HK5: Does the Surgical Approach Influence the Rate of Periprosthetic Joint Infection after Primary Total Hip Arthroplasty

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Response/Recommendation: No. The surgical approach does not appear to impact the risk of periprosthetic joint infection (PJI) in patients undergoing primary total hip arthroplasty (THA). However, recent evidence suggests that the direct anterior approach (DAA) may increase the risk of superficial infection and wound complications when compared to other approaches.

Strength of Recommendation: Moderate

Delegate Vote:

Rationale:

A number of surgical approaches for primary total hip arthroplasty (THA) have been described, with the direct anterior approach (DAA), posterior approach (PA), and direct lateral approach (DLA) being the most commonly used worldwide[1]. In recent years, the DAA has witnessed a surge in popularity following reports that it results in superior short-term functional outcomes when compared to the PA and DLA. However, we now have substantial evidence to demonstrate that all three approaches are safe and demonstrate excellent results in patients undergoing THA[2,3]. Despite this, the impact of the surgical approach on the risk of developing subsequent PJI in this setting remains unclear, with a recent meta-analysis citing a higher risk for infection with the utilization of the DAA[4].

A systematic review of existing literature on the association between surgical approach and PJI in patients undergoing primary THA was performed using the following databases: Embase, PubMed, and Cochrane. The primary outcome of this review was to determine the risk of developing PJI between the DAA, PA, and DLA. The secondary outcome was to examine whether there was a difference in the odds of developing wound complications between different surgical approaches. 781 records were identified, and 94 studies were considered eligible for full-text review. From these, 34 studies with a comparison group were eligible for inclusion (**Table 1)**.

Over the last two decades, the DAA has gained traction in this setting following reports that it results in the shortest recovery time after surgery[5]. Despite initial enthusiasm, a number of investigations have since suggested that the DAA increases the risk of PJI following primary THA when compared to the PA or DLA[6,7]. Aggarwal et al. found that patients who received the DAA were twice as likely to experience PJI (odds ratio [OR] 2.2; $P = 0.006$) when compared to their counterparts in the non-DAA group[8]. Notwithstanding, it is important to recognize that a growing body of evidence has demonstrated no difference in the development of PJI between surgical approaches in patients undergoing THA[9,10]. In a meta-analysis that included 164,307 patients, Miller et al. found that patients who received the DAA approach had significantly lower odds for the development of PJI (risk ratio [RR] 0.55; $P = 0.002$) when compared to patients who received the PLA[11]. In another study, Namba et al. found no difference in PJI risk between patients who received the DAA and those who received the PA[12]. Moreover, Shohat et al. demonstrated that the

DAA for THA did not increase the risk of subsequent PJI (1.3% in the DAA group versus 0.9% in the DLA group, $P > 0.05$)[13]. Similarly, Acuna et al. showed that DAA patients had significantly lower odds for the development of PJI when compared to patients who received the PA (OR 0.66; $P < 0.001$) or DLA (OR 0.56; $P < 0.001$)[14]. Furthermore, in a study of the Australian National Joint Replacement Registry, Hoskins et al. found that after adjusting for confounding variables, patients in the DAA group had a lower rate of revision for infection compared to those in the PA group[15].

Regardless of the surgical approach utilized, increased body habitus and obesity have been shown to be independent predictors of poor outcomes in patients undergoing primary THA. More recently, there has been evidence to suggest that the DAA increases the risk of wound complications in patients who are morbidly obese, when compared to the PA and DLA, especially in those who have a large pannus[16–18]. In one study, Shah et al. found that patients in the DAA had significantly higher odds of developing PJI in patients who have a body mass index (BMI) of ≥ 35[19]. Similarly, Christensen et al. demonstrated that patients who received the DAA were more likely to require reoperation for wound complications (1.4 versus 0.2%, $P = 0.007$), when compared to their counterparts in the PA group[20]. In another study, Chalmers et al. found that patients who received the DAA had an increased risk of reoperation for superficial infection (RR 2.67; $P = 0.007$)[21]. Moreover, Salmons et al. showed that the absolute risk rate of wound complications was higher in the DAA group (3.7 versus 2.6%, $P < 0.001$) when compared to patients in the PA and DLA groups[22].

Although it is now well-established that the DAA, DLA, and PA all have excellent results, the impact of surgical approaches on the risk of PJI remains a contentious issue. Based on our extensive review of the data, we can conclude that the type of surgical approach is not a risk factor for the development of PJI in most patients undergoing THA. However, the DAA has a higher risk of wound complications in the morbidly obese population, especially in patients who have a large pannus. Future randomized controlled trials are necessary to identify factors that increase the risk of infection and wound complications in patients undergoing THA using the DAA.

References:

1. Patel N, Golwala P. Approaches for Total Hip Arthroplasty: A Systematic Review. *Cureus*. 2023;15(2):e34829. doi:10.7759/cureus.34829

2. Awad ME, Farley BJ, Mostafa G, Saleh KJ. Direct anterior approach has short-term functional benefit and higher resource requirements compared with the posterior approach in primary total hip arthroplasty : a meta-analysis of functional outcomes and cost. *Bone Joint J*. 2021;103-B(6):1078-1087. doi:10.1302/0301-620X.103B6.BJJ-2020-1271.R1

3. Trousdale WH, Taunton MJ, Mabry TM, Abdel MP, Trousdale RT. Patient Perceptions of the Direct Anterior Hip Arthroplasty. *J Arthroplasty*. 2017;32(4):1164-1170. doi:10.1016/j.arth.2016.10.006

4. Dockery DM, Allu S, Glasser J, Antoci V, Born CT, Garcia DR. Comparison of periprosthetic joint infection rates in the direct anterior approach and non-anterior approaches to primary total hip arthroplasty: a systematic review and meta-analysis. *Hip Int*. 2023;33(4):633-639. doi:10.1177/11207000221129216

5. Rodriguez JA, Deshmukh AJ, Rathod PA, et al. Does the direct anterior approach in THA offer faster rehabilitation and comparable safety to the posterior approach? *Clin Orthop Relat Res*. 2014;472(2):455-463. doi:10.1007/s11999-013-3231-0

6. Ilchmann T, Zimmerli W, Bolliger L, Graber P, Clauss M. Risk of infection in primary, elective total hip arthroplasty with direct anterior approach or lateral transgluteal approach: a prospective cohort study of 1104 hips. *BMC Musculoskeletal Disorders*. 2016;17(1):471. doi:10.1186/s12891-016-1332-0

7. Aggarwal VK, Elbuluk A, Dundon J, et al. Surgical approach significantly affects the complication rates associated with total hip arthroplasty. *Bone Joint J*. 2019;101-B(6):646-651. doi:10.1302/0301-620X.101B6.BJJ-2018-1474.R1

8. Aggarwal VK, Weintraub S, Klock J, et al. 2019 Frank Stinchfield Award: A comparison of prosthetic joint infection rates between direct anterior and non-anterior approach total hip arthroplasty. *Bone Joint J*. 2019;101-B(6_Supple_B):2-8. doi:10.1302/0301-620X.101B6.BJJ-2018-0786.R1

9. Smith JO, Frampton CMA, Hooper GJ, Young SW. The Impact of Patient and Surgical Factors on the Rate of Postoperative Infection After Total Hip Arthroplasty-A New Zealand Joint Registry Study. *J Arthroplasty*. 2018;33(6):1884-1890. doi:10.1016/j.arth.2018.01.021

10. Chalmers BP, Puri S, Watkins A, et al. No Difference in the Rate of Periprosthetic Joint Infection in Patients Undergoing the Posterolateral Compared to the Direct Anterior Approach. *J Arthroplasty*. 2023;38(6):1089-1095. doi:10.1016/j.arth.2023.03.003

11. Miller LE, Gondusky JS, Kamath AF, Boettner F, Wright J, Bhattacharyya S. Influence of surgical approach on complication risk in primary total hip arthroplasty. *Acta Orthop*. 2018;89(3):289-294. doi:10.1080/17453674.2018.1438694

12. Namba RS, Inacio MCS, Paxton EW. Risk factors associated with surgical site infection in 30,491 primary total hip replacements. *J Bone Joint Surg Br*. 2012;94(10):1330-1338. doi:10.1302/0301-620X.94B10.29184

13. Shohat N, Goswami K, Clarkson S, et al. Direct Anterior Approach to the Hip Does Not Increase the Risk for Subsequent Periprosthetic Joint Infection. *The Journal of Arthroplasty*. 2021;36(6):2038-2043. doi:10.1016/j.arth.2021.02.016

14. Acuña AJ, Do MT, Samuel LT, Grits D, Otero JE, Kamath AF. Periprosthetic joint infection rates across primary total hip arthroplasty surgical approaches: a systematic review and meta-analysis of 653,633 procedures. *Arch Orthop Trauma Surg*. 2022;142(10):2965-2977. doi:10.1007/s00402-021-04186-3

15. Hoskins W, Bingham R, Lorimer M, Hatton A, de Steiger RN. Early Rate of Revision of Total Hip Arthroplasty Related to Surgical Approach: An Analysis of 122,345 Primary Total Hip Arthroplasties. *J Bone Joint Surg Am*. 2020;102(21):1874-1882. doi:10.2106/JBJS.19.01289

16. Purcell RL, Parks NL, Cody JP, Hamilton WG. Comparison of Wound Complications and Deep Infections With Direct Anterior and Posterior Approaches in Obese Hip Arthroplasty Patients. *J Arthroplasty*. 2018;33(1):220-223. doi:10.1016/j.arth.2017.07.047

17. Watts CD, Houdek MT, Wagner ER, Sculco PK, Chalmers BP, Taunton MJ. High Risk of Wound Complications Following Direct Anterior Total Hip Arthroplasty in Obese Patients. *J Arthroplasty*. 2015;30(12):2296-2298. doi:10.1016/j.arth.2015.06.016

18. Klasan A, Neri T, Oberkircher L, Malcherczyk D, Heyse TJ, Bliemel C. Complications after direct anterior versus Watson-Jones approach in total hip arthroplasty: results from a matched pair analysis on 1408 patients. *BMC Musculoskelet Disord*. 2019;20(1):77. doi:10.1186/s12891-019-2463-x

19. Shah NV, Huddleston HP, Wolff DT, et al. Does Surgical Approach for Total Hip Arthroplasty Impact Infection Risk in the Obese Patient? A Systematic Review. *Orthopedics*. 2022;45(2):e67-e72. doi:10.3928/01477447-20211227-03

20. Christensen CP, Karthikeyan T, Jacobs CA. Greater prevalence of wound complications requiring reoperation with direct anterior approach total hip arthroplasty. *J Arthroplasty*. 2014;29(9):1839-1841. doi:10.1016/j.arth.2014.04.036

21. Chalmers BP, Puri S, Watkins A, et al. No Difference in the Rate of Periprosthetic Joint Infection in Patients Undergoing the Posterolateral Compared to the Direct Anterior Approach. *J Arthroplasty*. 2023;38(6):1089-1095. doi:10.1016/j.arth.2023.03.003

22. Salmons HI, Larson DR, Couch CG, et al. Surgical Approach and Body Mass Index Impact Risk of Wound Complications Following Total Hip Arthroplasty. *J Arthroplasty*. 2024;39(9S2):S459-S463. doi:10.1016/j.arth.2024.03.047

23. Lindgren V, Garellick G, Kärrholm J, Wretenberg P. The type of surgical approach influences the risk of revision in total hip arthroplasty: a study from the Swedish Hip Arthroplasty

Register of 90,662 total hipreplacements with 3 different cemented prostheses. *Acta Orthop*. 2012;83(6):559-565. doi:10.3109/17453674.2012.742394

24. Malek IA, Royce G, Bhatti SU, et al. A comparison between the direct anterior and posterior approaches for total hip arthroplasty: the role of an "Enhanced Recovery" pathway. *Bone Joint J*. 2016;98-B(6):754-760. doi:10.1302/0301-620X.98B6.36608

25. Ilchmann T, Zimmerli W, Bolliger L, Graber P, Clauss M. Risk of infection in primary, elective total hip arthroplasty with direct anterior approach or lateral transgluteal approach: a prospective cohort study of 1104 hips. *BMC Musculoskelet Disord*. 2016;17(1):471. doi:10.1186/s12891-016-1332-0

26. Mjaaland KE, Svenningsen S, Fenstad AM, Havelin LI, Furnes O, Nordsletten L. Implant Survival After Minimally Invasive Anterior or Anterolateral Vs. Conventional Posterior or Direct Lateral Approach: An Analysis of 21,860 Total Hip Arthroplasties from the Norwegian Arthroplasty Register (2008 to 2013). *J Bone Joint Surg Am*. 2017;99(10):840-847. doi:10.2106/JBJS.16.00494

27. Triantafyllopoulos GK, Memtsoudis SG, Wang H, Ma Y, Alexiades MM, Poultsides LA. Surgical approach does not affect deep infection rate after primary total hip arthroplasty. *Hip Int*. 2019;29(6):597-602. doi:10.1177/1120700018825237

28. Tissot C, Vautrin M, Luyet A, Borens O. Are there more wound complications or infections with direct anterior approach total hip arthroplasty? *Hip Int*. 2018;28(6):591-598. doi:10.1177/1120700018759617

29. Purcell RL, Parks NL, Cody JP, Hamilton WG. Comparison of Wound Complications and Deep Infections With Direct Anterior and Posterior Approaches in Obese Hip Arthroplasty Patients. *J Arthroplasty*. 2018;33(1):220-223. doi:10.1016/j.arth.2017.07.047

30. Smith JO, Frampton CMA, Hooper GJ, Young SW. The Impact of Patient and Surgical Factors on the Rate of Postoperative Infection After Total Hip Arthroplasty-A New Zealand Joint Registry Study. *J Arthroplasty*. 2018;33(6):1884-1890. doi:10.1016/j.arth.2018.01.021

31. Angerame MR, Fehring TK, Masonis JL, Mason JB, Odum SM, Springer BD. Early Failure of Primary Total Hip Arthroplasty: Is Surgical Approach a Risk Factor? *J Arthroplasty*. 2018;33(6):1780-1785. doi:10.1016/j.arth.2018.01.014

32. Lenguerrand E, Whitehouse MR, Beswick AD, et al. Risk factors associated with revision for prosthetic joint infection after hip replacement: a prospective observational cohort study. *Lancet Infect Dis*. 2018;18(9):1004-1014. doi:10.1016/S1473-3099(18)30345-1

33. Klasan A, Neri T, Oberkircher L, Malcherczyk D, Heyse TJ, Bliemel C. Complications after direct anterior versus Watson-Jones approach in total hip arthroplasty: results from a matched pair analysis on 1408 patients. *BMC Musculoskelet Disord*. 2019;20(1):77. doi:10.1186/s12891-019-2463-x

34. Tay K, Tang A, Fary C, Patten S, Steele R, de Steiger R. The effect of surgical approach on early complications of total hip arthroplasty. *Arthroplasty*. 2019;1(1):5. doi:10.1186/s42836-019-0008-2

35. Docter S, Philpott HT, Godkin L, et al. Comparison of intra and post-operative complication rates among surgical approaches in Total Hip Arthroplasty: A systematic review and meta-analysis. *J Orthop*. 2020;20:310-325. doi:10.1016/j.jor.2020.05.008

36. McMaster Arthroplasty Collaborative (MAC). Risk Factors for Periprosthetic Joint Infection Following Primary Total Hip Arthroplasty: A 15-Year, Population-Based Cohort Study. *J Bone Joint Surg Am*. 2020;102(6):503-509. doi:10.2106/JBJS.19.00537

37. Pincus D, Jenkinson R, Paterson M, Leroux T, Ravi B. Association Between Surgical Approach and Major Surgical Complications in Patients Undergoing Total Hip Arthroplasty. *JAMA*. 2020;323(11):1070-1076. doi:10.1001/jama.2020.0785

38. Huang XT, Liu DG, Jia B, Xu YX. Comparisons between Direct Anterior Approach and Lateral Approach for Primary Total Hip Arthroplasty in Postoperative Orthopaedic Complications: A Systematic Review and Meta-Analysis. *Orthop Surg*. 2021;13(6):1707-1720. doi:10.1111/os.13101

39. O'Connor CM, Anoushiravani AA, Acosta E, Davidovitch RI, Tetreault MW. Direct Anterior Approach Total Hip Arthroplasty Is Not Associated with Increased Infection Rates: A Systematic Review and Meta-Analysis. *JBJS Rev*. 2021;9(1):e20.00047. doi:10.2106/JBJS.RVW.20.00047

40. Bendich I, Landy DC, Do H, et al. Intraoperative Complications and Early Return to the Operating Room in Total Hip Arthroplasty Performed Through the Direct Anterior and Posterior Approaches. An Institutional Experience of Surgeons After Their Learning Curve. *J Arthroplasty*. 2021;36(8):2829-2835. doi:10.1016/j.arth.2021.03.046

41. Metzger CM, Farooq H, Hur JO, Hur J. Transitioning from the Posterior Approach to the Direct Anterior Approach for Total Hip Arthroplasty. *Hip Pelvis*. 2022;34(4):203-210. doi:10.5371/hp.2022.34.4.203

42. Qvistgaard M, Nåtman J, Lovebo J, Almerud-Österberg S, Rolfson O. Risk factors for reoperation due to periprosthetic joint infection after elective total hip arthroplasty: a study of 35,056 patients using linked data of the Swedish Hip Arthroplasty Registry (SHAR) and Swedish Perioperative Registry (SPOR). *BMC Musculoskelet Disord*. 2022;23(1):275. doi:10.1186/s12891-022-05209-9

43. Dockery DM, Allu S, Glasser J, Antoci V, Born CT, Garcia DR. Comparison of periprosthetic joint infection rates in the direct anterior approach and non-anterior approaches to primary total hip arthroplasty: a systematic review and meta-analysis. *Hip Int*. 2023;33(4):633-639. doi:10.1177/11207000221129216

44. Makhdom AM, Hozack WJ. Direct anterior versus direct lateral hip approach in total hip arthroplasty with the same perioperative protocols one year post fellowship training. *J Orthop Surg Res*. 2023;18(1):216. doi:10.1186/s13018-023-03716-6

45. Luger M, de Vries M, Feldler S, Hipmair G, Gotterbarm T, Klasan A. A propensity score-matched analysis on the impact of patient and surgical factors on early periprosthetic joint infection in minimally invasive anterolateral and transgluteal total hip arthroplasty. *Arch Orthop Trauma Surg*. 2023;143(8):5405-5415. doi:10.1007/s00402-022-04756-z

46. Wernecke GC, Jin XZ, Lin JL, Harris IA. The Impact of Surgical Approach on 90-Day Prosthetic Joint Infection After Total Hip Replacement - A Population-Based, Propensity Score-Matched Cohort Study. *J Arthroplasty*. 2024;39(1):151-156. doi:10.1016/j.arth.2023.06.033

Table 1. Studies included in the review article.

Study & Publication Year	Approaches Examined	Level of Evidence
Namba et al., 2012[12]	DAA, PA, & DLA	III
Lindgren et al., 2012[23]	DAA & PA	III
Christensen et al., 2014[20]	DAA & PA	III
Watts et al., 2015[17]	DAA & PA	III
Malek et al., 2016[24]	DAA & PA	III
Ilchmann et al., 2016[25]	DAA & DLA	III
Mjaaland et al., 2017[26]	DAA, PA, & DLA	III
Triantafillopoulos et al., 2018[27]	DAA & PA	III
Tissot et al., 2018[28]	DAA & PA	III
Miller et al., 2018[11]	DAA & PA	III
Purcell et al., 2018[29]	DAA & PA	III
Smith et al., 2018[30]	DAA, PA, & ALA	III
Angerame et al., 2018[31]	DAA & PA	III
Lenguerrand et al., 2018[32]	PA & DLA	II
Aggarwal et al., 2019[8]	DAA, PA, & DLA	III
Klasan et al., 2019[33]	DAA & ALA	III
Tay et al., 2019[34]	DAA, PA, & DLA	III
Docter et al., 2020[35]	DAA, PA, & DLA	III
Adili et al., 2020[36]	DAA, PA, & DLA	III
Pincus et al., 2020[37]	DAA, PA, & DLA	III
Hoskins et al., 2020[15]	DAA, PA, & DLA	III
Huang et al., 2021[38]	DAA & DLA	III
O'Connor et al., 2021[39]	DAA, PA, & DLA	III
Shohat et al., 2021[13]	DAA & DLA	III
Bendich et al., 2021[40]	DAA & PA	III
Metzger et al., 2022[41]	DAA & PA	III
Qvistgaard et al., 2022[42]	DAA, PA, & DLA	III
Acuna et al., 2022[14]	DAA, PA, & DLA	III
Dockery et al., 2022[43]	DAA, PA, & DLA	III
Makhdom et al., 2023[44]	DAA & DLA	III
Salmons et al., 2023[22]	DAA, PA, & DLA	III
Luger et al., 2023[45]	DLA & ALA	III
Chalmers et al., 2023[21]	DAA & PA	III
Wernecke et al., 2024[46]	DAA & PA	III

DAA, direct anterior approach; *PA*, posterior approach; *DLA*, direct lateral approach; *ALA*, anterolateral approach.