

Traction-related complications in hip arthroscopy for 26 years. A systematic review

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ABSTRACT

The primary aim of the study is to determine the rate of traction-related complications in hip arthroscopy (HA) including perineal compression and distraction injuries, and the secondary objective is to report the incidence of complications in HA found on the studies selected by a systematic review. Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines were used for data extraction from the PubMed and Cochrane databases obtained in February 2022. Reviewers extracted the title, author, date of publication, number of hips treated and number of complications describing the affected area, nerve and soft tissue injury related to traction. Studies on postless HA and HA combined with other procedures were excluded. Twenty-six years of HA literature was found in the search that included 35 studies and 8126 hips (89% Level IV) that reported the complications found during the procedure and described complications related to traction. A total of 623 hips (7.7%) had some sort of complications during HA, and complications related to traction were in 227 hips (36%). Injuries caused specifically by the perineal compression were in 144 hips (23%) that included the pudendal nerve and soft tissue injury of the groin area. Complications caused by the distraction were in 83 hips (13%) that included sciatic and peroneal nerve injury, numbness or pain of ankle and foot. HA complications occurred in 7.7% of hips treated, which is found in this systematic review. One-third of the complications are related to traction, 23% are caused by perineal compression and 13% are caused by distraction.

INTRODUCTION

Hip arthroscopy (HA) surgery has become a common procedure and transformed the management of hip disorders. Indications to treat intra-articular and extra-articular hip pathology are increasing thanks to the development of new instruments and evolving techniques [1, 2]. Numerous studies demonstrate the importance of HA for the management of femoroacetabular impingement syndrome, labral and chondral pathology in the central compartment [3–9]. To gain access to this compartment, distraction of the joint is necessary. A hip traction device may be used, generally a hip fracture table or a commercial specialized distractor, both utilizing a perineal post to make counter-traction. Although HA has been shown to be a relatively safe procedure with a low rate of complications, the high vector forces of the perineal post against the groin (compression-type injury) and the traction itself (distraction-type injury) may injure neurologic and soft tissue structures [10, 11]. To avoid these complications, most authors recommend a maximum traction time of 2 hours, <25 kg of traction force and a well-padded perineal post (>9 cm). [12–14] The current reported complication rate

in HA is 1–8% [10, 12]. Traction-related complication caused by the perineal post and the distraction are considered major complications that usually resolve with time [13, 15, 16]. They are common complications in HA that are significantly higher than previously reported [16].

The main objective of this study is to determine the rate of traction-related complications in HA including compression and distraction injuries, and the secondary objective is to report the incidence of complications in HA by performing a systematic review of the available literature.

METHODS

Study identification and search strategy

In February 2022, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines were used to identify relevant articles in the PubMed and Cochrane databases (Cochrane Reviews and Cochrane Trials). The key terms used were 'hip' AND 'arthroscopy' OR 'arthroscopic' AND 'complication' AND 'post' (Fig. 1).

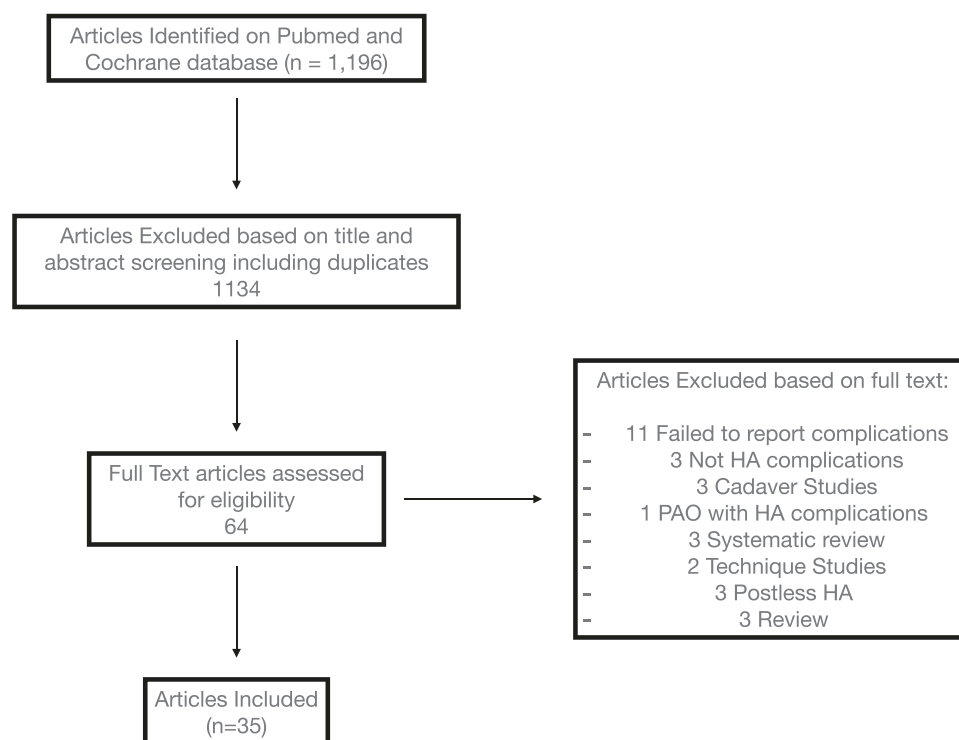


Fig. 1. Outline of the systematic search strategy.

All articles ($N = 1196$) appearing as part of the search were screened by three orthopedic surgeons (C.R.A., C.A.N. and J.P.) for content pertaining to clinical studies that reported the complications caused by the perineal post and distraction in HA. Differences in opinion were resolved by a fourth, senior orthopedic surgeon (C.S.A.) to ensure that the studies met the inclusion and exclusion criteria, which were established *a priori*.

Articles were included based on the following criteria: (i) studies were in the English language, (ii) studies composed of all levels of evidence, (iii) studies performed on human patients, (iv) studies that reported traction-related complications that include perineal compression-type injuries (pudendal nerve neuropraxia or palsy, groin numbness, erectile dysfunction, dyspareunia, perineal, vaginal, penis and scrotum soft tissue injury) and distraction-type injury (sciatic nerve injury, peroneal nerve injury, decreased sensation, numbness or pain on knee, ankle and foot). We excluded review articles, technique articles, postless HA articles, HA combined with other procedures articles, articles with overlapping patient populations, experimental articles and studies using an animal model.

In addition, the reference of identified articles was searched to capture any additional relevant articles for full-text review.

Quality of assessment

All studies included in this systematic review were evaluated using Methodological Index for Non-Randomized Studies (MINORS) criteria, to assess their quality by three orthopedic surgeons (C.R.A., C.A.N. and J.P.) trained in HA procedures. MINORS is a validated score tool for non-randomized studies (case reports, case series and cohort studies). Each author calculated a MINORS score for each study, and then, a final

mean MINORS score was obtained. The level of evidence for each study was determined according to the level reported in the article.

Data extraction and collection

Microsoft Excel (Microsoft Office 2018; Microsoft, Redmond, WA, USA) was used to organize the data from all included studies. Reviewers extracted the title, author, demographics, date of publication, number of hips treated and number of complications describing the complications of the affected area, nerve and soft tissue injury related to traction.

RESULTS

In February 2022, our literature search identified 1196 articles from the PubMed and Cochrane databases. After the title and abstract review, we selected 64 articles for full-text review. Of these, 35 articles met the inclusion criteria for this systematic review by describing detailed complications related to traction (Fig. 1). The findings of the remaining articles that have been selected for this systematic review are presented in Table I.

Literature

Twenty-six years (1995–2021) of HA literature was found in the search that included 8126 hips that reported the complications found during the procedure and described complications related to traction.

Study characteristics

There were 31 (89%) articles designated as Level IV evidence, three articles as Level III (8.6%) and one article as

Table I. Findings of the selected articles

Author	Year	Patients	Total complication cases	Rate (%)	Traction-related complications				
					Compression-type injury		Distraction-type injury		
					Pudendal nerve	Groin soft tissue	Sciatic nerve	Peroneal nerve	Others
Schindler	1995	24	2	8.30	2				
Funke	1996	19	3	15.80	1	1 vulvar hematoma			
Griffin	1999	640	10	1.60		1 vaginal tear	3		
Farjo	1999	28	3	10.70	1		2		
Sampson	2001	530	34	6.40	4		4	10	
Clarke	2003	1054	15	1.40		1 vaginal tear	3		
Kocher	2005	54	7	13.00	3				
Lo	2006	73	17	23.30			5		
Byrd	2009	207	3	1.40	1				
Contreras	2010	150	15	10.00	8	1 vulva edema	1		
Gedouin	2010	111	7	6.30	1	1 skin necrosis of labium			
Suoza	2010	194	12	6.20	5	1 vulva edema, 1 scrotum necrosis			
Byrd	2011	100	6	6.00	1		2		
Byrd	2011	116	30	25.90	1				
Nwachukwu	2011	218	4	1.80	2				
Martin	2012	30	0	0.00					
Telleria	2012	60	14	23.30			4		
Pailhe	2013	150	13	8.70	3				1 ankle pain
Polat	2013	42	4	9.50	2				
Dietrich	2014	317	21	6.60	2				
Park	2014	200	30	15.00	4				2 ankle pain
Sharfmann	2016	62	20	32.30	2			5	
Larson	2016	1615	140	8.70	23			1	
Cvetanovich	2016	37	2	5.40	1				
Sariali	2018	47	3	6.40					
Kern	2018	100	13	13.00	9		1	1	
Reda	2018	221	82	37.10	34				24 foot numbness. 9 calf, knee and gluteal area
Domb	2017	287	7	2.40					1 toe numbness, 1 foot numbness
Cvetanovich	2018	386	26	6.70	9				
Ortiz-Declet	2019	34	5	14.70					1 toe numbness
Nazal	2019	11	0	0.00					
Torres	2020	40	2	5.00			2		
Goa	2020	27	1	3.70		1 scrotal swelling			
Lim	2020	34	5	14.70	5				
Zeman	2021	908	67	7.40	12				
Total		8126	623	7.70	136	8	27	17	39

Level II (2.8%), presented in Table II. The mean MINORS score obtained was 10.8 ± 2.05 which supports a fair average quality of evidence. The number of subjects per study ranges from 11 to 1615 hips. Fifty-five percent of the patients included were female. The mean patient age in the studies was 33 years.

Complications

A total of 623 hips (7.7%) had some sort of complications during HA, and complications related to traction were in 227 hips (36%). Injuries caused specifically by the perineal post

(compression) were in 144 hips (23%) that included the pudendal nerve and soft tissue injury of the groin area. Complications caused by the distraction were in 83 hips (13%) that included sciatic nerve injury, peroneal nerve injury, decreased sensation, numbness and pain on knee, ankle and foot.

Compression-type injury

There were 144 hips (23%) that included the pudendal nerve and soft tissue injury of the groin area. The pudendal nerve injury was prevalent with 136 cases (22%). Eight (1.8%) patients had some

Table II. Summary of studies selected

Author	Gender (M/F)	Mean age, years (range)	Study design	Level of evidence	Mean MINORS score	Country
Schindler	12/9	16 (11–21)	Case series	4	5–16	The USA
Funke	8/11	29 (21–46)	Case series	4	8–16	Switzerland
Griffin	NS	NS	Case series	4	9–16	The UK
Farjo	15/13	41 (14–70)	Cohort study	2	11–16	The USA
Sampson	NS	NS	Case series	4	11–16	The USA
Clarke	458/596	37 (6–80)	Case series	4	6–16	The UK
Kocher	14/28	15.2 (5.9–18.9)	Case series	4	13/16	The USA
Lo	NS	43 (22–61)	Case series	4	9–16	Taiwan
Byrd	138/62	33	Case series	4	13/16	The USA
Contreras	2/13	33.9 (24–50)	Case series	4	8–16	Spain
Gedouin	78/32	31	Case series	4	12–16	France
Suoza	115/79	36.2 (7–78)	Case series	4	9–16	Brazil
Byrd	67/33	34 (13–76)	Case series	4	12–16	The USA
Byrd	148/52	28.6 (11–60)	Case series	4	12–16	The USA
Nwachukwu	24/151	15.56 (6–18)	Case series	4	12–16	The USA
Martin	8/22	NS	Case series	4	14/16	The USA
Telleria	29/31	37.5	Case series	4	12–16	The USA
Pailhe	71/79	48 (17–75)	Case series	4	12–16	France
Polat	25/17	35.1 (16–52)	Case series	4	11–16	Turkey
Dietrich	NS	NS	Case control	3	13/16	Germany
Park	97/100	44 (19–70)	Case series	4	10–16	Korea
Sharfmann	27/35	35.2	Case series	4	10–16	Israel
Larson	810/805	30.5 (12–76)	Case series	4	12–16	The USA
Cvetanovich	11/26	17	Case series	4	11–16	The USA
Sariali	NS	36	Case series	4	10–16	France
Kern	37/63	29 (13–62)	Case series	4	10–16	The USA
Reda	113/108	39.8	Case series	4	13/16	Canada
Domb	36/94	37.2	Case control	3	22/24	The USA
Cvetanovich	135/251	33	Case control	3	14/16	The USA
Ortiz-Declet	15/19	20.8	Case series	4	11–16	The USA
Nazal	8/1	36 (17–48)	Case series	4	11–16	The USA
Torres	20/19	43.1	Case series	4	9–16	Spain
Gao	15/12	57 (50–74)	Case series	4	11–16	China
Lim	18/14	14.8 (10.8–18)	Case series	4	11–16	Korea
Zeman	417/491	37 (14–67)	Case series	4	13/16	The Czech Republic

NS, not specified.

soft tissue injury caused by the perineal post that included the penis, scrotum and vulvar area. Six patients with vulvar injuries and two with scrotum injuries were reported.

Distraction-type complications

There were 181 hips (26%) that included sciatic nerve, peroneal nerve, numbness and pain on knee, ankle and foot. The sciatic nerve injury was present in 27 cases (3.8%) and the peroneal nerve injury was found in 17 hips (2.4%). The numbness and pain on the knee, ankle and foot were reported in 137 hips (20%).

DISCUSSION

This systematic review reports the current incidence of traction-related complications in HA. HA has increased since the procedure gained popularity in the last decade. Complications in HA have been reported from the early 90s to the present day. Twenty-six years of literature was found mentioning complications related to traction.

HA has historically been a safe procedure with major complications on rare occasions. Reports of major complications are almost always <1% in previous systematic reviews [17]. Although they have described injuries associated with traction like the current review, they have also reported a wide spectrum of complications. The lowest rate of complications related to post traction reported in the articles that met the inclusion criteria in this review was 0%, and the highest rate reported was up to 37%. The rate of complications depends largely on the surgical times and the learning curve of the surgeon [18]. Clarke *et al.* reported a 1.4% complication rate in a prospective study of 1054 HAs in the late 1990s, and 20 years later, Larson *et al.* reported an 8.3% complication rate in 1615 consecutive HAs [19, 20]. The increment in complications is caused by the development of new techniques and the increasing indications for HA [15, 21]. This systematic review reported a 7.7% overall complication rate during HA; a third of them were traction related and 23% were caused by the perineal post. Hip traction with a perineal post is routinely used for HA procedures. This tool facilitates access to the joint, but complications have been widely reported since its

use. Complications related to the post are reported regardless of the surgical position in both supine and lateral decubitus positions [22]. Multiple studies have shown that nerve neuropraxia and soft tissue injury are the principal complications during traction with a perineal post [1, 4, 10, 13, 14]. One of the first perineal post complications cases was described by Hofmann *et al.* during hip fracture fixation [23]. The soft tissue injury on the groin was also mentioned in hip fracture fixation and femur nailing [23, 24]. These complications are usually transient and resolved within 6 weeks to 3 months [15].

Distraction-type injuries were also proved to have a high rate of complications (13%). They are reported as not only sciatic and peroneal nerve neuropraxia but also numbness, tingling or pain on ankle and foot. Numbness on this area may be caused by the prolonged compression of the foot to the superficial and deep fibular nerves during distraction [25]. Also, tight boots or wrapping of the foot may cause this symptom. Frandsen *et al.* mentioned that this is an unusual highly underreported problem that disappeared within 2–4 weeks [16].

This traction-related complications associated by compression and distraction are proved to be an issue that needs to be addressed carefully in every procedure. Ways to reduce the probability of groin complications are to use a >9-cm diameter well-padded post, decrease traction time, use <25 kg of traction or perform a postless technique. The distraction complications can also benefit from these recommendations [10, 12].

Limitations

One of the main limitations of this review is the 26 years of follow-up, despite is enough time to describe HA complications, during these years HA has changed, and complications are not the same as in early years. Another main limitation is that many of the studies are case series with a consequent low level of evidence. Traction-related complications involving those due to distraction as those due to perineal compression occur depending on some factors, among which are the diameter of the post, the time of traction, the force of traction, the experience of the surgeon and others. A limitation of this study is related to the absence of data regarding the aforementioned factors, making it difficult to avoid bias.

CONCLUSION

HA complications occurred in 7.7% of the hips treated, which is found in this systematic review. One-third of the complications are related to traction, 23% are caused by compression of the post on the groin area and 13% are caused by the distraction.

DATA AVAILABILITY

Data will be available upon request.

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CONFLICT OF INTEREST STATEMENT

None declared.

REFERENCES

1. Casp A, Gwathmey F. Hip arthroscopy: common problems and solutions. *Clin Sports Med* 2018; **37**: 245–63.
2. Sing D, Feeley B, Tay B *et al.* Age-related trends in hip arthroscopy: a large cross-sectional analysis. *Arthrosc - J Arthrosc Relat Surg* 2015; **31**: 2307–13.
3. Lynch TS, Terry M, Bedi A *et al.* Hip arthroscopic surgery: patient evaluation, current indications, and outcomes. *Am J Sports Med* 2013; **41**: 1174–89.
4. McCarthy J, Lee J-A. Hip arthroscopy: indications, outcomes, and complications. *Instr Course Lect* 2006; **55**: 301–8.
5. Smart L, Oetgen M, Noonan B *et al.* Beginning hip arthroscopy: indications, positioning, portals, basic techniques, and complications. *Arthrosc - J Arthrosc Relat Surg* 2008; **23**: 1348–53.
6. Shindle M, Voos J, Nho S *et al.* Arthroscopic management of labral tears in the hip. *J Bone Jt Surg* 2008; **90**: 2–19.
7. Domb BG, Hartigan DE, Perets I. Decision making for labral treatment in the hip: repair versus débridement versus reconstruction. *J Am Acad Orthop Surg* 2017; **25**: e53–62.
8. Fontana A, Bistolfi A, Crova M *et al.* Arthroscopic treatment of hip chondral defects: autologous chondrocyte transplantation versus simple debridement—a pilot study. *Arthroscopy* 2012; **28**: 322–9.
9. Dallich AA, Rath E, Atzmon R *et al.* Chondral lesions in the hip: a review of relevant anatomy, imaging and treatment modalities. *J Hip Preserv Surg* 2019; **6**: 3–15.
10. Mei-Dan O, Kraeutler MJ, Garabekyan T *et al.* Hip distraction without a perineal post: a prospective study of 1000 hip arthroscopy cases. *Am J Sports Med* 2018; **46**: 632–41.
11. Charles T, Jayankura M. Evaluation of hip arthroscopy using a hip-specific distractor for the treatment of femoroacetabular impingement. *PLoS One* 2021; **16**: 1–12.
12. Martin HD, Palmer IJ, Champlin K *et al.* Physiological changes as a result of hip arthroscopy performed with traction. *Arthroscopy* 2012; **28**: 1365–72.
13. Beutel BG, Collins JA, Garofolo G *et al.* Hip arthroscopy outcomes, complications, and traction safety in patients with prior lower-extremity arthroplasty. *Int Orthop* 2015; **39**: 13–8.
14. Sampson TG. Lateral approach to hip arthroscopy. In: Sekiya JK, Safran MR, Ranawat AS, *et al.* (eds). *Techniques in Hip Arthroscopy and Joint Preservation Surgery*. Philadelphia: WB Saunders, 2011, 95–104.
15. Habib A, Haldane CE, Ekhtiari S *et al.* Pudendal nerve injury is a relatively common but transient complication of hip arthroscopy. *Knee Surg Sports Traumatol Arthrosc* 2018; **26**: 969–75.
16. Frandsen L, Lund B, Grønbech Nielsen T *et al.* Traction-related problems after hip arthroscopy. *J Hip Preserv Surg* 2017; **4**: 54–9.
17. Gupta A, Redmond JM, Hammarstedt JE *et al.* Safety measures in hip arthroscopy and their efficacy in minimizing complications: a systematic review of the evidence. *Arthroscopy* 2014; **30**: 1342–8.
18. Schüttler KF, Schramm R, El-Zayat BF *et al.* The effect of surgeon's learning curve: complications and outcome after hip arthroscopy. *Arch Orthop Trauma Surg* 2018; **138**: 1415–21.
19. Clarke MT, Arora A, Villar RN. Hip arthroscopy: complications in 1054 cases. *Clin Orthop Relat Res* 2003; **406**: 84–8.
20. Larson CM, Clohisy JC, Beaulé PE *et al.* Intraoperative and early post-operative complications after hip arthroscopic surgery: a prospective multicenter trial utilizing a validated grading scheme. *Am J Sports Med* 2016; **44**: 2292–8.
21. Sharfman ZT, Amar E, Tsvieli O *et al.* Complications of hip arthroscopy: patient perspectives. *Orthop Nurs* 2016; **35**: 208–13.
22. de Sa D, Stephens K, Parmar D *et al.* A comparison of supine and lateral decubitus positions for hip arthroscopy: a systematic

- review of outcomes and complications. *Arthroscopy* 2016; **32**: 716–25.e8.
23. Hofmann A, Jones RE, Schoenvogel R. Pudendal-nerve neurapraxia as a result of traction on the fracture table. A report of four cases. *J Bone Joint Surg Am* 1982; **64**: 136–8.
 24. Brumback RJ, Ellison TS, Molligan H *et al*. Pudendal nerve palsy complicating intramedullary nailing of the femur. *J Bone Joint Surg Am* 1992; **74**: 1450–5.
 25. Poage C, Roth C, Scott B. Peroneal nerve palsy: evaluation and management. *J Am Acad Orthop Surg* 2016; **24**: 1–10.