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Original Research Article

Ninety-day emergency department rebound following pediatric tonsillectomy: a retrospective cohort study

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ABSTRACT

Background: Tonsillectomy is a very common pediatric surgical procedure. Post-operative complications such as hemorrhage, nausea, and dehydration frequently result in emergency department (ED) visits, leading to increased healthcare resource utilization. Understanding the patterns and predictors of post-tonsillectomy ED visits is crucial for developing strategies to improve care and reduce unnecessary healthcare burden.
Methods: A retrospective cohort study was conducted using administrative datasets to analyse province-wide ED visits within 90 days post-discharge following pediatric tonsillectomy. The study included all pediatric patients (<16 years) who underwent total or partial tonsillectomy at the pediatric health centre between April 1, 2016, and March 31, 2022. The first ED visit post-operation was categorized as either "surgical" or "medical" based on the presenting concern.
Results: A total of 702 ED visits from 527 unique patients were analyzed. The surgical ED rebound rate was 9.6%, with all surgical visits occurring within the first 30 days post-discharge. The most common reasons for surgical ED presentations were pain (20.3%), hemorrhage (14.0%), and nausea/vomiting (5.1%). Notably, 50.9% of surgical ED visits were classified as potentially preventable.
Conclusions: Post-tonsillectomy complications significantly contribute to pediatric ED visits, with pain and haemorrhage being the most frequent concerns. More than half of surgical ED visits did not require admission, suggesting that these visits could be mitigated through improved caregiver education, standardized analgesic regimens, and enhanced outpatient follow-up. Future interventions, including telemedicine, wearable monitoring, and AI-powered patient engagement tools, may reduce preventable ED utilization and optimize post-operative recovery.

Keywords: Pediatric, Tonsillectomy, Complications, Pain, Bleeding, Emergency department, Rebound

INTRODUCTION

Adenotonsillectomy is one of the most prevalent surgical interventions in pediatric patients, primarily warranted for recurrent infections and sleep-disordered breathing.[1-3] Given the sheer volume of these procedures, the healthcare system can bear a significant burden in managing any ensuing complications.[1,2,4-6] Well known complications include hemorrhage, pain, nausea, vomiting, and respiratory distress, often leading to diminished oral intake and subsequent dehydration.[1,3-5,7] All post-operative complications have been associated with emergency department (ED) visits with some leading to heightened readmission rates as high as 7.8%, underscoring the importance of comprehensive post-operative care.[1,7,8] Existing research has focused on the critical role of standardized analgesic protocols in ensuring adequate pain management, thereby mitigating

pain-related complications that contribute substantially to ED visits.[1,7] This is particularly important in the pediatric population, as poorly managed postoperative pain disrupts physiological and psychological functions, leading to reduced oral intake, sleep disturbances, anxiety, and behavioral changes.[2,3,9,10] Other studies have shed light on the significance of surgical technique, particularly in relation to post-tonsillectomy hemorrhage and pain, with findings suggesting that the use of cold techniques, or performing tonsillotomy over tonsillectomy, may correlate with lower complication rates.[1-3,11] However, there remains a notable gap in understanding the specific landscape of pediatric post-tonsillectomy ED visits within Canada's publicly funded healthcare system. To address this, our study aims to comprehensively evaluate ED visits within 90 days following tonsillectomy over a 6-year period. As the first of its kind in the Canadian healthcare context, this research endeavors to provide valuable insights into the patterns and factors influencing pediatric post-tonsillectomy emergency care utilization.

METHODS

Study design

A retrospective cohort study was performed through electronic chart review to assess ED visits in Nova Scotia's Central Zone in the 90-day post-discharge period following pediatric total/partial tonsillectomy +/- adenoidectomy at the IWK Health (University Hospital in Halifax, Nova Scotia). This study received approvals and waiver of consent from the Nova Scotia Health (NSH) Quality Improvement Office and the NSH Ethics Office as exempt from Research Ethics Board review to allow collection, publication, and presentation of data (#1028137).

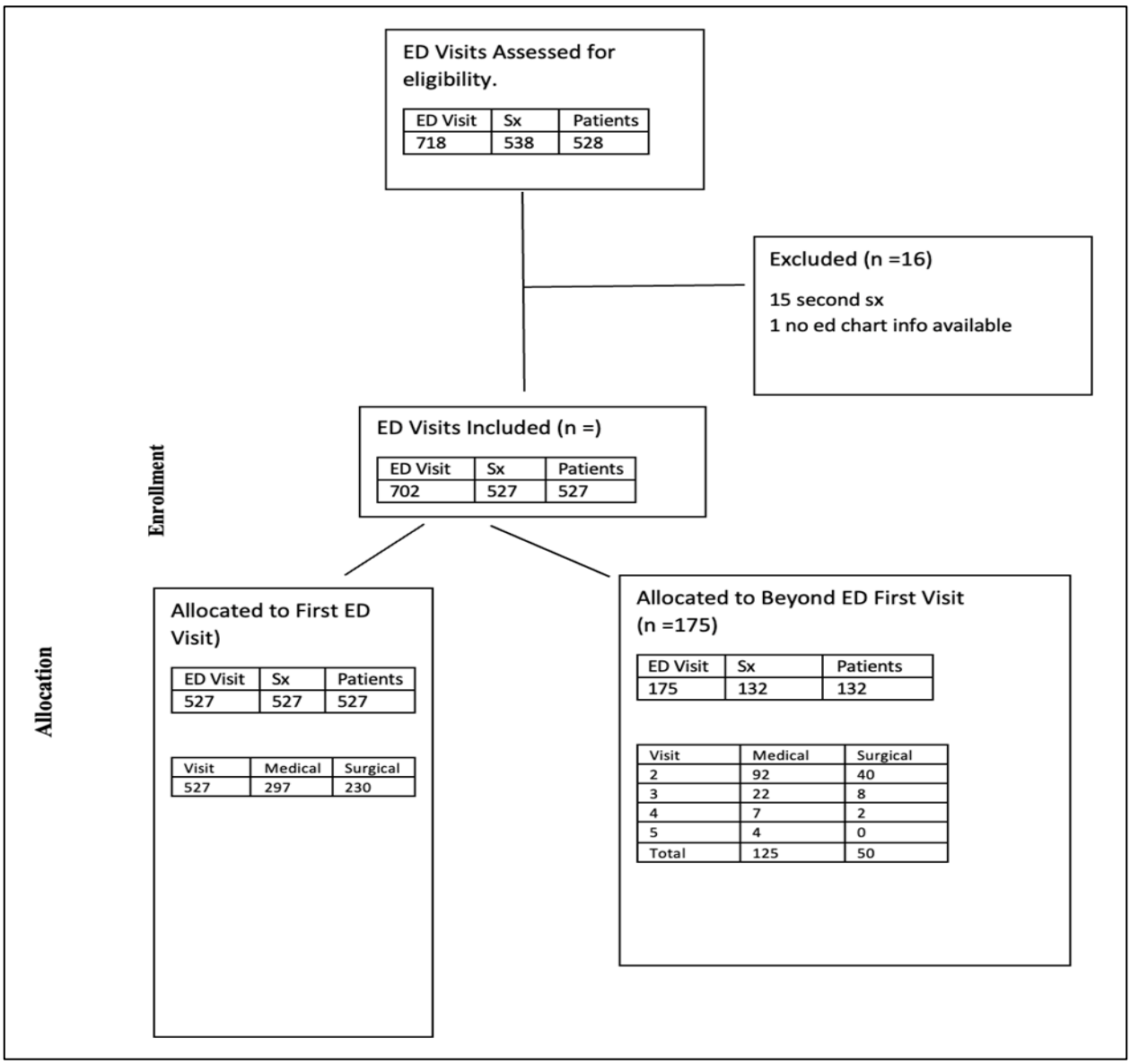

Figure 1: Patient flow based on emergency department visits.

Inclusion criteria

All pediatric patients (<16 years of age) who underwent a primary procedure of tonsillectomy +/- adenoidectomy at the study institution, regardless of indication, with an ED visit anywhere in the province within 90-days post-discharge were included. Surgery inclusion dates were April 1, 2016-March 31, 2022, with the ED visit dates extended from April 1, 2016-June 29, 2022, to allow a 90-day post-discharge window. Tonsillectomy patients were identified using NSH administrative datasets Discharge Abstract Database (DAD) and the National Ambulatory Care Reporting System (NACRS) who had a primary procedure Canadian Classification of Health Intervention (CCI) code of 1FR59JAGX, 1FR78DAAB, 1FR87LA,1FR89LA, and 1FR89WJ.[12] Only patients with a valid Nova Scotia health card were included in this study, as out-of-province residents may have visited an ED in their home province (e.g., New Brunswick or Prince Edward Island). Patients who underwent laser/robotic procedures or tonsillectomy with resection of other oropharyngeal subsites were excluded.

Data collection

A standardized electronic data collection form was developed in REDCap (Research Electronic Data Capture) prior to beginning the chart review.[13] The charts of all pediatric patients who were seen in an ED across the entire province of Nova Scotia were reviewed. Patient age, sex, primary care status, and Charlson comorbidity score were collected to demographically describe the cohort.[14] Patient's residence categorization of urban or rural was determined by Canada Posts Corporation (CPC) postal code designation of second digit equal to zero classified as "rural."[22] The procedure date, hospital site of ED visit, and surgical technique were also collected.

To best characterize the nature of the ED visit, the triage chief complaint, discharge diagnosis, discharge destination (admission or home), length of stay in the ED, and general interventions performed were collected. Additionally, all visits were categorized as either medical or surgical. Surgical visits were defined as any visits considered to be related to the surgery and medical visits were defined as any visit unrelated to the surgery. If a patient had multiple symptoms/reasons for presentation to the ED, the most concerning reason was selected (i.e., if a patient presented with a concern for bleeding and pain, bleeding was selected as the reason for presentation). Surgical ED visits which did not result in admission, did not require any significant intervention, and were not due to a presentation of bleeding were deemed "potentially preventable."

Data analysis

The rate of post-tonsillectomy ED visits and the frequency of primary presenting complaints were recorded. Results were reported descriptively with categorical variables as absolute counts with percentages, and continuous variables as means±standard deviations (SDs). All ED presentations were categorized as either first ED visit or repeat ED visit (Figure 1). Additionally, patients who were transferred from a tertiary to a primary health center were also included. Repeat ED visits and transfers were included in the analysis to account for resource utilization. However, complication rates were calculated based on first ED visits only to avoid skewing results based on repeated presentations with the same complications. Results with values N<5 were suppressed and listed as **N<5 as per our approval requirements for privacy.

RESULTS

Overall ED visits

A total of 2394 patients underwent a total/partial tonsillectomy +/- adenoidectomy over the 6-year study period, performed by 10 otolaryngologists at the IWK Health in Halifax. Of these patients, there were 718 ED visits within 90 days post-discharge, accounting for 538 surgeries from 528 unique patients. Overall, this represents a 22.1% (528/2394) ED rebound rate. Of these 718 ED visits, 16 (2.2%) were excluded, with a remaining 702 visits from 527 unique patients used in our analysis (Figure 2). Fifteen were excluded because it was the patient's second surgery, and one was excluded because there was missing data from the patient's chart.

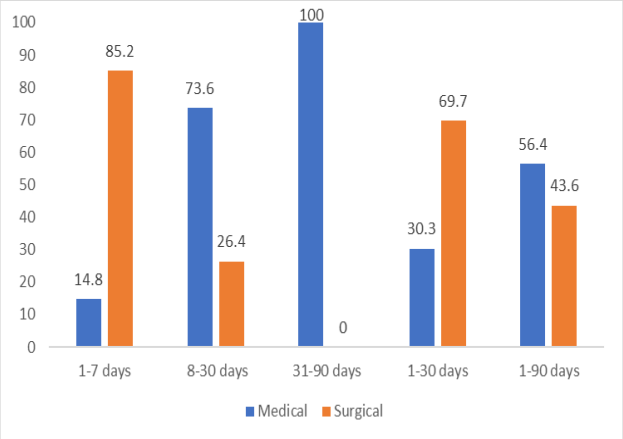

Figure 2: Percentage of ED visits per post-discharge day period.

Demographics and surgical technique

The mean age of the cohort presenting to the ED was 5.6±3.7 years. Most patients were male (56.7%), lived in urban locations (77.4%), and had access to a primary care physician (94.9%). Patient demographic information is presented in Table 1. The most common billing code indication for surgery was sleeping disordered breathing (n=316,60.0%), followed by tonsillar hypertrophy (n=87, 16.5%) and chronic tonsillitis (n=70,13.3%) (Table 2).

Most surgeries were performed in the outpatient setting (87.1%).

Table 1: Patient demographics and ED visit characteristics.

Characteristic	1-90 days	1-30 days
Total patients	527	330
Age (y), mean (SD)	5.6 (3.7)	5.9 (3.7)
Gender N (%)		
Female	228 (43.3)	146 (44.24)
Male	299 (56.74)	184 (55.76)
Geography of where patient lives		
Rural	119 (22.58)	63 (19.09)
Urban	408 (77.42)	267(80.91)
Primary care status		
Has primary care	500 (94.88)	314(95.15)
No primary care	26 (4.93)	15(4.55)
Null	<5 (0.19)	<5 (0.30)
Comorbidity score		
0	525 (99.62)	329 (99.70)
1	<5 (0.38)	<5 (0.30)
Visit type		
Medical	297 (56.36)	100 (30.30)
Surgical	230(43.64)	230 (69.70)
Days between SX and ED, mean (std)	27.1(28.9)	6.9 (6.9)
Overall	9.0 (4.0-53.0)	5.0 (2.0-8.0)
Medical	45.0 (20.0-66.0)	12.0 (5.0-20.5)
Surgical	4.0 (2.0-6.0)	4.0 (2.0-6.0)

Abbreviations: ED: Emergency Department; STD: Standard Deviation; Y:Years.

ED presentation characteristics

Of the 527 ED first visits included in our analysis, 297 (56.4%) were classified as medical while 230 (43.6%) were deemed to be related to the surgery. This translates to a 9.6% (230/2394) surgical ED rebound rate following pediatric tonsillectomy. Notably, all surgical ED visits occurred within the first 30 days (n=230), with the majority occurring within the first week (n=207) (Figure 2).

Figure 2 provides a distribution of ED presentation based on post-discharge day. The median time between surgical discharge and ED rebound for medical and surgical presentations were 45 and 4 days, respectively. Finally, most patients returned to an ED within Nova Scotia Central Zone (64.5%,9.6%).

Surgical ED presentations

Surgical visits accounted for 69.7% of total ED visits within the first 30 days post-discharge and 85.2% of visits within the first 7 days (Figure 3; Table 1). After 30 days, the distribution of medical versus surgical visits switched, with 100% of visits classified as medical (Figure 3).

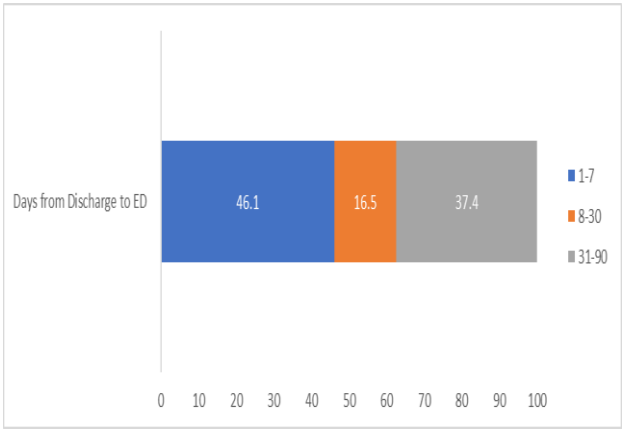

Figure 3. Proportion of days between discharge and initial ED visit.

Table 2: Surgical indications of ED rebounds.

Indication	N (%) within 90 days
Sleep apnea	316 (60.0)
Adenoid hypertrophy	87 (16.5)
Chronic tonsillitis	70 (13.3)
Tonsillar hypertrophy	32 (6.1)

Table 3: ED presentation reason.

ED presentation reason	Number of presentations; N (%)
Surgical visits (n=230)	
Pain related to surgery	107 (20.3)
Bleeding	74 (14.0)
Nausea/vomiting uncomplicated	27 (5.1)
Fever	10 (1.9)
Dehydration	5 (1.0)
Medical visits (n=297)	
Other medical not related to the primary	52 (9.9)
Pulmonary not related to the surgery	43 (8.2)
Pain not related to the surgery	38 (7.2)
Musculoskeletal not related to the surgery	35 (6.6)
Trauma not related to the surgery	34 (6.5)

Abbreviations: ED: Emergency Department; % reported is of surgical visits and medical visits separately.

The most common surgical reasons for presentation to the ED were pain (n=107;20.3%), bleeding (n=74;14.0%), and nausea and vomiting (n=27;5.1%). The top indications for ED presentation are presented in Table 3.

Among 230 surgical ED visits, 38.3% (n=88) resulted in hospital admission, while 6.1% (n=14) required a return to the operating room. Most surgical ED visits did not require admission and were discharged home after being seen by a physician in the ED (n=142,61.7%; Table 4). In total, 50.9% (117/230) of surgery-related ED visits following pediatric tonsillectomy did not present with bleeding, require admission, or any significant intervention in the ED and were thus deemed potentially preventable.

Table 4: ED disposition.

Disposition	Number of visits, N (%)
Medical and surgical visits (n=527)	
Discharged home	396 (75.14)
Admitted to hospital	106 (20.11)
Discharged home with follow-up	<5 (0.57)
Left without being seen	21 (3.98)
Other	<5 (0.19)
Surgical visits only (n=230)	
Discharged home or left without being seen	142 (61.7)
Admitted to hospital	88 (38.3)

DISCUSSION

Given the high frequency of tonsillectomies in the pediatric population, post-operative complications may contribute significantly to ED visits, operating room takebacks, and hospital readmissions, placing a substantial burden on both patients and the Canadian healthcare system. Implementing strategies to reduce this burden will not only alleviate the strain but also enhance patient quality of life.

Our study found a 9.6% surgical ED rebound rate within 90 days post-discharge following pediatric tonsillectomy, all of which occurred within the first 30 days. This is in keeping with previous studies reporting ED rebound rates of 7.6-12.8%.[15-17] The most common reasons for ED visits were pain (20.3%), bleeding (14.0%), and nausea and vomiting (5.1%). Notably, more than half of the surgical ED visits (50.9%) did not involve active bleeding or require hospital admission, indicating that a significant proportion of visits were "potentially preventable" since they rarely required any significant intervention in the ED. Our findings highlight the need for improved post-operative education for families regarding expected symptoms, red flag signs requiring urgent care, and at-home management strategies. Pain accounted for the most ED visits of all complications, in keeping with previous studies.[3,8,9,18,19] Thus, post-operative pain management is a key factor in reducing post-tonsillectomy ED visits. Pediatric patients may struggle to follow pain management protocols effectively, particularly regarding medication adherence and hydration, leading to preventable ED visits.[3,9,20] Additionally, several studies have found that caregivers have a tendency to significantly undertreat post-tonsillectomy pain in the pediatric population.[4,9,20-22] This aligns with previous research indicating that inadequate pain control is a primary driver of post-tonsillectomy ED visits.[4,16] Standardized, multimodal post-operative analgesic protocols, including the use of dexamethasone, may help mitigate these complications. A single dose of intra-operative corticosteroids, such as betamethasone or dexamethasone, has been shown to reduce pain, decrease nausea and vomiting, increase oral intake, and improve overall post-operative recovery.[3,9,21] Additionally, preventative analgesia and antiemetics, beginning in the pre-operative and intra-operative periods, has also been suggested to decrease post-operative pain and nausea, highlighting an important role for multidisciplinary collaboration with anesthesiologists.[9] Dehydration is another common concern following tonsillectomy, exacerbated by pain-related reduced oral intake.[7,15] Institutional protocols emphasizing the importance of hydration post-surgery and clear patient education on maintaining adequate fluid intake could help reduce dehydration-related ED visits.[15] Additionally, reinforcing early and scheduled post-operative follow-up with primary care providers or otolaryngology clinic nurses may help address mild complications before they necessitate an ED visit.

Pain management innovations, such as virtual reality (VR)-based distraction therapy, have been studied in pediatric populations undergoing painful procedures. Research indicates that VR interventions can significantly reduce pain perception and anxiety in children undergoing surgeries.[23] Similarly, gamification strategies have been incorporated into healthcare to improve health promotion and medication adherence in pediatric patients, demonstrating an opportunity for increased engagement and better compliance with treatment plans.[24,25] These approaches could be particularly beneficial for children recovering from tonsillectomy, where effective pain management and hydration are crucial in preventing complications and reducing emergency department visits.

Hemorrhage was the second most common reason for ED presentation, accounting for 14.0% of surgical ED visits and 55.7% of readmissions. The overall post-tonsillectomy hemorrhage rate in this cohort was 3.09% (74/2394), aligning with previous studies reporting rates of 2.0-3.5%.[16,17,26,27] Strategies such as tranexamic acid (TXA) administration has been utilized in some EDs as safe, non-invasive options for short-term stabilization or to aid in reducing hospital admissions in this population.[28,29] Additionally, surgical technique has been

identified as a potential factor influencing bleeding rates, with intracapsular tonsillectomy associated with lower rates of post-operative pain and hemorrhage.[2,3,11,30] While post-tonsillectomy hemorrhage remains a known risk, ED visits for this reason are largely unavoidable given the potential for fatal outcomes if left unaddressed. However, there is research to suggest that these ED visits may be predictable based on patient factors including age, sex, surgical indication, and operative technique.[30,31] Additionally, the presence of a minor post-operative bleed was found to dramatically increase the risk of a second, more severe bleed, thus serving as an additional predictive factor.[30]

The development of standardized discharge criteria from the ED may help in ensuring appropriate follow-up rather than unnecessary hospital admissions.[32,33] The National Institute for Health and Care Excellence has incorporated standardized criteria into condition-specific guidelines, such as the management of acute upper gastrointestinal bleeding, to improve patient outcomes.[32] Some studies have suggested that patients with a normal oropharyngeal examination and no active bleeding may be safely discharged with close outpatient follow-up.[34] Such standardized criteria may be used by both family physicians and ED physicians in managing post-tonsillectomy patients.

The expansion of telemedicine and AI-driven healthcare solutions has revolutionized postoperative care, particularly in remote monitoring and patient engagement. AI-powered chatbots have been increasingly integrated into postoperative follow-up protocols, providing real-time patient education, symptom assessment, and triage recommendations.[35,36] These chatbots utilize natural language processing to guide patients through recovery by answering questions, reminding them about medication schedules, and identifying concerning symptoms that may warrant further evaluation.[37] In surgical fields such as orthopedics and general surgery, telehealth platforms incorporating AI-driven interactions have reduced unnecessary emergency department visits by allowing clinicians to intervene early when postoperative issues arise. Such approaches could be particularly impactful in pediatric tonsillectomy, where parents often struggle with determining whether complications like dehydration, fever, or prolonged pain require urgent care.

Remote telemedicine follow-ups have also gained traction in various medical specialties, improving accessibility to healthcare providers while minimizing patient burden.[38] Studies have demonstrated that telemedicine follow-ups for minor surgical procedures can provide comparable, if not superior, outcomes to in-person visits, particularly when combined with remote monitoring tools.[39,40] In pediatric surgery, virtual follow-ups can alleviate parental anxiety, ensuring that children recover properly while reducing unnecessary healthcare utilization. Additionally, integrating telemedicine with wearable monitoring devices could allow for seamless remote assessment of hydration levels, oxygen saturation, and pain control, ultimately reducing hospital readmissions.[40]

Applying these interventions to pediatric tonsillectomy presents an opportunity to significantly enhance patient outcomes. AI-driven risk assessment could help identify children at higher risk for postoperative complications, allowing for tailored perioperative management. Wearable devices could provide continuous monitoring at home, reducing unnecessary emergency visits while enabling early detection of complications. AI chatbots could assist caregivers in identifying concerning symptoms and guiding them through at-home care, while telemedicine follow-ups could ensure timely interventions. Finally, VR-based pain management and gamification strategies could improve adherence to postoperative care, reducing reliance on opioids and ensuring proper hydration. By leveraging these cutting-edge innovations, the field of pediatric otolaryngology can move towards a more personalized, effective, and technology-driven approach to tonsillectomy care. While this study provides valuable insights into post-tonsillectomy ED visits in a publicly funded healthcare system, several limitations should be considered. First, as a retrospective cohort study, our findings are subject to potential biases, including misclassification and incomplete documentation in electronic medical records. Although we employed standardized data extraction methods to minimize these issues, reliance on administrative datasets may limit the granularity of clinical details. Second, our study is limited to a single Canadian province, which may impact the generalizability of findings to other healthcare settings with different patient populations, surgical practices, and healthcare access patterns. Future multicenter studies with broader geographic representation would help validate these findings. Third, while we categorized ED visits as medical or surgical and identified “potentially preventable” visits, the absence of standardized criteria for defining preventability introduces an element of subjectivity. Further prospective research is needed to refine these definitions and assess interventions aimed at reducing unnecessary ED presentations. Finally, while we explored factors such as pain management, surgical technique, and discharge education, we did not assess patient-reported outcomes or caregiver perspectives, both of which play a crucial role in post-tonsillectomy recovery. Incorporating qualitative assessments and patient-reported outcome measures (PROMs) in future studies would provide a more comprehensive understanding of post-operative challenges and opportunities for improvement.

CONCLUSION

In conclusion, this study highlights the significant burden of post-tonsillectomy ED visits within a publicly funded healthcare system, with a 9.6% surgical ED rebound rate

within 90 days, the majority occurring in the first week post-discharge. Pain, hemorrhage, and nausea/vomiting emerged as the leading causes of ED presentation, emphasizing the need for improved post-operative pain management, hydration strategies, and caregiver education.

A key finding was that more than half of surgical ED visits did not involve active bleeding or require hospital admission, suggesting that many visits may be preventable with enhanced discharge protocols, standardized analgesic regimens, and improved outpatient follow-up. Future efforts should focus on integrating telemedicine, wearable monitoring, and AI-powered chatbots to support at-home recovery and reduce unnecessary healthcare utilization. Innovative approaches, including virtual reality-based pain distraction, gamification for medication adherence, and AI-driven patient engagement, present promising avenues for optimizing post-tonsillectomy care. By leveraging these technological advancements, healthcare systems can move towards a more proactive, patient-centered model of perioperative management, ultimately improving patient outcomes and reducing the strain on emergency healthcare resources.

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Ethical approval: This study received approvals and waiver of consent from the Nova Scotia Health (NSH) Quality Improvement Office and the NSH Ethics Office as exempt from Research Ethics Board review to allow collection, publication, and presentation of data (#1028137).

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