HK8 - Does the use of antibiotic-impregnated PMMA cement reduce the incidence of infection in patients undergoing reimplantation for periprosthetic joint infection?

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Response/Recommendation:

Unknown. While some studies have reported high success with the use of antibiotic-impregnated PMMA cement in reimplantation, others show limited infection control. In addition, the use of uncemented implants during reimplantation has also demonstrated favorable outcomes.

Strength of recommendation: Moderate

Delegate Vote:

Rationale:

The use of antibiotic-impregnated polymethyl methacrylate (PMMA) cement in reimplantation for periprosthetic joint infection (PJI) has been proposed as an adjunctive strategy for local antibiotic delivery, aiming to enhance infection eradication while minimizing systemic toxicity [1]. However, the concentration of antibiotics such as vancomycin, gentamicin, tobramycin, or erythromycin in antibiotic-loaded bone cement (ABLC) may not reach and remain at the minimum inhibitory concentration (MIC), and the minimum biofilm eradication concentration (MBEC) over a prolonged period [2]. This raises questions about whether the use of antibiotic-impregnated PMMA cement effectively reduces the incidence of infection in patients undergoing reimplantation for PJI.

To answer the question posed above, a comprehensive systematic review was conducted with inclusion criteria restricted to English-language original articles reporting prospective or retrospective clinical studies on patients who underwent single- or two-stage revision total joint arthroplasty (TJA) for PJI. The review included studies evaluating the use of ALBC or no ALBC in revision total knee arthroplasty (TKA) and cementless or cemented techniques with or without ALBC in revision total hip arthroplasty (THA). A comprehensive literature search of the PubMed and Scopus databases yielded 788 abstracts. After the initial screening, 74 studies were selected for full-text review, and 25 were included in the final evaluation. The total number of patients across all included studies was 2,192. There were fifteen studies that focused on two-stage revision [3-17], eight studies examined single-stage revision [18-25], and the remaining two studies reported on both single- and two-stage revisions [26, 27]. Most two-stage revisions utilized antibiotic cement spacers or beads between stages [3-17, 26]. An ALBC was used during reimplantation in 13 studies, covering 990 patients. In contrast, another 14 studies, including two that assessed both ALBC and non-ALBC patients, reported 1,202 patients who did not receive ALBC during reimplantation.

The infection control rate, defined as a successful revision of TJA without recurrence or new infection in patients who received antibiotic-impregnated PMMA cement during reimplantation, ranged from 75 to 100%, with an average follow-up duration from 22.3 months to 10.5 years [11, 24]. Hsieh et al. [10] reported on 24 patients who underwent two-stage revision THA for PJI with massive bone loss. They used a cemented polyethylene cup within a metal cage

for patients who have acetabular deficiencies and a cemented allograft-prosthesis composite for those who have segmental femoral bone loss. Their ALBC protocol during reimplantation involved adding two grams (g) of antibiotics (mostly vancomycin) per 40 g pack of cement. After a follow-up period of 4.2 years (range, two to seven), no patients experienced recurrent infection. However, two cases of fractures of the cement femoral stem and one case of dislocation occurred, though these complications were unrelated to infection. Another study by Kuo et al. [13] investigated 10 knee and 12 hip PJI cases caused by methicillin-resistant *Staphylococci*. They performed two-stage revisions, using one g of daptomycin per 40 g pack of bone cement during reimplantation in the second stage. Their treatment protocol achieved a 100% success rate, with no recurrence of infection during a mean follow-up of 33.7 months (range, 24 to 57 months). However, a study by Leijtens et al. [15] reported an unsatisfactory success rate in 10 patients who hada late infection of a cemented THA treated with two-stage revision while retaining the original well-fixed femoral cement mantle. During the second-stage revision, they implanted a cemented polyethylene cup on the acetabular side and performed a cement-within-cement revision on the femoral side. The ALBC consisted of bone cement mixed with 500 mg of erythromycin and 3,000,000 international units of colistin. After a mean follow-up of 26 months (range, five to 54 months), the primary microorganism was successfully eradicated in only two patients (20%).

In studies that did not use antibiotic-impregnated PMMA cement during reimplantation, whether in cemented revision THA or TKA, or cementless revision THA, the success rate without reinfection ranged from 83 to 100%. The mean follow-up duration for these patients varied between 35 months and 10.4 years [8, 12]. There were four studies that reported a 100% success rate with no relapse or new episodes of infection. Born et al. [26] found that all 21 single-stage revision THAs with a cementless stem had no infection failure over a mean follow-up of seven years. Another three studies performed a two-stage revision THA using a cementless prosthesis during the second-stage revision and found no reinfection following surgical intervention [8, 16, 17]. Similarly, several other studies reported high infection control rates despite not using antibiotic-impregnated PMMA cement [3-5, 9, 12, 18, 20, 21, 24].

While antibiotics in cement may help protect the implant-bone interface during the early postoperative period, infection eradication and successful treatment appear to depend more on meticulous surgical debridement, optimized systemic antibiotic therapy, and the host immune response.

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