

HK50: Should Debridement, Antibiotics, and Implant Retention (DAIR) be offered to patients who have acute hematogenous periprosthetic joint infection?

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Response/Recommendation: A DAIR is an acceptable option for patients who have acute hematogenous PJI. However, the procedure, on average, has a nearly 40% failure rate in this patient population. Infection with *Staphylococcus aureus* and prolonged symptom duration are major risk factors associated with treatment failure.

Level of Evidence: Moderate

Delegate vote:

Rationale:

A systematic review was conducted to evaluate the outcomes of Debridement, Antibiotics, and Implant Retention (DAIR) for the treatment of acute hematogenous periprosthetic joint infection (PJI). The search across PubMed, Scopus, Web of Science, and Embase yielded 906 records, of which 45 studies met the inclusion criteria following a two-step screening process by two independent reviewers (1-45). The included studies comprised 38 retrospective and seven prospective designs, with the majority (17 studies) conducted in the USA, followed by Spain (six studies) and Korea (four studies) (Table 1). The treatment success rate in these patients was assessed using proportion analysis with the inverse variance method, conducted in R software. Publication bias was evaluated using Egger's regression test.

The 45 studies collectively included 1,989 patients who had reported mean ages ranging from 59 to 74 years across 30 studies. Among 20 studies reporting sex distribution, 49% of the patients were male (673 of 1,376). The mean follow-up duration ranged from 0.3 to 8.5 years. Of the included studies, 22 focused on acute hematogenous PJI after total knee and hip arthroplasty (TKA and THA), 16 exclusively on TKA, and five exclusively on THA (Table 1).

The definition of acute hematogenous PJI varied among the studies, but mostly was defined as infection occurring in the setting of hematogenous seeding to an arthroplasty, with or without documented bacteremia. There were 19 studies that defined it as an infection occurring after four weeks post-index procedure, 16 studies after three months, and three studies after six months. There were eight studies that did not specify a definition (Table 1). To consider infection as acute, most studies considered the duration of symptoms less than four weeks.

Staphylococcus aureus was the most reported infective organism (pooled prevalence: 37.4% [95% confidence interval (CI): 31.5–43.6%], $I^2 = 54\%$), followed by Streptococcal species (pooled prevalence: 25.4% [95% CI: 17.9–34.6%], $I^2 = 68\%$). In studies reporting polymicrobial and culture-negative infections, polymicrobial cases accounted for 8.0% (95% CI: 5.1–12.3%, $I^2 = 63\%$), while culture-negative infections comprised 19.9% (95% CI: 11.2–32.9%, $I^2 = 70\%$) (Table 2).

The mean interval from symptom onset to DAIR ranged from 3.3 to 15 days, while the mean time from the index procedure to DAIR (joint age) ranged from 1.3 to 6.5 years. Most studies utilized six weeks of intravenous antibiotics following DAIR, with considerable variability in the duration of oral antibiotics (Table 2). Definitions of treatment success were primarily based on the absence of clinical symptoms and laboratory markers of infection (e.g., ESR, CRP, synovial fluid analysis), while treatment failure was defined as infection recurrence, the need for further surgery, or PJI-related death (Table 3).

Across all included studies (comprising 1,986 cases), the treatment success rate for DAIR ranged from 20 to 100%, with an overall pooled estimate of 61.1% (95% CI: 55.5–66.5%, $I^2 = 74\%$); Figure 1). Egger's regression test indicated no publication bias ($P = 0.13$).

Subgroup Analyses

- TKA (Knee Joint): Success was reported in 385 out of 677 cases (pooled prevalence: 60.3% [95% CI]: 51.7–68.3%, $I^2 = 74\%$).
- THA (Hip Joint): Success was reported in 76 out of 116 cases (pooled prevalence: 63.8% [95% CI]: 46.9–77.8%, $I^2 = 56\%$).
- Definition of Acute Hematogenous PJI (three months): Among 16 studies ($n = 1,296$), success was achieved in 743 cases (pooled prevalence: 61.0% [95% CI]: 52.2–69.2%, $I^2 = 82\%$).

- Definition of Acute Hematogenous PJI (four weeks): Among 19 studies (n = 447), success was achieved in 255 cases (pooled prevalence: 61.2% [95% CI]: 52.3–69.4%, $I^2 = 61.5\%$).

Staphylococcus aureus infections were identified as a significant risk factor compared to other microorganisms in seven studies using multivariate regression analyses. There were five studies that reported that prolonged symptom duration increased the likelihood of failure. Previous reports have a related length of symptoms from two to eight days, although Uriarte et al. (20) identified 11 days as a critical cutoff point for success. The same study also highlighted that treatment by general orthopaedic surgeons was associated with a higher failure rate compared to hip specialists (85 versus 33%). Furthermore, the exchange of removable components was linked to improved success rates, as reported in three studies (Table 3). A multicenter study suggested that the CRIME80 score may be useful for selecting the appropriate candidates for DAIR in AHI PJI, although studies have failed to validate it in external cohorts (44). Overall, the optimal candidate for DAIR in AHI PJI still needs to be defined but probably may include relevant factors including the patient characteristics, coexistence with bacteremia or endocarditis, duration of symptoms, implant stability, or soft-tissue viability.

In conclusion, DAIR for treating acute hematogenous PJI reveals a success rate of 61.1%. While this is lower than the success rate for acute postoperative PJI, DAIR remains a viable option, particularly when considering the factors associated with treatment failure. *Staphylococcus aureus* infections and prolonged symptom duration are significant risk factors. The variability in definitions and treatment protocols across studies highlights the need for standardized guidelines to improve outcomes. Future research should focus on optimizing treatment strategies and identifying patient-specific factors that influence success rates.

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