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Preoperative Antibiotic Prophylaxis and the Incidence of Surgical Site Infections in Elective Clean Soft Tissue Surgery of the Hand and Upper Limb: A Systematic Review and Meta-Analysis

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Background: Surgical site infections (SSI) are the most frequent early complications of hand surgeries. These infections are rare and predominantly superficial.[1-4] However, the indications still remain uncertain and decisions about the administration of preoperative antibiotic prophylaxis in elective clean soft tissue surgeries of the hand and upper limb are still based on the institution's traditions and the surgeon's preferences. [1,5,6,9,10] Therefore, a systematic review of the literature and a meta-analysis was conducted to investigate the impact of antibiotic prophylaxis on the prevention of SSI in this type of surgeries.

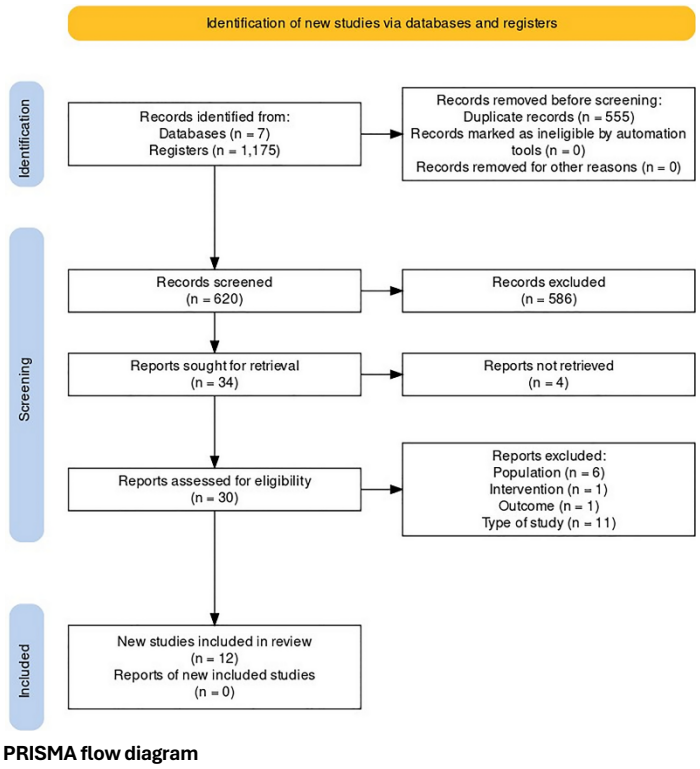

Figure 1 – PRISMA flow diagram

Methods: An electronic search was performed in the following databases: MEDLINE/Pubmed, PMC/Pubmed, Web of Science/Clarivate Analytics, Embase/Elsevier, Scopus/Elsevier, BVS/Lilacs, and the Cochrane Library, with no restrictions regarding publication language or date (Figure 1). The search strategy was built and validated with the collaboration of a librarian from the School of Medical Sciences at UNICAMP: ("Antibiotic Prophylaxis" OR Premedication) AND ((Hand AND "Upper Extremity") OR Hand) AND "General Surgery" AND ("Postoperative Complications" OR "Surgical Wound Infection"). This review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement, published in 2020.[11] The study protocol is available in the Prospective Register of Systematic Reviews (PROSPERO) database under code CRD42023417786. The primary outcome of interest was the occurrence of SSI following elective clean soft tissue surgeries of the hand and upper limb according to the administration of preoperative antibiotic prophylaxis and no antibiotic prophylaxis. Surgeries involving simultaneous bone procedures or orthopedic implants were excluded. Study selection and data extraction were conducted independently by two reviewers. The assessment of bias risk was facilitated by RoB 2.0 and ROBIS-I tools.[12,13]

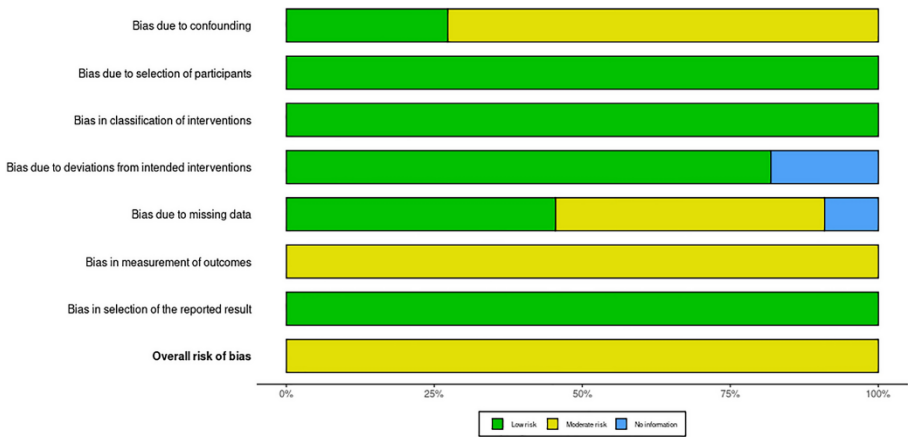

Figure 2 – Weighted bar chart: risk of bias in nonrandomized intervention studies (ROBIS-I)

The magnitude of the intervention effect was estimated using the relative risk (RR). The meta-analysis was performed with the Review Manager and R software tools, using the Mantel-Haenszel random-effects model and a 95% confidence interval (CI). Results with p≤0.05 were considered statistically significant. The quality of evidence was assessed using the GRADE approach.

Results: The initial search yielded 1,175 titles, from which 12 articles met the inclusion criteria for the systematic review, and 10 were included in the subsequent meta-analysis. [4,7,14-23] The majority of these studies were non-randomized intervention trials, exhibiting a moderate risk of bias (Figure 2). According to our review, preoperative antibiotic prophylaxis did not have a statistically significant impact on the incidence of SSI (RR=1.13; 95%CI: 0.91–1.40; p=0.28) (Figure 3). Moderate statistical heterogeneity was observed (I^2=44%), and the pre-specified sensitivity analysis highlighted the consistency of the results. The overall quality of evidence for this outcome was rated as low (Table 1).

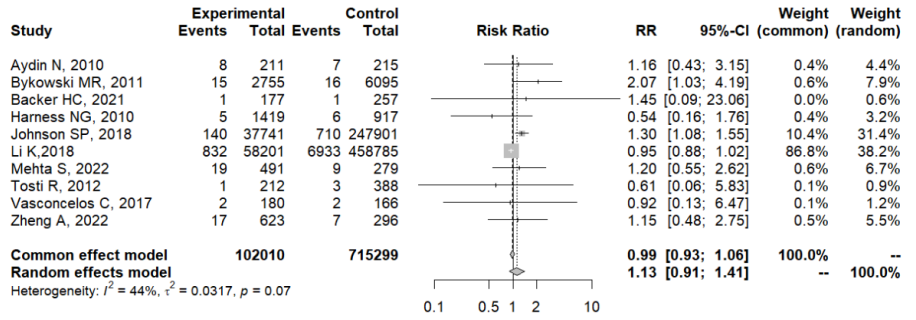

Figure 3 – Forest plot: fixed and random effects model (*R software*)

Assessment of certainty of evidence							Number of patients		Effect		
Number of studies	Study design	Risk of bias	Inconsistency	Indirection of evidence	Imprecision	Other considerations	Administration of preoperative antibiotic prophylaxis	Placebo or no drug prophylaxis	Relative risk (95% CI)	Absolute risk (95% CI)	Certainty of evidence
Surgical site infections (follow-up: from 30 to 180 days)											
10[a]	Observational study[b]	Serious[c]	Not serious[d]	Not serious[e]	Serious[f]	None	1040/102,010 (1.0%)	7694/715,299 (1.1%)	RR 1.13 (0.91–1.39)	Plus 1 per 1000 (from minus 1 to plus 4)	⊕⊕◯◯ LOW
Serious complications secondary to SSI—not measured											
–	–	–	–	–	–	–	Only 7 out of 10 studies included in this meta-analysis reported serious complications of surgical wounds, which accounted for 23% (24 out of 104) of postoperative SSI cases.[g]				–
Minor complications of surgical wounds—not measured											
–	–	–	–	–	–	–	Only 2 out of 10 studies included in the meta-analysis reported minor complications of surgical wounds. Of these, 0.89% (7 out of 780) of the patients showed these complications				–
Adverse reactions and side effects to antimicrobials—not measured											
–	–	–	–	–	–	–	Only 1 out of 10 studies included in the systematic review (but not in the meta-analysis due to the number of events = 0) reported adverse reactions and side effects to antibiotics. Patients who received preoperative antibiotics had significantly more adverse reactions and side effects related to the administration of these drugs than patients who did not receive antibiotic prophylaxis (16.2% versus 5.5%; p = 0.029, chi-squared test). Also, 1 out of 10 patients who use antimicrobials has adverse reactions and side effects to these drugs				–
Comparative costs of preoperative antibiotic prophylaxis—not measured											
–	–	–	–	–	–	–	Only 1 out of 10 studies included in the meta-analysis reported costs of preoperative antibiotic prophylaxis. For each patient, the total healthcare expenses in the first 30 days after surgery (including the date of the surgical procedure) is higher when preoperative intravenous antibiotics were administered when compared to cases that did not receive these medications (US $6070 versus US $4891, respectively; p < 0.001)				–

Table 1– GRADE evidence profile

Conclusions: While these results were consistent with the findings from individual studies included in this review, it is important to note that, given the threshold of p≤0.05 for statistical significance, no definitive conclusions can be drawn from the quantitative analysis of the data obtained.

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