Prospective Analysis of Hip Arthroscopy with 10-year Followup

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Abstract Arthroscopic surgery of the hip is a well-established technique with numerous recognized indications. Despite the well-accepted nature of this procedure, there have been no outcomes studies with extended followup. We investigated the response to hip arthroscopy in a consecutive series of patients with 10 years followup. Since 1993, all patients undergoing hip arthroscopy have been assessed prospectively with a modified Harris hip score preoperatively and then postoperatively at 3, 12, 24, 60, and 120 months. A cohort of 50 patients (52 hips) was identified who had achieved 10-year followup and represent the substance of this study. There was 100% followup. The average age of the patients was 38 years (range, 14–84 years), with 27 males and 23 females. The median improvement was 25 points (preoperative, 56 points; postoperative, 81 points). Fourteen patients were converted to THA and two died. Four patients underwent repeat arthroscopy. There were two complications in one patient. The presence of arthritis at the time of the index procedure was an indicator of poor prognosis. This study substantiates the long-term effectiveness of arthroscopy in the hip as treatment for various disorders, including labral pathology,

chondral damage, synovitis, and loose bodies. Arthritis is an indicator of poor long-term outcomes with these reported methods.

Level of Evidence: Level IV, therapeutic study. See Guidelines for Authors for a complete description of levels of evidence.

Introduction

We first performed hip arthroscopy in 1990 and developed a reliable technique that has been well described [2, 9, 10]. Our publications contributed substantially in formulating the early indications for this procedure, which include loose bodies, labral tears, chondral injuries, synovitis, impinging osteophytes, ruptured ligamentum teres, arthritis, and avascular necrosis [4, 5, 12]. Hip arthroscopy has become an accepted procedure with a rapidly expanding base of scientific literature.

Experiences of the last decade have served as the foundation for more advanced procedures now being performed. However, there have been no outcomes studies with extended followup to document the results of these fundamental techniques. In the absence of these data, there has been no information regarding the durability of these methods.

We hypothesized hip arthroscopy performed during the last decade would result in successful outcomes with extended followup. Thus, we investigated the response to hip arthroscopy in a consecutive series of patients with 10 years followup in terms of the following four outcomes: (1) improvement in modified Harris hip score (mHHS), (2) complications, (3) need for repeat surgery, including conversion to THA, and (4) conversion to THA as a function of various demographics.

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Materials and Methods

Since 1993, we have prospectively assessed all patients undergoing hip arthroscopy [6, 7]. Our database currently includes more than 3000 consecutive cases. All data were gathered by the second author (KSJ) by personal interview or telephone. All procedures were performed by the senior author (JWTB). Arthroscopy was performed on the central compartment only, using the supine distraction method with a modified fracture table, using three standard portals and combinations of 70°- and 30°-arthroscopes [2, 9, 10]. The substance of this study includes the first 52 consecutive procedures performed on 50 patients (two had bilateral procedures) who had achieved 10 years followup. The data obtained and presented in this manuscript have been granted exemption status by the Institutional Review Board.

All patients were assessed using a modification of the Harris hip score that better adapts it to hip arthroscopy. This included an assessment based on pain (44 points) and function (47 points). A multiplier of 1.1 provides a total possible score of 100. The elements of deformity (4 points) and range of motion (5 points) from the original Harris hip score [16] were deleted as neither of these is a principle indication for arthroscopy. The score was recorded preoperatively and then postoperatively at 1, 3, 6, 12, 24, 60, and 120 months, or until the patient dropped out. Dropout was defined as any patient whose outcome was known, but a score reflective of their arthroscopic results was not available, either because they had conversion surgery to THA or had died.

Study variables included age and gender, diagnosis (patients could have one or more diagnoses), duration of symptoms before arthroscopy, and onset of symptoms (traumatic = a major injury such as auto accident, fall from height, hip dislocation, etc; acute = a twisting episode or other well-defined event precipitating the acute onset of symptoms; insidious = no injury or precipitating event, but simply the gradual onset of worsening symptoms). The center-edge (CE) angle was recorded on the anteroposterior radiograph in all cases. In addition, notation was made regarding whether it was a Workers' Compensation case or whether there was pending litigation. Complications also were recorded.

One hundred percent followup was achieved among the 50 patients (two had bilateral procedures for a total of 52 procedures) at 10 years from the time of their operations. Among the 52 procedures, there were 28 left and 24 right hips, and among the 50 patients, there were 27 males and 23 females. Their ages ranged from 14 to 84 years with an average of 38 years. Diagnoses included labral disorders (30), chondral damage (27), arthritic disorder (14), dysplasia (10), synovitis (nine), loose bodies (seven), and avascular necrosis (AVN) (four). Among patients with labral tears, the

locations were anterior (15), lateral (12), anterolateral (7), and posterior (6). Among patients with chondral damage, there were one Grade II, 14 Grade III, and 12 Grade IV lesions using the Outerbridge classification [21]. The duration of symptoms ranged from 1 to 156 months, with an average of 21 months. The onset was traumatic in 12 cases, acute in 17, and insidious in 23. The CE angle ranged from 19° to 48° with an average of 31°. Eight cases involved Workers' Compensation and eight had pending litigation.

This study is a continuation of the first report with 2 years followup, published in 2000 [6]. In this index report, the biostatistician recommended using the median score for recording the results among the various groups. Patients who dropped out were assigned a score lower than the minimum score of those who had completed 10 years followup. This avoided excluding those who dropped out, which could cause the results to appear falsely superior. Chi square and Wilcoxon tests were used for categoric and continuous variables, respectively. The distribution of duration of symptoms was skewed; therefore, a log transformation was used. Multivariable logistic regression was performed to examine factors that might predict dropout status. A linear model with mixed effects was conducted to study the association between eight different followup times and score measurements including baseline, assuming random effect among 52 procedures. Owing to the small sample size, this model was adjusted only for age and gender. Two-tailed *p* values less than 0.05 were considered significant.

Results

Overall, the median mHHS improved ($p = 0.02$) 25 points from a preoperative value of 56 points to 81 points at 10 years postoperatively (Fig. 1). These results included 14 patients who dropped out owing to a subsequent THA and two deaths. In patients with no evidence of arthritis, the mHHS improved by a median score of 39 points, where loose bodies were present. Improvement of the median score of 38 points was noted in treatment of chondral damage, 31 points for labral disorders and 22 points for synovitis (Figs. 2, 3). Patients with traumatic onset of symptoms had the largest median improvement in mHHS (40 points) compared with insidious onset (23 points) and acute (−23 points). There was a disproportionate number of patients with arthritis in the acute onset group (six of 17), which is the likely explanation for the negative value or deterioration of the mHHS in this cohort. The median improvement for Workers' Compensation cases was 18 points and pending litigation 22 points. Looking at parameters of age, duration of symptoms, and CE angle, the numerous subgroupings and modest cohort size limit statistical analysis, but several observations can be made.

Fig. 1 A graph shows median results at various times (months) using the mHHS.

Fig. 2 A graph shows median preoperative and postoperative mHHS for various diagnoses.

Fig. 3 A graph shows median preoperative and postoperative mHHS excluding patients with a diagnosis of arthritis.

Results were better in younger patients, especially in the second, third, and fourth decades (Fig. 4A); patients with duration of symptoms less than 18 months also seemed to

do better (Fig. 4B); and patients with a CE angle between 26° and 40° did better than those with lesser or greater values (Fig. 4C). However, arthritis had a substantial influence on these observations, as excluding the patients with arthritis essentially eliminated the appearance of better results in younger patients (Fig. 5A), those with more recent onset of symptoms (Fig. 5B), and those with normal CE angles (Fig. 5C).

Two complications occurred in one patient who underwent arthroscopy for synovial chondromatosis. Multiple loose bodies were removed via the anterior portal tract, resulting in partial neurapraxia of the lateral femoral cutaneous nerve. A previous anatomic study showed proximity of these branches to the anterior portal and these can be at risk for partial or permanent neurapraxia [8]. The patient also had a localized area of myositis ossificans develop along this tract. He later underwent open excision of the bony lesion and diagnostic arthroscopy to rule out residual intraarticular disease. The myositis ossificans was resolved successfully, but the area of diminished sensation in the lateral thigh persisted.

Conversion to THA was required most commonly in patients with baseline degenerative arthritis or AVN. Eleven of 14 (79%) patients with evidence of arthritis required conversion to THA. Three of four patients with AVN had Stage V disease and underwent arthroscopy as a palliative procedure to postpone a THA. These results were uniformly poor, with two undergoing arthroplasty and one worse (-4 points) at 10 years. A fourth patient with Stage II AVN underwent loose body removal with symptomatic improvement (20 points), but then underwent core decompression and subsequently an arthroplasty at 7 months. Three other patients underwent subsequent arthroscopic procedures. One of these underwent three procedures in an 18-month period. She had sustained an acute twisting injury and underwent arthroscopy for a torn portion of the anterior labrum. After initial improvement, her symptoms deteriorated and a second arthroscopic procedure defined a partial rupture of her ligamentum teres, which was débrided. Again, a period of initial improvement was followed by deterioration in her symptoms, which ultimately responded to more aggressive resection of the anterior labrum. A successful outcome has been maintained at 10 years followup from the most recent procedure. This case illustrates shortcomings in understanding the nature of intraarticular disease, and the causation of intraarticular mechanical hip pain. Two patients sustained a subsequent separate injury, undergoing repeat arthroscopy at 3.5 and 5.5 years after their index procedures. Now 10 years after the index procedure, they remain improved with followups of 10 and 9 years from the subsequent procedure. These cases remain included with the data as the index procedure did not preclude a successful outcome and joint preservation at 10 years followup.

Fig. 4A–C The graphs show median preoperative and postoperative mHHS based on (A) age (by decade), (B) duration of preoperative symptoms (in months), and (C) CE angle.

Dropout status was related to age and diagnosis of arthritis disorders. Excluding patients with arthritis disorders, age became a marginally significant factor to predict dropout status ($p = 0.07$). No other relationship was identified between dropout status and other factors, including duration of symptoms, gender, CE angle, side, onset, litigation, Workers' Compensation, and other diagnoses, but the number of patients was too small to state that no relationship exists. Patients who dropped out had lower median baseline scores than those who did not drop out (53.5 points versus 56.5 points), but it was not statistically different and baseline score did not predict dropout status.

Discussion

Hip arthroscopy is a well-accepted technique. However, there have been no studies on long-term outcomes. In this

study, with complete 10 years followup, we have documented improvement in mHHS achieved and maintained, and the conditions likely to result in poorer outcome requiring conversion to THA.

The limitations of this study are numerous and evident. The data are based on concepts and technology that existed through the midpart of the last decade. Femoroacetabular impingement had not yet been described and arthroscopy of the peripheral compartment had not yet been developed [13, 15]. The number of patients is small, resulting in insufficient power to make broad substantial statistical observations. The Harris hip score is an imperfect outcome measurement tool. However, its usefulness has been validated, especially the pain and function portions used in this method [23]. A more applicable recording instrument is needed, especially for patients who do not have arthroplasty. However, until such an instrument is established, we continue to use the mHHS initiated in 1993 to maintain consistency of the reported data.

Fig. 5A–C The graphs show median preoperative and postoperative mHHS excluding patients with a diagnosis of arthritis based on (A) age (by decade), (B) duration of preoperative symptoms (in months), and (C) CE angle.

Looking at the entire cohort of patients (Fig. 1), the greatest improvement was noted in the first month. Results began to plateau at 3 months but showed gradual improvement throughout the first year. This improvement was maintained at 2 years followup but diminished slightly at 5 years. The decline at 5 years followup was noted across all diagnostic categories, with no single subgroup primarily responsible. The results at 10 years approached those of the 2-year level, even accounting for the substantial decline in the arthritis subgroup.

The most gratifying results were with removal of symptomatic loose bodies and this is consistent with previous literature [3, 5, 11, 12]. Labral lesions represent the most common disorder, with a 60% incidence. Resection resulted in substantial improvement (31 points) in the patients without arthritis but was much poorer when including those with arthritis (−5 points). This observation is consistent with other studies showing poor outcomes in

the presence of associated arthritis [14]. Our study indicates the results of simple labral débridement in the absence of arthritis can be maintained with time. However, these data predate current concepts in the etiology of labral disorders and techniques of labral repair [18, 19, 22]. These factors are likely to be important, especially in light of poor results in patients with associated arthritis. Arthroscopic débridement for synovial disease represented a diverse group with two each of rheumatoid arthritis, chemically induced synovitis, inflammatory synovitis, and traumatic synovitis and one synovial chondromatosis. The median improvement of 26 points suggests arthroscopy does have a place in the management of synovial disease of the hip, as has been documented for other joints [1, 20]. Chondral lesions had a 19-point improvement but jumped to 38 points when patients with arthritis were excluded, suggesting the results of arthroscopic management of traumatic chondral lesions in the absence of arthritis can be

quite favorable. Arthritis was based on variable radiographic features of subchondral sclerosis or erosions, joint space narrowing, and osteophyte formation. Fifty percent of these patients had measurable improvement (> 10 points) at 2 years followup, 36% remained improved at 5 years, and by 10 years, 11 (79%) had undergone conversion surgery to THA. Thus, although there may be a limited role for simple débridement procedures in select cases of arthritis to postpone the eventuality of an arthroplasty, frank discussion with the patient is necessary regarding expectations. Arthroscopy as a palliative procedure for end-stage AVN is contraindicated, although another study supports its role as a staging procedure and method of addressing coexistent intraarticular disorders in patients considered for revascularization procedures [17].

Patients with traumatic onset of symptoms had a better response to treatment than those of insidious onset, with patients with acute onset doing the poorest. We believe, even in patients who may describe a specific twisting injury, underlying predisposition and a less favorable outcome should be suspected. Results among Workers' Compensation cases and pending litigation were poorer but still reasonable and, in most cases, do not represent a contraindication to arthroscopy.

Conversion to a THA constitutes a poor result but in some cases may not necessarily mean a clinical failure. Four patients with degenerative arthritis (two with osteoarthritis, one with inflammatory arthritis, one with rheumatoid arthritis) underwent THA at an average of 12 months. However, in three, the severity of the disease was not appreciated with only slight radiographic changes, and the advanced disease evident at arthroscopy provided important information in the subsequent decision for THA. Also, one 35-year-old patient with rheumatoid arthritis remained improved from his arthroscopic procedure (21 points), but subsequently chose to undergo a THA at 14 months post-operatively based on his observation of function of other patients who had a THA. Seven more patients with arthritis experienced a more extended period of pain relief, converting to THA at an average of more than 7 years.

This is the only published study reporting the results of hip arthroscopy with extended followup. The complete nature of the data collection reliably substantiates the role of arthroscopy for various disorders with diagnostic and therapeutic benefits but also illustrates its limitations. As a palliative procedure for end-stage disease associated with AVN, it is uniformly unsuccessful. Arthritis is an indicator of poor long-term results and represents an area with the greatest need for improvement. The improved understanding of precursors to arthritis emphasizes the need for better restorative and joint-preserving strategies.

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References

1. Bynum CK, Tasto J. Arthroscopic treatment of synovial disorders in the shoulder, elbow, and ankle. *J Knee Surg.* 2002;15: 57–59.
2. Byrd JW. Hip arthroscopy utilizing the supine position. *Arthroscopy.* 1994;10:275–280.
3. Byrd JW. Hip arthroscopy for post-traumatic loose fragments in the young active adult: three case reports. *Clin J Sport Med.* 1996;6:129–133; discussion 133–134.
4. Byrd JW. Hip arthroscopy: patient assessment and indications. *Instr Course Lect.* 2003;52:701–709.
5. Byrd JW. Hip arthroscopy. *J Am Acad Orthop Surg.* 2006;14:433–444.
6. Byrd JW, Jones KS. Prospective analysis of hip arthroscopy with two year followup. *Arthroscopy.* 2000;16:578–587.
7. Byrd JW, Jones KS. Prospective analysis of hip arthroscopy with five year followup. *Arthroscopy.* 2003;19(6 suppl 1):88.
8. Byrd JW, Pappas JN, Pedley MJ. Hip arthroscopy: an anatomic study of portal placement and relationship to the extra-articular structures. *Arthroscopy.* 1995;11:418–423.
9. Byrd JWT. Hip arthroscopy: the supine position. In: McGinty J, Caspari R, Jackson R, Poehling G, eds. *Operative Arthroscopy.* 2nd Ed. New York, NY: Raven Press; 1995:1091–1099.
10. Byrd JWT. The supine position. In: Byrd JWT, ed. *Operative Hip Arthroscopy.* New York, NY: Thieme; 1998:123–128.
11. Byrd JWT. Arthroscopy of select hip lesions. In: Byrd JWT, ed. *Operative Hip Arthroscopy.* New York, NY: Thieme; 1998:153–170.
12. Byrd JWT. Indications and contraindications. In: Byrd JWT, ed. *Operative Hip Arthroscopy.* New York, NY: Thieme; 1998:7–24.
13. Dienst M, Godde S, Seil R, Hammer D, Kohn D. Hip arthroscopy without traction: in vivo anatomy of the peripheral hip joint cavity. *Arthroscopy.* 2001;17:924–931.
14. Farjo LA, Glick JM, Sampson TG. Hip arthroscopy for acetabular labrum tears. *Arthroscopy.* 1999;15:132–137.
15. Ganz R, Parvizi J, Beck M, Leunig M, Notzli H, Siebenrock KA. Femoroacetabular impingement: a cause for osteoarthritis of the hip. *Clin Orthop Relat Res.* 2003;417:112–120.
16. Harris WH. Traumatic arthritis of the hip after dislocation and acetabular fractures: treatment by mold arthroplasty. An end-result study using a new method of result evaluation. *J Bone Joint Surg Am.* 1969;51:737–755.
17. Hunter DM, Ruch DS. Hip arthroscopy. *J South Orthop Assoc.* 1996;5:243–250.
18. Kelly BT, Weiland DE, Schenker ML, Philippon MJ. Arthroscopic labral repair in the hip: surgical technique and review of the literature. *Arthroscopy.* 2005;21:1496–1504.
19. Murphy KP, Ross AE, Javernick MA, Lehman RA Jr. Repair of the adult acetabular labrum. *Arthroscopy.* 2006;22:567.e1 3.
20. Ogilvie-Harris DJ, Weisleder L. Arthroscopic synovectomy of the knee: is it helpful? *Arthroscopy.* 1995;11:91–95.
21. Outerbridge R. Etiology of chondromalacia patella. *J Bone Joint Surg Br.* 1961;43:752–754.
22. Wenger DE, Kendell KR, Miner MR, Trousdale RT. Acetabular labral tears rarely occur in the absence of bony abnormalities. *Clin Orthop Relat Res.* 2004;426:145–150.
23. Wright JG, Young NL. A comparison of different indices of responsiveness. *J Clin Epidemiol.* 1997;50:239–246.