

HK54: Is there a role for repeat debridement, implant retention, and antibiotic administration (DAIR) in patients who have acute periprosthetic joint infection (PJI) of the hip or knee?

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Response/Recommendation:

Possibly. In patients who have an acute PJI of the hip or knee, repeat DAIR appears to increase the overall success rate of infection eradication when performed after failure of initial DAIR or as a planned, two-stage procedure.

Level of Evidence: Moderate

Delegate Vote:

Rationale:

In the treatment of acute postoperative or late hematogenous PJI of the hip or knee, the DAIR procedure is considered the first option. However, high failure rates in controlling infection with DAIR have been presented in several studies [1–4]. Although a strong consensus (86%) against performing repeat DAIR after the failed first DAIR procedure was reported at the International Consensus Meeting (ICM) in 2018, the role of repeat DAIR has evolved [5]. When reported as an individual procedure and not as part of the entire cohort, the literature demonstrates that a second DAIR has, at best, equivalent or typically lower success than an initial DAIR procedure. Hence, in 2018, Argenson et al. recommended the removal of the implants after the failure of the first DAIR procedure to avoid additional surgeries [5]. However, the latter study and other studies did not always evaluate combined success rates of single and repeat DAIR procedures of the entire cohort for implant retention.

In order to answer the question posed above, we conducted a comprehensive systematic review and meta-analysis to determine if there is data regarding the efficacy of repeat DAIR procedures on the success rates of infection eradication. A search of PubMed/Medline, Scopus, and Embase databases was conducted from inception to September 2024 to identify potentially eligible studies investigating the success of repeat DAIR procedures. The initial literature search identified 544 articles, from which 291 duplicates were eliminated, leaving 252 records for screening by at least two independent reviewers. Ultimately, 12 studies, which were published between 1997 and 2022, that examined the success rates of single DAIR and repeat DAIR procedures in TKA and/or THA were included in this analysis, with the repeat DAIR procedures being performed on patients who had already undergone a failed DAIR procedure. [1–4, 6–13]. Therefore, the success of a single DAIR procedure was compared to the success of combined results of single and repeat DAIR procedures for the entire cohort to evaluate its overall success for infection eradication and implant retention. Studies investigating outcomes of the planned multiple irrigation and debridement procedures were excluded because of differences in the surgical techniques. The total cohort included 1,396 joints. Among those, 1,046 joints (75%) underwent only a single DAIR procedure, and the remaining 350 joints (25%) underwent second or multiple DAIR procedures after the failure of the first DAIR (Figure 1). The analysis revealed that the success rate of single DAIR [57% (0.50; 0.64)] was slightly higher than the repeat DAIR [53% (0.39; 0.66)], without a statistically significant difference. However, combined results of single and repeat DAIR procedures demonstrated a

significantly increased success rate compared to the single DAIR technique [72% (0.61; 0.81)] ($P < 0.01$). According to these results, we can assume that at least half of the patients undergoing resection arthroplasty for persistent acute infection would be treated with implant retention.

In a recent multicenter study involving 197 patients, Auñón et al. found that repeat DAIR had a lower success rate (54.5%) compared to one-stage (76.2%) or two-stage exchange (79.3%) [14]. The authors also identified key factors associated with failure, including non-specialized surgical teams in the first DAIR, lack of mobile component exchange, polymicrobial infections, and antibiotic resistance. Crucially, the study also states that when patients who have these risk factors were excluded, the success rate of the second DAIR increased to 83.3%.

The optimal timing of repeat DAIR procedures is also a topic of debate. There is also no consensus on the optimal duration of antibiotic therapy following repeat DAIR procedures [1, 10]. Wouthuyzen-Bakker et al. reported that repeat DAIR should be performed as soon as possible after the first DAIR fails [9]. Triantafyllopoulos et al. concluded that patients who had a longer duration between the first and second DAIR had a poorer outcome [10]. They used 20 days as a cutoff, suggesting that repeat DAIR may be more effective when performed sooner rather than later.

Planned repeat DAIR, also referred to as a two-stage debridement protocol, also referred to as Double DAIR, involves an initial debridement with prosthesis retention and placement of antibiotic-impregnated cement beads, followed by a second debridement typically done five to six days after the first debridement to remove the beads and insert new modular parts [15]. This approach aims to provide a high local concentration of antibiotics while preserving the prosthesis and minimizing the need for more invasive procedures. Chung et al. reported an 86.7% success rate with this protocol in a cohort of 83 patients who have an acute PJI. This success rate is higher than that reported for single-stage debridement in other studies. The higher success rate may be attributed to the use of high-dose local antibiotics and the second debridement, which helps to further reduce the bacterial burden and remove any residual infected tissue.

The current analysis also has some limitations: the majority of the studies reviewed are limited by their retrospective nature, small sample sizes, and heterogeneity. Indications for repeat DAIR, patient selection, the time between index surgery and occurrence of symptoms, the interval between the two procedures, patient and organism characteristics, and lack of differentiation between acute postoperative PJI and late-hematogenous PJI were not standard among all included studies.

In conclusion, the current analysis demonstrates an increased success rate of repeat DAIR when results of the entire cohort are reported (initial DAIR combined with repeat DAIR) in patients who have an acute PJI of the hip or knee. A shorter duration of time between the first and second DAIR and the exchange of modular parts is associated with increased success. Repeat DAIR procedures should be considered as a meaningful option over immediate one- or two-stage exchange arthroplasties. Shared decision-making between the surgeon and the patient is crucial, weighing the potential benefits and risks of repeat DAIR against alternative treatment strategies.

References:

1. Mont MA, Waldman B, Banerjee C, Pacheco IH, Hungerford DS: Multiple irrigation, debridement, and retention of components in infected total knee arthroplasty. *J Arthroplasty* 12, 426–33 (1997)

2. Perez BA, Koressel JE, Lopez VS, Barchick S, Pirruccio K, Lee G-C: Does a 2-Stage Debridement Result in Higher Rates of Implant Retention Compared With Single Debridement Alone? *J Arthroplasty* 37, S669–S673 (2022)
3. Sancho I, Otermin-Maya I, Gutiérrez-Dubois J, Aláez I, Librero J, Portillo ME, Hidalgo-Ovejero Á: Redo DAIR: The Game Is Seldom Worth the Candle. *Antibiotics (Basel)* 12, (2022)
4. Toh RX, Yeo ZN, Liow MHL, Yeo S-J, Lo N-N, Chen JY: Debridement, Antibiotics, and Implant Retention in Periprosthetic Joint Infection: What Predicts Success or Failure? *J Arthroplasty* 36, 3562–3569 (2021)
5. Argenson JN, Arndt M, Babis G, Battenberg A, Budhiparama N, Catani F, Chen F, de Beaubien B, Ebied A, Esposito S, Ferry C, Flores H, Giorgini A, Hansen E, Hernugrahanto KD, Hyonmin C, Kim TK, Koh IJ, Komnos G, Lausmann C, Loloi J, Lora-Tamayo J, Lumban-Gaol I, Mahyudin F, Mancheno-Losa M, Marculescu C, Marei S, Martin KE, Meshram P, Paprosky WG, Poultsides L, Saxena A, Schwechter E, Shah J, Shohat N, Sierra RJ, Soriano A, Stefánsdóttir A, Suleiman LI, Taylor A, Triantafyllopoulos GK, Utomo DN, Warren D, Whiteside L, Wouthuyzen-Bakker M, Yombi J, Zmistowski B. Hip and Knee Section, Treatment, Debridement and Retention of Implant: Proceedings of International Consensus on Orthopedic Infections. *J Arthroplasty*. 2019 Feb;34(2S):S399-S419. doi: 10.1016/j.arth.2018.09.025. Epub 2018 Oct 19. PMID: 30348550.
6. Jacobs AME, Valkering LJJ, Bénard M, Meis JF, Goosen JHM: Evaluation One Year after DAIR Treatment in 91 Suspected Early Prosthetic Joint Infections in Primary Knee and Hip Arthroplasty. *J Bone Jt Infect* 4, 238–244 (2019)
7. Grammatopoulos G, Kendrick B, McNally M, Athanasou NA, Atkins B, McLardy-Smith P, Taylor A, Gundle R: Outcome Following Debridement, Antibiotics, and Implant Retention in Hip Periprosthetic Joint Infection-An 18-Year Experience. *J Arthroplasty* 32, 2248–2255 (2017)
8. Veerman K, Raessens J, Telgt D, Smulders K, Goosen JHM: Debridement, antibiotics, and implant retention after revision arthroplasty: antibiotic mismatch, timing, and repeated DAIR associated with poor outcome. *Bone Joint J* 104-B, 464–471 (2022)
9. Wouthuyzen-Bakker M, Löwik CAM, Ploegmakers JJW, Knobben BAS, Dijkstra B, de Vries AJ, Mithoe G, Kampinga G, Zijlstra WP, Jutte PC, Northern Infection Network Joint Arthroplasty (NINJA): A Second Surgical Debridement for Acute Periprosthetic Joint Infections Should Not Be Discarded. *J Arthroplasty* 35, 2204–2209 (2020)
10. Triantafyllopoulos G, Poultsides LA, Zhang W, Sculco PK, Ma Y, Sculco TP: Multiple Irrigation and Debridements for Periprosthetic Joint Infections: Facing a Necessity or Just Prolonging the Inevitable? *J Arthroplasty* 31, 219–24 (2016)
11. Vilchez F, Martínez-Pastor JC, García-Ramiro S, Bori G, Maculé F, Sierra J, Font L, Mensa J, Soriano A: Outcome and predictors of treatment failure in early post-surgical prosthetic joint infections due to *Staphylococcus aureus* treated with debridement. *Clin Microbiol Infect* 17, 439–44 (2011)
12. Azzam KA, Seeley M, Ghanem E, Austin MS, Purtill JJ, Parvizi J: Irrigation and debridement in the management of prosthetic joint infection: traditional indications revisited. *J Arthroplasty* 25, 1022–7 (2010)

13. Lizaaur-Utrilla A, Gonzalez-Parreño S, Gil-Guillen V, Lopez-Prats FA: Debridement with prosthesis retention and antibiotherapy vs. two-stage revision for periprosthetic knee infection within 3 months after arthroplasty: a case-control study. *Clin Microbiol Infect* 21, 851.e11–7 (2015)
14. Auñón Á, Bernaus M, Veloso M, Font-Vizcarra L, Esteban J, Mijangos M, Hernández N, Achaerandio A, Baeza J, Argüelles F, Rojas R, Sánchez J, Martínez-Roselló A, Monfort M, Martínez J, Corredor A, de Espinosa JML, Castellanos J, Martínez Pastor JC, Alías A, Boadas L, Muñoz-Mahamud E, Sabater M: Outcomes of the Subsequent Periprosthetic Joint Infection Revisions after a Failed Debridement, Antibiotics and Implant Retention: A Multicentric Study of 197 Patients. *Surg Infect (Larchmt)* [Epub ahead of print], doi: 10.1089/sur.2024.047 (2024)
15. Chung AS, Niesen MC, Graber TJ, Schwartz AJ, Beauchamp CP, Clarke HD, Spangehl MJ: Two-Stage Debridement With Prosthesis Retention for Acute Periprosthetic Joint Infections. *J Arthroplasty* 34, 1207–1213 (2019)

Figure

Fig. 1

