Review

IMPACT OF HIP ARTHROSCOPY ON PROSTHETIC JOINT INFECTION IN ELECTIVE TOTAL HIP REPLACEMENT: A SYSTEMATIC REVIEW OF THE LITERATURE

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ABSTRACT

Total hip arthroplasty (THA) is the definitive surgical treatment for advanced joint diseases, aiming to improve patient quality of life and reduce pain. However, concerns have been raised about whether prior arthroscopy (HA) may increase the risk of postoperative complications, such as surgical site infections (SSIs) and prosthetic joint infections (PJIs), in patients undergoing subsequent arthroplasty. Understanding this relationship is essential for optimizing surgical outcomes and clinical decision-making. This systematic review aims to demonstrate evidence regarding the impact of prior arthroscopy on the risk of SSI and PJI in hip arthroplasty. Comprehensive research was conducted on PubMed, EMBASE, and other databases according to PRISMA guidelines. A total of 13 studies were included in the review. Most studies found no significant increase in SSI/PJI risk following arthroplasty after prior arthroscopy. Current evidence does not suggest a consistent increase in SSI/PJI risk following arthroplasty after arthroscopy. However, targeted management may be beneficial in high-risk populations.

KEYWORDS: *total hip arthroplasty, hip arthroscopy, surgical site infection, prosthetic joint infection, total hip replacement*

INTRODUCTION

Hip arthroscopy (HA) is a minimally invasive surgical procedure for diagnosing and treating hip pathologies, including labral tears, chondral defects, loose bodies, and femoroacetabular impingement (FAI) (1-3). Total hip arthroplasty (THA) is considered the gold standard treatment for patients who fail conservative management and continue to experience persistent and debilitating pain due to hip conditions such as osteoarthritis. Other indications for THA include hip fractures, avascular necrosis, inflammatory arthritis, development of hip dysplasia, and failed previous hip surgeries (3).

This systematic review of the literature aims to summarise the available evidence of the impact of HA before elective total hip replacement, which could increase the risk of infection, surgical site complication, or prosthetic joint infection.

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MATERIAL AND METHODS

This systematic review evaluates the risk of surgical site infection (SSI) and prosthetic joint infection (PJI) following total hip arthroplasty. The inclusion criteria comprise undergoing THA, with or without prior arthroscopy on the same joint, and a comparison group of patients undergoing arthroplasty without prior arthroscopy. The primary outcomes assessed include the incidence of SSI/PJI, postoperative complications, and revision rate. The review considered cohort- studies, case-control studies, and systemic reviews. A comprehensive literature search was conducted in major health databases, including PubMed and EMBASE, adhering to PRISMA guidelines. The purpose was to synthesize and analyze information from various sources to meet the study's aims.

RESULTS

A total of 1759 studies were downloaded from databases and registers, with 283 references removed due to duplication. Of the 1476 studies screened, 1426 were excluded. Fifty studies were assessed for eligibility, and 37 of these were excluded. The review included a total of 13 studies, which comprised a combination of cohort and case-control designs (Fig. 1). The population analyzed in these studies varied widely regarding demographic characteristics, comorbidities, and surgical intervals between arthroscopy and arthroplasty.

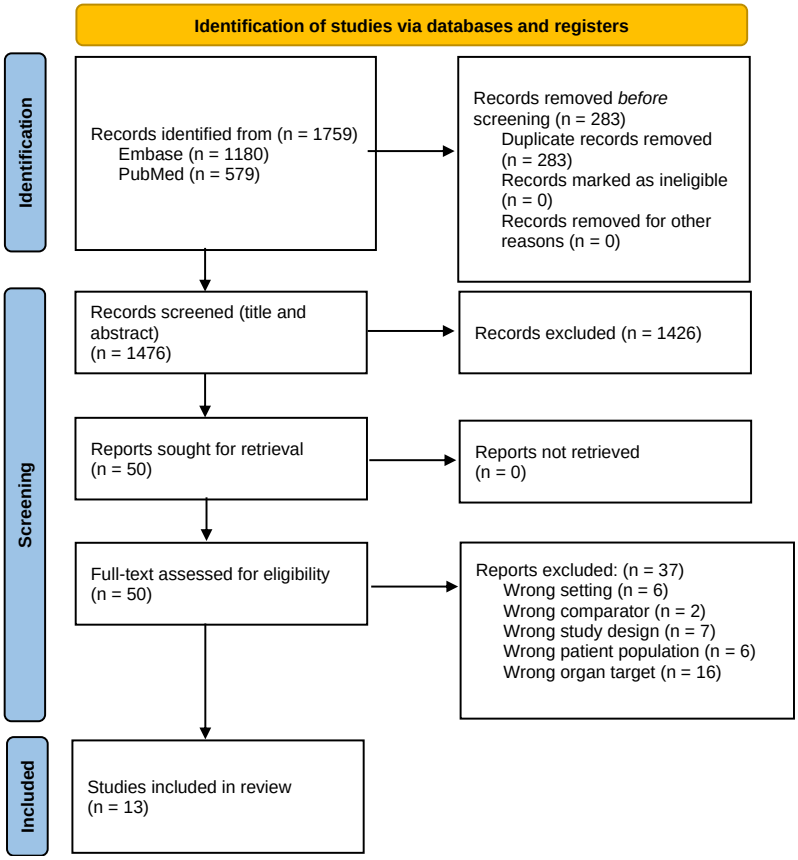

Fig. 1. *PRISMA*

Table I and II summarize the details, outcomes, and results of studies included in this systematic review comparing patients with prior HA (focus on individuals who underwent THA following a previous HA, examining the potential impact of prior HA on functional recovery, complications, and overall surgical success) and Control Group (primary THA). The tables provide detailed insights into the methodology, sample sizes, and key findings from each study, highlighting similarities and differences in functional outcomes, complication rates, and revision risks between the two groups.

Table I. *Study characteristics included within the review.*

Author	Year	Design	Country	Level of evidence	Arthroscopy	Control
Lemme et al.	2021	Retrospective Cohort-study	USA	III	1,940 (648 M)	1,940
Bolarinwa et al.	2020	Retrospective Cohort-study	USA	III	110 (43 M)	10,951
Ross et al.	2022	Matched Cohort-study	USA	III	3,156 (1,119 M)	3,156
Malahis et al.	2021	Retrospective Cohort-study	USA	III	2,600 (1,022 M)	2,600
Lindman et al.	2021	Matched Case-Control study	Sweden	III	135 (84 M)	71,891
Vovos et al.	2019	Matched- Controlled study	USA	III	95 (43 M)	95
Charles et al.	2017	Matched- Controlled study	USA	III	39 (14 M)	39
Perets et al.	2017	Matched-Controlled study	USA, Israel	III	35 (15 M)	35
Jain et al.	2019	Retrospective Cohort study	UK	III	18 (8 M)	63
Rosinsky et al.	2019	Systematic review	USA	III	305 (170 M)	502
Chaundry et al.	2019	Systematic review	USA	III	235 (104 M)	374
Liu et al.	2022	Systematic review and meta-analysis	China	III	16,321	303,625
Bryan et al.	2016	Retrospective Comparative study	USA	III	42 (18 M)	84

Table II. *Summary of key findings and impact of hip arthroscopy on elective total hip arthroplasty.*

Author	Outcomes	Results SSI/PJI in prior HA
Lemme et al.	Dislocations, aseptic loosening, PJI, and revision surgery	Increase of infection rate when THA is performed within a short interval of time
Bolarinwa et al.	90-day readmission, aseptic dislocation/revision, SSI, and hip stiffness	No significant increase in infection rate in SSI (p=0.796)
Ross et al.	Readmission, pulmonary embolism, urinary tract infection, blood transfusion, PJI, dislocation, periprosthetic fracture, mechanical complications, aseptic revision, and opioid claim	Lower rate of PJI (0.6% HA vs 1.3% control, OR 0.50, CI 0.28-0.84, p = 0.010)
Malahis et al.	Revision, dislocation, aseptic loosening, and PJI	Increased risk of PJI within 2 years of THA (OR 1.86, CI 1.26-2.77, P = 0.010) and aseptic loosening (OR 2.81, CI 1.66-4.76, p = <0.001). Increased risk of revision with pre-existing OA (OR 3.72, CI 3.15-4.57, P = 0.012)
Lindman et al.	EQ-5D Index, EQ-VAS, hip pain, satisfaction with surgery	One deep infection (p = 0.3)
Vovos et al.	Intraoperative complications, estimated blood loss, operative time, and postoperative complications	No difference in infection rate, increase rate of postoperative complications (32.6% vs 15.8%, p = 0.007), and higher rate of wound complications (5.3% vs 0%, p = 0.023)
Charles et al.	Operative time, hemoglobin drop, intraoperative blood loss, transfusion, opioids, functional mobility assessment, SSI, PJI, and revision rate.	No significant difference in SSI or deep PJI (p = 0.8)
Perets et al.	HHS, FJS-12, VAS for pain, satisfaction scores, postoperative complications, reoperation rates	No significant increase in risk of infection (p = 0.054)
Jain et al.	Postoperative OHS, intraoperative blood loss, surgical time, infection rate, postoperative complication, superficial wound infection, complex regional pain syndrome, trochanteric pain	Two cases of superficial infection (p > 0.005)
Rosinsky et al.	HHS, dislocation, infection rates, and revisions	Infection rate in HA group = 2.82%, not statistically significant (p > 0.05)
Chaundry et al.	HHS, lower Forgotten Joint Scores, VAS pain, intraoperative measures (operative time, blood loss), postoperative complications (infections, hip dislocation, revision rates), and patient satisfaction	No statistically significant differences in PJI rates
Liu et al.	HHS, revision rates, reoperations, risk of infections, aseptic loosening, periprosthetic fracture risk, and ROM	Significant increase in the risk of infection in (OR 1.83, p < 0.001)
Bryan et al.	HHS, complication rates, revision rates, dislocation, acute infection, and symptomatic leg length discrepancy	No difference in overall complications (p = 0.053)

**M: males; SSI: surgical site infection; PJI: periprosthetic joint infection; THA: total hip arthroplasty; HA: hip arthroscopy; OA: osteoarthritis; HHS: Harris Hip Score; FJS-12: Forgotten Joint Score; VAS: Visual Analogue Scale; ROM: range of motion.*

DISCUSSION

HA is a minimally invasive orthopedic procedure used to treat various hip conditions. Although HA is relatively uncommon, its use has increased steadily over the past decades (1). First described in 1931, the indications for HA have evolved (2), now including labral tears, chondral flap defects, loose bodies, and femoroacetabular impingement (FAI) (3).

The conversion rate from HA to total hip arthroplasty (THA) varies across studies; it was demonstrated that HA could delay but not eliminate the progression to THA, particularly in patients with osteoarthritis (OA). Reported conversion rates range from 9% to 50%, influenced by factors such as patient demographic characteristics, OA severity, and surgical details (4-6). Younger patients and those with milder stages of OA often experience longer intervals before requiring THA, with average durations ranging from approximately 1 to 3 years (5). On the other hand, advanced OA, older age, and obesity are associated with higher and more rapid rates of conversion (5, 6). Despite its benefits, the long-term impact of prior arthroscopy on infection rates and outcomes following THA remains a topic of debate, emphasizing the need for careful patient selection and counseling (6).

Several studies indicated no significant increase in infection following THA in patients with a history of prior HA. However, one study (7) compared 1,940 patients who underwent THA without prior HA to 639 patients who had THA within a year of HA and 1,301 patients who had THA more than a year after. The results demonstrated that arthroscopy was associated with a higher risk of complications, such as periprosthetic joint infections and aseptic loosening, particularly when THA was performed within a short interval after HA (7).

Another study (8), which included 110 patients undergoing FAI treatment between 2005 and 2014, reported no significant increase in surgical site infections ($p = 0.796$) or aseptic dislocations/revision ($p = 0.409$) within three years (8).

Ross et al. (9), in a study involving 3,156 patients, found that prior HA was associated with lower rates of prosthetic joint infection at one year (0.6% vs 1.3%; OR 0.50, 95% CI 0.28–0.84, $p = 0.010$). However, one study (10) indicated an increased risk of PJI within 2 years of THA (OR 1.86, 95% CI 1.26–2.77, $p = 0.010$) and aseptic loosening (OR 2.81, 95% CI 1.66–4.76, $p < 0.001$). Additionally, HA performed in patients with pre-existing OA significantly raised the risk of revision risk post-THA (OR 3.72, 95% CI 3.15–4.57, $p = 0.012$) (10).

A study based on the Swedish Hip Arthroplasty registry compared 135 patients who underwent THA following HA for FAI to 540 matched controls. The results showed one deep infection in the HA group and eight in the control group, with no significant difference between patients with and without prior HA ($p = 0.3$ for reoperations due to infection) (11).

Similarly, a large academic medical center conducted a retrospective analysis of 95 patients undergoing THA after HA with 95 primary THA controls, with the average time from HA to THA being 29 months, no significant difference in infection rates was proved (surgical site infection 4.2% in the HA group vs. 2.1% in the control, $p = 0.410$). However, higher rates of overall postoperative complications (32.6% vs. 15.8%, $p = 0.007$), including wound complications, were found (5.3% vs. 0%, $p = 0.023$) (12). Other studies suggested that the time interval between HA and THA did not significantly influence rates of infections or revisions, suggesting that factors such as surgical techniques and patient comorbidities might play a crucial role (10, 12).

A smaller study by Charles et al. compared 39 patients with prior HA to 39 matched THA controls and found no significant difference in SSI or deep PJI rate ($p=0.8$). This suggests no elevated infection risk in patients with prior HA undergoing THA (13).

Another study involving 35 patients undergoing THA after HA highlighted two minor infections in the HA group versus none in the control group, though this was not statistically significant ($p= 0.054$) (14). Additionally, Jain et al. (15) showed no significant differences in infection rates in a cohort of 18 patients who underwent THA after HA. The study documented only two cases of superficial infections in the HA group, which were successfully treated with antibiotics, and one in the control group (p-value >0.005). While some studies indicate a slightly higher rate of minor infections post-THA, these differences are not statistically significant in most cases. Larger sample sizes and long-term follow-up are needed to definitively assess the impact of prior HA on infection risks following THA.

A 2019 systematic review studied 305 hips with prior HA and 502 control hips and found infection rates were higher in five patients in the HA group (2.82%) compared to one patient in the control group (0.35%); the mean time to conversion was 23 months. However, the difference was not statistically significant ($p > 0.05$) (16). Another systematic review by Chaudhry et al. (17), including 235 HA patients and 374 controls, reported no statistically significant differences in PJI rates between groups. However, Liu et al. (18) meta-analysis demonstrated a significant increase in the risk of infection in the prior HA group compared with the control (OR 1.83, p-value < 0.001). The study emphasizes that prior HA is associated with a higher risk of PJI, particularly within two years. Another study found that the rate of infection

and complications did not differ significantly between patients with prior HA and those undergoing primary THA. The infection rate in the arthroscopy group included one acute postoperative deep infection compared to one periprosthetic infection in the control group. Statistical analysis showed no significant difference in overall complications (p=0.53) or revision rates (p=0.42). These findings suggest the need for careful patient selection, follow-up, and optimization of surgical timing (19).

Limitations

This study has several limitations, including the heterogeneity in study designs, which varied in methodology, patient demographics, and time intervals between HA and THA. Many studies had a limited sample size, limiting the statistical power to detect significant differences. Additionally, the retrospective nature of most studies introduces selection bias. The average follow-up period is short and does not allow to asses long-term outcomes and complications. Other factors, such as the severity of pre-existing OA, surgical procedures, and patient comorbidities, increase the risk of confounding.

CONCLUSIONS

Most studies have shown no significant increase in the postoperative superficial or deep infection risk following THA after previous HA compared with controls. The small sample size was a major limitation of some studies; however, those including a greater number of patients also do not generally indicate an increased infection risk. There may be a difference in infection risk based on underlying hip pathology, with one study demonstrating increased risk in OA patients and multiple studies demonstrating no increased risk in FAI. However, there is insufficient data to determine whether this is related to the underlying pathology or to confounding age of onset (FAI patients tended to be younger than OA patients). Further prospective studies with larger sample sizes and standardized methodology are needed to clarify these associations and guide clinical decision-making.

REFERENCES

1. Schairer WW, Nwachukwu BU, Suryavanshi JR, Yen YM, Kelly BT, Fabricant PD. A Shift in Hip Arthroscopy Use by Patient Age and Surgeon Volume: A New York State–Based Population Analysis 2004 to 2016. *Arthroscopy The Journal of Arthroscopic and Related Surgery*. 2019;35(10):2847-2854.e1. doi:https://doi.org/10.1016/j.arthro.2019.05.008
2. Burman M, Peltier LF. Arthroscopy or the Direct Visualization of Joints: An Experimental Cadaver Study. *Clinical Orthopaedics and Related Research*. 2001;390(5):5-9. doi:https://doi.org/10.1097/00003086-200109000-00003
3. McCarthy JC, Lee JA. Arthroscopic Intervention in Early Hip Disease. *Clinical Orthopaedics and Related Research*. 2004;429:157-162. doi:https://doi.org/10.1097/01.blo.0000150118.42360.1d
4. Piuzzi NS, Slullitel PAI, Bertona A, et al. Hip Arthroscopy in Osteoarthritis: A Systematic Review of the Literature. *HIP International*. 2015;26(1):8-14. doi:https://doi.org/10.5301/hipint.5000299
5. Schairer WW, Nwachukwu BU, McCormick F, Lyman S, Mayman D. Use of Hip Arthroscopy and Risk of Conversion to Total Hip Arthroplasty: A Population-Based Analysis. *Arthroscopy*. 2016;32(4):587-593. doi:https://doi.org/10.1016/j.arthro.2015.10.002
6. Haviv B, O'Donnell J. The incidence of total hip arthroplasty after hip arthroscopy in osteoarthritic patients. *BMC Sports Science, Medicine and Rehabilitation*. 2010;2(1). doi:https://doi.org/10.1186/1758-2555-2-18
7. Lemme NJ, Veeramani A, Yang DS, Tabaddor RR, Daniels AH, Cohen EM. Total Hip Arthroplasty After Hip Arthroscopy Has Increased Complications and Revision Risk. *The Journal of Arthroplasty*. 2021;36(12):3922-3927.e2. doi:https://doi.org/10.1016/j.arth.2021.07.020
8. Bolarinwa SA, Aryee JN, Labaran LA, Werner BC, Browne JA. Does Arthroscopic Repair of Femoroacetabular Impingement Pathology Affect Clinical Outcomes after Ipsilateral Total Hip Arthroplasty? *Hip & Pelvis*. 2020;32(1):35-41. doi:https://doi.org/10.5371/hp.2020.32.1.35
9. Ross BJ, Wortman RJ, Lee OC, Mansour AA, Cole WW, Sherman WF. Is Prior Hip Arthroscopy Associated With Higher Complication Rates or Prolonged Opioid Claims After Total Hip Arthroplasty? A Matched Cohort Study. *Orthopaedic Journal of Sports Medicine*. 2022;10(9). doi:https://doi.org/10.1177/23259671221126508
10. Malahias MA, Gu A, Richardson SS, De Martino I, Sculco PK, McLawhorn AS. Hip arthroscopy for hip osteoarthritis is associated with increased risk for revision after total hip arthroplasty. *HIP International*. 2020;31(5):112070002091104. doi:https://doi.org/10.1177/1120700020911043
11. Lindman I, Nåtman J, Öhlin A, et al. Prior hip arthroscopy does not affect 1-year patient-reported outcomes following total hip arthroplasty: a register-based matched case-control study of 675 patients. *Acta Orthopaedica*. 2021;92(4):408-412. doi:https://doi.org/10.1080/17453674.2021.1884795

12. Vovos TJ, Lazarides AL, Ryan SP, Kildow BJ, Wellman SS, Seyler TM. Prior Hip Arthroscopy Increases Risk for Perioperative Total Hip Arthroplasty Complications: A Matched-Controlled Study. *The Journal of Arthroplasty*. 2019;34(8):1707-1710. doi:https://doi.org/10.1016/j.arth.2019.03.066
13. Charles R, LaTulip S, Goulet JA, Pour AE. Previous arthroscopic repair of femoro-acetabular impingement does not affect outcomes of total hip arthroplasty. *International Orthopaedics*. 2016;41(6):1125-1129. doi:https://doi.org/10.1007/s00264-016-3330-0
14. Perets I, Mansor Y, Mu B, Walsh JP, Ortiz-Declet V, Domb BG. Prior Arthroscopy Leads to Inferior Outcomes in Total Hip Arthroplasty: A Match-Controlled Study. *Journal of Arthroplasty*. 2017;32(12):3665-3668. doi:https://doi.org/10.1016/j.arth.2017.06.050
15. Jain MV, Rajpura A, Kumar VS, et al. Functional outcome of total hip arthroplasty after a previous hip arthroscopy: a retrospective comparative cohort study. *HIP International*. 2018;29(4):363-367. doi:https://doi.org/10.1177/1120700018810509
16. Rosinsky PJ, Kyin C, Shapira J, Maldonado DR, Lall AC, Domb BG. Hip Arthroplasty After Hip Arthroscopy: Are Short-term Outcomes Affected? A Systematic Review of the Literature. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*. 2019;35(9):2736-2746. doi:https://doi.org/10.1016/j.arthro.2019.03.057
17. Chaudhry ZS, Salem HS, Hammoud S, Salvo JP. Does Prior Hip Arthroscopy Affect Outcomes of Subsequent Hip Arthroplasty? A Systematic Review. *Arthroscopy: The Journal of Arthroscopic & Related Surgery*. 2019;35(2):631-643. doi:https://doi.org/10.1016/j.arthro.2018.08.055
18. Liu Q, Tian Z, Pian K, et al. The influence of prior arthroscopy on outcomes of primary total lower extremity arthroplasty: A systematic review and meta-analysis. *International Journal of Surgery*. 2022;98:106218-106218. doi:https://doi.org/10.1016/j.ijsu.2021.106218
19. Haughom BD, Plummer DR, Hellman MD, Nho SJ, Rosenberg AG, Della CJ. Does Hip Arthroscopy Affect the Outcomes of a Subsequent Total Hip Arthroplasty? *The Journal of Arthroplasty*. 2016;31(7):1516-1518. doi:https://doi.org/10.1016/j.arth.2016.01.008