

Hip arthroscopy outcomes, complications, and traction safety in patients with prior lower-extremity arthroplasty

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Abstract

Purpose Given the potential for injury due to joint-distraction techniques during hip arthroscopy, this study investigated the outcomes and safety of traction during hip arthroscopy in a series of patients with a prior lower-extremity arthroplasty.

Methods Nine patients with a prior hip or knee arthroplasty (Group 1) and a matched cohort of nine additional patients with no prior hip surgery (Group 2) who underwent hip arthroscopy with traction between 2011 and 2013 were evaluated. Collected data included traction and operative times, Modified Harris Hip Scores (MHHS), Non-Arthritic Hip Scores (NAHS), and postoperative complications.

Results Both operative ($p=1$) and traction ($p=0.11$) times were similar in each group. Each group had a significant improvement in MHHS from baseline to final follow-up: from 39 to 73 ($p<0.001$) in Group 1 and from 49 to 75 ($p=0.03$) in Group 2. Similarly, the NAHS showed significant improvement in each group from baseline to final follow-up: from 41 to 71 ($p<0.001$) in Group 1 and from 48 to 74 ($p=0.02$) in Group 2. There was no difference between groups in MHHS or NAHS. There was one postoperative complication in Group 1 (a recurrent labral tear) and no complications from an existing arthroplasty or in Group 2.

Conclusions Hip arthroscopy in patients with a lower-extremity arthroplasty yields improved short-term clinical

outcomes without increased complications. The use of traction during hip arthroscopy is safe in this population.

Keywords Arthroplasty · Hip arthroscopy · Traction · Outcome · Complication

Introduction

Increasing indications for hip arthroscopy have expanded its role to include both diagnostic and therapeutic treatment options [1, 2]. Traditionally, hip arthroscopy has been employed to address labral tears and femoro-acetabular impingement (FAI), among other conditions [2, 3]. Recently, its use has been extended to patients who have undergone joint arthroplasty [4–8]. Although the majority of patients undergoing joint arthroplasty experience satisfactory pain relief, the diagnosis of persistent pain can be challenging, particularly in the absence of elevated acute-phase reactants or positive radiographic findings that may otherwise indicate a specific aetiology for the symptoms [8, 9]. Similar to Wasilewski and Frankl's findings regarding knee arthroscopy after total knee arthroplasty, hip arthroscopy can be beneficial in identifying pain generators, such as femoral-neck fractures, component loosening, and impingement after hip arthroplasty [4, 5, 7, 10].

Compared with arthroscopic knee and shoulder procedures, hip arthroscopy is considered more technically challenging due to joint constraints about the hip, including static factors such as labrum and bone, as well as dynamic factors such as neuromuscular forces [11, 12]. Consequently, surgeons rely on surgical distractors and fracture traction tables to provide adequate exposure of the femoro-acetabular articulation [13]. During hip arthroscopy, traction is applied to both lower extremities to ensure that the patient remains balanced

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on the operating table. Application of this additional force, which is transmitted through the joints along the lower extremity, introduces another avenue for iatrogenic injury, such as through overdistracted, thereby potentially leading to unanticipated complications (e.g. failure of previously placed implants, neurapraxias) that may require a revision procedure [14, 15]. To the authors' knowledge, however, there have been no clinical or biomechanical studies examining the traction effects and safety during hip arthroscopy on prior lower-extremity arthroplasties.

The purpose of this study was to evaluate outcomes following hip arthroscopy in patients with a prior lower-extremity arthroplasty by using the Modified Harris Hip Score (MHHS) and nonArthritic Hip Score (NAHS) and to investigate the safety of traction by prospectively assessing complications stemming from hip arthroscopy compared with a matched-control cohort. We hypothesised that prior joint arthroplasty would not be associated with worse outcomes or greater complication rates, and, ultimately, that traction during hip arthroscopy could be safely used in this population.

Materials and methods

Prospectively collected data from patients who underwent hip arthroscopy with traction between 2011 and 2013 were reviewed. Patients initially presented to the outpatient orthopaedics office for treatment of disabling hip or groin pain that had persisted for at least six months. All were identified as having intra-articular hip pathology as the likely source of their pain, and none had responded well to three months of nonoperative management, which included anti-inflammatories, activity modification and physical therapy. These patients were grouped into one of two cohorts: those with a history of hip or knee arthroplasty (Group 1), and those with no history of arthroplasty (Group 2). Inclusion criteria for Group 1 were previous ipsilateral or contralateral hip or knee arthroplasty, hip arthroscopy (requiring traction) following arthroplasty and a minimum of one year follow-up following arthroscopy. A control group (Group 2) matched Group 1 for factors such as age, gender, body mass index (BMI), and Kellgren–Lawrence hip osteoarthritis (OA) grade [16]. The same inclusion criteria were applied to Group 2, with the exception that no hip or knee arthroplasty preceded hip arthroscopy, and patients were excluded if they had prior hip surgery (arthroscopic or open) on the ipsilateral side.

All patient examinations and surgeries were performed by a single surgeon. Hip arthroscopy began after the induction of general anesthesia. To ensure that the patient was balanced on the operating table, traction was applied to the nonoperative lower extremity. After the operative hip was prepped and draped, traction was applied with a hip distractor, and C-arm fluoroscopy confirmed that sufficient distraction (~ 10 mm)

for adequate visualisation of the hip joint was achieved. Then, a diagnostic arthroscopy was performed using one anterolateral and one midanterior portal created with spinal-needle localisation as a guide for portal trajectory. Two polyether ether ketone (PEEK) cannulas were subsequently inserted, and a capsulotomy was completed to connect the two portals. Various intra-articular structures were then examined, including chondral surfaces of the femoral head and acetabulum, labrum, ligamentum teres, capsule, acetabular rim and femoral neck. Pathology present at any of these sites was addressed surgically, as needed, and the peripheral compartment was inspected after release of traction. At the conclusion of the case, the ipsilateral or contralateral hip or knee replacements were visualised with fluoroscopy to confirm that traction was free of complications. Postoperatively, patients were placed on one week of cephalexin (500 mg four times daily) for wound infection prophylaxis, two weeks of celecoxib (200 mg daily) for heterotopic ossification (HO) prophylaxis and aspirin (325 mg daily) for two weeks for deep vein thrombosis (DVT) prophylaxis.

Several data variables were collected for each patient. From the surgeon's operative report, data were gathered on the specific procedures and treatments performed during arthroscopy, in addition to traction and total operative times for each case. Postoperatively, complications following arthroscopy were also monitored and recorded. To assess functional outcomes, patients were evaluated pre-operatively (baseline) and postoperatively (final) using the MHHS and the NAHS.

Statistical analysis was performed with SPSS software (version 16.0.1, Chicago, IL, USA). The independent *t* test was employed for comparison of two continuous variables, and the paired *t* test was used to compare baseline (pre-operative) and final follow-up (most recent postoperative) scores within each group when data were normally distributed. The Mann–Whitney *U* test and Wilcoxon signed rank test were used in place of the independent and paired *t* tests, respectively, when data were not normally distributed. Pearson correlation coefficient (*r*) was used to assess associations between variables. All *p* values are two tailed, with *p*<0.05 indicating statistical significance.

Results

Eighteen patients were identified and evaluated for the study—nine in each group. Table 1 shows patient characteristics. Patients in Group 1 had a mean age of 56 years, a BMI of 28.9 and a Kellgren–Lawrence grade of 2.7; patients in Group 2 had a mean age of 53 years, a BMI of 28.6 and a Kellgren–Lawrence grade of 2.1. Gender stratification revealed a female predominance in both cohorts, with seven (78 %) women and two (22 %) men in Group 1, and six (67 %) women and three (33 %) men in Group 2. Additionally, the

Table 1 Patient characteristics

	Group 1			Group 2			P-value
	Mean	SD	Range	Mean	SD	Range	
Age (years)	56	7.9	41–68	53	6.5	44–64	0.28
BMI (kg/m ²)	28.9	4.7	21.6–36.6	28.6	5.3	18.8–37.3	0.89
K-L grade	2.7	0.9	0–3	2.1	0.7	0–3	0.39
Gender (n, %)							0.62
Male	2	22		3	33		
Female	7	78		6	67		
Laterality							0.37
Left	6	67		4	44		
Right	3	33		5	56		

SD standard deviation, BMI body mass index, K-L grade Kellgren–Lawrence osteoarthritis grade

left hip was the most commonly operated side, representing 67 % and 44 % in Groups 1 and 2, respectively. When comparing groups, patients were similar with regard to age ($p=0.28$), BMI ($p=0.89$), Kellgren–Lawrence grade ($p=0.39$), gender ($p=0.62$) and laterality ($p=0.37$). Upon review of Group 1 patients' surgical histories, two patients underwent hip arthroscopy after previously undergoing ipsilateral total knee replacement. One patient had an ipsilateral medial unicompartamental knee arthroplasty. Two patients had previously undergone contralateral total hip replacements and two had undergone contralateral hip resurfacing. Additionally, two arthroscopy patients had undergone contralateral total knee arthroplasty. The mean time interval from joint arthroplasty to hip arthroscopy was 3.4 years [standard deviation (SD) 2.4, range 0.7–7.9].

As demonstrated in Table 2, the most common procedures performed during hip arthroscopy were synovectomy, pincer resection or acetabuloplasty and chondroplasty. The least common was excision of a loose body, while one patient in Group 1 had a greater trochanter bursectomy and iliotibial-band release. There was a statistically significant difference in the rate of labral repair/debridement between cohorts, with all

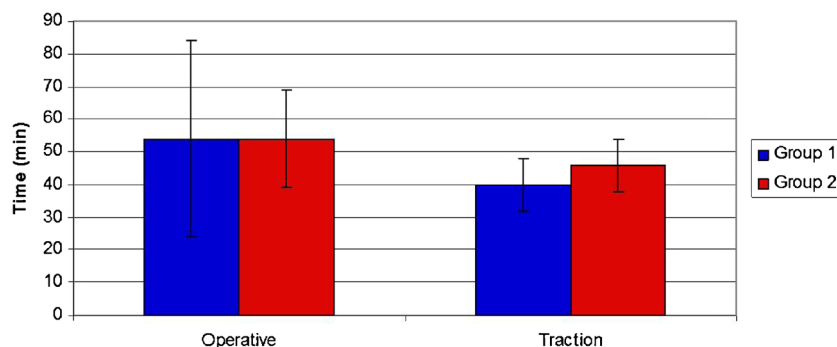
nine patients (100 %) Group 2 and four (44 %) Group 1 patients undergoing this procedure ($p<0.01$). No statistically significant differences were noted between cohorts in terms of other procedures (p values from 0.13 to 1). Moreover, total operative times for both groups were similar (Fig. 1), each with a mean of 54 minutes ($p=1$) and SD of 30 minute (range 26–112) and 15 minute (range 39–84) for Group 1 and Group 2, respectively. Likewise, traction times were similar, with a mean of 40 minute (SD 8, range 30–53) and 46 minute (SD 8, range 37–64) for Group 1 and Group 2, respectively ($p=0.11$).

In order to evaluate outcomes following hip arthroscopy, patients were assessed with both the MHHS and the NAHS (Table 3). All patients had a minimum of one year follow-up. Group 1 had a mean follow-up of 2.1 years (SD 0.7, range 1.5–2.7) after arthroscopy, while Group 2 patients had a mean follow-up of 2.8 years (SD 0.8, range two to 4.5). These intervals were statistically similar ($p=0.21$). Each group achieved a significant improvement in MHHS from baseline to final follow-up scores. A mean improvement from 39 to 73 ($p<0.001$) was evidenced in Group 1 patients and a change from 49 to 75 ($p=0.03$) in Group 2. Similarly, both groups had a statistically significant improvement in NAHS; Group 1

Table 2 Procedures performed during hip arthroscopy

Procedure	Group 1 [no. (%)]	Group 2 [no. (%)]	P value
Labral repair or debridement	4 (44)	9 (100)	< 0.01
Cam resection/femoral-neck osteochondroplasty	7 (78)	5 (55)	0.35
Pincer resection/acetabuloplasty	8 (89)	8 (89)	1
Synovectomy	9 (100)	9 (100)	1
Chondroplasty	5 (55)	8 (89)	0.13
Excision loose body	2 (22)	2 (22)	1
Gluteus medius tendon debridement	2 (22)	0 (0)	0.15
Greater trochanter bursectomy	1 (11)	0 (0)	0.33
Iliotibial band release	1 (11)	0 (0)	0.33

Fig. 1 Operative and traction times during hip arthroscopy. Mean values (in minutes) with standard deviation bars are illustrated



patients improved from a mean baseline score of 41 to a final follow-up score of 71 ($p < 0.001$); Group 2 improved from 48 to 74 ($p = 0.02$). When comparing baseline MHHS between cohorts, a trend towards lower scores with prior joint arthroplasty was noted ($r = -0.40$). The difference in these baseline values approached, but did not attain, statistical significance ($p = 0.14$). No significant differences were found between the final ($p = 0.91$), absolute change ($p = 0.39$), or percentage change ($p = 0.42$) in MHHS between cohorts. Additionally, no significant differences were found between baseline ($p = 0.25$), final ($p = 0.76$), absolute change ($p = 0.74$) and percentage change ($p = 0.68$) in NAHS between groups.

Only one complication was found in Group 1; this patient had a recurrent labral tear that necessitated revision hip arthroscopy. There were no complications or complaints associated with the previously replaced joints. Of note, the patient who had an ipsilateral unicompartmental knee arthroplasty underwent revision to a total knee replacement one month after hip arthroscopy. There was no change in functional status or pain level following arthroscopy, and the revision had been planned before the patient underwent hip arthroscopy.

Furthermore, there were no complications among Group 2 patients as of final follow-up. Ultimately, there was no statistically significant difference in the rate of complications following hip arthroscopy between cohorts ($p = 0.33$).

Discussion

Overall, our results suggest that the use of traction is safe during hip arthroscopy in patients with a prior lower-extremity arthroplasty. To comprehensively assess for many types of intra-articular pathology, effective femoroacetabular distraction is needed to allow for adequate joint visualisation and to fit appropriate arthroscopic equipment, while traction is also applied to the contralateral lower extremity to ensure balance [17]. Distraction techniques typically employ traction tables or surgical distractors that apply an axial force down the entire lower extremity [18]. Whereas distraction-related injuries are known complications of hip arthroscopy, there is a paucity of literature examining the effects of these distracting forces

Table 3 Modified Harris Hip Score and Non-Arthritic Hip Score analyses

Parameter	Group 1			Group 2			Pearson correlation coefficient ^a (<i>r</i>)	<i>P</i> value
	Mean	SD	Range	Mean	SD	Range		
MHHS								
Baseline	39	6	32–48	49	17	19–70	-0.4	0.14
Final	73	15	51–100	75	28	32–100	0	0.91
Absolute change ^b	34	12	14–56	26	28	-10–69	0.25	0.39
Percent change ^b	88	26	39–128	68	82	-16–223	0.24	0.42
NAHS								
Baseline	41	7	29–50	48	15	21–69	-0.3	0.25
Final	71	19	39–100	74	27	25–98	-0.08	0.76
Absolute change ^b	30	18	0–58	27	27	-25–63	0.09	0.74
Percent change ^b	74	41	0–135	64	64	-36–185	0.13	0.68

SD standard deviation, *MHHS* Modified Harris Hip Score, *NAHS* Non-Arthritic Hip Score

^a Relative to the presence of a total joint arthroplasty

^b Refers to change from baseline to final scores. A negative value indicates a lower final compared to baseline score

across lower-extremity arthroplasties present at the time of arthroscopy [15, 18].

Specifically, our findings demonstrate that hip arthroscopy performed in patients with a prior lower-extremity arthroplasty leads to improved short-term clinical outcomes. This is evidenced by the significant improvement in both MHHS ($p < 0.001$) and NAHS ($p < 0.001$) fscores from baseline following hip arthroscopy in this population. Similarly, significant improvements were also observed in the MHHS ($p = 0.03$) and NAHS ($p = 0.02$) of patients without a pre-existing arthroplasty. However, the degree of improvement was not significantly different between groups (p values 0.39–0.74). This suggests that both groups experienced a similar relative functional improvement, which supports our hypothesis and that the presence of a prior lower-extremity arthroplasty does not impair, or result in inferior, outcomes. In a small series of five patients who underwent arthroscopic evaluation of persistent hip pain following total hip arthroplasty, Lahner et al. showed that patients achieved a significant improvement in hip outcome scores and visual analogue scale (VAS) scores [8]. This is consistent with our findings.

Further confirming our hypothesis, there was no difference in the rate of complications following hip arthroscopy in either group. Only one complication (a recurrent labral tear) was observed in the cohort of patients with a prior arthroplasty, with no complications or complaints related to the arthroplasty itself in any patient. Overall, complication rates stemming from hip arthroscopy typically range from 0.5 % to approximately 7 % [18, 19]. The majority of complications are minor and transient, including iatrogenic labral or chondral damage, fluid extravasation and portal-related haematoma, while more serious phenomena such as infection and DVT have been reported [18]. None of the patients in our study experienced these complications. The most commonly cited complication following hip arthroscopy, however, is distraction-related injuries, occurring in up to 7 % of cases [20, 21]. These often present as neurapraxias to the sciatic, femoral or peroneal nerves due to excessive traction force and/or protracted procedures [22, 23]. While the amount of traction force used during hip arthroscopy varies depending upon whether or not the patient is paralysed, surgeons are typically advised to limit traction forces to < 50 lbs [18]. No studies, however, including the one we report here, have tested this force recommendation on joints that have undergone replacement. Moreover, avoiding continuous traction times greater than two hours has also been offered as a guideline for minimising the risk of neurapraxias [23]. The observation that no distraction-related neurapraxias were found in either of our cohorts may be attributable to the shorter traction times (on average within the 40 minute range) needed to perform the arthroscopies.

Operative and traction times were also assessed. In a study of patients with symptomatic hip arthroplasties undergoing arthroscopy, Bajwa and Villar reported a mean operative time

of 60 minute compared with 71 minute for a corresponding control group, a difference they determined as being statistically significant [7]. No traction times were noted. In contrast, while the exact times may vary depending on the severity of the underlying pathology, our investigation found no difference in total operative time (time from initial incision to wound closure) or traction time between patients with an arthroplasty and those with a native hip. Consequently, the presence of a lower-extremity arthroplasty did not increase the time needed to perform a hip arthroscopy.

This investigation is not without its limitations. Notably, the sample size of each group was relatively small. Statistically significant differences, however, were nonetheless noted between cohorts. Moreover, with mean follow-ups of approximately two years, outcomes and complications analyses were limited to short-term results. Also, the same surgeon performed all evaluations and arthroscopies. This helped mitigate any possible confounding effects from variability in techniques introduced by having multiple surgeons.

Summary

In conclusion, our study demonstrates that the use of traction is safe during hip arthroscopy in patients with a prior lower-extremity arthroplasty, as evidenced by improved short-term clinical outcomes without increased complications or complaints with respect to the replaced joint. Larger prospective clinical and biomechanical investigations with longer follow-up are needed to confirm these novel findings.

Conflict of interest None.

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