G14: Is preoperative anaemia a risk factor for SSI/PJI for patients undergoing major orthopaedic surgery?

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Response/Recommendation:

Yes. Preoperative anemia is a risk factor for surgical site infection (SSI) and periprosthetic joint infection (PJI) in patients undergoing major orthopedic surgeries.

Level of Evidence: Moderate

Rationale:

To address the question posed above we conducted a comprehensive systematic using the MeSH terms created by librarians. Literature search of four databases (PubMed, Scopus, Web of Science, and Embase) was conducted to identify 908 potential articles. After screening of the identified literature, 872 were excluded, leaving 36 studies that were eligible for inclusion in the final analysis. Inclusion criteria required studies addressing preoperative anemia as a risk factor for SSI/PJI in major orthopedic surgeries, including joint replacements, spine surgeries, complex lower limb fractures, and limb salvage procedures. A meta-analysis was conducted on all included studies, followed by subgroup analyses based on the type of major orthopedic surgery: hip and knee arthroplasties (20 studies), spine surgeries (11 studies), and shoulder arthroplasty (5 studies). Additionally, nine studies (3 hip/knee, 5 spines, 1 shoulder) reported separate results for superficial and deep SSI. Consequently, additional subgroup meta-analyses were performed specifically for superficial and deep SSI outcomes in spine surgeries.

The meta-analysis of all studies demonstrated a significant association between preoperative anemia and the risk of SSI/PJI, with a pooled odds ratio (OR) of 1.712 (95% CI: 1.566–1.870, $p = 0.0001$). Subgroup analyses revealed similar significant associations for hip and knee arthroplasties (OR: 1.732, 95% CI: 1.564–1.917, $p = 0.0001$), spine surgeries (OR: 1.520, 95% CI: 1.283–1.799, $p = 0.0001$) and shoulder arthroplasty (OR: 2.038, 95% CI: 1.514–2.744, $p = 0.0001$). In spine surgeries, separate meta-analyses for superficial and deep SSI outcomes also showed significant associations, with pooled ORs of 1.286 (95% CI: 1.117–1.479, $p = 0.0001$) and 1.847 (95% CI: 1.634–2.086, $p = 0.0001$), respectively (Figure 1).

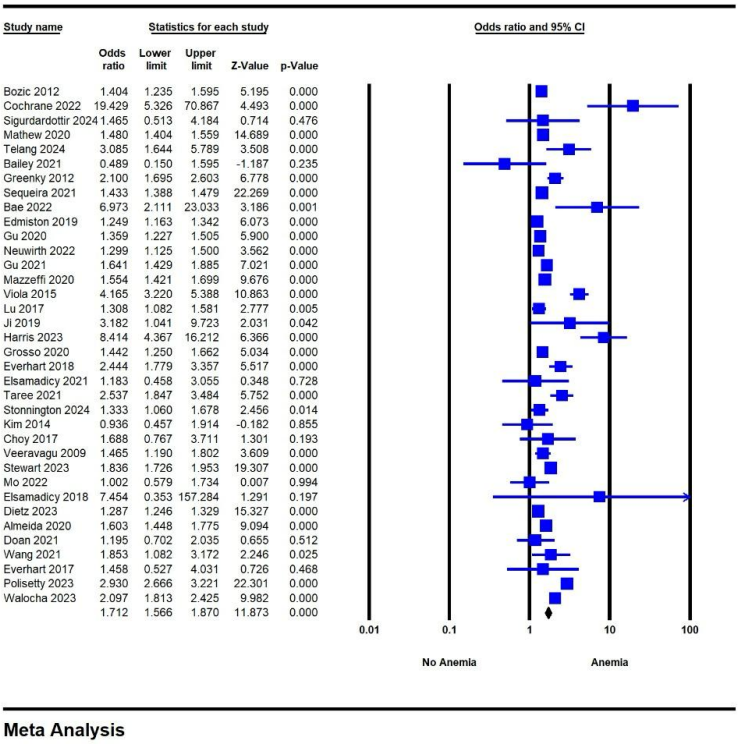

Figure 1. Meta analysis of all included studies (1-33)

Several limitations were encountered in this study. First, the definition of anemia varied across studies. Some studies classified anemia by severity (e.g., mild vs. moderate to severe). In these cases, data were extracted by grouping all anemia cases together and comparing them with non-anemia cases. Second, many studies were not exclusively focused on anemia as a risk factor but also examined various other factors using both univariate and multivariate analyses. Due to the wide variety of risk factors assessed across studies, including them in the meta-analyses would have introduced excessive complexity, making the study impractical. Therefore, only data related to anemia prevalence in SSI/PJI versus non-SSI/PJI groups were extracted. Third, some studies provided both unmatched and matched analyses. Although unmatched analyses included more patients, data from matched cohorts were prioritized for the meta-analysis due to their greater accuracy. Lastly, the definition of infection outcomes varied between studies (e.g., SSI, PJI, or wound infection). For consistency, different infection outcomes were pooled under the category of SSI/PJI. Additionally, subgroup analyses for superficial and deep SSI outcomes were performed specifically in spine surgery studies.

Thus, the meta-analyses were conducted under the following conditions:

- Cases of anemia were included irrespective of the heterogeneity in definitions across studies.

- Infection outcomes were pooled as SSI/PJI, regardless of variations in definitions among studies.
- Other potential risk factors were not considered in the meta-analyses. However, in studies providing both matched and unmatched analyses, data from the matched cohorts were used.

In conclusion, based on the current literature, preoperative anemia appears to be a significant risk factor for surgical site infection (SSI) and periprosthetic joint infection (PJI) in patients undergoing major orthopedic surgeries. Despite several limitations in this systematic review, the findings underscore that preoperative anemia is a modifiable risk factor that should be carefully managed to improve surgical outcomes. Further research is needed to establish standardized definitions and protocols for managing anemia in this patient population.

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