Lastly, a retrospective study by Tan et al. demonstrated no difference in the 90-day or 1-year PJIs in 4,523 outpatient TJA patients that received a single dose of antibiotics compared to 16,159 patients that received 24 hours of antibiotics, regardless of the patient's preoperative risk of PJIs [13].

When comparing infection rates between outpatient and inpatient total joint arthroplasty, the majority of the literature demonstrates no difference in the rate of postoperative infection. In a large retrospective review of the PearlDiver Database, Arshi et al. found that patients who underwent outpatient TKA demonstrated an increased risk of prosthesis explantation (adjusted odds ratio (OR) 1.35, 95% confidence interval (CI): 1.07-1.72) as well as irrigation and debridement (adjusted OR 1.50, 95% CI: 1.29-1.77) compared to inpatients [14]. Despite these findings, multiple large national database studies have demonstrated no difference in postoperative infection between outpatient and inpatient TJAs [15–18].

REFERENCES

[1] Berríos-Torres SI, Umscheid CA, Bratzler DW, et al. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017. JAMA Surg. 2017;152(8):784–791.

[2] World Health Organizaion. Global guidelines on the prevention of surgical site infection. 2016. http://apps.who.int/iris/bitstream/handle/10665/250680/9789241549882-eng.pdf;jsessionid=70B2932526C4105C06D33FD6EB991151?sequence=1.

[3] Shohat N, Parvizi J. Prevention of periprosthetic joint infection: examining the recent guidelines. J Arthroplasty. 2017;32:2040–2046. doi:10.1016/j.arth.2017.02.072

[4] World Health Organization. Fact sheet: antibiotic resistance. 2018. http://www.who.int/news-room/fact-sheets/detail/antibiotic-resistance.

[5] Allegranzi B, Zayed B, Bischoff P, et al. New WHO recommendations on intraoperative and postoperative measures for surgical site infection prevention: an evidence-based global perspective. Lancet Infect Dis. 2016;16:e288–e303. doi:10.1016/S1473-3099(16)30402-9

[6] Thornley P, Evaniew N, Riediger M, Winemaker M, Bhandari M, Ghert M. Postoperative antibiotic prophylaxis in total hip and knee arthroplasty: a systematic review and meta-analysis of randomized controlled trials. CMAJ Open. 2015;3:E338–E343. doi:10.9778/cmajo.20150012

[7] Kanellakopoulou K, Papadopoulos A, Varvaroussis D, et al. Efficacy of teicoplanin for the prevention of surgical site infections after total hip or knee arthroplasty: a prospective, open-label study. Int J Antimicrob Agents. 2009;33:437–440. doi:10.1016/j.ijantimicag.2008.10.019

[8] Periti P, Stringa G, Mini E, Surgery the ISG for AP in O. Comparative multicenter trial of teicoplanin versus cefazolin for antimicrobial prophylaxis in prosthetic joint implant surgery. Eur J Clin Microbiol Infect Dis. 1999;18:113–119. doi:10.1007/s100960050238

[9] Suter F, Avai A, Fusco U, Gerundini M, Caprioli S, Maggiolo F. Teicoplanin versus cefamandole in the prevention of infection in total hip replacement. Eur J Clin Microbiol Infect Dis. 1994;13:793–796. doi:10.1007/BF02111338

[10] Ritter MA, Campbell E, Keating EM, Faris PM. Comparison of intraoperative versus 24 hour antibiotic prophylaxis in total joint replacement. A controlled prospective study. Orthop Rev. 1989;18:694–696.

[11] Wymenga A, van Horn J, Theeuwes A, Muytjens H, Slooff T. Cefuroxime for prevention of postoperative coxitis. Acta Orthop Scand. 1992;63:19–24. doi:10.3109/17453679209154842

[12] Engesaeter LB, Lie SA, Espehaug B, Furnes O, Vollset SE, Havelin LI. Antibiotic prophylaxis in total hip arthroplasty: effects of antibiotic prophylaxis systemically and in bone cement on the revision rate of 22,170 primary hip replacements followed 0-14 years in the Norwegian Arthroplasty Register. Acta Orthop Scand. 2003;74:644–651. doi:10.1080/00016470310018135

[13] Tan TL, Shohat N, Rondon A, et al. Perioperative antibiotic prophylaxis in total joint arthroplasty: a single-dose is as effective as multiple-doses. Rothman Orthop J. 2018.

[14] Arshi A, Leong NL, D'Oro A, et al. Outpatient total knee arthroplasty is associated with higher risk of perioperative complications. J Bone Joint Surg Am. 2017;99:1978–1986. doi:10.2106/JBJS.16.01332

[15] Courtney PM, Boniello AJ, Berger RA. Complications following outpatient total joint arthroplasty: an analysis of a national database. J Arthroplasty. 2017;32:1426–1430. doi:10.1016/j.arth.2016.11.055

[16] Courtney PM, Froimson MI, Meneghini RM, Lee GC, Della Valle CJ. Can total knee arthroplasty be performed safely as an outpatient in the medicare population? J Arthroplasty. 2018. doi:10.1016/j.arth.2018.01.003

[17] Lovecchio F, Alvi H, Sahota S, Beal M, Manning D. Is outpatient arthroplasty as safe as fast-track inpatient arthroplasty? a propensity score matched analysis. J Arthroplasty. 2016;31:197–201. doi:10.1016/j.arth.2016.05.037

[18] Nelson SJ, Webb ML, Lukasiewicz AM, Varthi AG, Samuel AM, Grauer JN. Is outpatient total hip arthroplasty safe? J Arthroplasty. 2017;32:1439–1442. doi:10.1016/j.arth.2016.11.053

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QUESTION 5: Does extended prophylactic antibiotics therapy for patients undergoing aseptic revision help reduce the risk of subsequent surgical site infections/periprosthetic joint infections (SSIs/PJIs)?

RECOMMENDATION: In the absence of concrete evidence, we recommend the use of routine antibiotic prophylaxis (maximum 24 hours) for patients undergoing revision arthroplasty as long as the infection has been properly ruled out prior to surgery.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 81%, Disagree: 15%, Abstain: 4% (Super Majority, Strong Consensus)

RATIONALE

Infections are a common cause of failures post aseptic revisions, occurring after 5 to 9% for total knee arthroplasties (TKAs), and 1.35 to 17.3% for total hip arthroplasties (THAs) [1–6]. One of the modalities used to prevent SSIs and/or PJIs after arthroplasty is administration of prophylactic antibiotic therapy [7–9]. Considering the high rate of SSIs and PJIs after revision arthroplasties, one can argue that extended prophylaxis for longer than 24 hours may be indicated in these types of surgeries. Several studies conducted in primary TKA and THA, indicate no difference in the rate of SSI in patients who received prophylaxis for 24 hours and in those who received it for longer than 24 hours [10–14].

A comprehensive literature search was performed to identify studies evaluating the potential role of extended antibiotic prophylactic therapy following aseptic revision arthroplasty. A single retrospective study conducted by Claret et al. on 341 patients undergoing revision arthroplasty was identified [15]. The authors compared the rate of PJI after changing their local protocol from administering teicoplanin and ceftazidim before surgical incision to doing so again two hours after as an antibiotic prophylaxis (2007–2010) prolonging this regimen until the fifth day after revision surgery (2010–2013). Several criteria concerning inflammatory markers, imaging and synovial fluid analysis were performed to

rule out infection prior to revision surgery. They observed that the PJI rate, occurring within three months after revision surgery, was lower in the long prophylaxis group compared to the short prophylaxis group (2.2% vs. 6.9%, p = 0.049). In addition, prolonged antibiotic prophylaxis was the only variable independently associated with a lower rate of PJI in their analysis (odds ratio (OR): 0.27, 95% confidence intervals (CI): 0.07–0.99). These data suggest that there might be a protective effect of prolonging antibiotic prophylaxis. However, although no other protocol modifications were made during the study period according to the authors, bias cannot be completely ruled out due to the retrospective nature of the study, especially as diagnostic methods to rule out an infection prior to revision surgery have been improved over recent years. Thus, there is a need for a randomized controlled trial that can examine this question. The PARITY trial, an international prospective randomized controlled trial currently conducted in the field of orthopaedic oncology, may provide us with additional evidence about the potential benefit of extended antibiotic prophylaxis in high-risk patients undergoing joint arthroplasty [16].

REFERENCES

[1] Leta TH, Lygre SHL, Skredderstuen A, Hallan G, Furnes O. Failure of aseptic revision total knee arthroplasties. Acta Orthop. 2015;86:48–57. doi:10.3109/17453674.2014.964097.

[2] Jafari SM, Coyle C, Mortazavi SMJ, Sharkey PF, Parvizi J. Revision hip arthroplasty: infection is the most common cause of failure. Clin Orthop Relat Res. 2010;468:2046–2051. doi:10.1007/s11999-010-1251-6.

[3] Suarez J, Griffin W, Springer B, Fehring T, Mason JB, Odum S. Why do revision knee arthroplasties fail? J Arthroplasty. 2008;23:99–103. doi:10.1016/j.arth.2008.04.020.

[4] Mortazavi SMJ, Schwartzenberger J, Austin MS, Purtill JJ, Parvizi J. Revision total knee arthroplasty infection: incidence and predictors. Clin Orthop Relat Res. 2010;468:2052–2059. doi:10.1007/s11999-010-1308-6.

[5] Badarudeen S, Shu AC, Ong KL, Baykal D, Lau E, Malkani AL. Complications after revision total hip arthroplasty in the Medicare population. J Arthroplasty. 2017;32:1954–1958. doi:10.1016/j.arth.2017.01.037.

[6] Kosashvili Y, Backstein D, Safir O, Lakstein D, Gross AE. Dislocation and infection after revision total hip arthroplasty: comparison between the first and multiply revised total hip arthroplasty. J Arthroplasty. 2011;26:1170–1175. doi:10.1016/j.arth.2011.04.022.

[7] Parvizi J, Gehrke T, Chen AF. Proceedings of the International Consensus on Periprosthetic Joint Infection. Bone Joint J. 2013;95-B:1450–B1452. doi:10.1302/0301-620X.95B11.33135.

[8] Berríos-Torres SI, Umscheid CA, Bratzler DW, Leas B, Stone EC, Kelz RR, et al. Centers for Disease Control and Prevention guideline for the prevention of surgical site infection. JAMA Surg. 2017;152:784–791. doi:10.1001/jamasurg.2017.0904.

[9] Bryson DJ, Morris DLJ, Shivji FS, Rollins KR, Snape S, Ollivere BJ. Antibiotic prophylaxis in orthopaedic surgery: difficult decisions in an era of evolving antibiotic resistance. Bone Joint J. 2016;98-B:1014–1019. doi:10.1302/0301-620X.98B8.37359.

[10] Williams DN, Gustilo RB. The use of preventive antibiotics in orthopaedic surgery. Clin Orthop Relat Res. 1984:83–88.

[11] Nelson CL, Green TG, Porter RA, Warren RD. One day versus seven days of preventive antibiotic therapy in orthopedic surgery. Clin Orthop Relat Res. 1983:258–263.

[12] Hansen E, Belden K, Silibovsky R, Vogt M, Arnold WV, Bicanic G, et al. Perioperative antibiotics. J Arthroplasty. 2014;29:29–48. doi:10.1016/j.arth.2013.09.030.

[13] Bratzler DW, Houck PM, Surgical Infection Prevention Guidelines Writers Workgroup, American Academy of Orthopaedic Surgeons, American Association of Critical Care Nurses, American Association of Nurse Anesthetists, et al. Antimicrobial prophylaxis for surgery: an advisory statement from the National Surgical Infection Prevention Project. Clin Infect Dis. 2004;38:1706–1715. doi:10.1086/421095.

[14] de Beer J, Petruccelli D, Rotstein C, Weening B, Royston K, Winemaker M. Antibiotic prophylaxis for total joint replacement surgery: results of a survey of Canadian orthopedic surgeons. Can J Surg. 2009;52:E229–E234.

[15] Claret G, Tornero E, Martínez-Pastor JC, Piazuelo M, Martínez J, Bosch J, et al. A prolonged post-operative antibiotic regimen reduced the rate of prosthetic joint infection after aseptic revision knee arthroplasty. Surg Infect (Larchmt). 2015;16:775–780. doi:10.1089/sur.2015.044.

[16] U.S. National Library of Medicine. Prophylactic antibiotic regimens in tumor surgery (PARITY). https://clinicaltrials.gov/ct2/show/NCT01479283. Accessed August 3, 2018.

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QUESTION 6: Should duration and the type of antibiotic prophylaxis be altered in patients with a prior periprosthetic joint infection (PJI)?

RECOMMENDATION: Antibiotic prophylaxis should be tailored in patients with prior PJIs who are undergoing another subsequent elective primary or revision joint arthroplasty. Antibiotic prophylaxis should cover the initial causative organism(s) as well as the most common pathogens that can cause PJI with either single or dual antibiotics.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 93%, Disagree: 6%, Abstain: 1% (Super Majority, Strong Consensus)

RATIONALE

Patients with prior PJIs have a significantly higher risk for PJI in another prosthetic joint. Murray [1] described for the first time the risk of metachronous infections in multiple joints due to hematogenous spread. Studies by Parvizi et al. [2] and Leung et al. [3] both demonstrated that the majority of recurrent infections following PJI due to methicillin-resistant *Staphylococcus aureus* (MRSA) were reinfected with the same organism (66.7 and 89.9%, respectively).

Preexisting PJI was identified as a significant risk factor for a subsequent infection in a study by Luessenhop et al. in 1996 [4]. The presence of rheumatoid arthritis and a prior sepsis were shown to be significantly associated with a higher risk for development of subsequent PJI ($p < 0.001$ and $p < 0.0001$, respectively).

Another study by Jafari et al. [5] retrospectively identified 55 patients with PJI who had another prosthetic joint in place at the time of presentation. Eleven of them (20%) developed a PJI in a second joint, with the same bacteria in 36% of cases. Zmistowski et al. [6] found that recurrent PJI was due to the same organism as the index infection (PJI persistence) in 31.5% of 92 relapsed cases, following two-stage arthroplasty failure. A new organism (PJI reinfection) was observed in 68.5% of these cases. The only independent predictor of PJI persistence versus new infection was the original infecting organism, specifically Staphylococci (MRSA in particular). Moreover, polymicrobial PJIs were more frequently involved in immunocompromised hosts.

Bedair et al. [7] confirmed these observations in a multicenter, retrospective cohort study with 90 patients previously treated for PJI undergoing a second primary total hip or knee arthroplasty (THA or TKA). The study showed that patients with a history of PJI had a