabular dysplasia cohort, revision surgery was performed mostly with open approaches (94%) and included peri-acetabular osteotomy (PAO) in 73%, combined PAO/hip arthroscopy 16%, and isolated hip arthroscopy in 6%. In pediatric acetabular dysplasia, SCFE, and LCP cases, the majority of procedures were performed through open surgical approaches and commonly encompassed major deformity corrections (Table 4).

Table 4. Summary of surgical approaches and surgical procedures for the cohort and diagnostic subgroups

	FAI	Adult dysplasia	Pediatric dysplasia	SCFE	LCP	All cases
Secondary surgical approach						
Hip arthroscopy	52%	6%	6%	8%	8%	21%
Open approaches	46%	80%	80%	92%	84%	72%
Combined approaches	2%	14%	14%	0%	8%	7%
Secondary surgical procedures						
Acetabular articular cartilage procedure	24%	12%	17%	27%	18%	21%
Femoral head articular cartilage procedure	7%	2%	5%	9%	18%	8%
Labral procedure (refixation/débridement)	65%	29%	24%	38%	53%	45%
Acetabular rim trimming	30%	4%	7%	28%	24%	20%
Femoral head-neck osteochondroplasty	74%	65%	59%	91%	71%	74%
Femoral osteotomy	0%	4%	6%	17%	11%	6%
Periacetabular osteotomy	0%	64%	59%	1%	16%	25%

FAI = femoroacetabular impingement; SCFE = slipped capital femoral epiphysis; LCP = Legg-Calvé-Perthes.

Discussion

Hip preservation surgery has become more common during the past decade [6], yet there remains a need for refined indications, improved surgical techniques, and more consistent clinical results [2, 10, 17]. Analysis of treatment failures is one method to determine factors associated with poor outcomes and to identify aspects of the patient evaluation and treatment that may be refined to improve clinical results. Therefore, the purposes of this study were to (1) characterize patients undergoing hip preservation surgery after prior procedures; (2) compare hip pain and function in patients with prior procedures with those undergoing primary surgery; (3) determine the types of previous procedures and the reasons for secondary surgery; and (4) report the procedure profile of the secondary surgeries.

Although the current study provides useful information about the characteristics of patients undergoing secondary hip preservation surgery, it has limitations. First, the number of cases with previous hip surgery (15%) may reflect the tertiary care practices of the treating surgeons and may not be generalizable to all surgeons performing hip preservation procedures. Second, we cannot provide information on the relative rates of failure of different primary hip preservation surgery techniques because we do not have these data. Nevertheless, our data do characterize patients undergoing secondary hip preservation surgery. Third, the indications for another operation and the treatment choice(s) for secondary hip preservation surgery are surgeon-dependent. Our multicenter study group includes surgeons who use both open and arthroscopy techniques but collectively may favor open surgical techniques, especially in more complex or secondary cases.

Additionally, many of the involved surgeons have experience in treating both pediatric and adult hip disease, which may overrepresent the proportion of these cases (acetabular dysplasia, SCFE, and LCP) in the cohort. Fourth, complete surgical details of previous surgeries were not routinely available in the database in part because some (over 50% of the 359 hips) were performed at outside institutions. This precludes exploring factors (eg, technical aspects of the surgery) associated with failure of the initial surgical procedure. Finally, we have only reported descriptive data of this patient cohort. Future studies will focus on clinical outcomes as they become available with further followup.

In our study, patients undergoing secondary hip preservation surgery were young with an average age of 23 years and were more likely female (70%). Baseline clinical scores indicated major pain and dysfunction in these patients. The current literature on secondary (revision) hip preservation surgery is quite limited [2, 10, 17] (Table 5). Two previous studies analyzed patients undergoing revision hip arthroscopy [10, 17] and also reported a predominance of females (61% and 68%). Nevertheless, the patients in these studies were older (average ages of 33 and 34 years) than we report. One of these reports also documented the average preoperative mHHS (53 points), which was similar to the score for our cohort (59 points). Therefore, our data are consistent with the published literature in terms of patient characteristics in secondary hip preservation surgery. Our cohort expands on these previous studies by also analyzing patients in need of open corrective procedures (acetabular dysplasia, SCFE, LCP disease). In fact, increased awareness of these disorders and improved surgical treatments for these more complex deformities may decrease the number of failed joint preservation surgeries.

Table 5. Summary of published studies analyzing the reasons for secondary hip arthroscopy and/or joint preservation surgery

Study	Level/type of study	Demographics		Diagnosis for secondary surgery (%)					Secondary surgical approach (%)		
		Number of patients (hips)	Age of patients (years)	Male/female	Average time between primary and secondary surgeries (months)	Dysplasia	FAI	Laxity	OA	Arthroscopy	Open*
Philippon et al. [17]	IV/case series	37 (range, 37)	33 (range, 16–53)	12/25	20.5	3 (8.1%)	36 (97.3%)	13 (35.1%)	4 (10.8%)	37 (100%)	0
Heyworth et al. [10]	IV/prognostic series	23 (range, 24)	33.6 (range, 16–54)	9/14	6.1		19 (79%)			24 (100%)	0
Bogunovic et al. [2]	IV/prognostic series	58 (range, 60)	36 (range, 15–71)	19/39	25/31 [†]	9 (15.0%)	26 (43.3%)	2 (3.3%)	22 (36.7%)	38 (63.3%)	22 (36.7%)
Current study	IV/prognostic series	353 (range, 359)	23.2 (range, 10–54)	71/29	26	111 (30%)	109 (30%)			75 (21%)	260 (72%)

* Percent joint preservation, percent arthroplasty; [†] joint preservation/arthroplasty; FAI = femoroacetabular impingement; OA = osteoarthritis.

When comparing patients undergoing primary hip preservation surgery with those undergoing surgery after previous procedures, we identified differences. Those undergoing secondary surgery were more likely female and had a younger average age. Nevertheless, baseline clinical scores were similar. These data suggest that pre-arthritic hip disease in young female patients may be more challenging to treat. We speculate that diagnosis and treatment in this subgroup of patients are more challenging as a result of the various forms of mild structural instability (hip dysplasia), mild FAI, ligamentous laxity, and combined FAI/instability disorders. This patient population requires further investigation to establish improved diagnostic and treatment algorithms.

Excluding pediatric hip conditions, we found that residual FAI and acetabular dysplasia were the most common reasons for secondary procedures. Specifically, FAI was the most common indication for revision hip arthroscopy. Several authors have reported residual FAI was associated with poorer outcomes [10, 14, 17]. Philippon et al. [17] reported on a cohort of 37 patients undergoing revision hip arthroscopy for persistent pain, decreased ROM, or functional disability. Residual FAI was deemed to be present in 95% of patients, including 60% with previously untreated deformity and 32% with previously treated deformity. At a mean followup of 12.7 months, 16% had further revision surgery or THA. The remaining 84% of patients had a mean mHHS of 77 (range, 36–100) at latest followup. Heyworth et al. [10] reported a series of 24 revision hip arthroscopies performed at a mean of 2 years after the initial procedure. Residual bony impingement was present in 79% of cases. A failed labral repair was noted in 33% of cases, of which 75% had evidence of residual impingement. In our study, 75% of patients underwent treatment of bony deformity at the time of the secondary procedure. This was more commonly on the femoral side (73%) than the acetabular side (30%). These three reports suggest that repeat surgery for FAI is commonly indicated for residual deformity correction and persistent/recurrent intraarticular abnormalities.

Similarly, several studies have demonstrated that patients with underlying acetabular dysplasia may be at risk for poor short-term outcomes when treated with hip arthroscopy alone (rather than as an adjunct to open surgery) including persistent pain and iatrogenic instability after labral débridement or capsulotomy [11, 13, 16, 20]. Parvizi et al. [11, 16, 20] reviewed 34 patients with acetabular dysplasia who were referred after failed arthroscopic treatment at a mean 3.5 years after hip arthroscopy. Seventy percent of patients failed to have notable improvement in symptoms after arthroscopy. Seventy-nine percent of these patients developed osteoarthritis or femoral head migration at a mean followup of 3 years.

Yamamoto et al. [20] noted femoral head migration in one of 10 patients undergoing hip arthroscopy with underlying dysplasia. Byrd and Jones [3] reported patients with 48 dysplastic or borderline dysplastic hips at a mean followup of 2 years. Postoperative mHHS averaged 83 and 77, respectively. The authors noted some deterioration in outcome scores from 1 to 2 years postoperatively with two patients undergoing THA. In our study, nearly half of all patients undergoing secondary surgical treatment of adult acetabular dysplasia had a history of previous failed hip arthroscopy. These patients had an average age of 25.7 years and an average time since previous arthroscopy of 1.7 years. Collectively, these data raise concern regarding the efficacy of isolated hip arthroscopy in the treatment of patients with a predominance of dysplastic features and clinical signs and symptoms consistent with symptomatic dysplasia [15].

The procedure profile of secondary hip preservation surgeries in our cohort favored open surgical approaches and most commonly included deformity correction with a femoral osteochondroplasty and/or a PAO. These data are unique since we report on both open and arthroscopic approaches for secondary hip preservation procedures. In contrast, other contemporary reports have focused mostly on secondary arthroscopic procedures [10, 17]. Our data may reflect the surgeons' preference for open procedures in patients undergoing revision surgery but also indicate that hip arthroscopy has limitations in the correction of non-focal FAI disease patterns and acetabular dysplasia. Therefore, in patients with complex or nonfocal FAI and acetabular dysplasia with structural instability, the treatment options of an open surgical approach with comprehensive deformity correction should be considered to avoid persistent or recurrent symptoms.

The current study defines the patient population, baseline clinical scores, and previous surgeries performed in a large, prospective cohort of patients undergoing hip preservation surgery after previous procedures. The common diagnoses leading to surgery were FAI, acetabular dysplasia, SCFE, and LCP disease. This patient population is relatively young and exhibits substantial disability. Residual deformity (FAI and acetabular dysplasia) is a common cause of recurrent symptoms and a full spectrum of arthroscopic and open procedures is needed to provide comprehensive care to this expanding patient population. At the same time, attention needs to be directed at careful diagnosis and surgical planning when treating prearthritic hip disorders. Structural abnormalities should be defined and the surgical approach/procedures should focus on comprehensive deformity correction. For this study cohort, future studies will focus on clinical outcomes, defining the patient and surgical factors predicting outcomes, and defining the best surgical approaches for managing this challenging patient population.

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