

Overestimated Preoperative Routine

Is Dental Clearance before Cardiac Surgery Necessary?

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Abstract

Background: Dental clearance is routinely performed before cardiac surgery, as it is thought to be essential in reducing postoperative bacteremia and endocarditis. However, there is a lack of evidence supporting this routine.

Objectives: This study aimed to investigate the impact of dental clearance on postoperative outcomes after cardiac surgery.

Methods: This is a comprehensive review and analysis of relevant studies published between January 1, 1990 and January 1, 2023 in two electronic databases (PubMed and EMBASE). Pooled estimates in terms of relative risk (RR) or standardized mean difference were calculated according to outcome measures. Risk of bias and quality of studies were evaluated. A total of 7040 articles were found through the MEDLINE, EMBASE and Cochrane databases. Five articles were found to be eligible for inclusion in this review.

Results: There is no statistically significant benefit of preoperative dental clearance in terms of postoperative outcomes, including all-cause mortality (RR 0.92, 95% Confidence Interval [CI] 0.43–1.97), prosthetic valve endocarditis (RR 1.32, 95% CI 0.51–3.43), postsurgical infection (RR 1.02, 95% CI 0.77–1.36), and length of hospital stay (weighted mean difference 4.00, 95% CI -2.70–10.70).

Conclusions: Although the literature emphasizes the importance of preoperative dental clearance, no significant effect was seen with respect to all-cause mortality, infection, endocarditis, and length of hospital stay.

Keywords: Dental clearance; heart valve surgery; LVAD; mortality; prosthetic valve endocarditis

Introduction

In many cardiac surgery facilities, dental status is part of the routine assessment prior to valve surgery or interventions using prostheses, since the oral cavity serves as a potential reservoir for pathogens with the capacity to induce systemic infections. The presence of untreated dental infections, such as dental caries, periodontal disease or oral abscesses can cause bacteremia and are therefore seen as a substantial hazard for postoperative complications, including endocarditis, mediastinitis, prosthetic

valve infections and subsequent mortality. The prevalence of prosthetic valve endocarditis (PVE) is low, ranging from 1 to 6% [1]. However, it represents a critical and potentially fatal complication with a mortality rate of up to 40%, and it is commonly associated with specific bacterial strains, including Viridans group streptococci, *Streptococcus bovis*, *Haemophilus* spp., *Aggregatibacter actinomycetemcomitans*, *Cardiobacterium hominis*, *Eikenella corrodens*, *Kingella kingae*, *Kingella denitrificans*, *Staphylococcus aureus* and community-acquired en-

terococci when no primary focus is present [2–4]. The majority of these bacterial species are considered commensal inhabitants of the oral-pharyngeal region. As the oral cavity is not an isolated entity, dental caries, periodontal disease and oral infections can lead to systemic consequences [5].

Cardiac surgery with the use of extracorporeal circulation promotes the release of pro-inflammatory cytokines. This inflammatory cascade has the potential to aggravate preexisting oral infections, thereby facilitating the contamination of cardiac valves or prosthetic materials. Due to this oral-systemic connection, dental clearance is supported by American and European endocarditis guidelines alike. They strongly recommend that “potential sources of dental sepsis should be eliminated at least 2 weeks before implantation of a prosthetic valve or other intracardiac or intravascular foreign material...” (Class IIa, Level of Evidence C per American guidelines) [1, 2]. However, the most recent European endocarditis guideline does not make a clear statement regarding preoperative dental clearance anymore due to insufficient evidence [6].

The aim of this meta-analysis was to see whether existing data supports the routine performance of preoperative dental clearance.

Methods

To provide a clear structure and ensure transparent reporting, this study complies with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) and Meta-analysis of Observational Studies in Epidemiology (MOOSE) guidelines [7, 8].

Search Strategy and Study Inclusion

The MEDLINE, EMBASE and Cochrane databases were searched up to January 1, 2023 for full-length publications in English reporting on patients undergoing preoperative dental clearance before cardiac surgery. The search strategy is provided in the supplementary material (fig. S1). Because the data-sharing statements indicate confidentiality, authors were not contacted if the provided data was unclear. Studies by the same author, except for guidelines, letters, position papers, consensus statements and reviews, were included. First, the title and abstract were reviewed, then the remaining articles were reviewed in depth. Relevant articles identified by cross-referencing were added manually to ensure that no relevant studies were missed. A study was included if: (i) the patients were preoperatively screened; (ii) it included any outcomes after any type of predefined cardiac surgery; and (iii) the participants were adults.

Data extraction

After identifying relevant articles, we extracted clinically relevant data and data necessary for inclusion. In case of any disagreements, consensus was reached through discussion. The extracted study description data included location and design of the study, the number of included patients, the time span of patient inclusion, the time between preoperative dental clearance and following procedures, and relevant outcomes. The primary endpoints were all-cause mortality, incidence of PVE, post-surgical infection and length of hospital stay. We extracted total follow-up time, mean or median follow-up time and the number of events that occurred during this follow-up period for our endpoints.

Statistical analysis

Descriptive statistics were summarized as mean ± standard deviation or crude numbers with percentages, where appropriate. The primary endpoints of this study were the difference in all-cause mortality, the incidence of

PVE, post-surgical infection and the length of hospital stay.

The data was analyzed using ReviewManager Version 5.3 (Cochrane, London). Overall risk ratio and risk differences were calculated using a dichotomous setting with an inverse variance and, due to the expected heterogeneity, a random effects model was chosen. The heterogeneity was calculated using the I² and chi-squared coefficients. The confidence interval (CI) was set at 95%.

Results

Search Results

A total of 7040 articles were found through the MEDLINE, EMBASE and Cochrane databases. After removing duplicates and evaluating the titles and abstracts, 181 studies underwent a thorough examination of the full text. Four articles were found to be eligible for inclusion. A search of the references resulted in the inclusion of one additional study. The screening process is visually depicted in figure S1, ad-

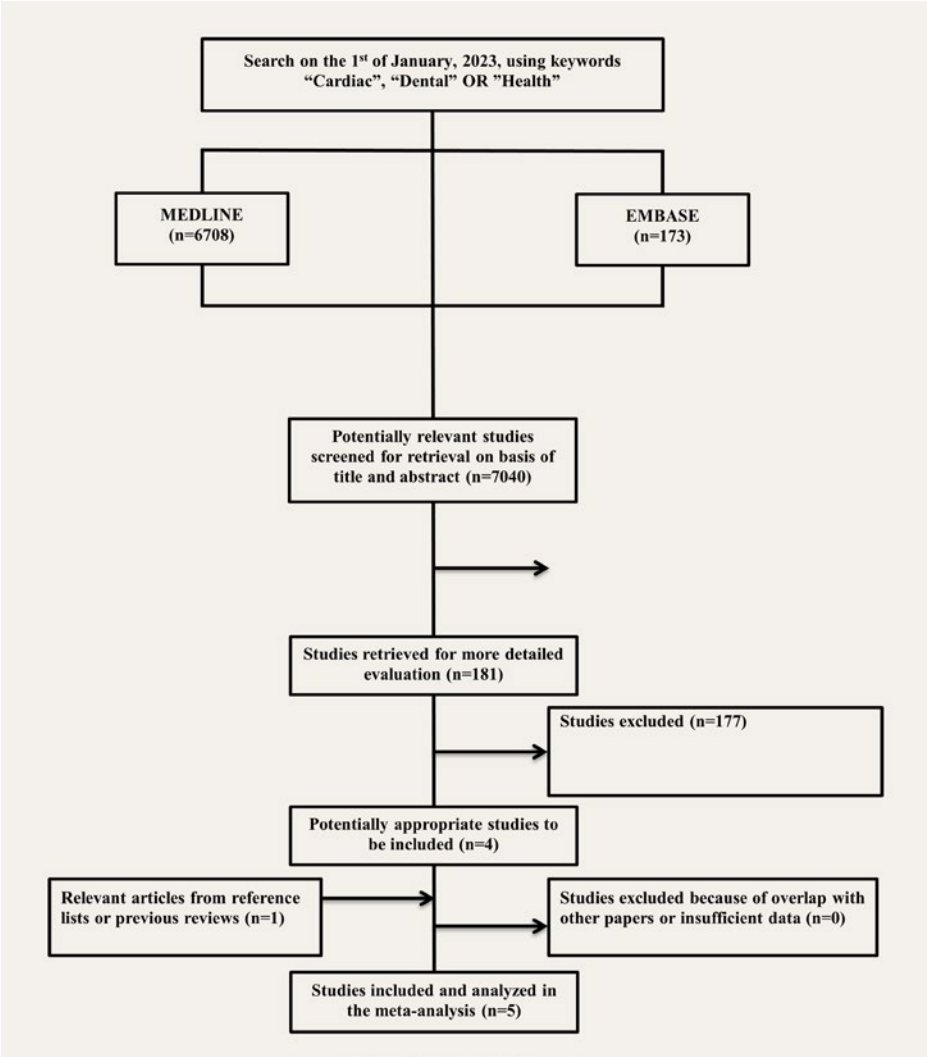


Figure S1: Flowchart of included studies.

Table 1: Characteristics of included studies

	Study Type	Location	No. of patients	Follow-up Period
Hakeberg et al., 1999 [13]	Prospective	Sweden	253	3 weeks
Wu et al., 2008 [9]	Retrospective	United States	98	6 months
Bratel et al., 2011 [11]	Prospective	Sweden	252	16 years
Nakamura et al., 2011 [10]	Retrospective	Japan	209	42 months
De Souza et al., 2016 [12]	Retrospective	Brazil	481	12 months

hering to the guidelines outlined by PRISMA. In the end, five studies were included in the review [9–13].

Included Studies

Table 1 and 2 depict the baseline characteristics and outcomes of the included studies.

Outcomes: All-cause Mortality

Among the included studies, four investigations provided data on all-cause mortality. In the meta-analysis the pooled relative risk (RR) was calculated to be 0.92 (95% CI 0.43–1.97), indicating a very low certainty of evidence (fig. 1) [9–12]. The RR suggests that there may be no discernible difference in the risk of all-cause mortality between individuals who underwent dental clearance before cardiac surgery and those who did not. There was

moderate heterogeneity between the studies ($p = 0.83$, $I^2 = 47\%$). The included studies were downgraded to a very low certainty of evidence for this outcome due to concerns regarding the bias risk.

Outcomes: Prosthetic Valve Endocarditis

Among the studies included in our analysis, three investigations provided data on the rates of prosthetic valve infective endocarditis [9, 12, 13]. The pooled estimate from these studies yielded a RR of 1.32 (95% CI 0.51–3.43), indicating a very low certainty of evidence (fig. 2). There was moderate heterogeneity between the studies ($p = 0.56$, $I^2 = 32\%$). The RR of 1.32 might suggest a potentially increased risk of developing prosthetic valve endocarditis for individuals who underwent dental clearance

compared to those who did not, although the difference is not statistically significant.

Outcomes: Postsurgical Infection

The rates of postsurgical infection were reported in two studies [10, 13]. A pooled RR of 1.02 (95% CI 0.77–1.36) was calculated, with a very low certainty of evidence, suggesting that there are no significant difference in the rate of postsurgical infection between individuals who received dental treatment before heart valve surgery and those who did not (fig. 3). There was low heterogeneity between the studies ($p = 0.89$, $I^2 = 0\%$).

Outcomes: Length of Stay

Among the included studies, three investigations provided data on the mean length of stay (LOS), ranging from 15 to 20 days [9, 10, 12].

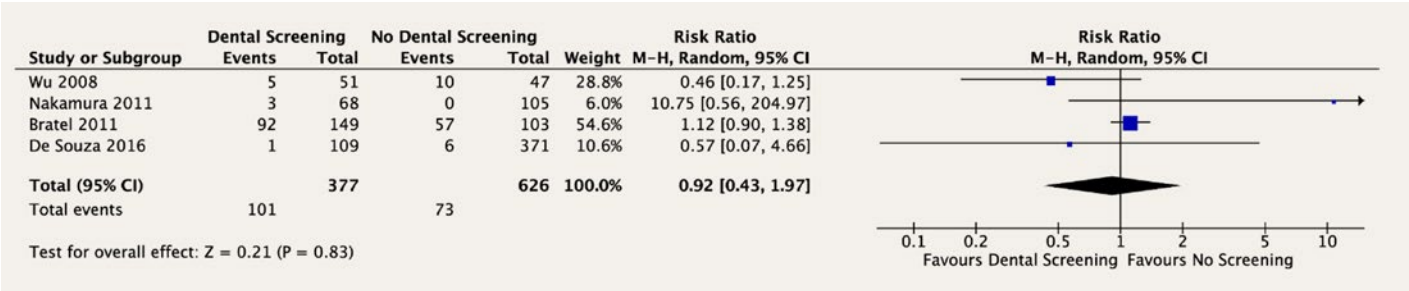


Figure 1: Risk Ratio for all-cause mortality after dental clearance. CI: Confidence Interval.

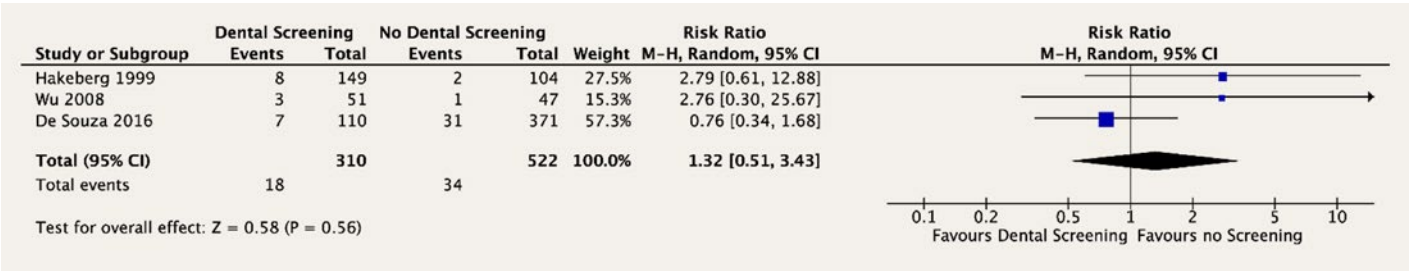


Figure 2: Risk Ratio for prosthetic valve endocarditis after dental clearance. CI: Confidence Interval.

Table 2: Dental treatment compared to no dental treatment

Outcome	No. of participants	Risk Ratio (95% CI)	Risk Difference with Dental Clearance
All-cause Mortality Follow-up Range: 6 mos – 16 yrs	984 (4 observational)	0.92 (0.43–1.97)	N/A
Infective Endocarditis Follow-up Range: 3 wks – 89 mos	815 (3 observational)	1.32 (0.51–3.43)	N/A
Post-surgical Infection Follow-Up Range: 3 wks – 42 mos	426 (2 observational)	1.02 (0.77–1.36)	N/A
Length of Hospital Stay Follow-Up Range: 1–42 mos	735 (3 observational)	N/A	4 Days more (2.7 fewer to 10.7 more)

CI: Confidence Interval.

Conducting a meta-analysis of this data, the estimated weighted mean difference in LOS was calculated to be 4.0 days (95% CI -2.7–10.7) (fig. 4). There was considerable heterogeneity between the studies ($p = 0.24$, $I^2 = 93\%$). It is important to note that there is substantial heterogeneity in the estimates across the studies. However, due to the limited number of studies available and the lack of variability in the predefined clinical aspects of these studies, it was not possible to investigate the source of this heterogeneity.

Discussion

This study describes the association between preoperative dental clearance and subsequent postoperative outcomes. We found no difference in all-cause mortality, incidence of postoperative endocarditis, postoperative infection and length of hospital stay after preoperative dental clearance before cardiac surgery. The current available evidence points to an unestablished association, leaving us without a clear understanding of whether preoperative dental clearance leads to a lower incidence of postoperative endocarditis. This lack of certainty primarily stems from two critical factors: the absence of adjusted analyses accounting for potential confounding variables and issues leading to imprecision due to population size.

After cardiac surgery, particularly after prosthetic heart valve replacement, patients have an increased risk of postoperative endocarditis. The current practice of preoperative dental clearance relies on retrospective data. As mentioned before, the American Endocarditis

guidelines recommend that “potential sources of dental sepsis should be eliminated at least 2 weeks before implantation of a prosthetic valve or other intracardiac or intravascular foreign material...” (Class IIa, Level of Evidence C per American guidelines) [2]. However, the current European guideline does not support dental clearance due to missing evidence [6].

In our meta-analyses among the included studies, the pooled RR of all-cause mortality was 0.92 (95% CI 0.43–1.97). This wide range may be attributed to differences in late-term mortality and the limited follow-up period in two of the four included studies. In previous population studies, oral health conditions were associated with long-term mortality [14]. However, bias stemming from poor oral health, which could potentially serve as an indicator for the overall health status or directly impact long-term survival, might be influencing these findings.

Existing data regarding dental clearance prior to various interventional modalities has shown insufficient data. Kouwenberg et al. investigated dental treatment prior to aortic valve surgery and, given the limited evidence available, about whether preoperative dental clearance might reduce the risk of postoperative endocarditis [15]. The studies included in this meta-analysis showed significant heterogeneity in terms of methodologies, patient populations and dental clearance protocols. The authors solely focused on assessing postoperative PVE, which provides an incomplete perspective on potential postoperative complications. The studies generally had a short follow-up period, potentially contributing to the

low incidence of PVE. Furthermore, variations in population characteristics could influence the PVE incidence. Notably, males tend to exhibit a higher incidence of periodontitis, oral cancer and worse oral hygiene, and might therefore have an increased tendency to develop PVE [16, 17]. Due to small populations, a subgroup analysis was not performed.

Preoperative dental clearance may even lead to unexpected negative outcomes. Patients undergoing heart surgery often present with both physical and psychological comorbidities, and dental procedures can introduce additional burdens, potentially worsening preexisting conditions [18, 19]. In case of heart valve surgery, dental screening led to stress-causing tooth extractions in 44% of patients [20]. Treating dental infections surgically may require changes in medication or prophylactic antibiotics, which can be inconvenient for patients [21]. Not all patients have easy access to dental care, especially those without dental insurance or in underserved areas. Therefore, requiring dental clearance can create barriers, potentially delaying a needed cardiac operation. Furthermore, dental procedures, even routine ones, carry risks of complication such as infection, bleeding and adverse reactions to anesthesia. Patients then have to deal with these complications in addition to the risks associated with cardiac surgery.

It is crucial to recognize several noteworthy limitations in the performed review. The first concern is the relatively small number of available studies, resulting in a very low certainty of evidence due to imprecision. Secondly, due to the small number of patients includ-

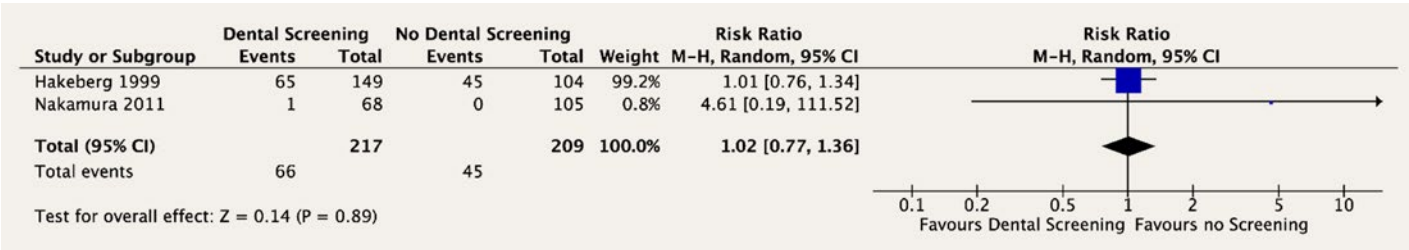


Figure 3: Risk Ratio for postsurgical infection after dental clearance. CI: Confidence Interval.

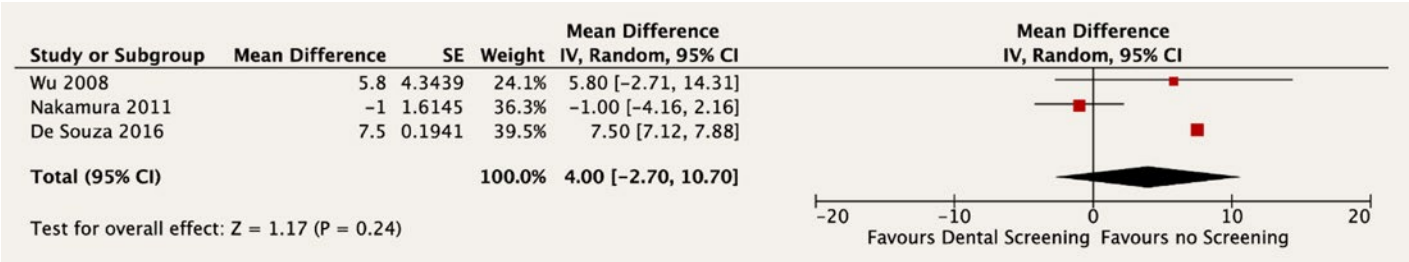


Figure 4: Weighted mean difference in length of stay at the hospital after dental clearance. CI: Confidence Interval.

ed in each study, significant baseline variables, such as smoking history, sex and age could not be accounted for. Despite these limitations, we have synthesized the available body of knowledge to provide valuable insights for clinical decision-making.

Based on the available evidence, it remains uncertain whether patients undergoing professional dental clearance prior to cardiac surgery can expect superior or inferior postoperative outcomes compared to those who do not receive (routine) oral health care.

Conclusion

Based on the, albeit very low amount of available evidence, there appears to be limited benefit of preoperative dental clearance with regards to postoperative outcomes such as mortality, incidence of postoperative endocarditis and infection, and length of hospital stay.

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Conflict of Interest Statement

The authors MC, MN, FP, CP and MS have no potential conflicts of interest to declare.

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Author Contributions

MC, MS and DR contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript. All authors discussed the results and commented on the manuscript.

Data Availability Statement

Data will not be made available to others.



References

You will find the full list of references online at <https://cvm.swisshealthweb.ch/en/article/doi/cvm.2024.1356564558/>.