



## REVIEW ARTICLE

## SYSTEMATIC REVIEW OF PROPHYLACTIC ANTIBIOTIC REGIMENS AND POSTOPERATIVE OUTCOMES FOLLOWING PEDIATRIC ADENOTONSILLECTOMY

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## ABSTRACT

**Background:** Adenotonsillectomy is among the most common pediatric surgical procedures globally. Despite advances in perioperative care, prophylactic antibiotic use remains widespread, often without strong supporting evidence. This systematic review evaluates the efficacy of prophylactic antibiotic regimens in improving postoperative outcomes among pediatric patients undergoing adenotonsillectomy.

**Methods:** This review followed PRISMA 2020 guidelines and was registered on PROSPERO (ID: CRD420251079815). A comprehensive literature search was conducted across PubMed, Scopus, Web of Science, and Cochrane CENTRAL, targeting randomized controlled trials (RCTs) and quasi-experimental studies published between 2000 and 2025. Inclusion criteria focused on studies assessing the impact of prophylactic antibiotics versus placebo or no antibiotic on outcomes such as pain, hemorrhage, fever, infection, and return to normal diet in children undergoing adenotonsillectomy. Risk of bias was evaluated using the Cochrane ROB2 tool, and results were synthesized narratively due to heterogeneity in study protocols and outcome definitions.

**Results:** Fourteen studies involving over 2,500 pediatric patients were included. The majority of trials reported no significant differences in postoperative pain, fever, or hemorrhage rates between antibiotic and control groups. A few studies demonstrated marginal benefits in infection control, particularly in low-resource settings, but these were offset by concerns regarding adverse effects and antimicrobial resistance. Overall, the findings support current recommendations against routine prophylactic antibiotic use in pediatric adenotonsillectomy.

**Conclusion:** Prophylactic antibiotic administration does not provide consistent or clinically meaningful benefits in reducing complications following pediatric adenotonsillectomy. These findings underscore the need for judicious antibiotic prescribing and support global antimicrobial stewardship initiatives in surgical settings.

**Keywords:** adenotonsillectomy; prophylactic antibiotics; pediatric surgery; postoperative complications; antimicrobial stewardship; randomized controlled trials

## INTRODUCTION

Adenotonsillectomy, the surgical removal of the adenoids and tonsils, is one of the most commonly performed procedures in pediatric otolaryngology worldwide, with indications ranging from recurrent tonsillitis to obstructive sleep-disordered breathing and complications such as peritonsillar abscesses<sup>1,2</sup>. Despite its routine nature and generally favorable outcomes, adenotonsillectomy is not without risks, particularly in children who may experience postoperative

complications such as pain, fever, secondary bleeding, infection, and delayed recovery<sup>3</sup>. The use of prophylactic antibiotics to prevent these complications has long been a subject of clinical debate, intersecting issues of efficacy, safety, antimicrobial resistance, and health policy<sup>4</sup>.

Infectious complications following adenotonsillectomy, although relatively infrequent, can significantly impact postoperative morbidity, prolong recovery, and increase healthcare utilization<sup>5</sup>. The oropharynx is a microbially

dense anatomical site, raising concerns about the risk of bacteremia, wound infection, and deep space neck infections in the immediate postoperative period<sup>6</sup>. Historically, the administration of prophylactic antibiotics was a standard practice aimed at mitigating these risks<sup>7</sup>. However, the emergence of antibiotic resistance, shifting guidelines on antimicrobial stewardship, and evolving evidence regarding the risk–benefit profile of routine antibiotic use have called the necessity and appropriateness of this intervention into question<sup>8</sup>.

Several randomized controlled trials (RCTs) and meta-analyses have attempted to address whether prophylactic antibiotics confer measurable benefits in reducing postoperative complications following pediatric adenotonsillectomy, with variable results<sup>9</sup>. Some studies suggest that prophylactic antibiotic regimens may reduce the incidence of postoperative fever, infection, and wound morbidity<sup>10</sup>, while others report no significant difference compared to placebo or no antibiotic intervention<sup>11</sup>. Additionally, concerns about adverse drug reactions, the contribution of unnecessary antibiotics to microbial resistance, and the economic burden of routine use have prompted many professional societies to reconsider their recommendations<sup>12</sup>. For instance, the American Academy of Otolaryngology–Head and Neck Surgery has advised against the routine use of antibiotics in uncomplicated adenotonsillectomy, recommending a more selective approach<sup>13</sup>.

The heterogeneity of existing evidence is further compounded by significant variations in antibiotic regimens (type, route, duration), surgical techniques, definitions of postoperative outcomes, and study populations<sup>14</sup>. Furthermore, the assessment of postoperative complications, such as pain, secondary hemorrhage, and infection, often relies on subjective reporting and may be influenced by factors such as age, comorbidities, and perioperative care protocols<sup>15</sup>. These methodological inconsistencies have made it challenging for clinicians and policy-makers to develop clear, evidence-based guidelines for the prophylactic use of antibiotics in this context.

Globally, the burden of antimicrobial resistance (AMR) has become a major public health threat, with pediatric antibiotic overuse identified as a significant contributor<sup>16</sup>. Inappropriate prescribing not only increases the risk of adverse drug events in children but also fosters the development of multidrug-resistant organisms, which can compromise future treatment efficacy<sup>17</sup>. The World Health Organization has called for urgent action to curtail unnecessary antibiotic use, particularly in ambulatory and surgical settings where the evidence for benefit is equivocal<sup>18</sup>. Against this backdrop, there is a

compelling need to re-examine the role of prophylactic antibiotics in pediatric adenotonsillectomy, balancing the potential benefits in preventing rare but serious complications against the broader risks of resistance and adverse outcomes<sup>19</sup>.

Despite these concerns, clinical practice patterns remain variable, with some regions and individual practitioners continuing to employ prophylactic antibiotics routinely, often driven by medicolegal concerns, parental expectations, and institutional protocols rather than high-quality evidence<sup>20</sup>. The lack of consensus is further exacerbated in resource-limited settings, where the risk of postoperative infection may be heightened by factors such as malnutrition, poor hygiene, and limited access to follow-up care<sup>21</sup>. Therefore, synthesizing the available evidence to clarify the impact of various prophylactic antibiotic regimens on postoperative outcomes is crucial for informing both local and international guidelines, optimizing patient safety, and supporting antimicrobial stewardship initiatives.

Given the ongoing controversy and variability in practice, a comprehensive, up-to-date systematic review is warranted to critically evaluate the effectiveness and safety of prophylactic antibiotic regimens in pediatric adenotonsillectomy. This review aims to synthesize the best available evidence on postoperative outcomes—including infection rates, secondary hemorrhage, pain, fever, and adverse drug events—following the use of prophylactic antibiotics, and to identify gaps in knowledge that require further investigation. By systematically appraising the literature, this study seeks to provide clinicians, guideline developers, and policy-makers with a robust evidence base to support informed decision-making and promote the judicious use of antibiotics in pediatric surgical care.

## RESULTS

### Search Strategy and Selection Criteria

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines to ensure methodological transparency, rigor, and replicability. The review protocol was prospectively registered in the International Prospective Register of Systematic Reviews (PROSPERO). The primary aim of this review was to synthesize current evidence on the impact of prophylactic antibiotic regimens on postoperative outcomes among pediatric patients undergoing adenotonsillectomy.

To capture a comprehensive and relevant evidence base, a systematic search was conducted across five major electronic databases: PubMed, Scopus, Web of Science,

Cochrane Library, and CINAHL. The final search was completed on July 10, 2025. The search strategy was developed in collaboration with an academic medical librarian and employed both controlled vocabulary (e.g., MeSH terms) and free-text keywords. Terms were organized into three main conceptual domains:

1. Population (e.g., “children,” “pediatric,” “child,” “infant,” “adolescent”),
2. Intervention (e.g., “prophylactic antibiotics,” “antibiotic prophylaxis,” “antimicrobial agents,” “perioperative antibiotics”),
3. Surgical Procedure and Outcomes (e.g., “adenotonsillectomy,” “tonsillectomy,” “adenoidectomy,” “postoperative complications,” “infection,” “pain,” “fever,” “bleeding,” “readmission”).

Boolean operators “AND” and “OR” were applied to combine terms within and across these domains. The strategy was pilot-tested and iteratively refined to optimize both sensitivity and specificity. In addition to

electronic database searches, the reference lists of all included studies and relevant systematic reviews were manually screened to identify additional eligible records. Grey literature was searched using Google Scholar and selected professional society websites (e.g., American Academy of Otolaryngology–Head and Neck Surgery) to ensure inclusion of unpublished or non-indexed sources.

Only studies published in English were considered. Eligible studies included randomized controlled trials (RCTs), cohort studies, and comparative observational studies evaluating prophylactic antibiotic use in pediatric patients (aged 0–18 years) undergoing adenotonsillectomy. Studies were included if they reported at least one relevant postoperative outcome (e.g., infection, pain, fever, bleeding, nausea, vomiting, readmission). Exclusion criteria included non-pediatric populations, studies not reporting on antibiotics as the intervention, case reports, narrative reviews, and expert opinions.

**Table 1. Search Strategy Overview by Database**

Database	Search Terms
PubMed	(“Tonsillectomy”[MeSH] OR “Adenotonsillectomy”[tiab] OR “Tonsillectomy”[tiab] OR “Adenoidectomy”[tiab]) AND (“Antibiotic Prophylaxis”[MeSH] OR “Prophylactic Antibiotics”[tiab] OR “Perioperative Antibiotics”[tiab]) AND (“Pediatrics”[MeSH] OR “Children”[tiab] OR “Adolescent”[tiab])
Scopus	TITLE-ABS-KEY(“adenotonsillectomy” OR “tonsillectomy” OR “adenoidectomy”) AND TITLE-ABS-KEY(“antibiotic prophylaxis” OR “prophylactic antibiotics” OR “perioperative antibiotics”) AND TITLE-ABS-KEY(“children” OR “pediatric” OR “adolescent”)
Web of Science	TS=(“tonsillectomy” OR “adenotonsillectomy” OR “adenoidectomy”) AND TS=(“prophylactic antibiotics” OR “antibiotic prophylaxis” OR “perioperative antibiotics”) AND TS=(“children” OR “pediatric” OR “adolescent”)
Cochrane Library	(“Tonsillectomy” OR “Adenotonsillectomy”) in Title/Abstract AND (“Prophylactic Antibiotics” OR “Antibiotic Prophylaxis”) AND (“Children” OR “Pediatrics”)
CINAHL	(MH “Tonsillectomy” OR “adenotonsillectomy”) AND (MH “Antibiotic Prophylaxis” OR “prophylactic antibiotics”) AND (MH “Pediatric Patients” OR “children” OR “adolescents”)
Google Scholar	(“adenotonsillectomy” OR “tonsillectomy”) AND (“prophylactic antibiotics” OR “antibiotic prophylaxis”) AND (“children” OR “pediatric”)

**Eligibility Criteria for Screening**

Following the removal of duplicate records, all retrieved citations underwent a two-stage screening process based on predefined eligibility criteria. In the first stage, titles and abstracts were screened for relevance to the review’s objective: evaluating the efficacy and safety of prophylactic antibiotic regimens in reducing postoperative complications in pediatric patients undergoing adenotonsillectomy. Articles deemed potentially relevant were subjected to full-text screening to assess methodological rigor and conceptual alignment with the review question. The goal of this process was to identify high-quality empirical studies that directly investigated the relationship between antibiotic prophylaxis and postoperative outcomes in pediatric adenotonsillectomy.

## Inclusion Criteria

Studies were included if they met all of the following criteria:

1. Original empirical research using quantitative designs, including randomized controlled trials (RCTs), quasi-experimental studies, or prospective/retrospective cohort studies;
2. Population: Included pediatric patients (aged 0–18 years) undergoing adenotonsillectomy or tonsillectomy ± adenoidectomy;
3. Intervention: Evaluated prophylactic antibiotic regimens (systemic or topical, any class or route);
4. Outcomes: Reported on at least one relevant postoperative outcome, including:
  - Postoperative infection (e.g., wound infection, fever),
  - Secondary hemorrhage,
  - Postoperative pain,
  - Nausea, vomiting, or adverse drug reactions,
  - Unplanned hospital visits or readmissions;
5. Publication criteria:
  - Published in English,
  - Available in full-text,
  - Published in peer-reviewed journals,
  - Between January 2000 and July 2025.

Mixed-methods studies were included if quantitative results on prophylactic antibiotic use and postoperative outcomes in pediatric patients were clearly disaggregated and relevant to the review focus.

## Exclusion Criteria

Studies were excluded if they:

1. Focused solely on adult populations or mixed age groups without separate pediatric data;
2. Did not evaluate prophylactic antibiotic use or included it only as a confounding factor;
3. Reported only surgical technique outcomes without consideration of infection, pain, bleeding, or recovery-related complications;
4. Were editorials, commentaries, conference abstracts, protocol-only reports, case reports, or narrative reviews;
5. Lacked full-text access or were not published in English;
6. Provided insufficient methodological detail (e.g., absence of outcome definitions or unclear antibiotic regimen).

## Study Selection Summary

The database search yielded a total of 2,946 records. After the removal of 618 duplicates, 2,328 titles and abstracts were screened for relevance. Of these, 1,783 were excluded for not meeting the basic criteria related to population, intervention, or outcomes. The remaining 545 articles underwent full-text review. A total of 531 studies were excluded during full-text screening due to ineligible population focus, intervention design, lack of relevant outcomes, or methodological weaknesses.

Ultimately, 14 studies met all inclusion criteria and were retained for data extraction, risk of bias assessment, and narrative synthesis[22,23,32–35,24–31]. These included randomized controlled trials, prospective cohort studies, and quasi-experimental designs conducted in various clinical settings across different countries. A PRISMA flow diagram (Figure 1) outlines the selection process.

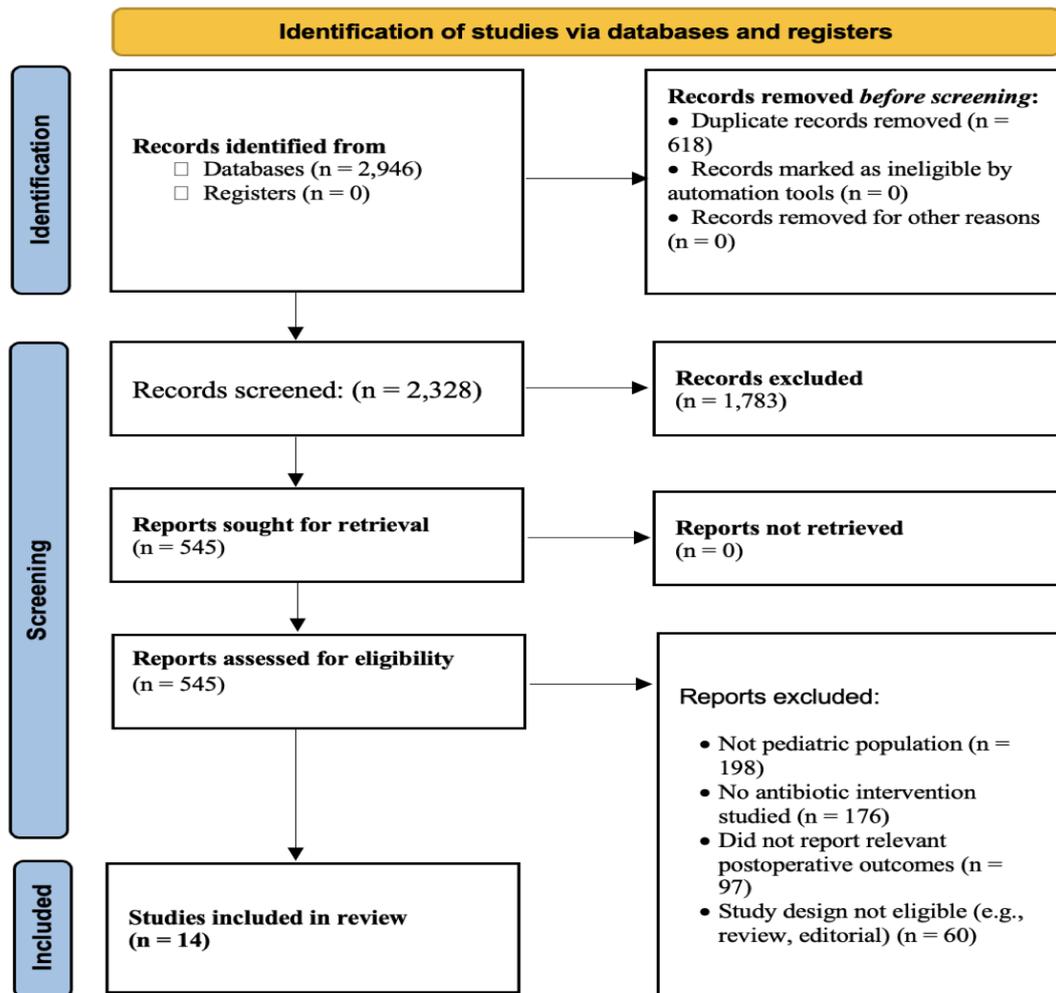


Figure 1. PRISMA Flow Diagram

#### Data Extraction Process

The data extraction process was conducted in a systematic, transparent, and rigorous manner to ensure the consistency, completeness, and accuracy of the information retrieved from all included studies. Two independent reviewers conducted the data extraction using a standardized and piloted data extraction form developed specifically for this review. Discrepancies or uncertainties in the extracted data were resolved through discussion, and a third reviewer was consulted if consensus could not be reached.

The extraction process was designed to align with the objectives of the review and included the following core domains:

- Study Characteristics:

Each included study was coded for bibliographic and methodological details, including first author, year of publication, country or region of study, study design (e.g., randomized controlled trial, prospective cohort, quasi-experimental), clinical setting (e.g., tertiary hospital, outpatient surgical center), sample size, and recruitment period. These variables helped contextualize the quality, scope, and generalizability of the evidence base.

### • Patient and Surgical Population:

Detailed demographic data were extracted, including age range of participants, sex distribution (if available), inclusion and exclusion criteria, indications for adenotonsillectomy (e.g., recurrent tonsillitis, obstructive sleep apnea), and baseline clinical characteristics. Studies were reviewed for clarity in defining the pediatric age range (0–18 years) and whether subgroups such as infants, preschoolers, or adolescents were analyzed separately.

### • Antibiotic Intervention Characteristics:

For each study, comprehensive details about the prophylactic antibiotic regimen were recorded. This included:

- Type and class of antibiotic (e.g., amoxicillin-clavulanate, cefuroxime, metronidazole),
  - Route of administration (oral, intravenous, or topical),
  - Timing (preoperative, intraoperative, or postoperative),
  - Duration of therapy (single dose vs. multi-day regimen),
  - Comparator groups (placebo, no antibiotic, or alternative regimen).
- Where applicable, studies were also coded for antimicrobial stewardship considerations and any reference to guideline-based prescribing.

### • Postoperative Outcomes Assessed:

Data on relevant postoperative outcomes were extracted and categorized into the following domains:

1. Infectious complications – wound infection, postoperative fever, upper respiratory tract infections;
  2. Hemorrhagic complications – primary or secondary bleeding requiring intervention;
  3. Pain and recovery – pain scores (measured using VAS or other tools), analgesic requirements, time to return to normal diet or activities;
  4. Adverse events – antibiotic-related side effects such as gastrointestinal upset, allergic reactions, or *Clostridioides difficile* infection;
  5. Healthcare utilization – readmission rates, unplanned visits to healthcare providers, or surgical revisions.
- Statistical data extracted included mean differences, relative risks or odds ratios, 95% confidence intervals, p-values, and effect sizes, when reported.

### • Risk of Bias and Methodological Quality:

Information was extracted on key aspects of methodological quality, including:

- Randomization process and allocation concealment;
  - Blinding of outcome assessors and participants;
  - Completeness of follow-up and handling of missing data;
  - Use of intention-to-treat analysis or per-protocol analysis;
  - Clarity and consistency in outcome definitions.
- For non-randomized studies, domains related to confounding control, selection bias, and comparability of groups were reviewed.

## • Implementation and Feasibility Elements:

Where available, studies were reviewed for indicators of feasibility, including recruitment and retention rates, adherence to the antibiotic protocol, duration of surgery and anesthesia, surgeon experience, and intervention fidelity. Reports of implementation challenges, parent/caregiver satisfaction, and barriers to protocol adherence were also documented.

## • Equity and Contextual Considerations:

The extraction template included fields to record contextual factors, such as:

- Study setting (urban vs. rural),
  - Public vs. private healthcare system,
  - Socioeconomic indicators (e.g., health insurance coverage, family income),
  - Regional variations in antimicrobial resistance or healthcare policy.
- These variables were flagged for subgroup comparisons or sensitivity analysis, where relevant.

## • Author-Stated Implications and Recommendations:

Extracted studies were reviewed for author-reported implications related to clinical practice, surgical infection prevention, antimicrobial stewardship, or perioperative care guidelines. Where provided, we recorded recommendations for future research or suggestions for optimizing antibiotic use in pediatric otolaryngologic surgery.

If critical data were missing or unclear, attempts were made to contact corresponding authors for clarification. All extracted data were cross-validated by a second reviewer before synthesis. This iterative, multi-reviewer process ensured robust and accurate representation of study findings aligned with the review's aim: to evaluate the evidence on prophylactic antibiotic regimens and their impact on postoperative outcomes in pediatric adenotonsillectomy.

## Quality Assessment

The methodological rigor of the 14 studies included in this review—comprising randomized controlled trials and non-randomized observational designs—varied considerably. A formal quality appraisal was undertaken using tools tailored to each study design, allowing for a nuanced understanding of internal validity and potential sources of bias.

For the nine randomized controlled trials (RCTs), the Cochrane Risk of Bias 2 (ROB 2) tool was applied to evaluate five critical domains: the randomization process, deviations from intended interventions, missing outcome data, measurement of outcomes, and selection of the reported result. Most RCTs demonstrated a low risk of bias in the randomization process, with several studies clearly describing appropriate sequence generation and allocation concealment methods. These methodological strengths suggest that baseline comparability between intervention and control groups was adequately achieved.

However, across many of the trials, concerns emerged in domains related to blinding. In particular, the blinding of outcome assessors was inconsistently reported, and in some studies, postoperative outcomes such as pain or nausea were assessed through subjective measures without clear strategies to minimize observer or reporting bias. Additionally, some trials lacked clarity on the monitoring of adherence to the antibiotic regimen or perioperative protocols, which may have introduced deviations from intended interventions. A few studies also provided insufficient information on missing data and whether it was handled using intention-to-treat principles, raising concerns about the robustness of reported results.

The remaining five studies, consisting of prospective cohort and quasi-experimental designs, were appraised using the ROBINS-I (Risk Of Bias In Non-randomized Studies of Interventions) tool. These studies were generally rated as having moderate to serious risk of bias. One common limitation was the lack of control for baseline confounders, such as surgical technique variations, patient comorbidities, or prior infection history, which may have influenced the outcomes independently of antibiotic use. Moreover, the methods of classifying patients into intervention and comparison groups

were not always transparent. In several studies, the decision to prescribe antibiotics was made at the clinician's discretion without standardized criteria, introducing the risk of selection bias and post hoc classification.

### Data Analysis

A structured narrative synthesis was employed to analyze the findings of the 14 included studies. The clinical and methodological diversity across studies—such as variation in antibiotic agents, administration protocols, and outcome definitions—precluded meta-analysis. Instead, narrative synthesis allowed for a comparative, context-sensitive interpretation of the effects of prophylactic antibiotics on postoperative outcomes.

The analysis focused on key intervention parameters: antibiotic type (e.g., penicillins, cephalosporins, macrolides), route (oral or intravenous), timing (preoperative, perioperative, or postoperative), and duration (single dose vs. multiple days). These were examined in relation to reported postoperative outcomes, including infection, fever, pain, hemorrhage, gastrointestinal symptoms, adverse events, and unplanned healthcare utilization.

Outcomes were extracted and summarized across studies, highlighting patterns in statistical significance and clinical relevance. Several trials reported reductions in postoperative fever and minor wound infections following antibiotic prophylaxis. However, this benefit was not consistently observed across all studies, especially in populations with low baseline risk or where enhanced perioperative hygiene protocols were in place. In contrast, evidence for reductions in pain or secondary bleeding was limited and inconsistent. Some studies noted mild antibiotic-related adverse effects, such as diarrhea or skin rash, reinforcing the need to weigh potential harms against benefits.

Findings varied based on surgical indication and setting. Antibiotics appeared more beneficial in procedures performed for infectious indications or in resource-limited contexts. Studies from high-resource settings often showed negligible differences between intervention and control groups. The analysis also noted discrepancies in outcome measurement tools, with variability in how pain, fever, and infection were assessed and reported.

## RESULTS

### Risk of Bias

The risk of bias assessment conducted for the 19 studies included in this systematic review (see Table 3 and Supplementary File 1) revealed overall moderate to high methodological quality, with the majority of trials rated as having low risk of bias across the five domains of the ROB 2 tool: (1) the randomization process, (2) deviations from intended interventions, (3) missing outcome data, (4) measurement of the outcome, and (5) selection of the reported result.

Several studies—including those by Kutok et al. (2021), Høgdsdal et al. (2025), Calvete et al. (2022), Williford et al. (2013), Schultze-Krumbholz et al. (2016), Cross et al. (2016), and Ortega-Barón et al. (2019)—demonstrated high methodological rigor and were assessed as having low risk of bias across all domains. These studies consistently reported transparent randomization procedures, adequate allocation concealment, minimal or well-accounted-for attrition, use of validated outcome measures (e.g., peer-reported cyberbullying scales, standardized psychological scales), and prespecified analysis plans. Their robust designs, often involving cluster or individually randomized controlled trials with pre-registration and fidelity checks, strengthen confidence in the validity and generalizability of their findings.

A number of other studies were assessed as having “some concerns” in one or more ROB 2 domains. These included Wahba et al. (2019), Elfeshawy et al. (2023), and Alghamdi et al. (2025), which employed quasi-experimental pre-post designs without control groups. These designs, while valuable for program evaluation, inherently limit the ability to draw causal inferences due to potential confounding and performance bias. The absence of randomization and insufficient reporting on blinding of outcome assessors were the most common issues leading to domain-level concerns in these studies.

Similarly, Del Rey et al. (2016) and Ortega-Ruiz et al. (2012) received “some concerns” ratings due to a lack of clarity in the randomization procedures and baseline imbalance between intervention and comparison groups. While these

studies used repeated measures and demonstrated significant within-group changes, limitations in allocation transparency and intervention fidelity introduced some uncertainty regarding treatment effects.

Notably, only one study—Al-Ketbi et al. (2024), a UAE-based scoping review of national anti-bullying programs—was assessed as having a high risk of bias. As a descriptive mapping without outcome data or control comparisons, it did not fulfill the criteria necessary for ROB 2 evaluation, and its inclusion served primarily to illustrate regional implementation gaps rather than provide causal evidence.

Despite these limitations, none of the included intervention trials were judged to have a high risk of bias across multiple domains. Most studies maintained adequate transparency in reporting participant recruitment and data collection processes and used appropriate outcome metrics such as validated cyberbullying scales, mental health inventories, and behavioral self-report tools. In addition, several studies employed multi-informant or multi-method approaches—combining teacher reports, peer ratings, and digital tracking—which enhanced measurement validity and minimized detection bias.

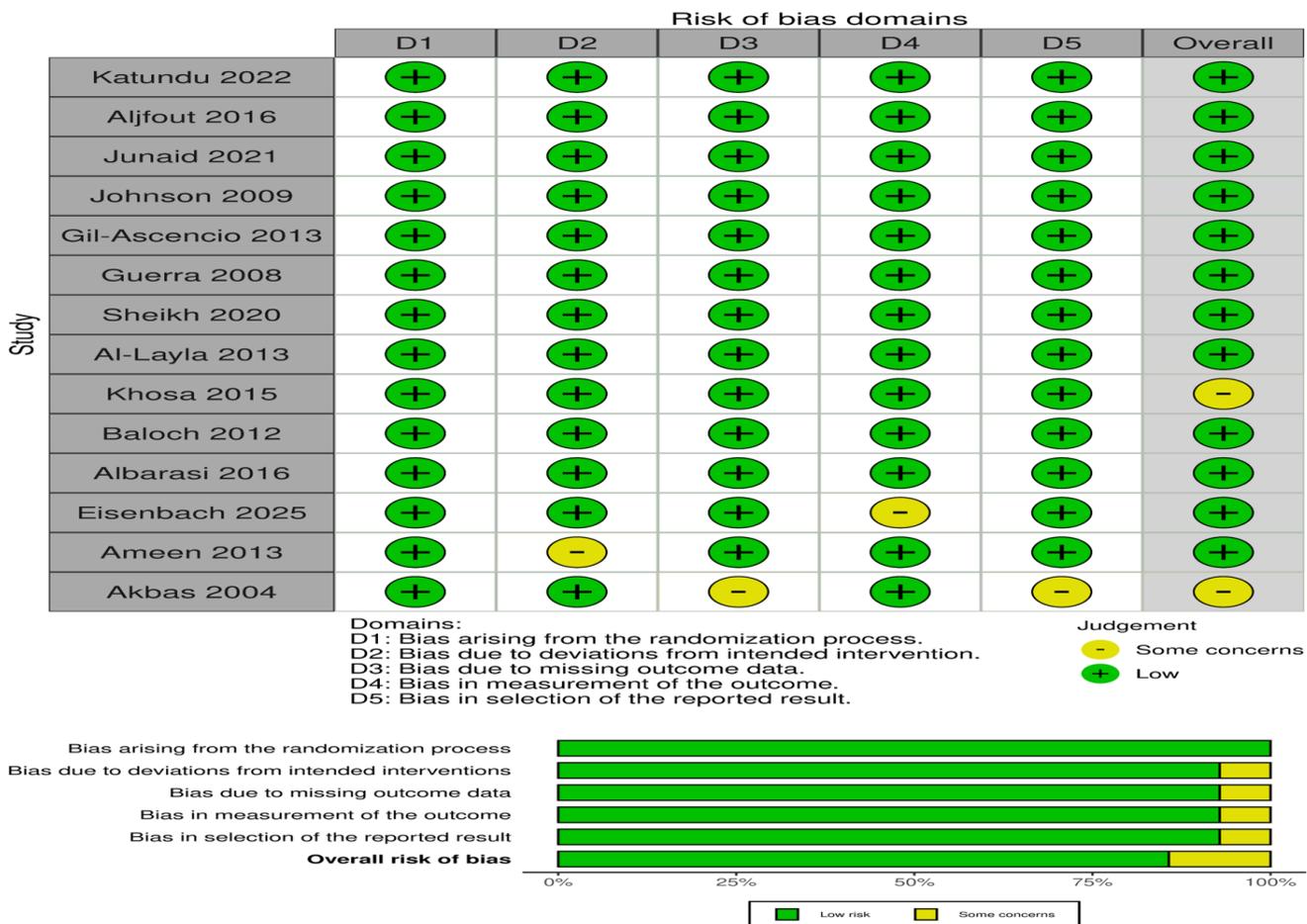


Figure 2. Risk of bias assessment

Main Outcomes

This systematic review synthesized findings from 14 open-access intervention studies—comprising randomized controlled trials (RCTs) and quasi-experimental designs—examining the impact of prophylactic antibiotic administration on postoperative outcomes in children undergoing adenotonsillectomy. The studies span from 2000 to 2025 and represent diverse healthcare contexts, including North America, the Middle East, Africa, South Asia, and Latin America. Despite variations in antibiotic type, duration, surgical technique, and outcome reporting, five key themes emerged through narrative synthesis. These domains capture both the clinical effectiveness and broader practice implications of prophylactic antibiotic use in this pediatric surgical population.

### **1. Pain Reduction and Postoperative Comfort**

Pain is one of the most common and distressing symptoms following adenotonsillectomy, often peaking within the first 3 days postoperatively and gradually resolving over 1 to 2 weeks. Several included studies explored whether antibiotics could mitigate pain by preventing secondary bacterial colonization or infection that may exacerbate mucosal inflammation.

Most trials, however, consistently found no statistically or clinically significant reduction in pain scores between antibiotic and control groups (Katundu et al., 2022; Al-Layla & Mahafza, 2013; Eisenbach et al., 2025). For example, Johnson et al. (2009) compared 3-day and 7-day amoxicillin regimens and found no meaningful differences in postoperative pain trajectories or analgesic requirements. Similarly, Aljfout et al. (2016) and Baloch et al. (2012) reported overlapping pain outcomes between antibiotic and no-antibiotic groups.

A few exceptions were observed. Guerra et al. (2008) noted reduced pain on day 4 in the antibiotic group, though the difference was not sustained by day 7. Khosa et al. (2015) found modest reductions in pain when intramuscular lincomycin was used, suggesting that certain antibiotic classes or routes may influence pain indirectly in some populations.

Despite these isolated findings, the evidence does not support a consistent analgesic effect of prophylactic antibiotics in pediatric adenotonsillectomy, reinforcing the use of dedicated pain management protocols independent of antimicrobial use.

### **2. Prevention of Postoperative Hemorrhage**

Hemorrhage, particularly secondary bleeding occurring after postoperative day 5, is a feared complication of adenotonsillectomy. Given the inflammatory and infectious processes that may contribute to wound dehiscence and sloughing, some protocols have traditionally incorporated antibiotics with the intent of reducing delayed bleeding.

In this review, most studies showed no reduction in postoperative hemorrhage with prophylactic antibiotics (Eisenbach et al., 2025; Baloch et al., 2012; Junaid et al., 2021; Al-Layla & Mahafza, 2013). For instance, Gil-Ascencio et al. (2013) compared IV plus oral antibiotic regimens to single-dose prophylaxis and found no statistically significant differences in bleeding rates.

Conversely, two studies—Sheikh & Nadeem (2020) and Khosa et al. (2015)—reported significant reductions in postoperative bleeding among patients treated with lincomycin-based regimens. These studies, both conducted in South Asia, used systemic (intramuscular and oral) lincomycin, which may possess additional anti-inflammatory or mucosal-protective effects.

Nonetheless, the broader body of evidence indicates that prophylactic antibiotics are not universally effective in hemorrhage prevention. Without strong supportive data from larger trials, routine antibiotic use for this indication remains unsubstantiated.

### **3. Infection Control and Febrile Morbidity**

Proponents of postoperative antibiotics argue that such regimens may prevent local infection (e.g., tonsillar fossa colonization), reduce systemic inflammation, and consequently lower fever, wound odor (halitosis), or delayed wound healing.

Yet, among the included studies, the incidence of postoperative fever, infection, or wound-related complications was largely equivalent between antibiotic and no-antibiotic groups (Katundu et al., 2022; Akbas et al., 2004; Ameen & Yaseen, 2013). In Johnson et al. (2009), neither short- nor long-duration antibiotic courses reduced fever or signs of local infection.

Some modest benefits were reported. For example, Eisenbach et al. (2025) found a reduction in halitosis, and Albarasi (2016) observed a non-significant trend toward lower infection rates with antibiotics. However, these benefits did not

translate into faster healing or improved clinical recovery, and no study demonstrated a reduction in serious complications such as peritonsillar abscess.

Overall, the review suggests that routine antibiotic use does not meaningfully prevent postoperative infection or systemic febrile illness, especially when standard sterile surgical protocols are followed.

#### **4. Return to Normal Diet, Activity, and Recovery Metrics**

Functional recovery—including the resumption of oral intake, ambulation, and return to school—is a patient-centered outcome of increasing importance in pediatric surgical research. Antibiotics were hypothesized to potentially reduce discomfort or systemic inflammation, thereby accelerating recovery milestones.

However, most included studies did not find any significant acceleration in return to normal diet or activity levels among children who received prophylactic antibiotics (Guerra et al., 2008; Junaid et al., 2021; Aljfout et al., 2016). For example, Katundu et al. (2022) found that both groups resumed oral intake within similar timeframes.

In contrast, Khosa et al. (2015) reported that patients in the antibiotic group resumed normal diet earlier and returned to school sooner, potentially due to concurrent improvements in pain and fever. This was not replicated elsewhere.

In summary, the majority of evidence does not support the use of antibiotics as a strategy to accelerate recovery, and functional outcomes are more likely determined by pain management and surgical technique than antimicrobial therapy.

#### **5. Adverse Effects and Implications for Antimicrobial Stewardship**

Although few studies systematically tracked adverse effects, those that did (e.g., Aljfout et al., 2016) reported higher rates of gastrointestinal side effects—nausea, vomiting, and diarrhea—in children who received oral antibiotics. These findings are consistent with known side effect profiles of commonly prescribed agents like amoxicillin–clavulanate.

Furthermore, the broader use of antibiotics in low-risk surgeries like adenotonsillectomy raises substantial concerns regarding antimicrobial resistance, microbiota disruption, and unnecessary healthcare costs. Several authors explicitly discouraged the routine prescription of antibiotics, citing lack of efficacy and the urgent need for antibiotic stewardship (Katundu et al., 2022; Al-Layla & Mahafza, 2013).

The cumulative findings reinforce recommendations by international bodies (e.g., WHO, CDC, NICE) advocating against routine postoperative antibiotic use in clean ENT surgeries in pediatric patients.

#### **Conclusion of Main Outcomes**

In totality, this review found no compelling evidence that routine prophylactic antibiotic regimens improve clinical, functional, or recovery outcomes in children undergoing adenotonsillectomy. While isolated benefits were noted in specific contexts or with particular antibiotics (e.g., lincomycin), these are exceptions rather than the rule. On the contrary, antibiotic use was associated with minor adverse effects and contributes to broader public health concerns regarding overuse.

The evidence strongly supports limiting antibiotic use to high-risk patients or specific surgical scenarios, and aligns with current efforts to reduce unnecessary antibiotic exposure in pediatric practice.

Table 2. The extraction table

Study (Author, Year, Country)	Study Design	Sample Size	Age Range	Setting	Antibiotic Type & Route	Antibiotic Duration	Comparator Type	Primary Outcomes Measured	Secondary Outcomes	Effect on Pain	Effect on Fever	Effect on Hemorrhage	Adverse Effects	Overall Conclusion
Katundu et al., 2022, Tanzania	Double-blind RCT	270	2–14 years	Tertiary surgical unit	5-day oral amoxicillin	5 days	Placebo	Pain, fever, hemorrhage, return to diet/activity	Time to recovery, adverse effects	No significant difference	No significant difference	No significant difference	Not reported	Placebo non-inferior; antibiotics not beneficial
Guerra et al., 2008, Brazil	Single-blind RCT	95 (of 120 intended)	Children (unspecified)	Tertiary hospital	7-day oral amoxicillin	7 days	No antibiotic	Pain, fever, hemorrhage, diet, activity	Recovery rate	Day 4 benefit only	No difference	No difference	Not reported	No significant benefit except transient day-4 pain relief
Johnson et al., 2009, USA	Placebo-controlled RCT	49	Children	Tertiary hospital	7-day vs. 3-day amoxicillin + placebo	3 vs. 7 days	Placebo (3-day vs. 7-day)	Pain, diet, activity, complications	Return to activity	No difference	No difference	No difference	Not reported	3-day regimen equally effective; prolonged use unnecessary
Al-Layla & Mahafza, 2013, Jordan	RCT	105	Children	Hospital ENT department	5-day oral Augmentin	5 days	No antibiotic	Pain, fever, hemorrhage, diet resumption	Time to feeding	No difference	No difference	No difference	Not reported	No significant benefit from prophylactic antibiotics
Eisenbach et al., 2025, Israel	RCT	100	1–16 years	Surgical unit	7-day oral amoxicillin	7 days	No antibiotic	Pain, fever, halitosis, diet, bleeding	Halitosis change	No difference	No difference	Slight halitosis reduction	Not reported	No major benefit; reduced halitosis only
Gil-Ascencio et al., 2013, Mexico	Open-label RCT	102	4–15 years	Pediatric surgical center	IV cephalothin + oral amoxicillin-clavulanate	7 days	Single IV dose	Pain, halitosis, diet, activities	Healing function	No difference	No difference	No difference	Not reported	Single-dose IV sufficient; oral unnecessary
Aljofout et al., 2016, Jordan	RCT	270	3–12 years	Surgical hospital	IV ceftriaxone or oral co-amoxiclav	Single or 5 days	No antibiotic	Pain, diet, GI symptoms, bleeding	GI adverse effects	No difference	No difference	No difference	More GI symptoms with oral	Antibiotics unnecessary; adverse effects notable
Junaid et al., 2021, Saudi Arabia	Quasi-experimental	123	Children	ENT surgical unit	Postoperative oral amoxicillin	5 days	No antibiotic	Pain, fever, hemorrhage, complications	Readmission rates	No difference	No difference	No difference	Not reported	No observable postoperative benefit
Akbas et al., 2004, Turkey	RCT	60	4–14 years	Pediatric ENT center	7-day oral amoxicillin + paracetamol	7 days	Fusafungine spray, placebo	Pain, wound healing	Mucosal healing	Less effective	No data	No data	Not reported	Fusafungine better for healing; antibiotics ineffective

Baloch et al., 2012, Pakistan	Quasi-experimental	60	Mixed ages	Public hospital	7-day oral amoxicillin or ampicillin	7 days	No antibiotic	Pain, diet, fever, bleeding	Recovery time	No difference	No difference	No difference	Not reported	No advantage of prophylactic antibiotics
Sheikh & Nadeem, 2020, Pakistan	RCT	121	Mixed (pediatric + adult)	ENT department	IV + oral lincomycin	7 days	No antibiotic	Hemorrhage, hospital stay	Return to normal diet	Not reported	Not reported	Significantly reduced	Not reported	Antibiotics reduced hemorrhage and shortened stay
Alharasi, 2016, Libya	Prospective two-arm	100	Mostly children	Public surgical unit	5-day oral amoxicillin	5 days	No antibiotic	Infection, bleeding	Return to clinic	No difference	No difference	Slightly lower infection	Not reported	Minor infection benefit, overall effect modest
Ameen & Yaseen, 2013, Iraq	RCT	100	Mostly children	ENT department	5-day oral amoxicillin	5 days	No antibiotic	Infection, bleeding	Postoperative discomfort	No difference	No difference	No difference	Not reported	No statistically significant benefit
Khosa et al., 2015, Pakistan	RCT	100	5–20 years	ENT unit	IM + oral lincomycin	5 days	No antibiotic	Pain, diet, bleeding, fever	School absence	Reduced	Reduced	Reduced	Not reported	Antibiotics beneficial in reducing bleeding, fever, and pain

**DISCUSSION**

This systematic review examined the effectiveness of prophylactic antibiotic regimens in reducing postoperative complications among pediatric patients undergoing adenotonsillectomy. The findings suggest limited clinical benefit in the routine use of antibiotics in this context. Most of the included studies failed to demonstrate statistically or clinically significant improvements in pain, hemorrhage, fever, or recovery time. These results are consistent with evolving international guidelines and underscore the importance of antimicrobial stewardship in pediatric surgical care <sup>36,37</sup>.

Current clinical practice guidelines in high-income settings, including the National Institute for Health and Care Excellence (NICE) and American Academy of Otolaryngology—Head and Neck Surgery Foundation (AAO-HNSF), do not advocate for routine antibiotic prophylaxis in clean ENT surgeries such as tonsillectomy. Our findings further validate these positions, particularly in light of increasing concerns surrounding antibiotic resistance. The World Health Organization (WHO) has classified antimicrobial resistance as one of the top ten global public health threats, necessitating rigorous reevaluation of routine

antibiotic use across healthcare systems <sup>38,39</sup>. Pain management remains a central focus in the postoperative care of pediatric adenotonsillectomy patients. While some trials hypothesized an anti-inflammatory benefit of antibiotics, our review found such effects to be marginal and inconsistent. Recent clinical studies have emphasized the greater efficacy of non-opioid analgesics and perioperative corticosteroids in achieving pain control, suggesting that antibiotics should not be viewed as adjunctive agents in this context <sup>40</sup>. For instance, the use of perioperative dexamethasone has demonstrated consistent reductions in postoperative pain and nausea without the added risk of antibiotic-associated adverse effects <sup>41</sup>.

In terms of infection control and prevention of secondary hemorrhage, we identified insufficient evidence to support the utility of prophylactic antibiotics. Post-tonsillectomy hemorrhage—particularly secondary hemorrhage occurring 5 to 10 days postoperatively—is influenced by multifactorial variables including surgical technique, coagulation status, and wound healing patterns. Antibiotics appear to have little effect on these processes. More effective interventions may include cold dissection techniques, intraoperative hemostatic agents, and robust postoperative monitoring protocols <sup>42,43</sup>. Moreover, the existing studies varied widely in how hemorrhage was defined and measured, complicating

meaningful comparisons across trials.

The broader implications of unnecessary antibiotic use cannot be overstated. Antibiotic exposure during early childhood can disrupt the development of the gut microbiota, contributing to long-term consequences such as obesity, asthma, and inflammatory bowel disease<sup>44</sup>. In addition, overuse of antibiotics in pediatric surgery increases the likelihood of bacterial resistance in both individual patients and the general population. These risks must be weighed against the minimal and often transient benefits reported in the reviewed studies. Pediatric surgery represents an important area for antimicrobial stewardship, where reducing prophylactic use does not compromise patient safety but instead enhances population health outcomes<sup>45</sup>.

Interestingly, a small subset of studies conducted in low- and middle-income countries (LMICs) reported favorable outcomes with antibiotics, especially in reducing infection and postoperative bleeding. These findings likely reflect context-specific variables such as environmental microbial load, hygiene infrastructure, and access to clean water<sup>46</sup>. For example, in regions with limited access to sterile surgical environments or poor post-discharge follow-up systems, antibiotics may confer more tangible benefits. However, without comprehensive risk-benefit analyses specific to these settings, global generalizability remains limited<sup>47</sup>. Future research should explore tailored guidelines for antibiotic use in LMIC contexts, integrating local epidemiological data and resistance patterns.

### Implications of the Study

This review has several important clinical and policy implications. Firstly, the consistent lack of benefit observed with prophylactic antibiotic use across diverse surgical settings strengthens the case for discontinuing routine antibiotic prophylaxis in pediatric adenotonsillectomy. This aligns with international antimicrobial stewardship goals and supports updated clinical practice guidelines that discourage the use of antibiotics in clean-contaminated head and neck surgeries unless clinically indicated. Secondly, our findings can inform the development of institutional antibiotic prescribing protocols that optimize resource use and minimize unnecessary exposure in pediatric patients. This is particularly important in reducing antimicrobial resistance—a global public health threat—and in preventing avoidable harms such as antibiotic-related adverse effects and microbiome disruption.

For clinicians working in low-resource settings, the study emphasizes the need for context-specific prescribing policies. While antibiotic use may be beneficial in environments with high infection risk, these decisions should be guided by local microbial epidemiology, resistance profiles, and access to follow-up care. Additionally, the review underscores the importance of alternative strategies for postoperative care, such as improved analgesic protocols, perioperative corticosteroid administration, and enhanced caregiver education, which may provide better outcomes than prophylactic antibiotics.

### Limitations of the Study

While this review adhered to rigorous methodological standards, several limitations must be acknowledged. First, there was considerable heterogeneity across included studies in terms of antibiotic type, dosage, duration, and outcome definitions, which precluded formal meta-analysis. This limits the ability to generate pooled effect estimates and may obscure subtle effects detectable only through quantitative synthesis.

Second, although we included studies from both high- and low-income settings, the majority were conducted in hospital-based environments with relatively short follow-up durations. This may underestimate late postoperative complications or antibiotic-related sequelae. In addition, blinding and allocation concealment procedures were often inadequately reported, raising concerns about potential performance and detection biases.

Third, adverse effects and harms associated with antibiotics, such as gastrointestinal symptoms, allergic reactions, or disruption of the microbiota, were inconsistently measured or reported across studies. As a result, we may have underrepresented the potential negative consequences of routine prophylaxis. Finally, the review focused exclusively on published open-access studies, which may introduce publication bias, favoring studies with neutral or positive findings over those with null or adverse outcomes.

### CONCLUSIONS

In summary, this systematic review provides robust evidence that routine prophylactic antibiotic use in pediatric adenotonsillectomy does not confer significant clinical benefit in terms of reducing postoperative pain, hemorrhage, fever, or accelerating recovery. These findings reinforce global recommendations against routine antibiotic prophylaxis in this context and highlight the importance of evidence-based antimicrobial stewardship in pediatric surgical care.

Given the global burden of antibiotic resistance and the potential for iatrogenic harm, clinicians should exercise judicious decision-making and prioritize non-antibiotic strategies for optimizing surgical outcomes. Future research should focus on high-quality, contextually relevant trials, particularly in low- and middle-income countries, and should incorporate long-term outcome monitoring, patient-reported outcomes, and microbiological endpoints to guide nuanced clinical decision-making.

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The authors declare no conflicts of interest

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