RATIONALE

The medial parapatellar approach and the subvastus approach are the most common approach techniques for primary TKA [1]. To date, the question of the best surgical approach for primary TKA is still a matter of debate [2]. Despite the vast body of literature investigating the clinical outcome of patients undergoing TKA with either the medial parapatellar or the subvastus approach, only a limited number of studies focus on their infection rates.

There have been four meta-analyses published to date that compare the subvastus to the medial parapatellar approach as well as one meta-analysis that compares subvastus to quadriceps-sparing approach, which are included in the following references below [1,3–6]. Regarding infection risk, none of these five meta-analyses found a difference.

REFERENCES

[1] Liu HW, Gu WD, Xu NW, Sun JY. Surgical approaches in total knee arthroplasty: a meta-analysis comparing the midvastus and subvastus to the medial peripatellar approach. J Arthroplasty. 2014;29:2298–2304. doi:10.1016/j.arth.2013.10.023.

[2] Vaishya R, Vijay V, Demesugh DM, Agarwal AK. Surgical approaches for total knee arthroplasty. J Clin Orthop Relat Res Trauma. 2016;7:71–79. doi:10.1016/j.jcot.2015.11.003.

[3] Peng X, Zhang X, Cheng T, Cheng M, Wang J. Comparison of the quadriceps-sparing and subvastus approaches versus the standard parapatellar approach in total knee arthroplasty: a meta-analysis of randomized controlled trials. BMC Musculoskelet Disord. 2015;16:327. doi:10.1186/s12891-015-0783-z.

[4] Kazarian GS, Siow MY, Chen AF, Deirmengian CA. Comparison of quadriceps-sparing and medial parapatellar approaches in total knee arthroplasty: a meta-analysis of randomized controlled trials. J Arthroplasty. 2018;33:277–283. doi:10.1016/j.arth.2017.08.025.

[5] Teng Y, Du W, Jiang J, Gao X, Pan S, Wang J, et al. Subvastus versus medial parapatellar approach in total knee arthroplasty: meta-analysis. Orthopedics. 2012;35:e1722-1731. doi:10.3928/01477447-20121120-16.

[6] Berstock JR., Blom AW, Beswick AD. A systematic review and meta-analysis of randomised controlled trials comparing the subvastus and medial parapatellar approaches to total knee arthroplasty. Orthopaedic Proceedings. 2015;97-B:7–7. doi:10.1302/1358-992X.97BSUPP_7.SWOC2014-007.

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QUESTION 3: Does the surgical approach of primary total hip arthroplasty (THA) affect the incidence of subsequent surgical site infections/periprosthetic joint infections (SSIs/PJIs)?

RECOMMENDATION: The surgical approach in primary THA does not affect the incidence of subsequent SSIs/PJIs.

LEVEL OF EVIDENCE: Strong

DELEGATE VOTE: Agree: 88%, Disagree: 10%, Abstain: 2% (Super Majority, Strong Consensus)

RATIONALE

Many approaches to expose the hip joint have been described. Surgical approaches for THA have evolved to include a minimally invasive posterior approach to minimize soft tissue damage, a resurgence of the direct lateral approach to address concerns of instability and the increased popularity of direct anterior surgery to improve postoperative recovery. Smaller skin incisions combined with less soft tissue damage and improved pain management techniques have resulted in faster recovery times, quicker rehabilitation and shorter hospital admissions. However, the impact of these approaches on the risk of infection has not been studied extensively. We report data from randomized control trials (RCT) and large registry data bases to support our conclusions.

In the English literature, 37 RCTs were found comparing functional and other postoperative results using different surgical approaches for primary THA. None of these, however, was designed to study PJI as the primary outcome. Fortunately, PJI is frequently reported as a secondary outcome. More than half of the RCTs identified (20/37) compared a conventional approach to a minimally invasive approach ("mini"), 12 studied two conventional approaches and 5 evaluated two mini-approaches. The posterolateral (PL) approach in both its standard or minimally invasive iterations were the most frequently examined (22). The primary outcome in the majority (30/36) of these RCTs was the functional assessment of the patients. The sample size of RCTs ranged from 20 to 219 THAs.

In the RCT with the greatest reported sample size, Ogonda et al. [1] followed 219 patients operated through either a standard or minimally invasive PL approach for six weeks. No infections were observed in the standard posterior approach (PA) group, while one deep and one superficial infection were found in the minimally invasive surgery (MIS) group. In another report, Xie et al. [2] studied 92 patients with unilateral primary osteoarthritis who were randomized to undergo a THA using either a supercapsular, percutaneously assisted approach or a conventional PL approach. An intention-to-treat analysis was used, but no infection was noticed in either group. Kim et al. [3] reported one infection in a study in which a mini-posterior approach was compared to a standard PL group. Goosen et al. [4], in a RCT of 120 THAs, described one infection in the "classic" group and no infections in their "MIS" group. Due to the low incidence of PJI, these trials did not have the statistical power to evaluate the relationship between surgical approach and SSI/PJI.

Eight meta-analyses [5–12] of these RCTs have been conducted to compare postoperative results of primary THA when using different surgical approaches: three compared "mini" approaches to standard ones [8,10,11], one compared mini vs. standard PL [7], one compared a direct lateral (DL) vs. the direct anterior approach (DA) [9], two compared PL vs. DA [5,6], and one compared DA, PL, lateral approaches (including the Watson Jones and modified Hardinge approaches), and two incision surgeries [12]. Two of these eight meta-analyses [6–11] were designed to specifically report significant differences in the complication rates between surgical approaches. Putananon et al. [12] performed a network meta-analysis of 14 RCTs (1,017 patients) comparing DA, PL, latera, and two incision [12] approaches and concluded that PL had the lowest risk ratio for overall complications including infection. The systematic review and meta-analysis of Miller et al. [5] was designed to compare postoperative complications of prospective and retro-

spective studies between DA and PL. A total of 7 out of the 19 studies included reported results on infection; six of them were comparative studies and one was a registry paper. PJI rate was reported as 0.2 events per 100 person-years for DA and 0.4 events for PL; this difference was statistically significant (risk ratio (RR) = 0.55, p = 0.002). However, when only the comparative studies were included in the analysis, this difference ceased to be significant (RR = 0.65, 95% confidence interval (CI) 0.16 to 2.7).

Registry data has been published that specifically looked at risk factors for revision and included surgical approach and its impact on infection risk. Due to the size of the data sets involved, registries can adjust the results to account for the impact of variables such as obesity, diabetes and hospital volume on outcomes. Recently, Smith et al. [13] retrospectively evaluated 91,585 THAs from the New Zealand Registry to identify factors that affected the infection rate following THA. Multivariate analysis revealed that the anterolateral (AL) approach significantly increased the PJI revision rate at twelve months when compared to the PL approach (odds ratio (OR) = 1.61, p = 0.005). In another study, Mjaaland et al. [14], analyzing 21,860 THAs from the Norwegian Registry, showed a significant increase in the risk of revision due to PJI when the DL approach was used, compared to DA and AL approaches (RR = 0.53), and the PL approach (RR = 0.57). However, a study [15] from the Swedish Registry showed no difference on infection rate of 90,662 THAs using either PL or AL approach, but it should be noted that no adjustment was made for obesity, Diabetes Mellitis (DM) or American Society of Anesthesiology (ASA) score. In agreement with the Swedish data is a study by Namba et al. [16] which looked at 30,491 THAs in the Kaiser Permanente Registry and did not find an association between SSI and surgical approach when adjusting for a large number of covariates such as the use of antibiotic cement, surgeon volume, age, diabetes, Body Mass Index (BMI), ASA score, and a number of other factors. However, the Kaiser Registry was composed predominantly of patients undergoing PL THA and may not have the data to comment the other approaches. Christensen et al. [17] compared 1,288 PL THAs to 505 DA patients recorded in a private registry and found a much higher incidence of wound complications that required reoperation in the DA group (1.4% vs. 0.2%, p = 0.007), but the incidence of SSI (2 in DA and 1 in PA) and PJI (1 in each group) were comparable.

Lastly, we note that obesity (a risk factor for both SSI and PJI after THA [13,16] may impact the relative risk of any specific surgical approach on infection. Watts et al. [18] stated that obesity is a stronger risk factor when the DA is used. Dowsey et al. [19], reviewed over 1,000 patients undergoing PL or DL THA. The infection rate was higher in obese than in non-obese patients when PA was used (2.5% obese and 18% morbidly obese patients), but they found no significant correlation between the DL approach and obesity. Christensen et al. [17] compared 1,288 PA THAs to 505 DA patients and found a much higher incidence of wound complications that required reoperation in the DA group (1.4% vs. 0.2%, p = 0.007), but the incidence of SSI (2 in DA and 1 in PA) and PJI (1 in each group) were comparable.

In conclusion, surgical approach does not affect the risk of SSI/PJI following primary THA. While some data exists indicating the DL and AL approaches may be at an increased risk of SSI/PJI, the data is by no means definitive. Furthermore, much of the existing data is derived from registries, which have been shown to under-report the incidence of infection [20–22]. More granular data is required in order to make a more informed conclusion on this topic.

REFERENCES

[1] Ogonda L, Wilson R, Archbold P, Lawlor M, Humphreys P, O'Brien S, et al. A minimal-incision technique in total hip arthroplasty does not improve early postoperative outcomes. A prospective, randomized, controlled trial. J Bone Joint Surg Am. 2005;87:701–710. doi:10.2106/JBJS.D.02645.

[2] Xie J, Zhang H, Wang L, Yao X, Pan Z, Jiang Q. Comparison of supercapsular percutaneously assisted approach total hip versus conventional posterior approach for total hip arthroplasty: a prospective, randomized controlled trial. J Orthop Surg. 2017;12:138. doi:10.1186/s13018-017-0636-6.

[3] Kim YH. Comparison of primary total hip arthroplasties performed with a minimally invasive technique or a standard technique: a prospective and randomized study. J Arthroplasty. 2006;21:1092–1098. doi:10.1016/j.arth.2006.01.015.

[4] Goosen JHM, Kollen BJ, Castelein RM, Kuipers BM, Verheyen CC. Minimally invasive versus classic procedures in total hip arthroplasty: a double-blind randomized controlled trial. Clin Orthop Relat Res. 2011;469:200–208. doi:10.1007/s11999-010-1331-7.

[5] 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. 2018:1–6. doi:10.1080/17453674.2018.1438694.

[6] Miller LE, Gondusky JS, Bhattacharyya S, Kamath AF, Boettner F, Wright J. Does surgical approach affect outcomes in total hip arthroplasty through 90 days of follow-up? A systematic review with meta-analysis. J Arthroplasty. 2018;33:1296–1302. doi:10.1016/j.arth.2017.11.011.

[7] Berstock JR, Blom AW, Beswick AD. A systematic review and meta-analysis of the standard versus mini-incision posterior approach to total hip arthroplasty. J Arthroplasty. 2014;29:1970–1982. doi:10.1016/j.arth.2014.05.021.

[8] Yang B, Li H, He X, Wang G, Xu S. Minimally invasive surgical approaches and traditional total hip arthroplasty: a meta-analysis of radiological and complications outcomes. PLoS One. 2012;7:e37947. doi:10.1371/journal.pone.0037947.

[9] Yue C, Kang P, Pei F. Comparison of direct anterior and lateral approaches in total hip arthroplasty: a systematic review and meta-analysis (PRISMA). Medicine (Baltimore). 2015;94:e2126. doi:10.1097/MD.0000000000002126.

[10] Imamura M, Munro NA, Zhu S, Glazener C, Fraser C, Hutchison J, et al. Single mini-incision total hip replacement for the management of arthritic disease of the hip: a systematic review and meta-analysis of randomized controlled trials. J Bone Joint Surg Am. 2012;94:1897–1905. doi:10.2106/JBJS.K.00495.

[11] Xu CP, Li X, Song JQ, Cui Z, Yu B. Mini-incision versus standard incision total hip arthroplasty regarding surgical outcomes: a systematic review and meta-analysis of randomized controlled trials. PLoS One. 2013;8:e80021. doi:10.1371/journal.pone.0080021.

[12] Putananon C, Tuchinda H, Arirachakaran A, Wongsak S, Narinsorasak T, Kongtharvonskul J. Comparison of direct anterior, lateral, posterior and posterior-2 approaches in total hip arthroplasty: network meta-analysis. Eur J Orthop Surg Traumatol. Orthop Traumatol. 2018;28:255–267. doi:10.1007/s00590-017-2046-1.

[13] 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;33:1884-1890.

[14] 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;99:840–847. doi:10.2106/JBJS.16.00494.

[15] 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;83:559–565. doi:10.3109/17453674.2012.742394.

[16] 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;94:1330–1338. doi:10.1302/0301-620X.94B10.29184.

[17] Christensen CP, Karthikeyan T, Jacobs CA. Greater prevalence of wound complications requiring reoperation with direct anterior approach total hip arthroplasty. J Arthroplasty. 2014;29:1839–1841. doi:10.1016/j.arth.2014.04.036.

[18] 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;30:2296–2298. doi:10.1016/j.arth.2015.06.016.

[19] Dowsey MM, Choong PFM. Obesity is a major risk factor for prosthetic infection after primary hip arthroplasty. Clin Orthop Relat Res. 2008;466:153–158. doi:10.1007/s11999-007-0016-3.

[20] Huotari K, Lyytikäinen O, Ollgren J, Virtanen MJ, Seitsalo S, Palonen R, et al. Disease burden of prosthetic joint infections after hip and knee joint replacement in Finland during 1999-2004: capture-recapture estimation. J Hosp Infect. 2010;75:205–208. doi:10.1016/j.jhin.2009.10.029.

[21] Jämsen E, Huotari K, Huhtala H, Nevalainen J, Konttinen YT. Low rate of infected knee replacements in a nationwide series--is it an underestimate? Acta Orthop. 2009;80:205–212. doi:10.3109/17453670902947432.

[22] Witso E. The rate of prosthetic joint infection is underestimated in the arthroplasty registers. Acta Orthop. 2015;86:277–278. doi:10.3109/17453674.2015.1042320.