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Femoroacetabular impingement: prospective study of rate and factors related for nerve injury after hip arthroscopy

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A B S T R A C T

Prospective, longitudinal, descriptive study was conducted from January 2016 to January 2018 to detect nerve dysfunction after hip arthroscopy. A total of 110 patients were included. Twenty-four hours after surgery, 62.7% reported symptoms of abnormal sensation at least in one area. The most common was the perineal area. Three weeks after hip arthroscopy, 42.6% still experienced abnormal sensation. Six months after hip arthroscopy, only one patient remained with symptoms. Nerve dysfunction after HA was more common than has been reported in the literature within large populations. Traction time was a significant factor for the development of perineal nerve dysfunction.

1. Introduction

Although hip arthroscopy (HA) is a safe and less invasive procedure, it is not free of complications. Several studies had focused in major complications as deep vein thrombosis, hip fracture, pulmonary embolism, deep infection, dislocation, conversion to arthroplasty, or death.[1–3] However, there are other complications defined as minor complications, like iatrogenic chondrolabral damage, or nerve injury.[4,5] Maybe because they don' t need treatment and most of them are temporary, there are studies that don't record them.[1–3]

Pudendal nerve and lateral cutaneous femoral nerve are the most commonly injury nerve reported. Compression in the perineal area associated with the traction, and sequential introduction of the instrumentation through arthroscopic portals can lead to these nerve injuries. These injuries most commonly occur perioperatively. Several studies including systematic reviews reported rates between 1% and 16.5%.[4,6–9] However, other studies have published higher rate of nerve injuries after HA, and this could indicate that nerve injuries are an underreported HA complication.[10–12]

The purpose of this study was to identify rate and factors related for nerve injury with HA from a one surgeon consecutive series of patients. Our hypothesis was that nerve injuries rate would be higher than the existing HA literature. To know the factors related could be used in orthopaedic practice to inform patients about this potential postoperative complication.

2. Methods

Since 2011, our prospective database registered all patients underwent HA. In our hospital, we perform between 50 and 60 HA per year. This prospective, longitudinal, descriptive study was conducted from January 2016 to January 2018 in a single hospital in Spain. All patients underwent HA for femoroacetabular impingement (FAI) were consecutively recruited. The Institutional Review Board approved the study, and all participants gave written informed consent to participate.

2.1. Surgical procedure

HA surgery was performed with the patient placed in the supine position on a traction table. A large padded perineal post and traction boots were used (Fig. 1). Distraction was performed under fluoroscopic guidance. Traction force was not measured. We used a pressure- and flow controlled pump. Standard anterolateral, mid-anterior, and distal anterolateral portals were performed (Fig. 2). Half-pipe cannulas were used for instrumentation. A cannula was used in mid-anterior portal. According to their condition, pincer and labral lesions were treated by acetabuloplasty and refixation of the labrum with suture anchors. After that, traction was released to access the peripheral compartment, and extended T-capsulotomy may be required for easier manipulation, and cam deformity was removed by motorized burr and with the assistance of fluoroscopic image intensifier. Capsulotomy was closed. All HA were performed by the same surgeons.

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Fig. 1. Right hip arthroscopy in supine position on a traction table. Large padded perineal post (black arrow) and traction boots (red arrow) were used.

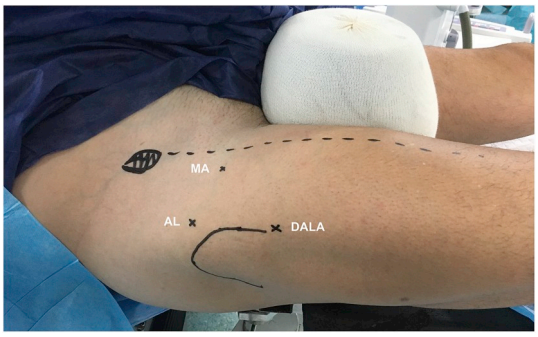

Fig. 2. Portals placement on a right hip: standard anterolateral (AL), mid-anterior (MA), and distal anterolateral (DALA).

2.2. Postoperative care

All patients followed the same postoperative pain and rehabilitation protocol. Patients were discharged after 24 h and partial load with crutches was allowed. Passive mobility was initiated in the immediate postoperative period, with restriction of rotations for 4 weeks and thereafter initiating the specific rehabilitation protocol. No orthesis which restricted hip mobility were used.

2.3. Primary outcomes

All patients were asked regarding symptoms of abnormal sensation (tingling, tickling, pricking, numbness or burning) in the groin area, lateral thigh, perineal area, knee or ankle; at 24 h, at 3 and 6 weeks, at 3 and 6 months after HA. If the symptoms had disappeared between two visits, patients were asked for how long the symptoms lasted. The hip surgeon performed also physical examination of the patients in each visit to detect nerve dysfunction in these areas.

2.4. Secondary study variables

We collected the following variables: age, sex, body mass index (BMI), diagnosis (cam, pincer or mixt FAI), type of anesthesia (general, rachianesthesie), arthroscopic procedure (labral repair, rim resection, cam decompression), duration of surgery (minutes), traction time (minutes), traction released (yes or no), and traction released time (minutes).

2.5. Statistical analysis

Statistical analyses were conducted with SPSS software v. 20.0 (SPSS Inc., Chicago, USA). We performed univariate analysis between potential independent association and symptoms of nerve dysfunction. For categorical variables, we assessed associations using the Chi-squared test and two-way tables. For quantitative variables, we used the Student's t-test and analysis of variance to compare means following assessment of normality through Kolmogorov-Smirnov test. If data distribution did not meet normality criteria, the Mann-Whitney *U* test and Kruskal-Wallis test were used. Odds ratios and the 95% confidence intervals were presented. For assessing associations between continuous variables, the Pearson's r correlation coefficient was calculated. Multivariate analysis was conducted using logistic regression to adjust for possible confounding variables and to identify the independent predictors of outcomes. We start from the variables that showed a significant difference with the primary outcome in bivariate analysis. Statistical significance was considered for p values less than 0.05.

3. Results

A total of 110 patients were included; all completed the study with no loss to follow-up. The mean age of the patients was 36 years (SD, 7.5; 95% CI, 31.7 to 40.4). There were 67 men (60.9%) and 43 women (39,1%). Mean BMI was 23.7 kg/m^2 (SD, 3.0; 95% CI, 22.0 to 25.5).

Preoperative diagnosis was mixt FAI in 78 patients (70.9%), cam type in 18 patients (16.3%), and pincer type in 14 patients (12.8%). The type of anesthesia was general in 76 patients (69%), and rachianesthesie in 34 patients (31%).

Labral repaired was performed in all patients, cam decompression in 96 patients (87.2%), and rim resection in 92 patients (83.6%).

Mean surgery time was 96.4 min (SD, 24.6; 95% CI, 82.1 to 110.6). Mean traction time was 58.2 min (SD, 21.7; 95% CI, 45.6 to 70.7). In 71 patients (64.5%) traction was released during a mean time of 10.4 min (SD, 7.4; 95% CI, 6.1 to 14.7).

Twenty-four hours after HA, 69 patients (62.7%) reported symptoms of abnormal sensation at least in one area. The perineal area was the most common in 65 patients (59%), followed by the lateral thigh in 15 patients (13.6%). Ten patients (9%) experienced abnormal sensation in these 2 areas. Five patients (4.5%) reported symptoms of abnormal sensation only in the lateral thigh. There were no clinically recognized sciatic or femoral nerve dysfunction in the current cohort.

Three weeks after HA, 43 patients (39%) still experienced abnormal sensation in the perineal area, and 4 patients (3.6%) in the lateral thigh.

Six weeks after HA, 10 patients (9%) had symptoms in the perineal area, and 2 patients (1.8%) in the lateral thigh.

The number of patients with symptoms decreased at 3 months after HA to 2 patients (1.8%) in the perineal area, and 1 patient (0.9%) in the lateral thigh. Six months after HA, only the patient with symptoms in the lateral thigh remained.

The symptoms disappeared at a mean of 3.6 weeks after HA (SD, 2.0; 95% CI, 2.4 to 4.7).

Symptoms for perineal nerve dysfunction 24 h after HA were not related to age, sex, type of anesthesia, or arthroscopic procedure. BMI was lower in patients with nerve dysfunction, and this difference was significant ($p = 0.008$). Mean surgery time and mean traction time was higher in patients with nerve dysfunction ($p = 0.03$ and $p = 0.004$, respectively). In 67.6% of the procedures where the traction had been released, the patients had symptoms (Table 1).

Patients who still experienced symptoms of nerve dysfunction 3 weeks after HA recorded higher mean surgery time and mean traction time, and these differences were significant ($p = 0.02$ and $p = 0.003$, respectively) (Table 2). There was correlation between traction time and number of weeks with symptoms of nerve dysfunction ($r = 0,376$, $p = 0,02$). Traction time higher than 50 min was a risk factor for postoperative symptoms of perineal nerve dysfunction at 24 h after HA, with an odds ratio of 2.4 (95% CI, 1.0 to 5.5); and at 3 weeks after HA, with an odds ratio of 0.3 (95% CI, 0.1 to 0.8). If traction time was higher than 60 min, the odds ratio increased to 4.4 (95% CI, 1.9 to 10) at 24 h after HA; and to 3.9 (95% CI, 1.7 to 8.4) at 3 weeks after HA.

Table 1
Association between perineal neurapraxia 24 h after HA and secondary study variables.

Study variable		Symptoms (n = 65)	No symptoms (n = 45)	p-value
Age (years), mean (SD)		38.8 (9.2)	37.6 (7.8)	0.53
Sex	Men, n (%)	40 (59.7)	27 (40.3)	0.87
	Women, n (%)	25 (58.1)	18 (41.9)	
BMI (kg/m^2), mean (SD)		23.3 (2.7)	25.4 (3.6)	0.008
Type of anesthesie	General, n (%)	41(53.9)	35 (46.1)	0.10
	Rachianesthesie, n (%)	24 (70.5)	10 (39.5)	
Surgical procedure	Labral repair + Rim resection + Cam decompression, n (%)	47 (60.2)	31 (39.8)	0.66
	Labral repair + Cam decompression, n (%)	9 (50)	9 (50)	
	Labral repair + Rim resection, n (%)	9 (64.2)	5 (35.8)	
Surgery time (minutes), mean (SD)		100.8 (21.3)	90.8 (20.0)	0.03
Traction time (minutes)		61.9 (18.5)	51.3 (13.8)	0.004
Traction time	Yes, n (%)	50 (76.9)	26 (57.7)	0.03
> 50 min	No, n (%)	15 (23.1)	19 (42.3)	
Traction time	Yes, n (%)	40 (76.9)	12 (23.1)	0.0003
> 60 min	No, n (%)	25 (43.1)	33 (56.9)	
Traction released	Yes, n (%)	48 (67.6)	23 (32.4)	0.01
	No, n (%)	17 (43.5)	22 (56.5)	

When adjusted the significance variables in the multiple logistic regression model, traction time and traction time higher than 60 min proved to be longer significant for perineal nerve dysfunction at 24 h after HA (p = 0.01, and p = 0.002, respectively), and 3 weeks after HA (p = 0.03, and p = 0.001, respectively).

Concerning symptoms in the lateral thigh, there were no association with any secondary study variables (p > 0.05) (Table 3).

4. Discussion

This study found a higher rate of postoperative nerve injury symptoms after HA than reported in the current literature. In our study 62.7% of the patients reported symptoms of nerve dysfunction 24 h after HA.

Previous studies published a rate between 1% and 16.5%.[4,6–9,13] A systematic review of 92 studies and more than 6000 patients reported temporary nerve injury in 86 patients (1.4%).[4] Another recent systematic review with 53 studies and 8071 patients, reported temporary nerve injury in 127 patients (2%).[5] Last year, another systematic review with 24 studies including 3405 patients reported pudendal nerve injury in 62 patients (1.8%).[13] Most the studies included in these systematic reviews were level IV evidence and retrospective. Larson published a prospective study with 1615 consecutive hips in patients underwent HA procedures at 4 institutions, and reported 1.4% pudendal nerve neurapraxia, and 16.5% lateral femoral cutaneous nerve disturbance.[8]

Three studies reported higher rate of postoperative nerve injury. Dippmann reported postoperative numbness in 43% of 52 patients in their retrospective study.[10] Frandsen found that 22% of the patients in their study with 100 patients experienced numbness in the groin area.[11] And Reda found a 37% postoperative numbness in their retrospective study with 221 patients.[12] They all used specific questionnaires to ask patients about nerve affectation after HA. Dippmann used a questionnaire with 4 simple questions offered to the patient at 1 year postoperatively about nerve dysfunction symptoms.[10] Frandsen used a questionnaire with 25 questions related to patient's perception of traction-related problems. Patients had to fill out the questionnaire 10 days after HA.[11] Reda performed a telephone survey with 4 questions to patients who underwent hip arthroscopic surgery performed during the period of 4 years.[12] In our prospective study, patients were asked face to face about experience abnormal sensation at 24 h, at 3 and 6 weeks, and at 3 and 6 months after HA. We recorded 62.7% of the patients with symptoms of nerve dysfunction in our series. Maybe these differences in nerve injury rates reported in the literature could show a low appreciation of this complication by hip arthroscopic surgeons. Specific patient reported outcomes measures (PROMs) would allow surgeons to detect higher number of patients describing nerve affection after HA.

Obesity was related to higher risk of complications after HA.[14] In our study, lower BMI was related to 24-h pudendal nerve dysfunction. This result is not in agreement with other authors.[12,15] However, we did not measure traction force, and maybe similar force was performed in all patients, regardless BMI.

Duration of surgery had been related in the development of postoperative numbness. Larson published a statistically greater incidence of complications with longer surgical time.[8] Reda reported an odds ratio of 2.18 if the surgery took longer than 50 min.[12] In our study, surgery time was also greater in patients with pudendal nerve neurapraxias.

Traction is generally used in hip arthroscopic procedures. There is a concern in the literature about which factor is more important, the maximum traction weight or the total traction time. Larson associated pudendal nerve neurapraxias with longer traction time.[8] Dippmann did not find a relation between traction time and nerve dysfuntion.[10] Habib

Table 2
Association between perineal neurapraxia 3 weeks after HA and secondary study variables.

Study variable		Symptoms (n = 43)	No symptoms (n = 67)	p-value
BMI (kg/m^2), mean (SD)		23.5 (2.5)	24.6 (3.7)	0.11
Surgery time (minutes), mean (SD)		103.1 (21.3)	92.4 (20.3)	0.02
Traction time (minutes)		64.6 (19.3)	52.4 (14.1)	0.003
Traction time > 50 min	Yes, n (%)	27 (62.7)	56 (83.5)	0.01
	No, n (%)	16 (37.3)	11 (16.5)	
Traction time > 60 min	Yes, n (%)	29 (76.9)	23 (23.1)	0.0007
	No, n (%)	14 (43.1)	44 (56.9)	
Traction released	Yes, n (%)	32 (45)	39 (55)	0.08
	No, n (%)	11 (28.2)	28 (71.8)	

Table 3
Association between lateral cutaneous femoral nerve neurapraxia 24 h after HA and secondary study variables.

Study variable		Symptoms (n = 15)	No symptoms (n = 95)	p-value
Age (years), mean (SD)		39.7 (6.2)	38.0 (8.9)	0.45
Sex	Men, n (%)	8 (11.9)	59 (88.1)	0.51
	Women, n (%)	7 (16.2)	36 (83.8)	
BMI (kg/m^2), mean (SD)		23.3 (2.8)	24.3 (3.3)	0.28
Type of anesthesie	General, n (%)	9 (11.8)	67 (88.2)	0.41
	Rachianesthesie, n (%)	6 (17.6)	28 (82.4)	
Surgical procedure	Labral repair + Rim resection + Cam decompression, n (%)	9 (11.5)	69 (88.5)	0.49
	Labral repair + Cam decompression, n (%)	4 (22.2)	14 (77.8)	
	Labral repair + Rim resection, n (%)	2 (14.2)	12 (85.8)	
Surgery time (minutes), mean (SD)		93.1 (20.4)	96.9 (21.5)	0.58
Traction time (minutes)		58.6 (15.0)	57.0 (17.7)	0.75
Traction released	Yes, n (%)	10 (14)	61 (86)	0.85

reported in their review that the rate of pudendal nerve injuries was higher in studies that reported longer traction times.[13] However, Telleria used intraoperative sciatic nerve monitoring during HA, and found that maximum traction weight, not the total traction time, was the greatest risk factor for sciatic nerve dysfunction.[16] Maybe the most common interpretation of this complication is a combination of traction and compression. In our study, we did not find any sciatic nerve injury. However, traction time greater than 50 min, and chiefly traction time greater than 60 min was associated with pudendal nerve neurapraxias. We recommend traction time must be kept to a minimum during hip arthroscopy.

Most studies describe these symptoms as a temporary phenomenon that resolves over time. Dippmann reported that the number of patients with symptoms of nerve dysfunction decreased within the first year, with the most rapid decrease within the first 6 weeks after surgery.[10] Frandsen published that traction-related problems were transient and typically disappeared within 2–4 weeks.[11] Reda found that majority of the patients' symptoms had resolved by 6 months.[12] Habib reported that all patients with pudendal nerve injury had resolved within 6 weeks to 3 months.[13] Our results agree with those published, and the number of patients with symptoms decrease also within the first 6 weeks after HA.

Symptoms of nerve dysfunction in lateral thigh had no association with any secondary variables in our study, with a 13.6% rate. Larson reported a 16.5% rate of periportal sensory disturbances, and related it with labral repair procedures, when large cannulas were used for suture management.[8] Dippmann reported a 15.3% rate, and presumed that these lesions were related to portal placement and instrumentation. They did not find significant differences in traction time in their analysis.[10] And Reda referred the highest rate with a 40.2%.[12] There is a general recommendation to make stab incisions through the skin for arthroscopic portals, and used a halfpipe to change instruments.

Strengths of the present study included the analysis of a single-series with standardized diagnosis, surgical and postoperative management. We explicitly address postoperative nerve dysfunction with specific questions and physical examination. And, data had been collected prospectively and allowed to evaluate factors associated with this complication. However, this study has also several limitations. Firstly, we did not study the amount of traction applied to the leg. Secondly, we did not have any information about the level of relaxation given by the anesthesia.

5. Conclusion

Our study shows that postoperative nerve dysfunction after HA was more common than has been reported in the literature within large populations. These symptoms resolve mostly within 3 months after HA. Of all the factors studied, traction time greater than 60 min was found to be a risk factor to develop pudendal nerve neurapraxia. As a rule, traction time must be kept to a minimum. For lateral cutaneous femoral nerve neurapraxia, stab incisions and proper instruments should be used. Patients should be informed of these complications related to nerve injury after HA.

Declarations of interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jor.2019.03.017.

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