HK58: Does the type of infective organism influence the success rate of Debridement, Antibiotics and Implant Retention (DAIR)?

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Response/Recommendation:
Yes. Based on retrospective studies, the type of infective organism appears to influence the success rate of DAIR.

Level of Evidence: Moderate

Delegate Vote:

Rationale:
There are a number of factors that influence the outcome of DAIR in patients with acute PJI (REF). In order to answer the question posed above, we conducted a comprehensive review of the literature. Using MeSH terms developed by librarians, we searched for the designated PICCO terms into two databases(Pubmed and EMBASE). 453 studies were initially identified as appropriate. After screening, 112 studies met the inclusion criteria for full review and data extraction. All of the studies reviewed were retrospective in nature and attempted to investigate the influence of organisms type on the success of DAIR.

Several studies have demonstrated that infections caused by *Staphylococcus aureus* are associated with a significantly increased risk of treatment failure(1–6). Reported odds ratios (OR) for failure vary between 3.27 (p=0.02)(7) up to 7.1 (p=0.0012) (8). When comparing methicillin-resistant *S. aureus* (MRSA) with methicillin-sensitive *S. aureus* (MSSA), Lora et al.(9) analyzed a series of 345 patients. Although they found no overall prognostic differences between MRSA- and MSSA-related periprosthetic joint infections (PJI), there was a higher incidence of treatment failure in MRSA-PJI during therapy (HR 2.34).
Scheper et al(10) conducted a systematic review and meta-analysis of 4,380 patients and reported that the overall success rate of *S. aureus* treatment after debridement, antibiotics, and implant retention (DAIR) was 62% (based on 2922 patients across 54 studies). When comparing MRSA and MSSA outcomes, no significant difference was found (MRSA: 58%, MSSA: 60%; p=0.459). This trend remained consistent when outcomes were analyzed by joint type.
For late acute infections, *S. aureus* was identified as a significant independent variable for treatment failure (11) with an OR of 1.8 (p=0.03)(12). Treatment success rates for late acute PJIs were significantly lower (34%) compared to 75% for other PJIs ($p < 0.001$)(13). In another study by Nandi et al.(14) on 115 patients, infections with *S. aureus* were associated with a much higher risk of reoperation due to recurrence in total knee arthroplasty (TKA) infections (OR

24.9; p=0.0004). Conversely, Huotari et al.(15) studied 85 acute *S. aureus* PJIs treated with DAIR, reporting that the original implant was retained in 80% of patients (89.3% in late acute PJIs and 75.4% in early acute PJIs). Suppressive antibiotic therapy, which was not considered a failure in their study, was administered to 26.5% of patients and was more commonly used in late acute PJIs (46.2% vs. 17.5% for early acute PJIs; p=0.006).

After *S. aureus*, enterococcal PJIs are also associated with poor outcomes(1,16). The largest study on enterococcal PJIs, conducted by Tornero et al.(17), analyzed 94 patients treated with debridement, antibiotics, and implant retention (DAIR). Their findings was that *Enterococcus* infections were challenging to treat as they frequently occurred in the context of polymicrobial infections in hosts that had comorbidities.

Gram-negative infections have also been identified as predictors of failure after DAIR. Zhu et al.(3) reported an increased risk of failure for patients with gran negative PJI (OR 1.85, p = 0.027). Similarly, Rodríguez-Pardo et al.(18) documented a DAIR success rate of only 41% in gram-negative, ciprofloxacin-resistant PJIs. Papadopoulos et al.(19) further highlighted that DAIR is associated with significantly higher failure rates in multidrug-resistant (MDR) and extensively drug-resistant (XDR) gram-negative bacterial (GNB) PJIs compared to implant removal (OR 3.57, p < 0.001).

In a systematic review, González et al.(20) observed one-year and two-year free of treatment failure rates after DAIR for acute infections: 65% and 67% for hip PJIs, and 67% and 72% for knee PJIs, respectively. Among these cases, *Proteus spp.* infections were identified as significant risk factors for treatment failure in acute PJIs.

Streptococcal infections appear to be associated with a poorer prognosis also. Lora et al.(21), in a study of 462 patients, reported a failure rate of 42.1%. While no specific streptococcal species was significantly linked to higher overall failure rates, a non-significant trend suggested a better prognosis for *S. pneumoniae*. These findings are consistent with those of Mahieu et al.(22), who observed a poor prognosis for patients treated with DAIR: 50% experienced relapse, whereas all patients treated with prosthesis exchange did well with no (adjusted p < 0.001). Additionally, *S. agalactiae* was identified as an independent factor for treatment failure. Supporting this, Fiaux et al. reported that DAIR was associated with a higher risk of failure, particularly in patients with infected total knee arthroplasty(23). In contrast, Lam et al.(24) reported a notably high success rate of 91% for patients treated with the DAIR strategy as the final surgical procedure.

Polymicrobial infections appear to be associated with a worse prognosis, as evidenced by data from Bernaus et al.(25) (p = 0.024) and Chen et al.(26) (p < 0.01), both of which highlight significantly higher failure rates in these cases compared to monomicrobial infections.

Lastly, fungal infections have been associated with poor outcomes. In a recent study, Dinh et al.(27) identified the use of DAIR (OR, 1.946 *P* = .012), and infections caused by *C. parapsilosis* as significant risk factors for treatment failure. Similarly, González et al.(28), in a systematic review of fungal PJIs, concluded that two-stage revision is more effective than DAIR in preventing recurrence. Specifically, two-stage revision showed a protective effect against recurrence in hip and knee PJIs (OR 0.20, p = 0.016) and knee PJIs alone (OR 0.18, p = 0.04).

The 2018 International Consensus Meeting (ICM) on fungal infections recommended that DAIR should be offered selectively to immunocompromised patients due to its relatively high failure rates. DAIR is best reserved for truly acute PJIs after the initial arthroplasty, especially in otherwise healthy patients (type A).
In conclusion and based on our research, it appears that a number of factors influence the outcome of DAIR in patients with acute PJI. One of those factors appears to be the type of infective organism. The presence of resistance, such as methicillin resistance, and infection with fungal organisms and polymicrobial infections are among the challenging infections to treat and carry a relatively high failure rate after DAIR.

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