

Complications following hip arthroscopy: a retrospective review of the McMaster experience (2009–2012)

Kevin Chan, MD
 Forough Farrokhyar, BSc, MPhil,
 PhD
 Sarah Burrow, MD, MSc
 Marcin Kowalczyk, MD
 Mohit Bhandari, MD, PhD
 Olufemi R. Ayeni, MD, MSc

From the Division of Orthopaedic
 Surgery, Department of Surgery,
 McMaster University, Hamilton, Ont.

Accepted for publication
 Feb. 4, 2013

Correspondence to:

O. Ayeni
 McMaster University Medical Centre
 1200 Main St. West, 4E15
 Hamilton ON L8N 3Z5
 ayenif@mcmaster.ca

DOI: 10.1503/cjs.021712

Background: The use of hip arthroscopy has been steadily rising as technology, experience and surgical education continue to advance. Previous reports of the complication rate associated with hip arthroscopy have varied. The purpose of this study was to report our experience with hip arthroscopy complications at a single Canadian institution (McMaster University).

Methods: We performed a retrospective chart review of 2 hip arthroscopists at the same institution to identify patients who had undergone the index surgery and had been followed for a minimum of 6 months postoperatively. We used a standard data entry form to collect information on patient demographic and clinical characteristics, including age, sex, surgical indication and type of complication if any.

Results: A total of 211 patients underwent 236 hip arthroscopies. The mean age at time of surgery was 37 ± 13 years and mean follow-up was 394 ± 216.5 days. The overall complication rate associated with hip arthroscopy was 4.2% (95% confidence interval 2.3%–7.6%). We identified 4 major and 6 minor complications.

Conclusion: Overall, hip arthroscopy appears to be safe, with minor complications occurring more frequently than major ones. However, surgeons should recognize the possibility of serious complications associated with this procedure. Future research should focus on prospective designs looking for potential prognostic factors associated with hip arthroscopy complications.

Contexte : Le recours à l'arthroscopie de la hanche augmente de manière constante, au rythme des progrès réalisés aux plans de la technologie, de l'expérience et de l'enseignement de la chirurgie. Les rapports précédents sur les taux de complications associés à l'arthroscopie de la hanche ont varié. Le but de cette étude était de faire état de notre expérience en ce qui concerne les complications de l'arthroscopie de la hanche dans un établissement canadien (Université McMaster).

Méthodes : Nous avons procédé à une analyse rétrospective des dossiers de 2 spécialistes de l'arthroscopie de la hanche d'un même établissement pour recenser les patients qui ont subi une première chirurgie et qui ont été suivis pendant au moins 6 mois après leur intervention. Nous avons utilisé un formulaire standard d'entrée de données pour recueillir des renseignements sur les caractéristiques démographiques et cliniques des patients, notamment l'âge, le sexe, l'indication de la chirurgie et le type de complication, le cas échéant.

Résultats : En tout, 211 patients ont subi 236 arthroscopies de la hanche. L'âge moyen au moment de la chirurgie était de 37 ± 13 ans et le suivi moyen a été de $394 \pm 216,5$ jours. Le taux global de complications associées à l'arthroscopie de la hanche a été de 4,2 % (intervalle de confiance de 95 %, 2,3 %–7,6 %). Nous avons recensé 4 complications majeures et 6 mineures.

Conclusion : Dans l'ensemble, l'arthroscopie de la hanche semble sécuritaire, les complications mineures étant survenues plus souvent que les complications majeures. Toutefois, les chirurgiens doivent reconnaître le risque de complications graves associées à cette intervention. La recherche à venir devra s'attarder à des modèles prospectifs pour déceler les facteurs pronostiques potentiellement associés aux complications de l'arthroscopie de la hanche.

The use of hip arthroscopy has been steadily increasing. A recent review of the American Board of Orthopaedic Surgeons (ABOS) database showed an 18-fold increase in the number of hip arthroscopies performed from 1999 through 2009.¹ This dramatic rise is likely related to the appeal of a minimally invasive surgical approach and the increasing availability of formal training in hip arthroscopy. Despite its popularity, hip arthroscopy presents a unique set of technical challenges and considerations. These include the deep-seated nature of the ball-and-socket hip joint and the dense surrounding soft tissues that ultimately limit maneuverability of surgical tools, requiring longer instruments and specialized equipment for distraction.²

Reports of the complication rates associated with hip arthroscopy have varied in the literature. In 2001, Sampson² reported a complication rate of 6.4% for 530 hip arthroscopies. Clarke and colleagues³ reviewed 1054 cases between 1989 and 2001 and reported a complication rate of 1.4%. Such variability is likely related to multiple factors, including patient selection, surgeon experience, and a lack of a universal definition of complications.

The goal of the present study was to report our experience with hip arthroscopy at McMaster University. Specifically, we documented the complication rate following hip arthroscopy at our institution.

METHODS

Study design

We performed a single-centre retrospective chart review of patients who underwent hip arthroscopy between September 2009 and January 2012. The protocol for the conduct and analysis of the study was created a priori. The research ethics board at McMaster University approved this study.

Eligibility criteria

All patients who underwent hip arthroscopy at our institution were identified by contacting 2 arthroscopists (O.A., I.W.) and reviewing their patient roster. Patients were included if they attained at least 6 months' follow-up.

Intervention

Surgical indications

Patients undergoing hip arthroscopy had a history of groin and/or hip pain for a minimum of 3 months and failed nonoperative management (physiotherapy, oral anti-inflammatories). Physical examinations involving the anterior impingement test and log-roll tests⁴ confirmed intra-articular hip disorders. Radiographic imaging was used to assess bony morphology (femoroacetabular impingement [FAI], hip dysplasia, osteoarthritis) of the

hip, and magnetic resonance imaging (MRI) confirmed the presence or absence of intra- and extra-articular hip disorders (e.g., FAI, labral tears, loose bodies). In patients for whom there was an unclear diagnosis, an intra-articular injection was used to delineate the source of hip pain. Those with clearly identified pathology (history, physical, imaging, injection) were offered hip arthroscopy.

Surgical procedure

All patients had hip arthroscopy in the supine position and received intravenous antibiotics under general anesthetic with longitudinal traction applied to the operative limb.⁴ Standard portals included anterior, anterolateral and distal anterolateral portals. Once the central compartment of the hip (cartilage, labrum, ligamentum, capsule) was evaluated and treated appropriately, the peripheral compartment (head and neck junction of hip, ligaments, capsule) was evaluated and treated. The distal anterolateral portal was used for bony débridement when osseous lesions, such as a cam lesion were present. Fluoroscopy was used to assist the procedures in all cases.

Postoperative rehabilitation

All patients were limited to protected weight-bearing with crutches for 2–6 weeks, depending on the extent of the surgery. Patients who had surgery for FAI were restricted for 6 weeks. Patient follow-up visits occurred at 2, 6 and 12 weeks and at 6 and 12 months. All patients received supervised physical therapy for up to 12 weeks. The focus of physical therapy was gait training and range of motion during the first 6 weeks, then range of motion and proprioceptive training for the subsequent 6 weeks and, finally, strengthening for the following 6 weeks. The therapy was altered based on each patient's progress.

Outcomes

The primary outcome measure was the occurrence of a complication after hip arthroscopy. After a discussion with a focus group including 3 surgeons (S.B., O.R.A. and M.B.), we chose to define a complication as an event that resulted in a prolonged recovery from surgery (> 6 additional mo) or required a secondary intervention (medical or surgical treatment, including revisions of the index procedure). Major complications were further defined as those that had life-threatening sequelae or endangered the viability of the limb involved.

To determine the complication rate, we used a standard data entry form to collect patient demographic and clinical characteristics, including age, sex, surgical indication and type of complication. When possible, we also collected data on the presence of comorbidities, namely, diabetes mellitus, tobacco use, osteoporosis or immunocompromised status (HIV, AIDS, high-dose steroid use, rheumatoid arthritis, active cancer). Discrepancies in the

data were resolved by consultation with the surgeon who performed the procedure (O.A. or I.W.).

Sample size

The primary outcome for this study was the incidence of complications in patients who underwent hip arthroscopy. From a previous meta-analysis,⁵ the weighted incidence of complications in the literature was 4.0%. We hypothesized that a 95% confidence interval (CI) of $\pm 3\%$ around the complication rate would have high precision. Using normal approximation to binomial distribution, we calculated that a sample size of 172 patients would be required to produce a 95% CI $\pm 3\%$, with an α level of 0.05. Thus, we planned to recruit all eligible patients to increase precision. Our sample size of 236 would allow a 95% CI of $\pm 2.6\%$. We used StatsDirect software (www.statsdirect.com) for sample size calculation.

Statistical analysis

We performed a univariable analysis of complication. Categorical variables are reported as counts and percentages, and continuous variables are reported as means \pm standard deviation (SD). The proportion of complication rates are reported with 95% CIs. We considered results to be significant at $p < 0.05$. We used SPSS version 20.0 software for statistical analysis.

RESULTS

Patients

We identified a total of 211 patients undergoing 236 hip arthroscopies: 97 (46%) men and 114 (54%) women. The mean age at time of surgery was 37 ± 13 years, and the mean follow-up was 394 ± 216.5 days. Three patients had diabetes, 2 were immunocompromised (active cancer, chronic steroid use) and 13 were smokers. Table 1 lists the surgical indica-

Surgical indication	No. hips (%)
FAI	46 (19.5)
Labral tear	48 (20.3)
FAI and labral tear	127 (53.8)
FAI and loose body	6 (2.5)
FAI, labral tear and loose body	5 (2.1)
Labral tear and loose body	1 (0.4)
Labral tear and psoas impingement	1 (0.4)
Chondral defect	1 (0.4)
Capsular adhesions	1 (0.4)

FAI = femoroacetabular impingement.

tions for hip arthroscopy. The most common indication was FAI and labral tear, accounting for 127 (53.8%) hips, followed by labral tears alone (48 hips, 20.3%) and FAI alone (46 hips, 19.5%).

Complications

Based on our definition, a total of 10 complications occurred in 9 patients, for an overall complication rate of 4.2% (95% CI 2.3%–7.6%; Box 1). Four major complications occurred in 3 patients.

Box 1. Summary of complications

Major

- Hip dislocation ($n = 1$)
- Deep vein thrombosis ($n = 2$)
- Septic joint ($n = 1$)

Minor

- Neurapraxia ($n = 2$)
- Superficial wound infection ($n = 1$)
- Heterotopic ossification ($n = 2$)
- Capsular adhesion ($n = 1$)

One patient had an anterior dislocation secondary to a fall after an uncomplicated treatment for a mixed FAI deformity. This patient did not have any signs of joint hypermobility or laxity. Her centre edge angle was on the lower range of normal (25°), which suggested mild dysplasia. She was treated with an urgent closed reduction under general anesthesia and subsequent hip spica bracing for 6 weeks. Her rehabilitation restarted after the bracing period of 6 weeks in an uncomplicated fashion. During bracing, hip flexion ($> 60^\circ$) and all rotational movements were limited. Serial MRIs did not reveal avascular necrosis at the latest follow-up, and the patient made a full recovery.

In the second patient, after an identical FAI procedure, deep vein thrombosis (DVT) developed 6 weeks postoperatively and was treated with oral anticoagulants. This patient remained symptom-free after treatment of DVT; another physician, whose medical records could not be accessed retrospectively, treated the DVT, thus we were unable to specify the duration of anticoagulation.

Finally, a third patient experienced both a deep wound infection with *Staphylococcus aureus* and DVT shortly thereafter. Initial treatment consisted of irrigation and débridement of the wound followed by long-term intravenous and oral antibiotics (12 weeks) and oral anticoagulants. Follow-up MRI of the hip showed secondary osteomyelitis of the acetabulum. Secondary arthritis developed over a 6-month course, and this patient is now under consideration for hip arthroplasty. The patient's DVT resolved with oral anti-coagulation therapy.

No patients who experienced major complications had a history of predisposing conditions, such as coagulopathy or immunocompromised status.

Six patients experienced minor complications: 1 patient had mild paresthesias to the anterolateral thigh that was followed with serial observations, 2 patients had symptomatic heterotopic ossification treated nonoperatively, 1 patient had a superficial wound infection that was treated with a course of oral antibiotics, and 1 patient had a symptomatic capsular adhesion treated with an arthroscopic débridement. This patient received the diagnosis after having experienced ongoing hip pain following arthroscopic surgery for FAI and labral tear; repeat arthroscopy 8 months later identified extensive capsular adhesions. Finally, 1 patient experienced generalized leg numbness and difficulty moving the second, third and fifth toes about 6 weeks postoperatively. This patient was referred to Neurology, where a specific etiology could not be identified. The symptoms gradually resolved.

DISCUSSION

Our results revealed an overall complication rate of 4.2% following hip arthroscopy. We identified 4 major and 6 minor complications. Hip arthroscopy appears to be safe, with the majority of complications being non-life or limb threatening. However, we caution against considering hip arthroscopy a benign procedure. In our series, a deep wound infection and secondary osteomyelitis with consequent premature osteoarthritis developed postoperatively in 1 patient, who then required irrigation, débridement and intravenous antibiotics. Furthermore, DVT developed in 2 patients. Surgeons who perform hip arthroscopies should remain mindful of the infrequent, but serious complications that can occur. Patients considering the procedure should be thoroughly counselled regarding these adverse events. A careful discussion should occur to weigh the risks against the benefits of improved functional outcomes supported by current evidence.⁶

The results from our series are in keeping with the complication rates reported in the literature. Sampson² suggested that hip arthroscopy was associated with a complication rate ranging from 1.6% to 5%. A recent systematic review of 66 articles representing 6962 hip arthroscopies performed between 2000 and 2011 also found an overall complication rate of 4.0% (95% CI 2.9%–5.2%); 20 (0.3%) of the complications reported were severe.⁵ The authors concluded that hip arthroscopy was generally safe, but that larger prospective studies were needed.⁵

In reviewing the literature, traction injuries and secondary neurapraxias are thought to be the most common complication associated with hip arthroscopy.^{2,3,7} Clarke and colleagues³ suggested a rate ranging from 2.6% to 20%. In the present series, we identified 1 patient with

mild paresthesias to the anterolateral thigh, likely representing a neurapraxia of the lateral femoral cutaneous nerve, and another patient with generalized nonanatomic sensation and motor disturbances in the lower extremity. This lower rate in our series may represent technological advances in surgical therapy (e.g., dedicated traction tables) or the advancement in surgical training, as both participating surgeons obtained dedicated fellowship training in hip arthroscopy.

Two patients in our series experienced postoperative infections. Owing to the limited occurrence of this outcome, it is difficult to statistically analyze for potential risk factors. It remains unclear whether certain high-risk patients can be identified preoperatively and counselled regarding the incidence of infections after hip arthroscopy. Even less is known about the possible contribution of diagnostic intra-articular hip injections to the risk of postoperative infections. Further studies are needed to adequately identify potential predictors of this serious complication.

Two interesting trends emerged in our retrospective case review. First, we noticed that 6 of the 9 patients (67%) who had a complication were treated surgically for FAI (compared with 33% of complications in non-FAI surgery). It is possible that these patients were at risk for postoperative complications because treating FAI required more extensive bony surgery (e.g., rim trimming and osteoplasty) and longer traction and operative times. Further studies are required to determine whether FAI is a risk factor for postoperative complications.

In addition, DVT developed in 2 patients (0.8%), requiring anticoagulation. Salvo and colleagues⁸ recently studied 81 hip arthroscopy patients and found a DVT incidence of 3.7%. Bushnell and colleagues⁹ performed a non-systematic review of the literature and identified 27 studies of hip arthroscopy, including 5554 patients; the overall reported DVT rate was 0%. Guidelines, including the current American College of Chest Physicians (ACCP) guidelines on prevention of venous thromboembolic (VTE) events in orthopaedics,¹⁰ have not included specific recommendations on thromboprophylaxis for patients undergoing hip arthroscopy. However, extrapolating from patients who have had knee arthroscopy, the ACCP guidelines recommend no thromboprophylaxis in those without a history of venous thromboembolism.¹⁰ At our institution, we do not currently administer routine perioperative thromboprophylaxis in patients undergoing elective outpatient hip arthroscopy. Until further studies identify a clear benefit, a decision to provide anticoagulation prophylaxis should be made on an individual patient basis.⁹

The strengths of the current study are that we included every eligible patient from 2 surgeons performing a high volume of hip arthroscopies. We used consistent criteria to identify all complications, and the definition was constructed a priori in consultation with several orthopaedic

surgeons. Information about complications relating to this procedure will be directly helpful to all decision-makers, including patients and their treating physicians. This series is applicable to those in academic practice and relevant to the Canadian health care environment.

Limitations

Our findings need to be interpreted within the inherent limitations of a retrospective chart review, which is prone to data inaccuracies and missing data. Surgeon experience is also an important consideration in our study. The 2 hip arthroscopists (O.A., I.W.) at our institution are within their first 5 years of practice. Complication rates are expected to decrease with surgeon experience. Sampson described his complication rate decline from 15% in the first 60 cases to 6.2% in the next 500 cases, and 0.5% in his last 500 cases.^{2,11} Similarly, Bellotti and colleagues¹² reported 5 complications in their first 30 cases and only 2 in 67 subsequent cases. A combination of patient selection bias and surgeon experience likely contributed to this decline. In addition, the lack of a universally accepted definition of what constitutes a surgical complication can lead to the over- or under-reporting of complications by individual authors. Finally, another limitation of this study is the small number of events (10 complications) and lack of power to conduct multivariable regression analysis to explore the predictors of the complication. We would need at least 10 events per covariable to avoid poor estimation of Wald-based coefficients and their corresponding CIs.

CONCLUSION

Overall, hip arthroscopy appears to be safe, but surgeons need to consider the possibility of serious complications in the postoperative period. Future studies should focus on rigorous designs looking for potential predictors of

complications that would allow a more thorough risk assessment in the preoperative setting.

Acknowledgements: We thank Dr. Ivan Wong for providing access to his patient charts.

Competing interests: None declared.

Contributors: F. Farrokhyar, S. Burrow and M. Kowalczyk designed the study. M. Kowalczyk acquired the data, which K. Chan, F. Farrokhyar, M. Kowalczyk, M. Bhandari and O.R. Ayeni analyzed. K. Chan wrote the article, which all authors reviewed and approved for publication.

References

1. Colvin AC, Harrast J, Harner C. Trends in hip arthroscopy. *J Bone Joint Surg Am* 2012;94:e23.
2. Sampson TG. Complications of hip arthroscopy. *Clin Sports Med* 2001;20:831-5.
3. Clarke MT, Arora A, Villar RN. Hip arthroscopy: complications in 1054 cases. *Clin Orthop Relat Res* 2003;406:84-8.
4. Parvizi J, Leunig M, Ganz R. Femoroacetabular impingement. *J Am Acad Orthop Surg* 2007;15:561-70.
5. Kowalczyk M, Bhandari M, Farrokhyar F, et al. Complications following hip arthroscopy: a systematic review and meta-analysis. *Knee Surg Sports Traumatol Arthrosc* 2013;21:1669-75.
6. Kemp JL, Collins NJ, Makdissi M, et al. Hip arthroscopy for intra-articular pathology: a systematic review of outcomes with and without femoral osteoplasty. *Br J Sports Med* 2012;46:632-43.
7. Funke EL, Munzinger U. Complications in hip arthroscopy. *Arthroscopy* 1996;12:156-9.
8. Salvo JP, Troxell CR, Duggan DP. Incidence of venous thromboembolic disease following hip arthroscopy. *Orthopedics* 2010;33:664.
9. Bushnell BD, Anz AW, Bert JM. Venous thromboembolism in lower extremity arthroscopy. *Arthroscopy* 2008;24:604-11.
10. Falck-Ytter Y, Francis CW, Johanson NA, et al.; American College of Chest Physicians. Prevention of VTE in orthopedic surgery patients: antithrombotic therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest* 2012; 141(Suppl 2):e278S-325S.
11. Sampson TG. Complications of hip arthroscopy. *Techniques in Orthopaedics* 2005;20:63-6.
12. Bellotti V, Vilchez F, Erquicia JI, et al. Hip arthroscopy learning curve. *Knee Surg Sports Traumatol Arthrosc* 2010;18(Suppl 1):S65.