JURNAL
REKONSTRUKSI DAN ESTETIK

# *EFFECTIVENESS OF ANTIBIOTIC PROPHYLAXIS IN MAXILLOFACIAL TRAUMA SURGERY: A SYSTEMATIC REVIEW*

Naufal Agus Isa Mahendra [a], Muhammad Tidar Abiyyu [a], Iswinarno Doso Saputro [b], Yanuar Ari Pratama [b,c]

[a] Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia
[b] Department of Plastic Reconstructive and Aesthetic Surgery, Faculty of Medicine, Universitas Airlangga, Dr. Soetomo General Academic Hospital, Surabaya, Indonesia
[c] Department of Anatomy, Histology, and Pharmacology, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia

ARTICLE INFO

**Keywords:** Antibiotic prophylaxis, maxillofacial trauma, surgical site infection, perioperative infection, antimicrobial resistance

***Corresponding author*:**
Naufal Agus Isa Mahendra
Email address:
naufalmahen1608@gmail.com

***History*:**
Received: August 29, 2025
Revised: October 30 2025
Accepted: November 14, 2025
Published: December 1, 2025

**JRE : Jurnal Rekonstruksi dan Estetik**
**e-ISSN:2774-6062; p-ISSN: 2301-7937**
**DOI: 10.20473/jre.v10i2.72261**

**Available at:**
https://e-journal.unair.ac.id/JRE/

***How to cite*:** Mahendra NA, Abiyyu MT, Saputro I, & Pratama YA. EFFECTIVENESS OF ANTIBIOTIC PROPHYLAXIS IN MAXILLOFACIAL TRAUMA SURGERY: A SYSTEMATIC REVIEW.Jurnal Rekonstruksi dan Estetik. 2025; 10(2):122-133.

ABSTRACT

**Introduction:** The effectiveness of antibiotic prophylaxis in maxillofacial trauma surgery remains a subject of debate, with varying recommendations regarding its necessity and duration. This systematic review aims to evaluate the impact of prophylactic antibiotics on the incidence of surgical site infections (SSIs) in maxillofacial trauma patients.
**Methods:** A systematic literature search was conducted using Google Scholar, following predefined inclusion and exclusion criteria based on the PICO framework. Studies included observational cohort studies comparing the use of prophylactic antibiotics to either no antibiotics or different regimens of antibiotic administration. The quality of the selected studies was assessed using the JBI Critical Appraisal Checklist for Cohort Studies.
**Results:** Six studies met the inclusion criteria, with five reporting no significant reduction in SSIs with prophylactic antibiotic use, regardless of the timing or duration of administration. Only one study found a statistically significant decrease in SSIs with preoperative antibiotic prophylaxis. Variations in study design, antibiotic regimens, surgical techniques, and patient populations may have influenced the inconsistent findings.
**Conclusion:** The findings suggest that routine antibiotic prophylaxis in maxillofacial trauma surgery may not be universally beneficial and should be reconsidered in favor of a more selective, patient-specific approach. Given the increasing concerns regarding antimicrobial resistance, prophylactic antibiotics should be reserved for high-risk patients where a clear benefit can be demonstrated. Further research, particularly well-designed randomized controlled trials, is necessary to establish standardized guidelines and optimize perioperative infection control strategies.

**Highlights:**

1. Antibiotic prophylaxis does not significantly decrease surgical site infection rates in maxillofacial trauma surgery.
2. Post-operative antibiotic regimens are not recommended as they increase costs without reducing infection rates.

## INTRODUCTION

Trauma is a common indication for maxillofacial surgery, especially now with the rise of road transportation, with the mandible as the most common part prone to fracture.[1] These fractures require surgical and nonsurgical treatments to repair it.[2] For surgical treatments there are multiple factors that can affect the outcome of the procedure.[3] Surgical site infections (SSIs) are a significant concern in maxillofacial trauma surgery, leading to increased morbidity, prolonged hospitalization, and elevated healthcare costs.[4] Maxillofacial trauma is prone to infection because it involves the oral cavity, which is inhabited by oral fauna and nonsterile, especially after a traumatic injury.[5] Recent studies report an overall infection rate of 5.6% for maxillofacial fractures, with mandibular fractures exhibiting a higher rate of 8.9%. Specifically, surgical procedures such as open reduction and internal fixation (ORIF) for mandibular fractures have an SSI prevalence of approximately 4.2%.[6] Antibiotic prophylaxis is commonly used to mitigate the risk of SSIs in maxillofacial trauma surgeries.[7] However, its efficacy remains a subject of debate.[8] While some studies advocate routine prophylactic antibiotic use, others question its effectiveness, highlighting the concerns about potential adverse effects and the contribution to antimicrobial resistance.[9] The lack of consensus extends to the timing and duration of antibiotic administration, with practices varying widely across different clinical settings.[10] This unstandardized use of antibiotics may contribute to antimicrobial resistance, increase healthcare costs, and reduce patient compliance.[11] Given the variability in current practices and the potential implications for patient outcomes and public health, a critical evaluation of existing evidence is needed This systematic review aims to assess the effectiveness of antibiotic prophylaxis in reducing SSIs among patients undergoing maxillofacial trauma surgery. By synthesizing data from recent studies, we seek to provide clarity on whether routine antibiotic prophylaxis is justified and to inform evidence-based guidelines for clinical practice.

## METHODS

We used Harzing's Publish or Perish search engine to look up articles used in this review. We used 2 databases, Google Scholar and PubMed because these databases are the easiest to access using Publish or Perish.

Articles included were those studying antibiotic prophylaxis, specifically its role in maxillofacial surgery and how effective they are at preventing surgical site infections. We included retrospective studies, prospective studies, case reports and randomized controlled trials. We also excluded review articles such as systematic reviews and narratives reviews. The search and screening were performed by three reviewers, with a fourth acting as a referee in case of disagreement to decide whether to include it in this study or not. The keywords we used in this search are as follows.

Table 1. Keywords and Synonyms

| Keywords | Synonyms |
|---|---|
| Effectiveness | "Effectiveness"<br>"Outcome"<br>"Clinical effectiveness"<br>"Patient relevant outcome" |
| Antibiotic prophylaxis | "Antibiotic premedication" |
| Maxillofacial injury | "Maxillofacial trauma" |
| Surgery | "Trauma surgery"<br>"Plastic surgery" |

For Google Scholar, we combined our predefined keywords with the database's search operators to generate the final search string as follows: Effectivity OR Effectiveness OR Outcome OR "Clinical effectiveness" OR "Patient relevant outcome" AND "Antibiotic prophylaxis" OR "Antibiotic premedication" AND "Maxillofacial trauma" OR "Maxillofacial injury" AND Surgery OR "Trauma surgery" OR "Plastic surgery" OR "Maxillofacial surgery".

For PubMed, we adapted the keywords to the database's search syntax, resulting in the following final search string: Antibiotic prophylaxis AND Maxillofacial trauma AND Surgery.

We managed to find 104 articles that matched our keyword, 5 of them are duplicates which we eliminated so the total of articles we used for screening are 99 articles.

## PICO Framework, Inclusion and Exclusion Criteria

The study question was structured using the PICO framework. The population (P) consisted of patients of any age with maxillofacial trauma undergoing surgical management. The intervention (I) was the administration of systemic antibiotic prophylaxis, either before, during, or after surgery. The comparison (C) was made between patients who did not receive antibiotic prophylaxis and those who received different regimens, durations, or timings of prophylaxis. The primary outcome (O) was the incidence of surgical site infections (SSIs) and systemic infections following surgery.

Based on this framework, the inclusion criteria were studies involving maxillofacial trauma patients who underwent surgical treatment and received antibiotic prophylaxis at any perioperative stage, reporting its significance in preventing infections. Only cohort studies and randomized controlled trials (RCTs) published between 2023 and 2024 were considered. Exclusion criteria included non–maxillofacial trauma patients, those treated without surgery, articles focusing solely on surgical techniques without reporting antibiotic prophylaxis, narrative reviews, systematic reviews, meta-analyses, and studies published outside the specified timeframe.

Table 2. Inclusion and Exclusion Criteria

| Inclusion | Exclusion |
|---|---|
| Any maxillofacial trauma patient which undergoes surgical treatment | Non maxillofacial trauma patients |
| Given antibiotic treatments before after or during surgery | Maxillofacial trauma patients that did not receive surgical treatment |
| Reports use of antibiotic prophylaxis and studied its significance in preventing infections | The effect of antibiotic prophylaxis was not reported, but focused more on other aspects of the surgery such as surgical techniques |
| Cohort studies or Randomized Controlled Trials (RCTs) | Narrative reviews, Systematic reviews, Meta analysis |
| Between 2023-2024 | Before 2023 and after 2024 |

We screened 99 articles and found 11 articles matching our inclusion criteria. After full text screening, 4 articles were excluded due to having the wrong population and wrong outcomes. In the end, we had 6 articles that we are going to use for this study, 5 of them are Cohort studies while 1 of them is a Randomized Controlled Study.

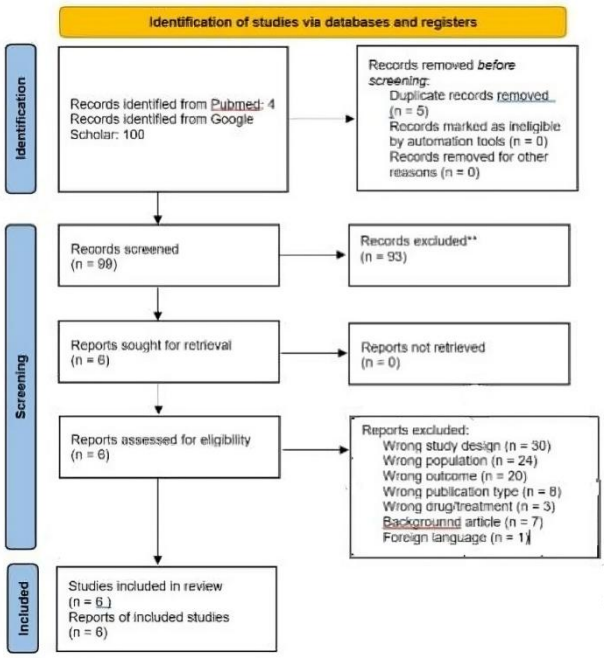


Figure 1 PRISMA Flow Diagram[12]

### Risk of Bias

Because we mainly use cohort studies as our subject of research there is an inherent risk of bias in this study. Retrospective cohort studies are vulnerable to information bias because of missing information when using existing records and selection bias, because individuals are selected after the outcome of study has occurred, so both conditions (exposure and outcome) are present at the moment of enrollment. In that case, it is easier that exposed or unexposed subjects would be related to the result of interest, causing selection bias. On the other hand, a prospective cohort design are prone to loss of follow-up. Both types of cohort studies may be influenced by information bias, confounding or interaction.

## RESULT

### Critical Appraisal

We assessed the quality of the literature using the JBI Critical Appraisal Checklist for Cohort Studies and Randomized Controlled Trial Studies.[13,14] The 6 obtained articles have met the inclusion criteria, the research design was appropriate as they used the cohort study and randomized controlled trial design. The statistical analysis had been carried out correctly, and the results from the outcome and group comparisons of these 6 studies agreed.

Table 3. JBL Critical Appraisal Tool for Cohort Studies[13]

| No. | Question | Gaessler et al. (2023) | Tucker et al. (2023) | Maurer et al. (2023) | Atwez et al. (2023) | Vishwanath et al. (2023) |
|---|---|---|---|---|---|---|
| 1. | Were the two groups similar and recruited from the same population? | Yes | Yes | Yes | Yes | Yes |
| 2. | Were the exposures measured similarly to assigning people to both exposed and unexposed groups? | Yes | Yes | Yes | Yes | Yes |
| 3. | Was the exposure measured in a valid and reliable way? | Yes | Yes | Yes | Yes | Yes |
| 4. | Were confounding factors identified? | Yes | Yes | Yes | Yes | Yes |
| 5. | Were strategies to deal with confounding factors stated? | Yes | Yes | Yes | Yes | Yes |
| 6. | Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)? | Yes | Yes | Yes | Yes | Yes |
| 7. | Were the outcomes measured in a valid and reliable way? | Yes | Yes | Yes | Yes | Yes |
| 8. | Was the follow up time reported and sufficient to be long enough for outcomes to occur? | Yes | Yes | Yes | Yes | Yes |
| 9. | Was follow up complete, and if not, were the reasons to loss to follow up described and explored? | Unclear | Yes | Yes | Yes | No |
| 10. | Were strategies to address incomplete follow up utilized? | Unclear | Unclear | Not applicable | No | No |
| 11. | Was appropriate statistical analysis used? | Yes | Yes | Yes | Yes | Yes |

Table 4. JBI Critical Appraisal tool for Randomized Controlled Trials[14]

| No. | Question | Mohanty et al. (2023) |
|---|---|---|
| 1. | Was true randomization used for assignment of participants to treatment groups? | Yes |
| 2. | Was allocation to treatment groups concealed? | Yes |
| 3. | Were treatment groups similar at the baseline? | Yes |
| 4. | Were participants blind to treatment assignment? | Yes |
| 5. | Were those delivering the treatment blind to treatment assignment? | No |
| 6. | Were treatment groups treated identically other than the intervention of interest? | Yes |
| 7. | Were outcome assessors blind to treatment assignment? | Yes |
| 8. | Were outcomes measured in the same way for treatment groups? | Yes |
| 9. | Were outcomes measured in a reliable way | Yes |
| 10. | Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analysed? | Yes |
| 11. | Were participants analysed in the groups to which they were randomized? | Yes |
| 12. | Was appropriate statistical analysis used? | Yes |
| 13. | Was the trial design appropriate and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial? | Yes |

Table 5. Characteristics and Outcomes of Included Studies

| No. | Article | N | Group | No Infection | Post-Op Infection | SSI (%) | *P*-value |
|---|---|---|---|---|---|---|---|
| 1. | Mohanty et al (2023) | 93 | Control* | 73 | 20 | 21.5 | - |
| | | 90 | Intervention | 67 | 13 | 14.4 | |
| 2. | Gaessler et al (2023) | 57 | Control* | 48 | 9 | 15.8 | 0.218 |
| | | 65 | Intervention | 50 | 15 | 23.1 | |
| 3. | Tucker et al (2023) | 3914 | Control** | 3180 | 14 | 0.4 | 0.79 |
| | | 2219 | Intervention | 2200 | 19 | 0.8 | |
| 4. | Maurer et al (2023) | 9 | Control** | 7 | 2 | 22 | 0.197 |
| | | 102 | Intervention | 95 | 7 | 6.8 | |
| 5. | Atwez et al (2023) | 35 | Control*** | 29 | 6 | 17.1 | 0.412 |
| | | 183 | Intervention | 161 | 22 | 12 | |
| 6. | Vishwanath et al (2023) | 138 | Control** | 135 | 3 | 2.17 | 0.90 |
| | | 144 | Intervention | 141 | 3 | 2.12 | |

*Control group was given only perioperative antibiotics
**Control group was not given any antibiotics
***Control group was given perioperative antibiotics or not given any antibiotics

## Study Characteristics

Two studies compared the use of only perioperative antibiotics with adding additional doses of prophylaxis.[15,16] Three studies did not administer antibiotics at all for the control group.[17–19] One study combined patients who aren't given antibiotic prophylaxis and patients who were given only perioperative prophylaxis, the group was then compared with patients who are given an additional dose of prophylaxis.[20] One study focused on pediatric fractures[18] while another study focused on animal bite-related facial traumas.[17] One article only studied mandibular fractures[20] while another studied only nasal fracture patients.[19] Two

studies included every maxillofacial injury patient in their study, not just specific types of fractures.[15,16] All the studies have two groups, one group acts as a control group where they are not given antibiotics or only given intraoperative/perioperative antibiotics (usually right before surgery) and the other group acts as the intervention group where they are given more than one dose or prolonged antibiotic treatment.

All the studies could not find any significant difference between using antibiotics/more than 1 dose and not using prophylactic antibiotics. Every intervention group is given antibiotics, the only thing that differs from each study between the intervention groups is time of administration.

## DISCUSSION

Mohanty et al. reported that both the control and intervention groups were administered 1.2 g of intravenous amoxicillin/clavulanate 8 hours preoperatively, followed by a single intraoperative dose.[16] The intervention group was then also administered the same regimen post-surgery for 3 days while the control group was not. The intervention group was categorized into three groups based on the type of fractures, which are Mandibular, Zygomaticomaxillary (ZMC) and Le Fort. In mandibular fractures, Mohanty et al. found no significant difference between control and intervention group ($p = 0.416$), although the control group, which received only a single perioperative dose, developed more complications than the group that was given a 3 day postoperative antibiotic course, although the difference wasn't statistically significant.[16] No statistically significant differences were found in both Le Fort ($p = 0.348$) and ZMC fractures ($p = 1.000$).[16] Therefore, the study concluded that a single perioperative dose is enough to minimize postoperative complications in maxillofacial trauma surgeries.[16]

In Gaessler et al.'s study, both the control and intervention group were given intravenous antibiotic prophylaxis one hour prior to mucosal or skin incision, they were given the same regimen as Mohanty et al.'s study which is amoxicillin/clavulanate but Gaessler uses 2.2 grams instead of 1.2 and they also used Clindamycin 600 mg administered intravenously if Penicillin allergy was present.[15,16] For post-operative antibiotics in the intervention group, Gaessler et al used the same regimen for 2 days 1-2 times a day, and changed the regimen to per oral amoxicillin/clavulanate thrice a day (625 mg) for days 3 until day 5 and clindamycin IV for days 1-2 (600 mg) and per oral (PO) thrice daily for days 3 until day 5 (300 mg). Gaessler found no statistically significant difference between control and intervention group in relation to SSI rate ($p = 0.218$).[15] The study concluded that a single-dose regimen is as effective as a 5-day regimen in reducing the incidence of SSIs following ORIF for facial fractures.[15]

In Tucker et al.'s study the control group is not given any antibiotics at all, while the intervention group was split into three based on the timing of antibiotic administration.[18] Preoperative was defined as antibiotics given a month before surgery, intraoperative were given the same day, postoperative is given a month after surgery. 660 patients were given antibiotics preoperatively, 1396 patients intraoperatively, and 163 postoperatively. They did not find any statistical difference between the control and intervention group in relation to SSI rate ($P = 0.79$), but they did find that the timing of administration has a statistically significant association with infection development ($P = 0.044$).[18] This study concluded that patients that received intraoperative antibiotics are more likely to develop infection compared to preoperative or postoperative administration ($P = 0.023$).[18]

Maurer et al.'s study observed specifically animal bite cases that causes maxillofacial injury. Control group was not given any antibiotics at all, while the intervention group was given antibiotics.[17]

This study does not state clearly the timing of antibiotic administration. The regimens used in this study are amoxicillin with clavulanic acid, clindamycin, cefuroxime, cefazolin, penicillin, ciprofloxacin, and metronidazole. They did not find any significant statistical difference between administration of antibiotics compared to not using antibiotics in regards to SSI rate ($p = 0.197$).[17] The study concluded that there is no difference in SSI rates for pediatric patients prescribed antibiotics and those who were not.[17]

Atwez et al. 's study compared between not using antibiotics or just 1 dose of perioperative antibiotics with patients who received a scheduled preoperative antibiotic prophylaxis.[20] The regimens used are Clindamycin, Ampicillin/ sulbactam, Cefazolin, Ceftriaxone, Piperacillin/ tazobactam, Metronidazole, Ciprofloxacin, and Penicillin with Clindamycin being the most used antibiotics.[20] They found that receiving less than one dose of antibiotics isn't associated with incidence of SSI ($p = 0.485$).[20] When comparing between infected patients and those who aren't, more than one dose of antibiotic prophylaxis does not correlate with reduction nor increase of SSI occurrence ($p = 0.412$).[20] Therefore the study concludes that the use of preoperative antibiotic prophylaxis or more than a single dose of perioperative antibiotic prophylaxis has no association with reduction of SSI rate.[20]

The study by Vishwanath et al. specifically investigated nasal fractures.[19] They compared between using antibiotics and not using antibiotics. The regimens found in this study are Cefazolin, Bacitracin Ceftriaxone, Clindamycin, Doxycycline, Fluoroquinolone, Cephalexin, and Penicillin-based.[19] There was no significant difference in SSI rate between antibiotic patients and nonantibiotic patients ($P = 0.90$).[19] The study concluded that antibiotic use for prophylaxis does not significantly decrease infection rates in closed or open nasal bone fractures.[19]

All of the studies have similar outcomes, they concluded that antibiotic use isn't significant in reducing SSI rate. A study by Gaal et al. concluded that just using intraoperative antibiotics is enough for mandibular fractures, which matches the results of the 6 studies in this review.[21] A prospective study by Jang et al. supports the conclusion of this study, where he states that using postoperative antibiotics is not recommended, but instead by not using these prolonged regimens it gives the patient biological and cost benefits.[22] A systematic review and meta-analysis by Habib et al. support the findings of this systematic review. In the study they found that routine use of post-operative antibiotics is not necessary for maxillofacial trauma surgery.[23] Blatt et al's study also aligns with the results of this study, where he found in mandibular and Lefort-1/2 fractures, prolonged antibiotics use is ineffective in reducing SSI incidence.[24]

A study by Mundinger et al. delved into evidence-based literatures about the use of antibiotic prophylaxis in craniofacial surgery. This systematic review found that most literature does not support frequent use of pre- and post-operative antibiotics in upper and midface fractures, but with low level of evidence.[25] Preoperative antibiotic use in comminuted mandible fractures is supported, but postoperative antibiotics in mandible fractures is not.[25]

Several international clinical practice guidelines also provide recommendations that align with the findings of this review. The Cochrane Database of Systematic Reviews highlights that the routine use of postoperative antibiotics in maxillofacial trauma surgery offers no significant benefit in preventing surgical site infections (SSIs), emphasizing instead the importance of perioperative dosing strategies and strict adherence to aseptic techniques.[28] Similarly, the World Health Organization (WHO) Global Guidelines for the Prevention of Surgical Site Infection recommend against prolonged postoperative antibiotic

prophylaxis, stating that a single preoperative or perioperative dose is sufficient for most clean-contaminated surgical procedures, including maxillofacial interventions.[29] These guidelines support the principle of antimicrobial stewardship, highlighting the risks associated with antibiotic overuse and resistance.

Furthermore, the U.S. Centers for Disease Control and Prevention (CDC) also advise against extending antibiotic use beyond 24 hours after surgery for clean and clean-contaminated operations, unless there is clear clinical evidence of infection.[30] This recommendation reinforces the conclusion of this review that prolonged prophylaxis does not provide additional benefit and may, in fact, contribute to higher healthcare costs and antimicrobial resistance. Integrating these authoritative guidelines into surgical practice could standardize care globally, ensuring that maxillofacial trauma management remains both effective and aligned with broader public health priorities.

Several studies further support this recommendation by showing that postoperative continuation of antibiotic prophylaxis beyond 24 hours does not provide additional benefit in reducing surgical site infections in facial fracture repairs. While evidence on the optimal regimen remains limited, current findings consistently suggest that prolonged prophylaxis is not beneficial.[23,31-33]

Research consistently demonstrates that prolonged postoperative antibiotic prophylaxis offers no significant advantage over single-dose perioperative administration in maxillofacial surgery. Bartella et al. (2018) found no statistically significant differences in surgical site infections between patients receiving prolonged prophylaxis (5 days) versus single-shot perioperative prophylaxis in 901 consecutive maxillofacial surgery patients.[8] Similarly, Gaessler et al. (2023) reported no significant difference in infection rates or severity between single-dose and prolonged antibiotic prophylaxis groups in facial fracture patients undergoing open reduction with internal fixation.[15] Milic et al. (2020) conducted a systematic review concluding that prophylactic antibiotic use is not routinely recommended for upper or midface fractures.[7] Blatt & Al-Nawas (2019) reinforced these findings, noting that for maxillofacial trauma, antibiotic prophylaxis might reduce surgical site infections, but prolonged postoperative dosing shows no additional benefit, supporting shorter antibiotic regimens aligned with antimicrobial stewardship principles.[24]

This systematic review offers novel contributions to the plastic and aesthetic reconstruction surgery by synthesizing the most current evidence in regards to antibiotic prophylaxis in maxillofacial trauma surgery. To this day, there has not been any conclusive articles about the efficacy of antibiotic prophylaxis in maxillofacial trauma surgery. This review updates the existing body of evidence by focusing on studies published between 2023 and 2024, addressing recent advances and controversies in antibiotic prophylaxis for maxillofacial trauma surgery. This review challenges traditional practices which routinely use antibiotics post-operatively or overextends antibiotic use by choosing a more selective approach. This is in line with current antimicrobial stewardship principles, which focuses more on individualized patient care while minimizing unnecessary antibiotic exposure. The study encourages the development of patient specific prophylactic strategies based on a patient's risk factors, providing a foundation for future antimicrobial guideline development and contributing to the optimization of infection control in surgical settings.

This study has several methodological and contextual strengths. It uses the PRISMA flow diagram and the JBI Critical Appraisal Tools to assess the methodological quality of both cohort and randomized controlled trials, ensuring a robust and systematic screening process. This article addresses a

clinically significant issue, which is the role of prophylactic antibiotics in maxillofacial trauma surgery, making its findings directly relevant to surgical and infectious disease management of trauma surgery. The inclusion of varied study types and patient populations allows for a broad and representative overview of the existing evidence. Additionally, the discussion extends beyond clinical outcomes to include the implications of antibiotic overuse, which aligns this study with the broader public health objective of reducing antimicrobial resistance.

However, this study has several limitations. The literature search was primarily limited to Google Scholar due to access issues with Publish or Perish, which restricted the results to a maximum of 100 articles per search, yielding 104 relevant studies. PubMed provided only 4 relevant results, while ScienceDirect was unavailable because it requires special access to integrate with Publish or Perish. Furthermore, the included studies exhibited a high degree of heterogeneity in terms of antibiotic regimens, surgical techniques, fracture types, patient populations, and definitions of SSI, which complicated direct comparisons and reduced the generalizability of the findings. The relatively small sample sizes in several studies may have also affected the statistical power to detect differences in infection rates. Lastly, restricting the review to studies published between 2023 and 2024 may have led to the omission of relevant foundational research.

The data suggests that while preoperative prophylaxis may be justified in selected high-risk cases, routine extended antibiotic use may not be necessary and could contribute to antimicrobial resistance. Instead, prophylaxis should be tailored to high-risk patients where a clear benefit can be demonstrated. Alternative infection control strategies such as improving surgical protocols, optimizing wound care, and implementing strict aseptic techniques should also be explored as it may contribute to an even bigger role in reducing infection rates. By limiting the use of antibiotics in maxillofacial surgeries, we could potentially lower hospital costs and reduce further development of antimicrobial resistance.[26,27]

Further research is necessary to establish standardized guidelines on antibiotic prophylaxis in maxillofacial trauma surgery. A more selective approach based on patient-specific risk factors may provide better outcomes while minimizing unnecessary antibiotic exposure. Emphasis should be placed on identifying high-risk patient populations who may benefit from targeted antibiotic administration, rather than advocating for routine prophylaxis in all cases. Thus, we can ensure better patient outcomes while also addressing the pressing global issue of antibiotic resistance.

## CONCLUSION

This systematic review found limited evidence supporting the effectiveness of antibiotic prophylaxis in reducing surgical site infections (SSIs) in maxillofacial trauma surgery. Most studies reported no significant benefit, and the overall findings were inconsistent due to heterogeneity in study design, antibiotic regimens, patient populations, and definitions of SSI. Given these limitations and the small number of available studies, routine use of extended antibiotic prophylaxis cannot be recommended.

A more selective approach targeting high-risk patients may provide greater benefit while reducing unnecessary antibiotic exposure and reducing the risk of antimicrobial resistance. Future research should focus on well-designed randomized controlled trials with standardized SSI definitions and consistent antibiotic protocols to guide evidence-based clinical practice. Ultimately, optimizing antibiotic stewardship in maxillofacial trauma surgery is essential not only for improving patient safety and outcomes, but also for reducing

healthcare costs and addressing the global threat of antimicrobial resistance.

## ACKNOWLEDGMENTS

The authors express their gratitude to the Plastic Reconstructive and Aesthetic Surgeon Department at Dr. Soetomo General Academic Hospital, Surabaya, Indonesia for their valuable support.

## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

## FUNDING DISCLOSURE

This study is not funded by any party

## AUTHOR CONTRIBUTION

All of the authors have contributed to the planning, data collection and analysis, writing, and approval of this paper for the publishing stages of the research

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