Do Complications in Hip Arthroscopy Change With Experience?

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Purpose: The aim of this study was to evaluate the type and incidence of complications during the development of hip arthroscopic techniques. **Methods:** A retrospective series of 194 files of patients treated with hip arthroscopy in a tertiary hospital from December 1999 to March 2008 was reviewed for complications. The incidence of complications was recorded consecutively for each group of 30 patients and in intervals of 2 years. A comparison between the complication rates was performed within the time frames and the set of cases. The type and severity of complications were also recorded. **Results:** There were 12 complications (6.1%) in this series. Of these, 5 were neurologic (2.6%), 4 were musculoskeletal (2%), and 3 were vascular/ischemic (1.5%). According to severity, 2 were considered major complications (1%), 8 were intermediate (4.1%), and 2 were minor (1%). The incidence of complications did not change with time ($P = .959$) or with the number of cases performed ($P = .771$), but different types of complications occurred along the learning curve. **Conclusions:** The nature of complications changed with experience, but no significant variation in the incidence was observed over the 9-year period of experience with hip arthroscopy. **Level of Evidence:** Level IV, therapeutic case series.

The reported prevalence of complications in hip arthroscopy ranges from 0% to 13%.[1-9] The most common complications are related to excessive distraction forces and compression against the perineal post or to incorrect placement of a portal.[6,10] Hip arthroscopy is known to have a steep learning curve.[8] In endoscopic procedures the learning curve can be quantified as a function of operating time,[11] number of manual movements of the surgeon to perform a defined task,[12] patient hospitalization time, need for use of alternative approaches, and various outcome measures.[11-14] However, it can also be referred to as a function of complications over time or number of cases performed.[14] One of the common assumptions about learning curves is that complications will decrease with experience.

The aim of this study was to evaluate the type and incidence of complications during the development of hip arthroscopic techniques. We hypothesized that complication rates would decrease with experience in hip arthroscopy.

METHODS

The medical files of every patient submitted to hip arthroscopy in a tertiary hospital were retrospectively reviewed for complications from December 1999 to March 2008. One hundred ninety four patients were identified and included in the study. No patients were excluded. There were 115 male patients (59.3%) and

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79 female patients (44.7%). The mean age was 36.2 years (range, 7 to 78 years; SD, 12.2 years). The mean follow up was 39.5 months (range, 4 to 103 months; SD, 22.4 months). The right hip was operated on in 109 cases (56.1%) and the left in 85 (43.9%). This study has been approved by the ethical committee of our institution (registry No. 102/08). The most common indications for surgery were labral tears, chondral lesions, loose bodies, and femoroacetabular impingement.

The incidence of complications was recorded consecutively for each group of 30 patients and at intervals of 2 years, since the beginning of our experience, in 1999. The comparison between the complication rates was performed within the time frames and the set of cases, by use of the χ^2 method with SPSS software for Windows, version 11.0.1 (SPSS, Chicago, IL). An α of .05 was set as significant.

Complications were classified as neurologic, musculoskeletal, or vascular/ischemic. For this anatomic classification, musculoskeletal complications refers to those that comprised the hip joint (including the articular space, the femur, and the acetabulum) and the surrounding muscles. Neurologic complications referred to all types of damage to peripheral nerves. Vascular/ischemic complications included any possible compression, damage, or harm to arteries, veins, or lymph vessels.

According to severity, complications were separated into major, which caused definitive consequences to the patient or required a new surgical treatment for its resolution; intermediate, which were transient and resolved completely with time or after clinical treatment; and minor, which could be resolved during the same procedure.

All the procedures were performed with the patient in the supine position[15] under general anesthesia by the same surgeon. An orthopaedic table was used with a centric perineal post with a large foam roll that provided a lateral force vector. Distraction was applied to the lower limb until the vacuum sign was noted on fluoroscopy. Further space was available after injection of 20 mL of saline solution in the joint through the anterior-lateral portal (lateral peritrochanteric).[16] The portals used were the anterior and anterior-lateral in most cases. Later in our series, we substituted the anterior portal with another more distal and lateral portal (mid-anterior portal). Use of the posterior-lateral portal was rarely necessary.[15,17] The infusion pump was set to an initial pressure of 60 mm Hg. The pressure was adjusted as necessary.

RESULTS

There were 12 complications (6.1%) in this series. Neurologic complications were observed in 5 cases, musculoskeletal in 4, and vascular/ischemic in 3.

There were 2 major complications (1%): 1 musculoskeletal and 1 vascular/ischemic. In 1 case the excessive resection of the anterior acetabular rim in a patient with femoroacetabular impingement led to anterior hip dislocation on postoperative day 1. The other patient had partial necrosis of the scrotum skin.

Among the 8 intermediate complications (4%), 5 were neurologic. There were also 2 cases of vascular/ischemic complications and 1 musculoskeletal. The 5 patients who complained of pudendal nerve palsy recovered completely after 8.4 weeks on average (range, 2 to 12 weeks). In 1 case, beyond the perineal numbness, the patient reported loss of erection, which took 12 weeks to resolve. Among the vascular/ischemic cases, 1 had deep venous thrombosis (DVT) that resolved without problems after adequate medical treatment. The other patient had a transient vulva edema that subsided after 1 week. The musculoskeletal complication in this group was a femoral neck stress fracture in a patient with cam deformity who had undergone osteoplasty for femoroacetabular impingement.

Both minor complications were musculoskeletal (1%). In both cases there were breakages of the guidewires within the soft tissue around the joint. They were removed at the same surgery, without any further morbidity. There were no infections or permanent neurologic injuries.

Table 1 details the cases related to articular distraction. Table 2 shows the comparison between the incidences along the years. The analysis of the incidence in time intervals of 2 years showed an increase in the complication rate related to time, which was not significant ($P = .959$). The incidence of complications was also analyzed in intervals of 30 consecutive cases. No significant variation in the complication rate could be observed on a case basis ($P = .771$). Figures 1 and 2 show the number and type of complications along the learning curve.

DISCUSSION

Clarke et al.[6] stated that most common complications in hip arthroscopy are related to distraction and portal placement. In our experience, 7 of 12 complications (58.3%) were related to traction and none to portal placement. In 1 case, considered severe, there

TABLE 1. *Complications Related to Articular Distraction*

Case No.	Sex	Age	Diagnosis	Procedure	Surgery Duration	Complication	Type	Severity
29	F	27 yr	Labral tear + loose body	Labial debridement + loose body removal	NQ	Vulva edema	Vascular	Intermediate
43	M	21 yr	Labral tear	Debridement	NQ	Partial skin necrosis of scrotum	Vascular	Major
117	M	40 yr	Medial OA	Labial debridement + osteochondroplasty	90 min	Pudendal nerve palsy + transient impotence	Neurologic	Intermediate
145	F	38 yr	Labral tear	Debridement	NQ	Pudendal nerve palsy	Neurologic	Intermediate
159	M	23 yr	FAI	Osteochondroplasty	60 min	Pudendal nerve palsy	Neurologic	Intermediate
171	F	24 yr	FAI + labral tear	Osteochondroplasty + labral repair	60 min	Pudendal nerve palsy	Neurologic	Intermediate
173	M	26 yr	FAI	Osteochondroplasty	240 min	Pudendal nerve palsy	Neurologic	Intermediate

NOTE. Source: Medical Archives, Santa Casa de São Paulo, 2008.
Abbreviations: NQ, not quantified; OA, osteoarthritis; FAI, femoroacetabular impingement.

was partial skin necrosis of the scrotum that required plastic surgery correction, and another case, considered intermediate, had vulva edema that resolved after 1 week. Similar problems have been reported by other authors including Funke and Munzinger,[2] who reported 1 case of vulva hematoma, and Eriksson et al.,[18] who had 1 case of skin necrosis of the scrotum. Five other patients in our series had neurologic complications. Other authors have reported this problem as well. Glick[1] reported 9 neurologic complications in 60 hip arthroscopies. Pudendal nerve palsy accounted for 4 cases and sciatic nerve impairment for the other 5; all had a full recovery. In 19 consecutive hip arthroscopies, Funke and Munzinger reported 1 case of pudendal nerve palsy due to traction, which resolved within 3 weeks. Byrd[15] found pudendal nerve palsies in 10% of 20 consecutive cases with a similar evolution after 1 week.

TABLE 2. *Comparison Between Incidence of Complications for 2-Year Intervals*

	No. of Cases	Incidence of Complications	*P* Value*
Time sets			.959
1999 (December) to 2000	1	0% (0)	
2001 to 2002	30	3.45% (1)	
2003 to 2004	49	6.52% (3)	
2005 to 2006	73	7.46% (5)	
2007 to 2008 (March)	41	7.69% (3)	
Total	194	6.1%	—

NOTE. Source: Medical Archives, Santa Casa de São Paulo, 2008. Absolute values are shown in parentheses.
*Calculated with χ^2 method.

We encountered 2 musculoskeletal complications in patients with femoroacetabular impingement, rarely reported in the literature.[19,20] One of them, considered major, consisted of anterior dislocation of the hip after excessive acetabular rim trimming. The patient was being treated for a pincer deformity and already had signs of moderate osteoarthritis (Tönnis grade II). The consequent instability was severe, and we performed a total hip replacement to treat this patient. The other patient had a femoral neck stress fracture after excessive removal of bone during a procedure for correction of a cam deformity. This complication was considered intermediate because the fracture healed after 8 weeks of conservative treatment without sequela. We acknowledge that femoroacetabular impingement is a relatively new condition, and the parameters for correction are often subjective. Caution is recommended when approaching this condition, because excessive bone resection can cause great morbidity, as we have experienced in 2 cases.

In this study there were 2 cases of guidewire breakage. Both cases were considered minor complications

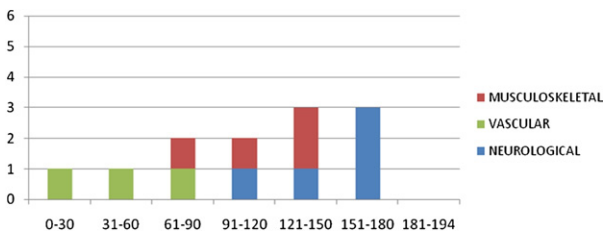

FIGURE 1. Number of complications (vertical axis) per set of 30 consecutive cases (horizontal axis), according to complication type. (Source: Medical Archives, Santa Casa de São Paulo, 2008.)

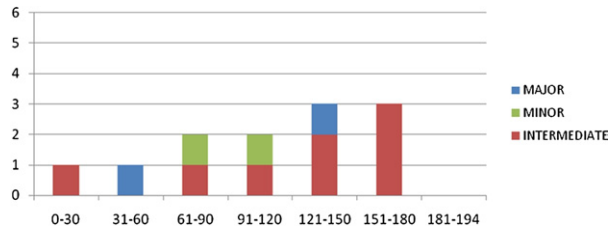

Figure 2. Number of complications (vertical axis) per set of 30 consecutive cases (horizontal axis), according to complication severity. (Source: Medical Archives, Santa Casa de São Paulo, 2008.)

because we were able to retrieve the guidewires arthroscopically without further morbidity. Nevertheless, that is not always the case: some instruments may be difficult to retrieve and require additional incisions or surgeries. Glick[1] reported 1 case of instrument breakage within the joint. Clarke et al.[6] had 2 such cases, Sampson[19] had 2, and Byrd[3] had 1. To avoid such complications, we pull back the guidewire as we insert the arthroscopic cannula. This prevents the wire from bending and breaking within the patient. The use of guidewires made of nitinol, which is more difficult to break than other materials, also helps to prevent this complication.

There was 1 case of DVT in a patient in the immediate postoperative period. We were not able to identify any risk factors in this patient, and full recovery was observed after medical treatment. We usually recommend early mobilization for all patients. Mechanical or chemical prophylaxis may be provided to patients at high risk.[21] Most series do not report DVT as a complication of hip arthroscopy.[21] McCarthy and Lee[8] reported 1 case of DVT 30 days after surgery. Bushnell and Dahners[22] reported the only case of fatal pulmonary embolism associated with hip arthroscopy in a poly-traumatized patient.

Contrary to our initial hypothesis and to what was reported by Sampson,[5] our complications did not diminish with experience. The nature of our complications simply changed along the cases. This would appear to reflect the continuing evolution of hip arthroscopy. As surgeons become more accomplished with basic techniques, more challenging problems requiring more advanced technical applications are being undertaken, and new complications seem to be occurring.[9]

Decreases in surgical time have been observed as a function of the learning curve in arthroscopic procedures.[11,12,14] Vascular complications only occurred in our first 90 cases (Fig 2). One possible explanation for those types of complications could be the use of excessive surgical and traction time.[2,18] However, those variables could have been greater in our initial cases; we were unable to consistently retrieve that information from the files to reach any conclusion. More severe musculoskeletal complications happened from the 95th case to the 141st (in 2005); at that time, we were beginning our experience in the treatment of femoroacetabular impingement with more extensive procedures, involving rim trimming, femoral osteoplasty, and labral repair. It has been reported that the incidence of neurologic complications has more to do with the intensity of the force applied than with the time of traction.[2,23] Neurologic complications occurred later in our series (from the 117th case to the 173rd). However, we were not able to obtain this information from the files; our impression is that during that phase, we were less restrictive in the indication for this procedure for larger patients and those with narrower joint spaces, which might have required greater traction forces. This might imply that there is not 1 single learning curve for hip arthroscopy but that there are specific curves for each arthroscopic procedure.

After the 173rd case, we developed a modification in the foam roll of the perineal post to diminish the pressure over the perineum. It consists of a sulcus in the roll designed to distribute the load to the inner thigh, alleviating the pressure against the pudendal nerve. We have not experienced any other case of pudendal nerve palsy thus far. The effects of this modification are being evaluated in another study. We did not observe any complication related to portal placement or to sciatic nerve traction. No cases of retroperitoneal fluid extravasation, avascular necrosis, infection, reflex sympathetic dystrophy, or permanent neurologic injury, all of which have been reported in the literature,[1-9,18,19,22,24,25] were noted in our series either.

Probably the greatest strength of this study is the fact that it compares consecutive cases of patients operated on by the same surgeon, showing our experience since the very first case and therefore potentially portraying adequately 1 of the aspects of the learning curve for this procedure. The types and incidences of complications were within the reports in the literature, which further validates the relevance of our data. We believe that the original findings of this study, especially those regarding the change in the nature of complications, may help surgeons to become more realistic in their expectations about complications in hip arthroscopy. This might also be of value in the education of patients.

This study has several limitations. The retrospective design impeded us from obtaining adequate informa-

tion to define possible risk factors related to each type of complication (such as traction time and body mass index). In addition, the low number of complications did not allow us to perform powerful comparisons. Both classifications for complications that we used are novel for hip arthroscopy and have not been validated.

CONCLUSIONS

The nature of complications changed with experience, but no significant variation in the incidence was observed over the 9-year period of experience with hip arthroscopy.

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