

The Analysis Study of Risk of Complication Post Tonsillectomy in Children : A Comprehensive Systematic Review

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ABSTRACT

Background: This study aims to provide a comprehensive regarding possible postoperative complications following tonsillectomy in children, highlighting how various interventions and preoperative measures can influence outcomes and postoperative recovery. **Methods:** Following PRISMA 2020 guidelines, this systematic review focused exclusively on full-text articles published in English between 2014 and 2024. **Result:** The study conducted a comprehensive review of over 100 publications sourced from reputable databases, including ScienceDirect, SagePub, and PubMed. Following an initial screening, eight publications were identified as warranting more in-depth analysis. Consequently, a thorough review of these selected studies was performed to ensure a detailed and rigorous evaluation. **Conclusion:** The tonsillar lodge is crucial for children's health, but postoperative complications can arise in various forms. Despite advancements in anesthesia, challenges remain due to the surgical environment. Infectious and traumatic complications are prevalent, requiring timely detection and intervention. Timely detection and intervention are essential to optimizing patient outcomes and addressing these potential issues effectively.

Keyword: children, tonsillectomy, postoperative complication

INTRODUCTION

A tonsillectomy refers to the surgical removal of the tonsil, including its capsule, in children to treat conditions like persistent throat infections and sleep-related breathing disorders.¹ This procedure, often performed with adenoidectomy, is considered a straightforward surgery with minimal risk of respiratory complications. However, certain predispositions, such as children under 3, those with airway abnormalities, Down syndrome, blood clotting irregularities, neuromuscular disorders, and pronounced obstructive sleep apnea, are at higher risk.² Other potential complications include bleeding, pain after the operation, and postoperative nausea and vomiting.^{2,3}

Approximately 2% of patients experience perioperative morbidity following tonsillectomy. The literature reports an overall incidence of post-surgical problems ranging from 8% to 14%.⁴ Conversely, postoperative mortality stands at a rate similar to that of general

anesthesia alone, with one death per 10,000-35,000 cases.⁵ During the year of 1999-2001 in Italy, the recorded mortality rate was one death per 95,000 individuals. Nevertheless, acquiring precise statistics on actual mortality from scientific literature and news reports is a challenge.⁵ The hemorrhagic incidence in children is a significant concern, with an overall incidence ranging from 0.5% to 24%.⁶ The risk of hemorrhagic complications is influenced by anesthesia and hemorrhage, with children under six years of age having a three-fold lower bleeding risk than those over six. Males have a 1.3-fold higher hemorrhagic risk rate than females. Different diagnoses present different intrinsic risks, with patients undergoing surgery for adenotonsillar hypertrophy showing a lower bleeding risk compared to those undergoing surgery for recurrent infections.⁷ Cold instruments are associated with a lower bleeding risk (1.2%) than electrocauterization techniques (6%).⁵

A study comparing the effects of dexamethasone dosage on postoperative symptoms in children with tonsillectomy (TT) found that children given dexamethasone experienced less vomiting post-surgery, quicker oral intakes, and diminished throat pain.⁸ The study also found that radiofrequency surgery, compared to traditional tonsillectomy (TE), led to faster recovery, reduced pain, and similar benefits for snoring and infections.⁹ Both methods enhanced sleep patterns, behavior, and overall life quality. The findings suggest that dexamethasone before surgery effectively minimizes postoperative issues in children undergoing TT.^{8,9}

Children who receive outpatient narcotic prescriptions post-tonsillectomy experience fewer readmissions and less pain compared to those who don't. Carr et al found that 60.9% of patients were prescribed narcotics, with fewer readmissions.¹⁰ Klemetti et al's study found that preoperative counseling and enhancing fluid intake could reduce postoperative complications. While both groups experienced

increased pain and nausea post-surgery, those who received counseling seemed better prepared to cope with postoperative symptoms. Pre-surgery counseling could potentially reduce pain and strengthen children's resilience to post-surgery symptoms.¹¹ Overall, the pros and cons of narcotics for children post-tonsillectomy are minimal.^{10,11}

This study aims to provide a comprehensive review regarding possible postoperative complications following tonsillectomy in children, highlighting how various interventions and preoperative measures can influence outcomes and postoperative recovery.

METHODS

Protocol

The investigation was carried out with scrupulous conformity to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 criteria, guaranteeing strict respect to accepted methodological principles. Strictly following PRISMA 2020 standards demonstrates a dedication to improving the clarity, replicability,

and systematic thoroughness of the review process. The study incorporated thorough methodologies for conducting literature searches, extracting data, and synthesizing findings. These methods were well implemented to minimize biases and guarantee the strength of the conclusions.

Criteria for Eligibility

The present study offers a comprehensive examination of the studies undertaken throughout the last ten years about the potential for complications in pediatric patients undergoing tonsilectomy. Through the methodical examination and integration of data from other studies, this research seeks to clarify patterns and guide the improvement of patient care approaches for this group with multiple health conditions.

The main aim of this thesis is to highlight important themes that arise from a wide range of scholarly literature, therefore enhancing our awareness of the postoperative complications of tonsilectomy in children. In order to guarantee the thoroughness and precision of the

study, strict criteria for inclusion and exclusion were implemented. Only English-language peer-reviewed papers published from 2014 to 2024 were considered suitable for inclusion. Materials eligible for inclusion must also possess a DOI for the purpose of confirming their authenticity. In order to preserve the focus and integrity of the dataset, the analysis in question deliberately omitted non-research materials, including reviews, editorials, and duplicate entries from the same publication.

The systematic methodology employed in this study guarantees that the data used is both pertinent and trustworthy, therefore establishing a strong basis for deriving significant findings and progressing clinical practice.

Search Strategy

We used "tonsilectomy OR tonsilectomy surgery OR children" as keywords. The search for studies to be included in the systematic review was carried out using the PubMed, SagePub, and Sciencedirect databases.

Data retrieval

The authors conducted a thorough preliminary review of each article by examining its abstract and title to assess relevance before proceeding with a more detailed investigation. Only studies that aligned with the study's objectives and met the predefined inclusion criteria were considered for further review. This method allowed for the identification of a clear and consistent pattern across the research.

Full-text articles were restricted to those published in English to maintain consistency in the language of the studies. A rigorous screening process was applied to select content that was directly relevant to the study's focus and adhered to all established inclusion criteria. Articles not meeting these criteria were systematically excluded from further analysis and not included in the final evaluation.

The evaluation process included a comprehensive review of

various factors such as study design, titles, authors, publication dates, research locations, and methodologies. This meticulous approach ensured that the content analyzed was of the highest relevance and quality, thereby strengthening the overall findings of the study.

Quality Assessment and Data Synthesis

The authors performed a meticulous review of each article's abstract and title to identify those deserving further investigation. After this initial screening, all relevant documents underwent a comprehensive examination. The results of this evaluation guided the selection of review papers, ensuring that only the most pertinent studies advanced to detailed analysis. This rigorous approach streamlined the selection process and facilitated a thorough and nuanced assessment of the existing research and its context.

Table 1. Search Strategy

<i>Database</i>	<i>Search Strategy</i>	<i>Hits</i>
Pubmed	<i>("tonsilectomy" OR "tonsilectomy surgery" AND "children")</i>	7
Science Direct	<i>("tonsilectomy" AND "children")</i>	79
Direct		
Sagepub	<i>("tonsilectomy" AND "children")</i>	17

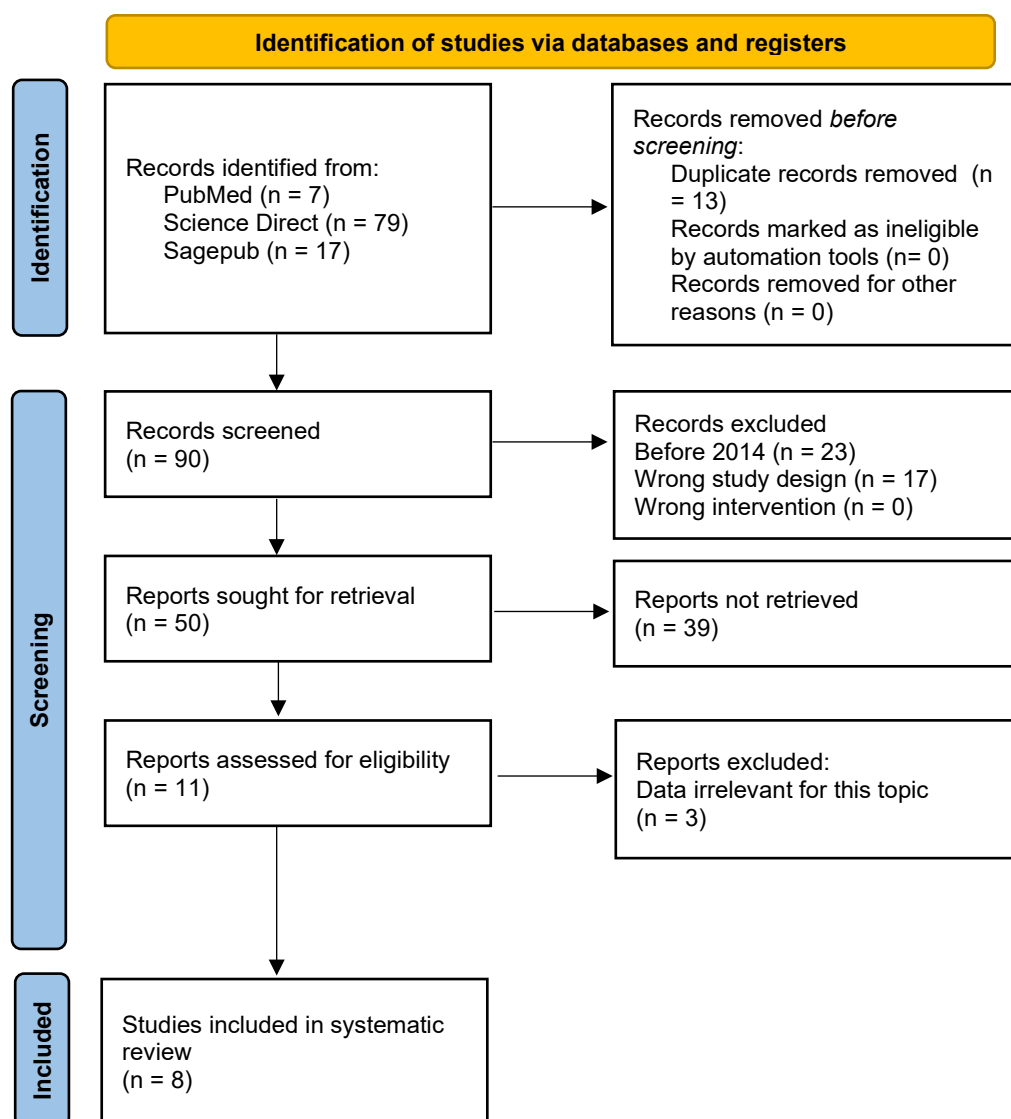


Figure 1. Article search flow chart

Table 2. Critical appraisal of Study

Parameters	(Amoi ls et al., 2016)	(Byar s et al., 2018)	(Susa man., 2018)	(Gehr ke et al., 2019)	(Katz et al., 2020)	(Vecchi a et al., 2020)	(Aldre ss et al., 2022)	(Sharm a et al., 2024)
1. Bias related to temporal precedence								
Is it clear in the study what is the “cause” and what is the “effect” (ie, there is no confusion about which variable comes first)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Bias related to selection and allocation								
Was there a control group?	No	Yes	No	No	No	No	No	No
3. Bias related to confounding factors								
Were participants included in any comparisons similar?	No	No	No	No	No	No	No	No
4. Bias related to administration of intervention/exposure								
Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	Yes.	Yes.	Yes.	Yes.	Yes.	No.	Yes.	Yes.
5. Bias related to assessment, detection, and measurement of the outcome								
Were there multiple measurements of the outcome, both pre and post the intervention/exposure?	No	No	No	No	No	No	No	No
Were the outcomes of participants included in any comparisons measured in the same way?	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Were outcomes measured in a reliable way?	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
6. Bias related to participant retention								
Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?	No	Yes	No	No	No	No	No	No
7. Statistical conclusion validity								
Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes

RESULT

We initiated the investigation by systematically gathering a significant assortment of papers from reputable sources such as Science Direct, PubMed, and SagePub. After a thorough three-stage screening process, we selected eight papers that were considered very pertinent to our ongoing systematic inquiry. Subsequently, we selected certain topics for further examination and meticulously evaluated each report. In order to expedite our study, we have included a concise summary of the evaluated information in Table 3.

Table 3. The literature included in this study

Author	Origin	Method	Sample	Result
Amoils et al.¹² (2016)	USA	Retrospective Study	115,214 participants	A study involving 18622 inpatients and 96,592 ambulatory patients found that inpatients had higher comorbidities and complication rates than those in ambulatory settings. Tonsillectomy and adenoidectomy were associated with increased risk for all complication types, with respiratory complications being more common in ambulatory settings. Inpatients aged 0 to 9 years experienced higher rates of airway and respiratory complications.
Byars et al.¹³ (2018)	Denmark	Cohort	Over 1 million participants	The study involved 1189061 children, with 48% female. Adenoidectomy and tonsillectomy increased the relative risk of upper respiratory tract diseases by 2- to 3-fold. Adenotonsillectomy increased the risk of infectious diseases by 17%, resulting in an absolute risk increase of 2.14%.
Susaman et al.¹⁴ (2018)	Turkey	Retrospective Study	892 patients	The overall PTH rate was 5.6%, with all instances

				being secondary. There was no significant difference in age, sex, post-operative time, bleeding management, or hospital stay between adult and pediatric cases. However, there was a significant difference in surgical indication and timing of PTH (primary or secondary).
Gehrke et al.¹⁵ (2019)	Germany	Retrospective Study	2000 patients	Postoperative complications in children requiring adenotonsillectomy are influenced by risk factors such as young age, low body weight, obstructive sleep apnoea, and pre-existing disorders. Identifying these patients early and monitoring them postoperatively can reduce unnecessary monitoring and complications.
Katz et al.¹⁶ (2020)	Canada	Retrospective Study	374 participants	A study of 374 children found that comorbidities, sleep-disordered breathing, and perioperative respiratory adverse events (PRAEs) were more common in children with craniofacial, genetic, cardiac, airway anomaly, or neurological conditions, AHI ≥ 5 events/h, and oxygen saturation nadir $\leq 80\%$ on preoperative polysomnography.
Vecchia et al.⁵ (2020)	Italy	Review	-	Pediatric age patients often undergo adenotonsillectomy procedures, despite a decrease in number.

				Advancements in surgical techniques and anesthesia have made this procedure less risky, but it's important to address potential adverse events and complications that can arise during this procedure.
Aldress et al.¹⁹ (2022)	Saudi Arabia	Retrospective Study	713 patients	Post-tonsillectomy bleeding is a significant risk factor in children, occurring in only 5.3% of tonsillectomies. Age, sleep disorder, and longer hospital stay after tonsillectomy are significant risk factors. This study highlights the importance of understanding these factors in managing post-tonsillectomy bleeding.
Sharma et al.³ (2024)	India	Retrospective Study	100 patients	The study showed no significant correlation between gender and postoperative complications in tonsillectomy patients, indicating a low phi coefficient. Postoperatively, 49.11% experienced no issues within 7 days, while common problems included pain/discomfort, nausea/vomiting, and secondary hemorrhage.

DISCUSSION

The tonsillar lodge has a rich blood supply primarily from the external carotid artery, with key vessels including the tonsillar artery, ascending palatine artery, and ascending pharyngeal artery. These vessels branch from the lingual artery or the external carotid artery, supplying arteriolar branches that penetrate the pharyngeal constrictor muscle and tonsillar parenchyma. Venous drainage occurs through a plexus connected to the pharyngeal plexus, while innervation comes from the tonsillar plexus, formed by the lingual and glossopharyngeal nerves.^{5,7}

Postoperative hemorrhages can be classified by timing into immediate, delayed, and late. Immediate hemorrhages typically result from inadequate intraoperative hemostasis, such as poor cauterization, flawed arterial ligation, or accidental detachment of ligation snares. Secondary hemorrhages occur within two weeks of surgery, commonly between the 6th and 10th days, but can happen up to 55 days

later. Patients with coagulation deficiencies or thrombocytopenia require proper therapy or prophylaxis to prevent bleeding complications.^{18,19} Late or secondary hemorrhages typically occur between the 6th and 10th postoperative day, often due to eschar falling or inappropriate postoperative behavior. Potential causes include vascular disruptions such as local necrosis, abnormal vessels from the carotid arteries, arterial loops, traumatic pseudoaneurysms, septic arteritis, or exposure of major vessels like the facial or lingual arteries. Despite the low overall incidence, such hemorrhages can be serious emergencies. Even minor recurrent bleeding should be taken seriously, and patients with any bleeding episode should be hospitalized.¹⁸

Recent advancements in anesthesia have improved safety across various procedures, including tonsillectomy. Nonetheless, challenges persist due to the close working environment of anesthesiologists and otolaryngology surgeons. This can lead to accidental displacement, bending, or bumping of the

endotracheal tube during surgery, potentially causing hypoventilation or extubation. Consequently, respiratory complications may arise from factors such as blood aspiration (blood ab ingestis), irritative laryngeal spasm during hemorrhage, delays or difficulties with orotracheal intubation, severe obstructive sleep apnea (OSAS), obesity, and the effects of drugs like promethazine and morphine, which can induce respiratory depression, apnea, contractions, and even cardiac arrest.^{5,18}

Infectious complications following tonsillectomy are now relatively rare, though literature reports an incidence ranging from 6% to 41%, particularly higher in children with recurrent acute otitis media or pharyngotonsillitis.²⁰ Transient bacteremia is more common, with *Haemophilus influenzae* being the most frequently isolated pathogen, although *Streptococcus viridans*, *Streptococcus pneumoniae*, and *Staphylococcus aureus* also appear with notable frequency in blood cultures. Minor complications include pneumonia and urinary tract

infections, while major complications, though rare, can involve meningitis, cerebral abscess, sepsis, and osteomyelitis at distant sites.^{21,22} Cervical osteomyelitis, resulting from the spread of infection through cervical planes, blood vessels, or the lymphatic system, can also occur postoperatively. Additionally, internal jugular vein thrombosis, or Lemierre Syndrome, has been reported, often originating from thrombosis in the tonsillar vein and potentially spreading to the internal jugular vein and occasionally to the cavernous sinus.⁷

Traumatic complications following tonsillectomy are more common than previously thought and typically result from patient positioning, inadequate tools, faulty electrical insulation, improper heat transfer, or operator errors. The most frequent issues include Grisel syndrome, characterized by subluxation or displacement of the atlantoaxial joint (C1 on C2), which is more common in children with Down syndrome due to increased ligament laxity^{23,24}; perforation of the posterior tonsil pillar, velar, or velopharyngeal

injury; dental trauma involving rupture, dislocation, or avulsion of teeth; dislocation of the temporomandibular joint; tongue hematoma; and pseudoaneurysm of the lingual artery, or less frequently, of the external or internal carotid arteries.²⁵⁻²⁷ Late surgical trauma complications may include rhinolalia, velar insufficiency often associated with dysphagia nasal regurgitation of food, and oropharyngeal stenosis.²⁸

Hematological and metabolic complications are exceptionally rare,

as are neurological issues. When they do occur, neurological complications may include dysgeusia or deficits in the hypoglossal or lingual nerves, often resulting from surgical or anesthetic maneuvers. Although these complications are uncommon, it is crucial to be vigilant and recognize them early to enable prompt diagnosis and effective treatment. Awareness of these potential issues can significantly improve patient outcomes by ensuring timely intervention.^{26,28}

Table. 4 Complications categorized based on the timing of their occurrence.⁵

Immediate onset	Medium onset	Late onset
Anesthesiological: 1. Cardiac-circulatory arrest 2. Hypoventilation 3. Intoxication 4. Ab ingestis during haemorrhage 5. Acute pulmonary oedema	Velo-pharyngeal insufficiency: 1. Palatine veil injury 2. Tonsil pillar injury 3. Uvular injury	Chronic pharyngitis
Hemorrhagic: 1. Primary (within 24 h) 2. Secondary (after 24 h)	Voice alterations: 1. Post-surgical pain 2. Vocal resonance apparatus modifications 3. Velo-pharyngeal incontinuity	Facial pain and dysphagia due to ossification of the stylohyoid ligament (Eagle's syndrome)
Oral cavity lesions: 1. Uvular oedema 2. Tongue ecchymosis and oedema 3. Dental avulsion 4. Mouth or lip burn 5. Temporomandibular joint dislocation 6. Mandibular condyle fracture	Neurological complications: 1. Dysgeusia 2. Glossopharyngeal nerve palsy 3. Facial nerve palsy 4. Horner's syndrome	
Local infections: 1. Neck lymph node suppuration or phlegmon 2. Paratonsillar cellulitis 3. Retro/parapharyngeal abscess	Compensatory hypertrophy of the remaining lymphatic tissue (lingual tonsil)	
Regional infections: 1. otitis 2. sinusitis 3. epiglottitis 4. pneumonia	Emotional trauma	
Subcutaneous emphysema or pneumomediastinum		
Grisel's syndrome		

CONCLUSION

The tonsillar lodge plays a crucial role in children's health, but postoperative complications can arise in various forms: immediate, delayed, or late. Despite advancements in anesthesia that have enhanced safety, challenges remain due to the intricacies of the surgical environment. Infectious complications, though relatively rare and occurring in 6% to 41% of cases—particularly in children with recurrent acute otitis media or pharyngotonsillitis—are still a concern. Traumatic complications, such as Grisel syndrome, dental injuries, and neurological issues, are more prevalent than once believed. Timely detection and intervention are essential to optimizing patient outcomes and addressing these potential issues effectively.

DISCLOSURE STATEMENT

Disclosure Statement : The authors have no conflicts of Interest to declare.

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