

Complications and Risk Factors for Morbidity in Elective Hip Arthroscopy: A Review of 1325 Cases

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Abstract

We conducted a study of elective hip arthroscopy patients to determine type and incidence of complications and rates of and risk factors for minor and major morbidity. Retrospectively searching the National Surgical Quality Improvement Program database, we identified 1325 patients who underwent elective hip arthroscopy between 2006 and 2013. Univariate and subsequent multivariate analyses were used to identify risk factors for complications.

Of the 1325 patients identified, 16 (1.21%) had at least 1 complication, and 6 (0.45%) had at least 1 major complication. The most common complication was bleeding result-

ing in transfusion (6 patients, 0.45%). Multivariate analysis found age over 65 years was an independent predictor of any complication (odds ratio [OR], 6.52; 95% confidence interval [CI], 1.35-31.54) and minor morbidity (OR, 7.97; 95% CI, 1.21-52.72).

Short-term morbidity after elective hip arthroscopy was low, and we conclude that hip arthroscopy should be considered a low-risk procedure. Surgeons who perform hip arthroscopy should be aware that age over 65 years is a risk factor for complications. These results may aid surgeons in counseling patients and may aid health systems in performing quality assessments.

Hip arthroscopy is a well-described method for treating a number of pathologies.¹⁻³ Surgical indications are wide-ranging and include femoral acetabular impingement (FAI), labral tears, loose bodies, osteochondral injuries, ruptured ligamentum teres, and synovitis, as well as extra-articular injuries, including hip abductor tears and sciatic nerve entrapment.^{2,4-6} Authors have suggested that the advantages of hip arthroscopy over open procedures include less traumatic access to the hip joint and faster recovery,^{7,8} and hip arthroscopy has been found cost-effective in select groups of patients.⁹

Overall complications have been reported in 1% to 20% of hip arthroscopy patients,^{6,8,10,11} and a meta-analysis identified an overall complication rate of 4%.⁸ Complications include iatrogenic chondrolabral injury, nerve injury, superficial surgical-site infection, deep vein thrombosis (DVT), instrument

failure, portal wound bleeding, soft-tissue injury, and intra-abdominal fluid extravasation.^{6,8,10-13} Rates of major complications are relatively low, 0.3% to 0.58%, according to several recent systematic reviews.^{8,12} Given the lack of universally accepted definitions, reports of minor complications (eg, iatrogenic chondrolabral injury, neuropraxia) in hip arthroscopy vary widely.⁸ Furthermore, many of the series with high complication rates represent early experience with the technique, and later authors suggested that complications should decrease with improvements in technique and technology.^{12,14,15}

The literature is lacking in reports of risk factors for patient morbidity and large multi-institutional cohorts in the setting of hip arthroscopy. We conducted a study of elective hip arthroscopy patients to determine type and incidence of complications and rates of and risk factors for minor and major morbidity.

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Take-Home Points

- Using the NSQIP database, the authors report that the overall complication rate was 1.21% after hip arthroscopy.
- The most common complications cited were bleeding requiring transfusion (0.45%), return to OR (0.23%), superficial infection (0.23%), and thrombophlebitis (0.15).
- Most common CPT code was arthroscopic débridement in 50% of cases, reflecting the types of cases being performed in the time period.
- FAI codes were less common in this database—labral repair in 24%, femoral osteochondroplasty in 16%, and acetabuloplasty in 9%.
- Use caution in patients over age 65 years as this appears to be a risk factor for morbidity.

Materials and Methods

This retrospective study was deemed compliant with HIPAA (Health Insurance Portability and Accountability Act of 1996) and exempt from the need for Institutional Review Board approval. In the National Surgical Quality Improvement Program (NSQIP), academic and private medical institutions prospectively collect patient preoperative and operative data as well as 30-day outcome data from more than 500 hospitals throughout the United States.¹⁶⁻²¹ Surgical clinical reviewers, who are responsible for data acquisition, prospectively collect morbidity data for 30 days after surgery through a chart review of patient progress notes, operative notes, and follow-up clinic visits. Patients may be contacted by a surgical clinical reviewer if they have not had a clinic visit within 30 days after a procedure to verify the presence or absence of complications or admissions at outside institutions, and in this way even outpatient complications should be captured.

If the medical record is unclear, the reviewer may also contact the surgeon directly. In addition, NSQIP data are routinely audited; the interobserver disagreement rate is 1.56%.²²

We used *Current Procedural Terminology (CPT)* billing codes to retrospectively survey the NSQIP database for hip arthroscopies performed between 2006 and 2013. Excluding cases of compromised surgical wounds, emergent surgeries, surgeries involving fracture, hip dislocations, preoperative sepsis, septic joints, and osteomyelitis, we identified 1325 cases with CPT codes 29861 (hip arthroscopy), 29862 (arthroscopic hip débridement, shaving), 29914 (arthroscopic femoroplasty), 29915 (arthroscopic acetabuloplasty), and 29916 (arthroscopic labral repair). Postoperative outcomes were categorized as *major morbidity or mortality*, *minor morbidity*, and *any complication*. A major complication was a systemic life-threatening event or a substantial threat to a vital organ, whereas a minor complication did not pose a major systemic threat and was localized to the operative extremity (previously used definitions^{23,24}). We have used

similar methods to report the rates of and risk factors for complications of knee arthroscopy, shoulder arthroscopy, and total shoulder arthroplasty.^{16,20,21} For any-complication outcomes, we included both major and minor morbidities, and mortality. NSQIP applies strict definitions (listed in its user file¹⁷) to patient comorbidities and complications. Data points collected included patient demographics, medical comorbidities, laboratory values, and surgical characteristics.

Initially, we performed a univariate analysis that considered age, sex, race, body mass index, current alcohol abuse, current smoking status, recent weight loss, dyspnea, chronic obstructive pulmonary disease, CPT code, congestive heart failure, hypertension, diabetes, peripheral vascular disease, esophageal varices, disseminated cancer, steroid use, bleeding disorder, dialysis, chemotherapy within previous 30 days, radiation therapy within previous 90 days, operation within previous 30 days, American Society of Anesthesiologists class, operative time, resident involvement, and patient functional status. We also included mean preoperative sodium, blood urea nitrogen, and albumin levels; white blood cell count; hematocrit; platelet count; and international normalized ratio. The analysis revealed unadjusted differences between patients with and without complications (*t* test was used for continuous variables, χ^2 test for categorical variables). Any variable with $P < .2$ in the univariate analysis and more than 80% complete data was considered fit for our multivariate model. We controlled for confounders by performing a multivariate logistic regression analysis. Three separate analyses were performed; the outcome variables were major morbidity or mortality, minor morbidity, and any complication. $P < .05$ was used for statistical significance across all models. We used SAS Version 9.3 (SAS Institute) for statistical analysis. Model quality was evaluated for calibration (Hosmer-Lemeshow test) and discrimination (*C* statistics). The calibration test yielded a modified χ^2 statistic, and $P > .05$ indicated the model was appropriate and fit the data well. Good discrimination is commonly reported to be between 0.65 and 0.85.

Results

Of the 1325 patients who underwent hip arthroscopy, 60% were female. Regarding age, 52% were younger than 40 years, and 45% were between 45 years and 60 years. The most common diagnoses were articular cartilage disorder involving the pelvic region (15%), enthesopathy of the hip (12%), and

joint pain involving the pelvic region or thigh (11%). The most common primary CPT code (50%) was for hip arthroscopic débridement (29862), followed by 24% for arthroscopic labral repair (29916), 16% for arthroscopic femoroplasty (29914), and 9% for arthroscopic acetabuloplasty (29915). Of the 16 complications found, 12 involved hip arthroscopic débridement, and 4 involved hip arthroscopic femoroplasty. There were no complications of arthroscopic acetabuloplasty (29915), arthroscopic labral repair (29916), or hip arthroscopy (29861).

Of the 1325 hip arthroscopy patients, 16 (1.21%) had at least 1 complication (Table 1). There were 6 major complications (0.45%) and 12 minor complications (0.91%). Bleeding resulting in transfusion was the most common complication (6 patients, 0.45%) followed by return to operating room (3 patients, 0.23%), superficial surgical-site infection (3 patients, 0.23%), and DVT/thrombophlebitis (2 patients, 0.15%). The primary CPT code for all patients who received a transfusion was for arthroscopic débridement (29862). Of the 6 patients who received a transfusion, 4 had a diagnosis of osteoarthritis or pain in the pelvis or thigh. There were no mortalities.

Univariate analysis identified age ($P = .014$), CPT code ($P = .036$), hypertension ($P = .128$), and steroid use ($P = .188$) as risk factors for any complication (Table 2). For the outcome of major morbidity, univariate analysis found no risk factors for complication (Table 3). For minor morbidity, univariate analysis identified age ($P = .005$), hypertension ($P = .038$), steroid use ($P = .133$), and CPT code ($P = .141$) as risk factors (Table 4). After likely confounding variables were controlled for, multivariate analysis showed age over 65 years (odds ratio [OR], 6.52; 95% confidence interval [CI], 1.35-31.54) was an independent predictor of any complication (Table 5). There were no independent predictors of major morbidity on multivariate analysis. After likely confounding variables were controlled for, multivariate analysis showed age over 65 years (OR, 7.97; 95% CI, 1.21-52.72) was an independent predictor of minor morbidity. Operative time was <3 hours for 91% of patients and <2 hours for 70% of patients.

Discussion

Earlier reports on hip arthroscopy did not consider risk factors for systemic morbidity and were mainly single-institution case series.^{3,10,11,13,25} Given a renewed focus on outcomes measurement and quality assessment in orthopedic surgery, we wanted to describe short-term complications of and risk fac-

tors for morbidity in hip arthroscopy. In this article, we report baseline data from a large multicenter cohort. For hip arthroscopy, we found low rates of short-term complications (1.21%) and major morbidities (0.45%). We considered many modifiable and nonmodifiable risk factors for complications and found age over 65 years to be an independent risk factor for any complication and minor morbidity. Several of our findings merit further discussion.

Other authors have reported hip arthroscopy complication rates of 1% to 20%, citing both systemic and local complications,^{6,8,10-12} and major complication rates of 0.3% to 0.58%.^{8,12} Minor complications of hip arthroscopy vary, and depend on definition, with long-term consequences unknown in some cases.⁸ Sensory neuropraxia, a relatively common minor complication in hip arthroscopy, is thought to be affected by the amount

Table 1. Frequency of Complications Among 1325 Patients Who Underwent Hip Arthroscopy

	n	%
Major Complication		
Organ space infection	0	0
Sepsis	0	0
Septic shock	0	0
Deep surgical-site infection	0	0
Wound dehiscence	1	0.08
Pulmonary embolism	0	0
Ventilator >48 h	0	0
Unplanned intubation	1	0.08
Acute renal failure	0	0
Cardiac arrest requiring CPR	0	0
Myocardial infarction	1	0.08
Stroke/CVA with neurologic deficit	0	0
Coma >24 h	0	0
Graft/prosthesis flap failure	0	0
Return to operating room	3	0.23
Total incidence	6	0.45
Minor Complication		
Superficial surgical-site infection	3	0.23
Pneumonia	1	0.08
Urinary tract infection	0	0
DVT/thrombophlebitis	2	0.15
Bleeding requiring transfusion	6	0.45
Peripheral nerve injury	0	0
Progressive renal insufficiency	0	0
Total incidence	12	0.91
Mortality		
	0	0
Any Complication		
	16	1.21

Abbreviations: CPR, cardiopulmonary resuscitation; CVA, cerebrovascular accident; DVT, deep vein thrombosis.

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Table 2. **Univariate Analysis of 1325 Patients Who Underwent Hip Arthroscopy With and Without Any Complication**

Characteristic	Any Complication, %		Unadjusted P ^a
	No (n = 1309)	Yes (n = 16)	
Age, y			.014
<40	98.99	1.01	
40-65	98.99	1.01	
>65	92.31	7.69	
Sex			.451
Male	99.07	0.93	
Female	98.61	1.39	
Race			1.000
Black	100.00	0.00	
White	98.68	1.32	
Other	98.92	1.08	
Body mass index, kg/m ²			.380
<35	98.91	1.09	
≥35	98.25	1.75	
Hip arthroscopy CPT code			.036
29861 (general)	100.00	0.00	
29862 (with débridement)	98.16	1.84	
29914 (with femoroplasty)	98.16	1.84	
29915 (with acetabuloplasty)	100.00	0.00	
29916 (with labral repair)	100.00	0.00	
Current alcohol abuse	0.73	14.29	.061
Current smoker	18.56	18.75	1.000
Recent weight loss	0.31	0.00	1.000
Dyspnea	1.07	0.00	1.000
Chronic obstructive pulmonary disease	0.53	0.00	1.000
Congestive heart failure	0.08	0.00	1.000
Hypertension	12.30	25.00	.128
Diabetes	3.44	0.00	1.000
Steroid use	1.22	6.25	.188
Bleeding disorder	0.46	0.00	1.000
ASA class (disturbance severity)			.641
1 (none) or 2 (mild)	98.84	1.16	
3 (severe) or 4 (life-threatening)	98.23	1.77	
Blood transfusion, n			1.000
0	97.67	2.33	
≥1	100.00	0.00	
Operative time, h			1.000
≤2	98.73	1.27	
>2	98.94	1.06	
PGY-1 resident involvement	99.61	0.39	.046
Functional status			1.000
Independent	98.82	1.18	
Totally or partially dependent	0.39	0.00	

^aUnivariate P-values with no statistical adjustments for other variables.

Abbreviations: ASA, American Society of Anesthesiologists; CPT, Current Procedural Terminology; PGY-1, postgraduate year 1.

Table 3. Univariate Analysis of 1325 Patients Who Underwent Hip Arthroscopy With and Without Major Morbidity or Mortality

Characteristic	Major Morbidity or Mortality, %		Unadjusted P ^a
	No (n = 1320)	Yes (n = 5)	
Age, y			.714
<40	99.71	0.29	
40-65	99.50	0.50	
>65	100.00	0.00	
Sex			1.000
Male	99.63	0.37	
Female	99.62	0.38	
Race			1.000
Black	100.00	0.00	
White	99.60	0.40	
Other	99.64	0.36	
Body mass index, kg/m ²			.366
<35	99.67	0.33	
≥35	99.12	0.88	
Hip arthroscopy CPT code			.581
29861 (general)	100.00	0.00	
29862 (with débridement)	99.39	0.61	
29914 (with femoroplasty)	99.54	0.46	
29915 (with acetabuloplasty)	100.00	0.00	
29916 (with labral repair)	100.00	0.00	
Current alcohol abuse	0.72	33.33	
Current smoker	18.48	40.00	
Recent weight loss	0.30	0.00	
Dyspnea	1.06	0.00	
Chronic obstructive pulmonary disease	0.53	0.00	
Congestive heart failure	0.08	0.00	
Hypertension	12.50	0.00	
Diabetes	3.41	0.00	
Steroid use	1.29	0.00	
Bleeding disorder	0.45	0.00	
ASA class (disturbance severity)			1.000
1 (none) or 2 (mild)	99.59	0.41	
3 (severe) or 4 (life-threatening)	100.00	0.00	
Blood transfusion, n			1.000
0	98.84	1.16	
≥1	100.00	0.00	
Operative time, h			.628
≤2	99.68	0.32	
>2	99.47	0.53	
PGY-1 resident involvement	99.61	0.39	
Functional status			1.000
Independent	99.61	0.39	
Totally or partially dependent	100.00	0.00	

^aUnivariate P-values with no statistical adjustments for other variables.

Abbreviations: ASA, American Society of Anesthesiologists; CPT, Current Procedural Terminology; PGY-1, postgraduate year 1.

Table 4. **Univariate Analysis of 1325 Patients Who Underwent Hip Arthroscopy With and Without Minor Morbidity**

Characteristic	Minor Morbidity, %		Unadjusted P ^a
	No (n = 1309)	Yes (n = 11)	
Age, y			.005
<40	99.27	0.73	
40-65	99.49	0.51	
>65	92.31	7.69	
Sex			.541
Male	99.44	0.56	
Female	98.98	1.02	
Race			1.000
Black	100.00	0.00	
White	99.09	0.91	
Other	99.28	0.72	
Body mass index, kg/m ²			.597
<35	99.25	0.75	
≥35	99.12	0.88	
Hip arthroscopy CPT code			.141
29861 (general)	100.00	0.00	
29862 (with débridement)	98.77	1.23	
29914 (with femoroplasty)	98.61	1.39	
29915 (with acetabuloplasty)	100.00	0.00	
29916 (with labral repair)	100.00	0.00	
Current alcohol abuse	0.73	0.00	1.000
Current smoker	18.56	9.09	.700
Recent weight loss	0.31	0.00	1.000
Dyspnea	1.07	0.00	1.000
Chronic obstructive pulmonary disease	0.53	0.00	1.000
Congestive heart failure	0.08	0.00	1.000
Hypertension	12.30	36.36	.038
Diabetes	3.44	0.00	1.000
Steroid use	1.22	9.09	.133
Bleeding disorder	0.46	0.00	1.000
ASA class (disturbance severity)			.242
1 (none) or 2 (mild)	99.25	0.75	
3 (severe) or 4 (life-threatening)	98.23	1.77	
Blood transfusion, n			1.000
0	98.82	1.18	
≥1	100.00	0.00	
Operative time, h			.738
≤2	99.05	0.95	
>2	99.47	0.53	
PGY-1 resident involvement	100.00	0.00	.034
Functional status			1.000
Independent	99.21	0.79	
Totally or partially dependent	100.00	0.00	

^aUnivariate P-values with no statistical adjustments for other variables.

Abbreviations: ASA, American Society of Anesthesiologists; CPT, Current Procedural Terminology; PGY-1, postgraduate year 1.

of traction against a perineal post and by increased operative time, with operative time under 2 hours previously suggested.^{3,6,10,11,13,25,26}

In the present study, the overall rate of any complication of hip arthroscopy was 1.21%, and the most common complications were bleeding resulting in transfusion, return to operating room, superficial surgical-site infection, and DVT/thrombophlebitis. When we excluded bleeding resulting in transfusion, the overall complication rate fell to 0.75%. Operative time was relatively short, <2 hours for 70% of patients. Last, there were no mortalities. As our data set did not include variables encompassing sensory neuropraxia or iatrogenic chondrolabral injury, we were unable to report on these data.

Surgeons and healthcare systems should be advised that rates of systemic complications in hip arthroscopy are low and that hip arthroscopy is a relatively safe procedure. Surgeons and healthcare systems can refer to our reported complication rates and risk factors when assessing quality and performing cost analysis in hip arthroscopy. For our 1325 patients, the major morbidity rate was 0.45%, within the range of previous reports.^{8,12} There were no nerve injuries in our patient cohort, likely because of the strict NSQIP definitions of nerve injury. We cannot report on sensory neuropraxia and iatrogenic chondrolabral injury. We speculate that lack of these variables may have artificially lowered our minor complication rate.

Some authors have reported clinical benefits of hip arthroscopy in older patients,²⁷⁻²⁹ whereas others have suggested age may be a negative prognostic factor.^{27,30} Suggested indications for hip arthroscopy in an elderly population include chondral defects, labral tears, and FAI in the absence of significant arthritic changes.^{28,29} Larson and colleagues,³⁰ who reported a 52% failure rate for osteoarthritis patients who underwent hip arthroscopy for FAI, concluded that arthroscopy should not be offered to patients with evidence of advanced radiographic joint space narrowing. Others have noted that patients who were under age 55 years and had minimal osteoarthritic changes had a longer interval between hip arthroscopy and total hip arthroplasty in comparison with patients over age 55 years.³¹ Previous work in knee arthroscopy found older age (40-65 years vs <40 years) was an independent predictor of short-term complications (1.5 times increased risk).²¹ In the present study, 7.69% of patients who were over age 65 years when they underwent hip arthroscopy had a complication, and we report age over 65 years as an independent risk factor for any complication

Table 5. Predictors of Morbidity as Identified Through Multivariate Regression Analysis of 1325 Patients Who Underwent Hip Arthroscopy

Age: >65 Years vs <65 and >40 Years	Adjusted Odds Ratio (95% Confidence Interval)
Risk of any complication	6.52 (1.35-31.54)
Risk of minor morbidity	7.97 (1.21-52.72)

(OR, 6.52) and minor morbidity (OR, 7.97). Surgeons should be aware that advanced age is an independent risk factor for complications in hip arthroscopy. Potential benefits of hip arthroscopy should be carefully weighed against the increased risk in this patient cohort, and surgeons should ascertain the scope of an elderly patient's disease to determine if hip arthroscopy is indicated and worth the potential risks.

To our knowledge, bleeding resulting in transfusion was not previously described as a complication of hip arthroscopy. In the present study, bleeding resulting in transfusion was the most common complication (6 patients, 0.45%), and all the affected patients had a primary CPT code for arthroscopic débridement (29862). The 6 primary diagnoses were hip osteoarthritis (3), thigh/pelvis pain (1), unspecified injury (1), and congenital hip deformity (1). The 6 transfusion patients also tended to be older (ages 30, 53, 64, 67, 76, and 90 years). Although drawing firm conclusions from so few patients would be inappropriate, we acknowledge that the majority who received a transfusion were older, underwent arthroscopic débridement of a hip, and had a primary diagnosis of osteoarthritis or pain. As transfusion practices can differ between surgeons and groups, we conclude that the risk for bleeding requiring transfusion is low in hip arthroscopy. Patients who are older and who undergo arthroscopic débridement of an osteoarthritic hip may be at elevated risk for transfusion.

This study had several limitations. First, with use of the NSQIP database, follow-up was limited to 30 days. We speculate that longer follow-up might yield higher complication rates and additional risk factors. Second, we could not distinguish individual surgeon or site data and acknowledge complications might differ between surgeons and sites that perform hip arthroscopy more frequently. Third, as data were limited to medical and broadly applicable surgical variables included in the NSQIP database, they might not be specific to hip arthroscopy, and we cannot report on iatrogenic chondrolabral injury and neuro-

praxia, 2 previously reported minor complications in hip arthroscopy. We speculate that data collection focused on problems specific to hip arthroscopy would yield more complications and risk factors.

Conclusion

According to the NSQIP data, the rate of short-term morbidity after elective hip arthroscopy was low, 1.21%. Surgeons may use our reported complications and risk factors when counseling patients, and healthcare systems may use our data when assessing quality and performance in hip arthroscopy. Surgeons who perform elective hip arthroscopy should be aware that age over 65 years is an independent predictor of complications. Careful attention should be given to this patient group when indicating hip arthroscopy procedures.

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This paper will be judged for the Resident Writer's Award.