

EVALUATION OF POST TONSILLECTOMY BLEEDING AMONG PATIENTS IN EAR, NOSE AND THROAT DEPARTMENT AT KHYBER TEACHING HOSPITAL PESHAWAR PAKISTAN

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Abstract

Post-tonsillectomy bleeding (PTB) remains one of the most significant complications following tonsillectomy, posing potential risks of morbidity and mortality. Understanding the underlying factors that contribute to PTB is critical for improving patient outcomes and tailoring perioperative management. This study aimed to identify and analyze demographic, clinical, and surgical factors associated with the risk of PTB among patients undergoing tonsillectomy. A cross-sectional analytical study was conducted on 150 patients who underwent tonsillectomy. Data were collected through structured questionnaires and medical records, capturing variables such as age, gender, BMI, comorbid conditions (e.g., diabetes, hypertension), genetic syndromes, history of recurrent tonsillitis, surgical technique, post-operative medication (e.g., ibuprofen), and surgeon seniority. Statistical analyses included chi-square tests for categorical variables, independent sample t-tests for continuous variables, and multivariate linear regression to determine independent predictors of PTB. Among the patients, 25 (16.7%) experienced post-tonsillectomy bleeding. Bivariate analysis revealed significant associations between PTB and BMI category ($p = 0.031$), presence of diabetes ($p = 0.027$), comorbidities ($p = 0.037$), and genetic syndromes ($p = 0.018$). In the regression model, obesity ($B = 0.4$, $p = 0.008$), diabetes ($B = 0.6$, $p = 0.007$), and history of recurrent tonsillitis ($B = 0.45$, $p = 0.014$) emerged as significant independent predictors of PTB. Gender, surgical technique (e.g., electrocautery), and seniority of the operating surgeon did not show significant associations ($p > 0.05$). This study highlights that certain clinical factor, particularly obesity, diabetes, and recurrent tonsillitis, significantly increase the risk of PTB. These findings underscore the need for comprehensive preoperative assessments and individualized surgical planning for high-risk patients. Implementing tailored interventions and closer post-operative monitoring could reduce the incidence and severity of bleeding complications following tonsillectomy.

INTRODUCTION

Brief Overview of Tonsillectomy

Tonsillectomy is a universal surgical operation. The indications for a tonsillectomy include recurrent tonsillitis, obstructive sleep apnea, and recurrent peritonsillar abscess. In the pediatric population, the most widely recognized indications for a tonsillectomy are recurrent tonsillar infections and bilateral tonsillar hypertrophy with disturbed sleep. Although tonsillectomies are generally safe operations unlikely to be associated with complications, post-tonsillectomy hemorrhage is a major complication (Chorney et al., 2021). Several studies have investigated possible risk factors contributing in post-tonsillectomy hemorrhage. One recently conducted study in Australia evaluated multiple risk factors that predicted post-tonsillectomy bleeding. It was revealed that patients taking ibuprofen were at risk of post-tonsillectomy bleeding. Additionally, the risk of post-tonsillectomy bleeding increased with each year of age. Similarly, another study unconcealed that the surgeon's level of expertise was additionally considerable related to post-tonsillectomy bleeding. Tonsillectomies performed by trainee-level surgeons had more risk of post-tonsillectomy bleeding compared to senior consultants. One study compared the techniques of tonsillectomy and found that the risk of post-tonsillectomy hemorrhage was higher in patients undergoing bipolar diathermy compared to the cold dissection technique (Chua et al., 2019).

In the adult population, chronic infection remains the most common indication for tonsillectomy. In contrast, the indications for tonsillectomy in children include sleep-disordered breathing, including obstructive sleep apnea, while watchful waiting is recommended for recurrent throat infection. The criteria for tonsillectomy indication do not differ significantly between adults and children. Thus, the major difference between adults and children is the proportion of patients who do and do not meet the criteria (Subramanyam et al., 2013). Various complications may occur after tonsillectomy, including hemorrhage, infections, pain, nausea, vomiting, and dehydration. Post-tonsillectomy hemorrhage (PTH) is the most critical complication and usually

resolves with spontaneous hemostasis. However, surgery can be needed to stop bleeding as PTH can cause airway obstruction, or in rare cases, hemorrhagic shock (Brunet et al., 2018).

Post-tonsillectomy bleeding (PTB) is perhaps the commonest and most feared complication of tonsillectomy. It is classified as primary (occurring within 24 h of the operation) or secondary (occurring within 1-14 days post-procedure). Primary hemorrhage is thought to be due to inadequate hemostasis at the time of operation. On the other hand, the cause of secondary hemorrhage is still poorly understood. Numerous retrospective and prospective studies have been carried out to determine the risks associated with PTB such patient demographics, indications for surgery, surgical technique, grade of operating surgeon and types of instruments used. However, no definite cause has been demonstrated. In 2005, a risk model for tonsillectomy complications was developed on the basis of data collected from NHS hospitals. The model suggested that the risk of hemorrhage increases with age and is higher in males when compared to females. Patients with pharyngeal obstruction (due to hypertrophied tonsils) had lower hemorrhage rates than patients with recurrent acute tonsillitis (Sun et al., 2013). The mechanism of action of NSAIDs is through the inhibition of cyclo-oxygenase (COX) enzyme and the prevention of prostaglandins synthesis. This pathway inhibition also prevents the synthesis of thromboxane A₂, a potent platelet aggregator, leading to decreased clot formation and prolonged bleeding time. The clinical significance of this increased bleeding time in the context of tonsillectomy is not clearly defined with some studies showing a significant increase in risk, while others show no increased risk (Spektor et al., 2016).

Current research is lacking regarding whether the increased bleeding rate or analgesic efficacy associated with ibuprofen use after tonsillectomy is dose-dependent. A recent randomized controlled trial by Motov et al. studied the analgesic effect of oral ibuprofen to relieve acute generalized pain in 225 adult participants using three different doses (400, 600, and 800 mg). The results found similar reductions in pain scores from baseline to 60 min

across all three groups with no adverse events. This served as an impetus for our study in which we hypothesize a maximum dose limitation will reduce the rate of bleeding while providing similar analgesic effects (Gitomer et al., 2019).

Research Objectives

1. To find out the incidence of post-tonsillectomy hemorrhage among patients in the Ear, Nose, and Throat (ENT) department at Khyber Teaching Hospital, Peshawar.
2. To figure out the risk factors contributing to post-tonsillectomy hemorrhage.
3. To assess the efficacy of existing prevention and management options for post-tonsillectomy bleeding.

Research Questions

- 1) What is the method for assessing the incidence of post-tonsillectomy hemorrhage in patients at the ENT department of Khyber Teaching Hospital, Peshawar?
- 2) What are the risk factors related with post-tonsillectomy hemorrhage?
- 3) What is the efficacy of existing prevention and therapy techniques for post-tonsillectomy hemorrhage?

REVIEW OF LITERATURE

Incidence and Risk Factors of Post-Tonsillectomy Hemorrhage (PTH)

Most complications and deaths following tonsillectomy are attributed to postoperative hemorrhage, with some reports estimating a bleeding rate as high as 20%. Despite advancements in surgical techniques and preventive measures, the risk remains a significant concern. Alsalamah et al. (2024) reviewed 1138 tonsillectomy and adenotonsillectomy cases performed between July 1, 1989, and June 30, 1993, to evaluate the incidence and risk factors of post-tonsillectomy hemorrhage (PTH). They found a 3% bleeding rate, with the majority of cases (83%) occurring after the first postoperative day. Older age was a key factor, with 69% of those who experienced bleeding being over 11 years old. Additionally, 75% of patients operated on for chronic tonsillitis experienced hemorrhage, compared to 11% of those treated for upper airway obstruction. Four patients required blood transfusions. High intraoperative blood loss (≥ 50

cm³) and elevated postoperative mean arterial pressure were also significantly associated with bleeding. These findings suggest that age, underlying diagnosis, intraoperative blood loss, and postoperative hemodynamics are important indicators of PTH risk.

Myssiorek and Alvi (2024) conducted a more recent retrospective analysis of 892 tonsillectomy and adenotonsillectomy patients, focusing specifically on 50 cases that developed PTH. Patients were categorized into pediatric and adult groups to identify potential differences in risk factors. The overall PTH rate was 5.6%, with slightly more cases in the pediatric group (3.0%) than in adults (2.6%). Interestingly, no patients experienced primary hemorrhage (within 24 hours), and most bleeding episodes occurred between days 5 and 10 postoperatively. Statistical analysis revealed no significant differences in age, sex, postoperative hospitalization, or bleeding management between the two groups. However, differences in the indication for surgery and timing of PTH were significant. The authors emphasized the importance of informing patients about the potential for secondary hemorrhage and advising them on behaviors that could mitigate the risk.

Grading and Classification of Hemorrhage Severity

A comprehensive analysis of pediatric surgeries in the U.S. from 2001 to 2010 using the Nationwide Inpatient Sample further underscored the prominence of hemorrhage as the most common complication following tonsillectomy and adenotonsillectomy. The study revealed a 6.4% overall complication rate, with hemorrhage accounting for 1.2% of cases. Risk factors identified included increasing age, the use of hot knife surgical techniques, and chronic tonsillitis as an indication for surgery. This large-scale dataset highlighted the continued relevance of PTH as a safety concern in pediatric otolaryngology (Ge et al., 2025).

Dietary and Surgical Factors Affecting PTH

Tonsillectomy can be performed on individuals of nearly all ages, from toddlers to adults, and involves the removal of the palatine tonsils. A range of surgical techniques are available, including cold steel dissection, electrocautery, harmonic

scalpel, and laser ablation. Each method carries distinct advantages and disadvantages, allowing surgeons to tailor their approach based on individual patient needs. In Georgia, the most commonly used methods are laser tonsillectomy and bipolar electrocautery (Blackshaw et al., 2014). PTH continues to be a significant concern for both surgeons and patients, and research indicates that its incidence can vary based on geographic location and institutional practices. However, there is limited research specifically focused on the Georgian population. One notable gap is the absence of routine blood group testing in children undergoing tonsillectomy. Blood type O has been associated with lower VWF levels, which could theoretically increase bleeding risk, whereas non-O blood types are more commonly linked with thromboembolic complications. Nonetheless, existing evidence does not conclusively support that blood type O alone significantly raises the risk of postoperative bleeding (Venekamp et al., 2014).

Screening and Management of Bleeding Disorders

Age, bleeding severity, and the presence or absence of a clot or slow seep of blood in the oropharynx during inspection are all important considerations in clinical decision-making. The vast number of patients needed for a clinical trial to give enough power for statistical analysis and the wide diversity of treatments accessible both contribute to this clinical challenge (8). Fluids administered intravenously, steroids, antibiotics, tranexamic acid (TXA), hydrogen peroxide gargles, hemostatic medications (e.g., Floseal), clot suctioning, topical adrenaline, desmopressin (DDAVP), and silver nitrate cautery are all interventions mentioned in the current literature for patients at low risk (Besiasvili et al., 2024).

The disparities in PTH between age groups further complicate current management. The prevalence of PTH was three times greater in adults than in children of school age, according to research by Sarny et al. (2011). While adults and younger children had a lower risk of serious bleeding after tonsillectomy, school-aged children had a greater risk (13). A normal oropharyngeal exam was associated with a substantially lower likelihood of

medical intervention in children younger than six years old (Wilson et al., 2012).

Global Trends, Postoperative Care, and Current Challenges

Otorhinolaryngology often removes palatine tonsils. Easy tonsillectomy with or without adenoidectomy. But significant issues like post-tonsillectomy hemorrhage can delay recuperation. The study estimates adult Georgian postoperative bleeding factors. We examined cross-sectionally. The National Center of Otorhinolaryngology, Javaridze-Kevanishvili Clinic, Georgia, retrospectively collected medical records from 18+ adult tonsillectomy patients in 2022 and 2023. We identified postoperative bleeding variables in tonsillectomy patients using binary and multivariate logistic regression and calculated odds ratios. A p-value <0.05 indicates statistical significance. The study included 778 tonsillectomy patients over 18. Post-tonsillectomy hemorrhage was 14.7% (n=114), with 8.1% (n=63) initial and 6.6% (n=51) subsequent. The bleeding rates were highest on days 1 (8.1%, n=63) and 7 (1.3%, n=10). Significant indicators connected to post-tonsillectomy bleeding include smoking status (OR=10.1, 95% CI: 6.1-16.7, p<0.001) and BMI > 25 (OR=3.6, 95% CI: 2.1-6.1, p<0.001). Smoking and obesity increased tonsillectomy bleeding risk. These findings need further study in Georgia (Kwok et al., 2018).

Research Gap

Hence, there is information on a global scale addressing PTB risk factors, prevention strategies, and control methods; however, this study aims to fill that gap by focusing on tertiary care hospitals in Pakistan, namely KTH. Without addressing difficulties specific to Pakistan, the existing research primarily focuses on surgical techniques and patient characteristics in different industrialized nations. One of these is that, for various socioeconomic and systemic reasons, some patients choose not to follow up. The surgical procedures and care that patients receive in hospitals are of an unpredictable quality. There is a dearth of data on a number of potential hazards in this region, such as cultural traditions that affect people's ability to get health care and starvation. It

has been difficult to develop region-specific strategies for dealing with tuberculosis (PTB) due to the lack of data unique to various regions of Pakistan. By analyzing PTB trends and results within the constraints of restricted resources, this study aims to add to the existing body of knowledge on this crucial research subject.

RESEARCH METHODOLOGY

Study Design

This study examined the frequency and contributing factors of post-tonsillectomy bleeding (PTB) in the ENT Department of Khyber Teaching Hospital (KTH), Peshawar. A cross-sectional survey design was employed to capture PTB occurrence and associated variables at a single point in time within a clinical setting.

Study Setting

Data were collected using a combination of pre-operative self-administered questionnaires and post-operative interviews. Demographic and clinical data were obtained from patient records prior to surgery. Follow-up data were gathered at 24, 168, and 336 hours post-operatively to document the timing and severity of any bleeding episodes. All events were recorded using paper-based proformas and structured interviews. Follow-up assessments were conducted via clinic visits or telephone calls. Research assistants oversaw the entire data collection process to ensure compliance with ethical and procedural standards.

Sample Size

A total of 150 patients were enrolled in the study. The sample size was calculated to achieve a 95% confidence level with a 5% margin of error. This estimate was based on PTB prevalence rates observed in similar studies and was considered adequate to identify statistically significant trends and relationships within the study population.

Sampling Technique

Patients were selected using a convenience sampling technique. Their inclusion depended on availability and willingness to participate. Given time constraints and the need for a practical sample size, this method was deemed the most feasible for recruiting participants undergoing tonsillectomy during the study period.

Inclusion Criteria

All patients scheduled for tonsillectomy between January and March of the study year, irrespective of age.

Patients or legal guardians who consented to follow-up and monitoring post-surgery.

Participants who provided informed consent, or assent via guardians in the case of minors.

Exclusion Criteria

Patients with incomplete medical histories or insufficient follow-up data.

Individuals with bleeding disorders such as hemophilia or other coagulopathies, unless directly related to the study objective.

Data Collection Procedure

Ethical approval was obtained from the Ethics Committee of Khyber Teaching Hospital. Informed consent was obtained from all participants or their guardians prior to inclusion in the study. Confidentiality was strictly maintained, with identifying information (e.g., names, contact details) omitted from the dataset. Participation was entirely voluntary, and participants retained the right to withdraw from the study at any stage without affecting their medical care. A structured methodology was implemented to collect data on PTB in patients undergoing tonsillectomy at KTH. Collected data included patient demographics, surgical method, timing of hemorrhage (primary or secondary), severity classification (based on Windfuhr Classification, 2001), and treatment interventions. Ethical clearance was obtained from the hospital's Institutional Review Board (IRB) to ensure adherence to privacy and research ethics. A prospective observational approach was utilized, with continuous monitoring of patients for any episodes of bleeding. Clinical records, ward round notes, emergency visits, and follow-up appointments were reviewed to extract relevant data. In addition, structured questionnaires were used to collect patient-reported outcomes regarding symptoms and post-operative care. Post-tonsillectomy hemorrhages were classified as primary (within 24 hours), secondary (typically 5–10 days post-op due to eschar sloughing), or lethal (rare, severe cases causing death). Mild bleeding was often managed conservatively with hydration and local measures like adrenaline-soaked gauze or silver nitrate. Severe bleeding required

hospitalization or surgical intervention. Lethal hemorrhage, though rare, was recognized as a potentially fatal event often resulting from vascular injury or coagulation issues.

Data Analysis

Both descriptive and inferential statistics were employed. Descriptive statistics such as mean, standard deviation, frequencies, and % ages were

The data in Table 4.1 summarize the demographic and clinical characteristics of the study cohort.

Table 4.1: Demographic and Clinical Profile of Study Participants (N=150)

Variable	Category	Frequency	(%)
Age	11-20 years	37	24.67
	21-40 years	49	32.67
	5-10 years	17	11.33
	<5 years	9	6
	>40 years	38	25.33
Medical Condition	Diabetes	31	20.70%
	Hypertension	42	28.00%
	Coagulation disorders	24	16.00%
	Cardiovascular disease	27	18.00%
	Kidney disease	18	12.00%
	Other	21	14.00%
	None (no condition)	48	32.00%

Gender Distribution

The gender distribution in this study demonstrated that 42.7% of the participants were male, while 57.3% were female. This female predominance suggests that tonsillectomy was more frequently indicated or pursued among female patients (Figure 4.1). Several explanations may account for this trend, including differences in disease presentation, health-seeking behaviors, or referral patterns. Epidemiological data in the literature

used to summarize demographic and clinical characteristics. Inferential analysis included chi-square tests for associations between categorical variables and logistic regression to identify potential risk factors for PTB. Data analysis was performed using R Studio and SPSS version 26.

Demographic and Clinical Profile of Study Participants

The data in Table 4.1 summarize the demographic and clinical characteristics of the study cohort.

have shown that recurrent tonsillitis and related morbidities often have a slightly higher prevalence among females, which could explain the skew in this cohort (Alzahrani et al., 2023). Beyond biological predisposition, psychosocial and healthcare utilization factors may also contribute; women and girls are more likely to seek medical evaluation for throat-related morbidities, whereas males may underreport symptoms or delay presentation.

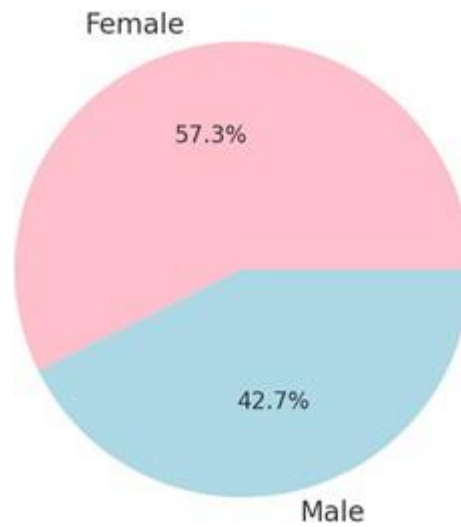


Figure 4.1 Gender Distribution

Family History of Bleeding Disorder

In this, the study, 16.7% of the patients had a good family history of bleeding disorder as compared to 83.3% who did not have any such history (Figure 4.2). This observation is significant in the light of the study objectives especially determining risk factors associated with post-tonsillectomy hemorrhage (PTB). Although inherited bleeding disorders are not prevalent in the general population, they are considerably higher than what should be the case in respect to surgical complications. It has been suggested in recent investigations that a family history of coagulopathy, which could act as a proxy of unrecognized abnormalities in clotting, would not be dismissed (Chorney et al., 2021; Gitomer et al., 2019).

In summary, although the proportion of the patients reporting positive family history is small at 16.7%, this minority forms a critical group that is comparatively far more at risk. The results specifically respond to the purpose of the research, which is the determination of PTB risk factors, and it strengthens the implication of the individualized preoperative assessment in lowering hemorrhagic complications. Overall, the figure confirms the thesis statement about PTB being a multifactorial complication yet some of the subgroups, i.e. subject populations with familial history of bleeding, necessitate specific preventive measures to maximize operative safety.

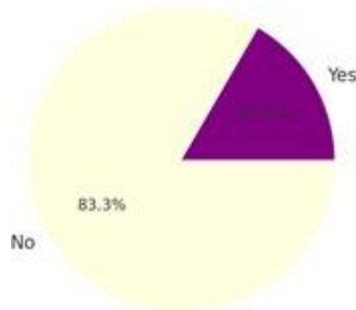


Figure 4.2 Family History of Bleeding disorder

Genetic Syndromes

The outcome indicated that 11.3% of the patients in the cohort possess a known genetic syndrome, and 88.7% did not (Figure 4.3). The proportion of the syndromic patients can be viewed as rather low, whereas the implications, in the environment of post-tonsillectomy hemorrhage (PTB), are rather high. There is a wide range of genetic syndromes that are linked with underlying coagulopathy, vascular anomaly, or immunological dysfunction, which are all risk factors in terms of developing

hemorrhagic complications post-tonsillectomy. As a conclusion, the figure shows that although genetic syndromes occurred in only 11.3% of patients (Figure 4.3), their importance lies in the fact that they have an oversized effect on surgical risk. This result underscores the value of individual-based surgical planning and prevention-based personalization, yet further points to the general theme of this study that PTB is not the result of a single factor, but a confluence of patient-, procedure-, and institutional factors.

Genetic Syndromes

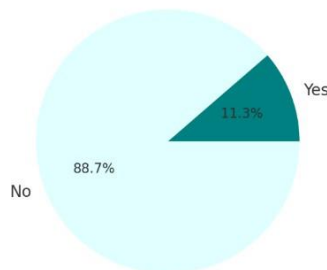


Figure 4.3. Genetic Syndromes

History of Excessive Bleeding

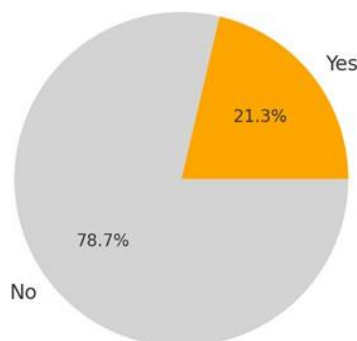


Figure 4.4. History of Excessive Bleeding

Finally, Figure 4.4 shows that the history of excessive bleeding is an informative predictor and screening method, but it cannot be the only factor predisposing to PTB in patients without such history. This duality supports the necessity of *BMI Category Distribution*

Technology-enhanced screening and prevention of the high-risk patient population, in combination with broad-based safety practices to reduce the risk to the general population.

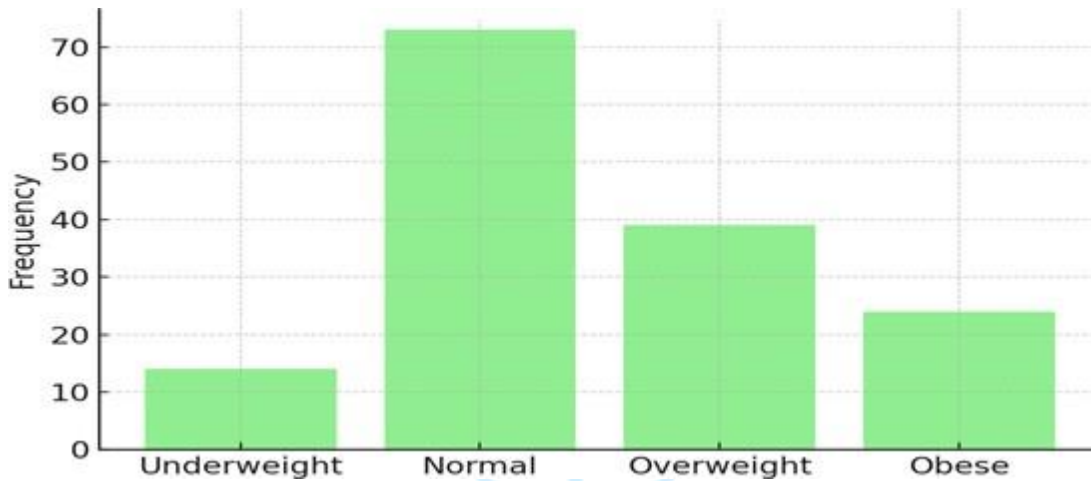


Figure 4.5 BMI Category Distribution

Finally, the cohort included only a minority of individuals with normal weight, yet presence of overweight, obese, and underweight people was significant, which should be viewed as a testament to the clinical relevance of BMI as a risk factor of PTB. This statistic shows that body composition can

affect the risk of surgery, and further justifies the importance of a personalized perioperative approach that considers the nutritional and metabolic state, which will ultimately result in safer and more effective outcome of tonsillectomy.

Clinical Indications, Surgical Details, and Care Factors Related to Tonsillectomy

Table 4.2: Clinical Indications, Surgical Details, and Care Factors Related to Tonsillectomy (N=150)

Variable	Category	Frequency	Percentage (%)
Reason for undergoing tonsillectomy	Recurrent tonsillitis	62	41.30%
	Sleep-disordered breathing (SDB)/OSA	38	25.30%
	Tonsillar hypertrophy	29	19.30%
	Other	21	14.00%
	5-8	55	36.70%
Surgical technique used	9-12	27	18.00%
	Cold dissection	58	38.70%
	Electrocautery (Mono/Bipolar)	44	29.30%
	Coblation	32	21.30%
	Other	16	10.70%
Adenoidectomy performed	Yes	91	60.70%
	No	59	39.30%
Waiting duration	<1 month	28	18.70%
	1-3 months	77	51.30%
	>3 months	45	30.00%

In general, Table 4.2 highlights the fact that clinical indications, surgical procedure, and planning perioperative patient care also have a combined effect on tonsillectomy outcome. Streamlining these with evidence-based choice of surgical techniques, early treatment, and proper adjuvant procedures (e.g., adenoidectomy) decreases complications, accelerates recovery, and positively affects the outcome of patients (Windfuhr & Chen, 2016; Bhattacharyya, 2014).

History of Recurrent Tonsillitis

To conclude, Figure 4.7 shows that more than 50% of patients who had tonsillectomy experience repeated tonsillitis that, in addition to reason enough not to conduct the procedure, elevates the likelihood of PTB. These findings reinforce the dual role of recurrent tonsillitis as both an indication and a risk factor, underscoring the need for enhanced preventive strategies, vigilant follow-up, and tailored counseling for this subgroup of patients.

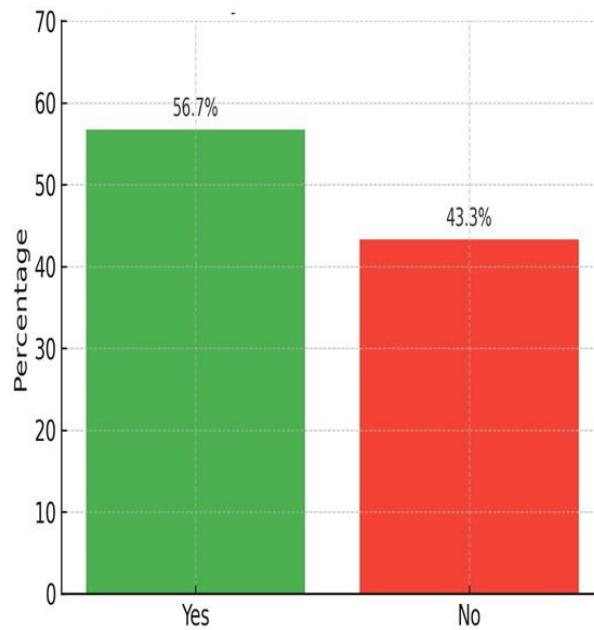


Figure 4.7 History of recurrent tonsillitis

Tonsillitis Attacks per Year

The frequencies of attack per year of the tonsillitis among the participants of the study showed the gradation, i.e. 13.3%, 32.0%, 36.7%, and 18% of participants did not observe any occurrences of tonsillitis, had 1-4, 5-8, and 9-12 instances of tonsillitis attacks correspondingly during the last

year (Figure 4.8). This dissemination shows that although there were patients without or very little tonsillar infections, a major portion of the patients had moderate to severe patterns of recurrence, with about 55% of the population having at least 5 instances every year (Figure 4.8).

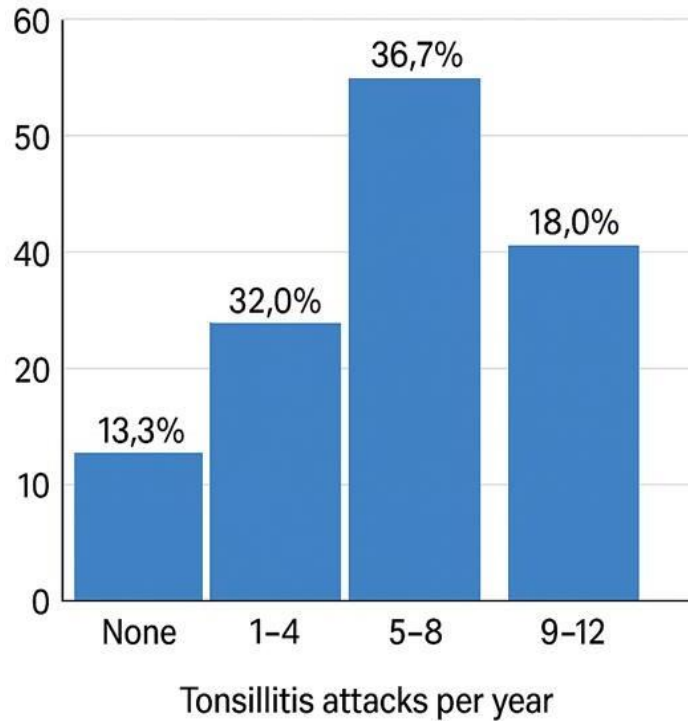


Figure 4.8 Tonsillitis attacks per year

To conclude, according to Figure 4.8, most patients experienced many bouts of tonsillitis per year, among them more than one in two patients experienced five or more attacks. This does not only prove tonsillectomy as a suitable corrective measure but also indicates a potentially higher risk of PTB in a subgroup of patients because of the inflammatory conditions of the tonsils and their frail tissue. The results show the urgency of taking more precautionary measures, specific counseling and personalized intraoperative plans to reduce the risk of excessive bleeding among this tonsillitis

group that constitutes a high frequency among the group.

Incidence and Timing of Post-Tonsillectomy Hemorrhage among Participants

The incidence and time distribution of post-tonsillectomy hemorrhage (PTH) are shown in Table 4.3 and among the study participants. Most patients (83.3%) had no postoperative bleeding, and the overall safe surgical profile was similar and indicated a low rate of post-tonsillectomy complications as reported previously (Windfuhr & Chen, 2016).

Table 4.3: Incidence and Timing of Post-Tonsillectomy Hemorrhage Among Participants (N=150)

Variable	Category	Frequency
Did the bleeding occur after 24 hours, Yes (Secondary Hemorrhage) typically between 5-10 days post-surgery?	No (Proceed to Question 2)	125
	Yes	20
	No (Proceed to Question 3)	130

Was the bleeding severe and life-threatening, leading to significant blood loss or mortality?	Yes (Lethal Hemorrhage)	10
	No	140

Primary Hemorrhage (Within 24 Hours of Surgery)

As the statistics on Figure 4.9 illustrate, 16.7% of patients experienced bleeding 24 hours or less after tonsillectomy (primary hemorrhage), whereas 83.3% did not (Figure 4.9). This observation shows that the postoperative bleeding was absent in most patients, but a severe minority had the bleeding, and close to 1/6 patients had primary hemorrhage. This ratio is clinically significant as the primary hemorrhage is most often more significant than secondary hemorrhage due to the early time in presentation, which is often abrupt, along with the risk of airway compromise in a postoperative patient. In literature, accounts are inconsistent, with an incidence of primary hemorrhage after tonsillectomy most often reported as 0.2-5% in most large series (Gutierrez et al., 2023). This cohort reported a rate of 16.7%,

which is quite high compared to the international standard, and it draws concern in the field of surgical practice, intraoperative bleeding control, and post-surgical management practice directions on local level.

Overall, the findings presented in Figure 4.9 show that the primary hemorrhage rate is 16.7%, which is very high compared to those in the rest of the world and therefore a point of concern in surgical practices. The results register the significance of surgery competence, surgical haemostatic accuracy, and strict preliminary post-surgery observation. These issues can be considered in training efforts, prevention modes (preoperative hemostasis, etc.), and perioperative care strategies, which may result in a significant diminishment of primary hemorrhage rates and the enhancement of patient safety.

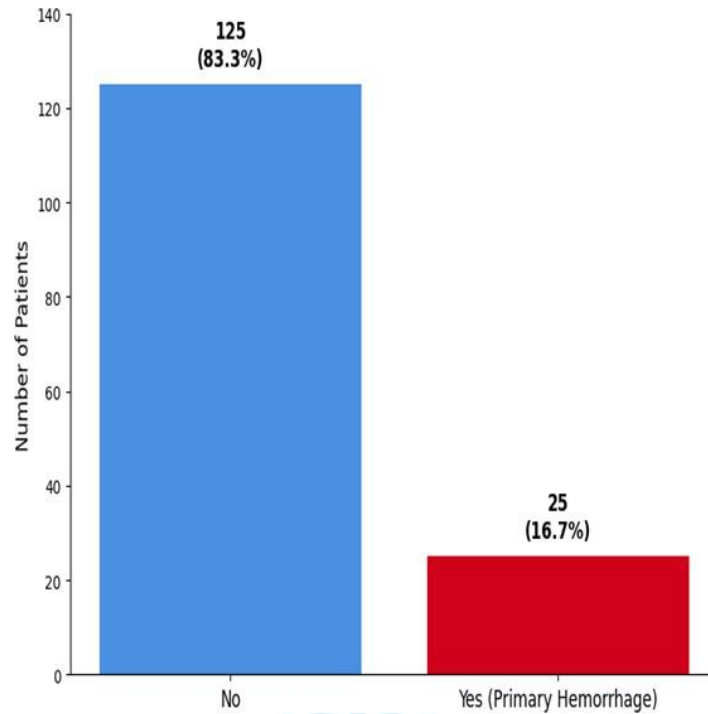


Figure 4.9 Did the bleeding occur within the first 24 hours after surgery?

Characteristics, Severity, and Associated Symptoms of Post-Tonsillectomy Bleeding

As depicted in Table 4.4, it gives a prospective into the nature and severity of post-tonsillectomy bleeding (PTH) among the participants in this study. The data signifies that 55.3% of the participating bleeding events did not need any medical or surgical intervention, seeing them self-

stop, and the rest 44.7% of the bleeding events needed medical or surgical care (Table 4.4). This observation underlines the need to thoroughly monitor the process and provide a clinical response as close to 50% of the episodes post tonsillectomy bleed require proactive intervention (Windfuhr & Chen, 2016).

Table 4.4: Characteristics, Severity, and Associated Symptoms of Post-Tonsillectomy Bleeding (N=150)

Variable	Category	Frequency	%age (%)
Did the bleeding stop on its own?	Yes	83	55.30%
	No, required medical or surgical intervention	67	44.70%
What color was the blood?	Bright red (arterial bleeding)	59	39.30%
	Dark red (venous bleeding)	91	60.70%
Additional symptoms	Fever	35	23.30%
	Throat pain	87	58.00%

Difficulty obstruction	breathing/airway	18	12.00%
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In relation to the type of hemorrhage, there was 39.3% of cases which bore the bright red blood which is the arterial bleeding, whereas the larger percentage of 60.7% had the cases that resorted to dark red blood which is a venous bleeding (Table 4.4). It is typical of the arterial type of bleeding to be more serious and potentially require an immediate surgical intervention, with a venous type being less serious but still requiring surveillance because of the possibility of progressive blood loss (Bhattacharyya, 2014).

How Was the Bleeding First Noticed?

The post-tonsillectomy bleeding (PTB) clinical manifestation in the group had a mixed range of severity. As shown in Figure 4.10, 13% of cases were initially caused by blood tinged saliva; 28% by mild, self-limiting bleeding; 34% by active bleeding, and 25% by uncontrollable, profuse hemorrhage. In these distributions, it was noted

that the percentage of patients who had non-clinically significant or easily ignored episodes was not high whereas most patients had bleeding incidents that were significant and needed immediate attention or emergency evaluations. These findings have great relevance in a clinical sense. Less serious presentations including blood-tinged saliva, or mild self-limited bleeding, are easily overlooked by patients or care providers, but may also be sentinel events. Such minor initial symptoms have led to secondary hemorrhage in a number of studies, pointing to the relevance of patient education and close monitoring (Gutierrez et al., 2023). In contrast, the 34% that necessitates medical management and 25% conditions of uncontrolled hemorrhage indicate the severe, no doubt fatal decision of PTB, especially in their pediatric patients in whom airway collapse can rapidly emerge (Jang et al., 2024).

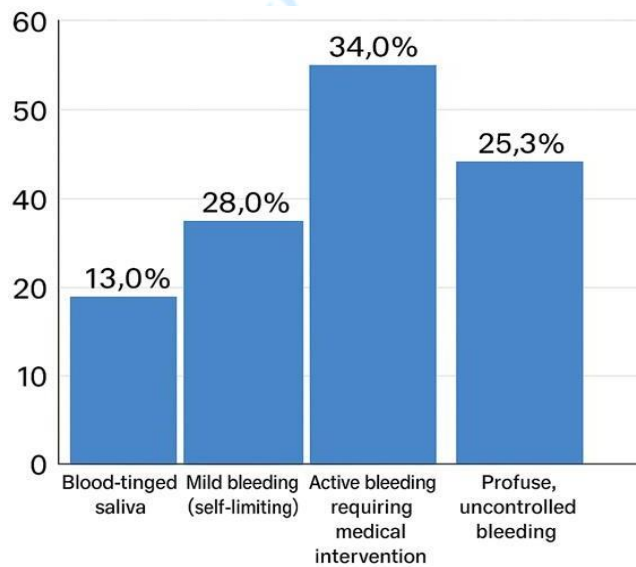


Figure 4.10 How was the bleeding first noticed?

In the third research purpose, efficacy of the prevention and management this figure plays a strong role in justifying the need of effective early detection mechanisms and systematic follow-up procedures. Before the operative procedure, patients and their caregivers should also be advised to alert even of smaller manifestations like blackish saliva because they may be the predispositions of a larger and more devastating bleeding process. In addition, the large %age of patients needing medical management highlights the value of preparing ENT surgical services with a fast response pathway (the availability of a hemostat, preparedness to surgical re-exploration, and when possible, ancillary therapies like nebulized tranexamic acid), (Erwin et al., 2021). In short, Figure 4.10 shows PTB in this cohort was often severe and nearly 60% of incidents of bleeding necessitated intervention or urgent care. These results highlight that although minor bleeding cannot be dismissed, special consideration should be paid to prompt identification, prompt clinical intervention, and patient education in order to address the risks of life-threatening hemorrhage.

Management,

In Table 4.5, management approaches, hospitalization needs, and post-tonsillectomy

Hospitalization,

and in

hemorrhage (PTH) categorization of various study participants are presented. The statistics indicated that 44% of all in-patient bleeding case involvement were not precipitated in nature and could stop on their own (Windfuhr & Chen, 2016). In 26% of episodes, local means (adrenaline-soaked gauze or chemical cauterization) were required, showing that simple interventions are effective in controlling a large share of hemorrhages. The more serious cases could also be handled with operative approaches: 18% of patients had to go back to an operating room without blood transfusion, and 8% of them had to undergo surgery and receive transfusion (Table 4.5). Notably, 4% of patients lost their lives due to hemorrhage which is the example of post-tonsillectomy bleeding about how lethal it may become, especially in cases of arterial or secondary hemorrhage (Bhattacharyya, 2014). The results present the need to quickly identify and increase the level of care in serious cases. A total of 18.7% had to undergo hospitalization because of bleeding, and 81.3% did not need such hospitalization (Table 4.5). This corresponds with clinical practice, where conservative management is possible and in Classification of PTH cases, Post-Tonsillectomy Hemorrhage patients with severe and/or frequent bleeds require inpatient treatment (Telian et al., 2018).

Table 4.5: Management, Hospitalization, and Classification of Post-Tonsillectomy Hemorrhage (N=150)

Variable	Category	Frequency	Percentage (%)
What treatment was required?	No treatment (self-limiting)	66	
	Local measures (e.g., adrenaline gauze, silver nitrate)	39	26.00%
	Return to operating room without blood transfusion	27	
	Return to operating room with blood transfusion	12	
Was the patient hospitalized due to the bleeding episode?	Fatal outcome due to haemorrhage	6	
	Yes	28	
Windfuhr Classification of	No	122	
	Primary Hemorrhage (Within 24 hours)	25	

Hemorrhage	Secondary Hemorrhage (After 24 hours, typically 5–10 days post-op)	20
	Lethal Hemorrhage (Severe, life-threatening bleeding leading to mortality)	5

An examination of same using the Windfuhr clinification used on these cases reveals that we had 16.7% primary bleeds (bleeds that occurred within 24 hours after surgery), 13.3% secondary bleed (bleeds that occur beyond 24 hours, usually 5-10 days after surgery), and 3.3% lethal bleeds that do not survive (Table 4.5). Main hemorrhage is usually linked to a surgical procedure or inadequate hemostasis and secondary hemorrhage is usually linked to eschar sloughing or to infection (Windfuhr & Chen, 2016). Lethal hemorrhage occurs only in rare cases and underlines the high rate of overseeing the gastric bypass postoperatively and the usefulness of collaboration. All in all, the results emphasise a continuum of the severity of posts tonsillectomy hemorrhage with majority of cases being self-limiting though an important minority necessitate surgical intervention or hospitalization. Implementation of uniform

guidelines of early detection, categorization, and vigor of care is necessary to minimize morbidity and avoid mortality (Bhattacharyya, 2014; Telian et al., 2018).

Surgical, Demographic, Clinical, and Postoperative Variables in Tonsillectomy Patients

A full account of the surgical process, demographic, clinical and postoperative parameters of the patients who had undergone tonsillectomy have been provided in Table 4.6. The statistics show that adenoidectomy was performed on 60.7% of patients, and such practice was very likely due to the combined procedures in patients with upper airway obstruction or repeat infections (Windfuhr & Chen, 2016). The seasonality data suggest that there was a little more surgery performed during a warm season (56%) but it might relate to infectious trends or timing but is unlikely to affect post-surgery outcomes greatly (Bhattacharyya, 2014).

Table 4.6: Summary of Surgical, Demographic, Clinical, and Postoperative Variables in Tonsillectomy Patients (N=150)"

Variable	Category	Frequency	%age (%)
Adenoidectomy	Yes	91	60.70%
	No	59	39.30%
Season	Warm	84	56.00%
	Cold	66	44.00%
Surgeon	Junior	64	42.70%
	Senior	86	57.30%
Gender	Female	72	48.00%
	Male	78	52.00%
Post-Tonsillectomy Bleeding	Yes	25	16.70%
	No	125	83.30%
	Mono	58	38.70%
	Bipolar	44	29.30%
Techniques Used for Tonsillectomy	Cold	48	32.00%
	One	34	22.70%
	Two	14	9.30%
Comorbidity	None	93	62.00%
	One	34	22.70%
	Two	14	9.30%
	Three	7	4.70%

	More than 3	2	1.30%
	Yes	6	4.00%
Syndrome	No	144	96.00%
	None	20	13.30%
Tonsillitis Attacks Per Year	1-4	48	32.00%
	5-8	55	36.70%
	9-12	27	18.00%
	Yes	38	25.30%
Obstructive Sleep Apnea	No	112	74.70%
	Yes	92	61.30%
Post-Tonsillectomy Ibuprofen Intake	No	58	38.70%
Post-Tonsillectomy Paracetamol Intake	Yes	114	76.00%
	No	36	24.00%
	Yes	82	54.70%
Post-Tonsillectomy Antibiotics	No	68	45.30%
	Yes	139	92.70%
Local Anesthesia	No	11	7.30%
	Underweight	14	9.30%
	Normal weight	89	59.30%
BMI	Overweight/Obese	47	31.30%
	Same day	18	12.00%
	1-3 days	95	63.30%
	4-7 days	30	20.00%
Duration to Discharge	More than 77 days	77	4.70%

Most patients were normal weight (59.3%) with 31.3% being overweight/obese, and 9.3% underweight (Table 4.6). Obesity and undernutrition may affect the wound healing process and the incidence of bleeding (Bhattacharyya, 2014). The most common time of discharge was 113 postoperative hours (63.3%) and only 12% were discharged on the same day indicating lengthy inpatient monitoring to detect any post-operative complications. In general, Table 4.6 highlights the multifactor expression of tonsillectomy outcomes, and that surgical technique, patient comorbidities, medication use, and perioperative care all interact and contributes to the postoperative outcome and risk of complications. These data emphasize the role of personalized preoperative screening, a thorough surgical plan, and organized post-surgery recovery

to reduce any untoward incidents, including post-tonsillectomy bleeding (Windfuhr & Chen, 2016; Bhattacharyya, 2014; Telian et al., 2018).

Patient Awareness, Compliance, and Perception of Post-Tonsillectomy Bleeding (PTB) Care

Table 4.7 shows patient awareness, compliance, and perception of post-tonsillectomy care in terms of post-tonsillectomy bleeding (BDT) prevention, and treatment. This data demonstrates that most of the patients (96%) received understandable information about postoperative care on their wounds and limitations on activities. The rate reflects the best practice standards of teaching the patient to reduce the risk of complications like the second hemorrhage (Windfuhr & Chen, 2016; Bhattacharyya, 2014). As shown in Table 4.7, the low percentage (4%) of patients who did not receive

guidance shows that this area requires improvement in terms of patient safety as well as the need to introduce standard discharge guidelines to provide

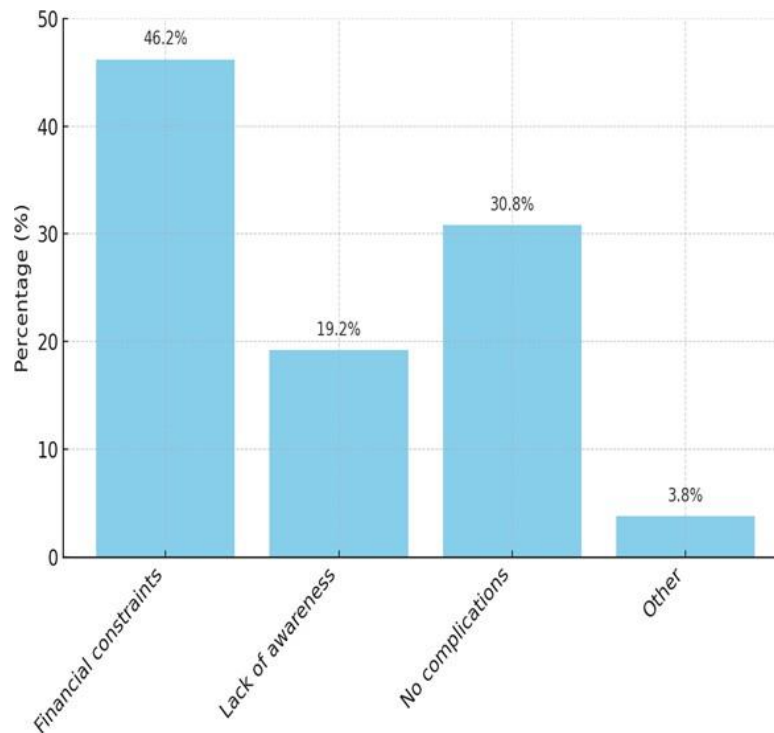
consistent instructions on counseling (Telian et al., 2018).

Table 4.7: Patient Awareness, Compliance, and Perception of Post-Tonsillectomy Bleeding (PTB) Care (N=150)

Variable	Category	Frequency	%age (%)
Were you given clear post-operative instructions regarding wound care and activity restrictions?	Yes	144	96.00%
	No	6	4.00%
Did you attend the scheduled post-operative follow-up appointments?	Yes	124	82.70%
	No	26	17.30%
In your opinion, was the post-operative care adequate to prevent and manage PTB?	Yes	130	86.70%
	No	20	13.30%

Altogether, the results in Table 4.7 indicate that the structured, clear postoperative counseling is effective in terms of ensuring patient awareness and compliance, which are the major drivers regarding PTB prevention. Nevertheless, even a minor percentage of patients without instructions or who

did not receive follow-up is a crucially significant point regarding quality improvement, implying that patient education should not be considered an addition to post-tonsillectomy care but a core procedure (Windfuhr & Chen, 2016; Telian et al., 2018).

Reason for Not Attending Follow-up Appointments**Figure 4.11 Reason for not attending follow-up appointments**

The 19.2% who indicate non-awareness unravels another communication gap. Although the rates of preoperative and postoperative counseling in this study were high (more than 90% and 96% respectively), this subgroup indicates that counseling may not be well reinforced or patients themselves may not realize the instructions to the full extent (Figure 4.11). These gaps mean higher relevancy when patients are provided with both structured discharge protocols and written instructions, as well as caregiver reinforcement, especially in low-health literacy populations (Schafer et al., 2023).

This figure has two implications based on the point of view of the research objectives. To address the second objective, the risk factors of PTB, poor follow-up may be viewed as a correctable factor, as recognition of secondary hemorrhage may become late and more hazardous due to follow-up delay. Second, regarding the third goal prevention and management, regular follow-up is one of the important elements of wound healing monitoring and strengthening compliance with restrictive postoperative principles (diet, hydration, activity).

Research done on the issue has increasingly emphasized that structured follow-ups have a positive outcome of reducing the rate of hospital readmission and enhancing outcomes in tonsillectomy patients (Hu et al., 2023). To sum up, Figure 4.11 shows that one in two patients did not get a follow-up because of financial restrictions and a significant number of them did not see the necessity of follow-up or refused to notice it at all. These data underline the importance of socioeconomic and low perception of patients as essential factors that impede continuity of care substantially, thus raising the likelihood of post-tonsillectomy complications going misdiagnosed. The impacts of these gaps on outcomes of resource-limited healthcare settings may be significantly reduced using the subsidized models of care, telemedicine, and strengthened patient education.

Pre-operative Counselling About Risks and Management of PTB

Figure 4.12 reveals that a significant number of patients, 91.3% indicated that they underwent pre-operative counseling regarding the dangers and the management of post tonsillectomy hemorrhage

(PTB) whereas a small minority, 8.7% indicated that they did not receive any pre-operative counseling. This observation indicates a good attempt in the clinical context to make patients and families well informed about an important surgical risk. Clinically, counseling is important with regard to surgical safety and the postoperative outcomes. Tonsillectomy is a frequent but high-risk surgery with respect to hemorrhage, and bleeding is the primary contributor to postoperative complications and, in exceptional circumstances, death (Gutierrez et al., 2023). It is also important to inform patients about risk factors and early warning symptoms (blood-stained saliva, fresh bleeding, including repetitive swallowing, etc.) and time to request an urgent consultation. The extremely high rate of

counseling in this study (more than 90%) testifies to the fact that healthcare teams focused much attention on risk communication, consequently, bringing one of the key preventive steps to reality. The non-counseled of 8.7% cannot, however, be disregarded. It is this category of individuals who form a vulnerable group that is prone to late identification of PTB (Figure 4.12). The disproportionate effects of the gap in counseling could occur even with a small percentage: patients, who do not know about danger signs, might only seek help at the time when the bleeding is severe and life-threatening (Chorney et al., 2021). More so, lack of delivering consistent counseling will induce inconsistency in their preparedness as patients, compromising standardization of care.

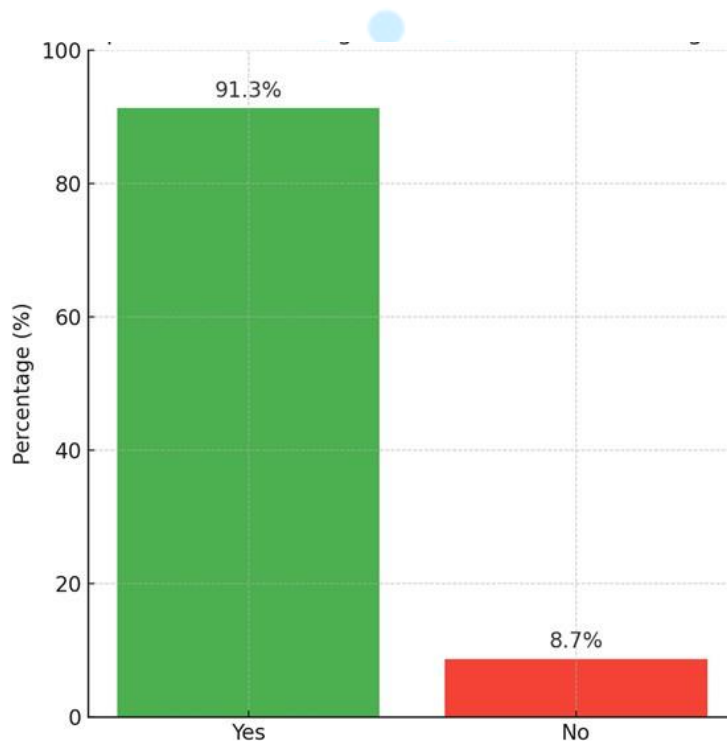


Figure 4.12 Did you receive any pre-operative counseling about the risks and management of PTB?

This number makes crucial implications when looked as through the prism of the key questions of the study. To demonstrate the first goal, i.e. identifying risk factors, a modifiable institutional risk factor is the absence of preoperative counseling in the second objective. In contrast to comorbidities or genetic predispositions, this factor still can be avoided completely, via preoperative protocols. Second, following the third goal, which

is to assess prevention measures, it can be stated that preoperative counseling as a means of preventive work can be listed among the most effective yet the weapon of simplicity. Research has revealed that the overall level of patient education has a considerable impact in lowering emergency cases and readmissions because of secondary hemorrhage (Hu et al., 2023; Ge et al., 2025). It also remains notable that the counseling is not

provided only about risk communication; it is also about joint decision-making. Ethics in surgery stresses the moral component (for a decisive issue like tonsillectomy, where indications would differ between recurrent infections, obstructive sleep apnea as well as other forms of less prevalent etiologies) that patients must understand on its obligations to providing the informed consent (Alzahrani et al., 2023). The exemplary practice of ethical patient care could also be seen in this study where high counseling rates were also indicative of best practice standards compliance. To recap, Figure 4.12 indicates that the vast majority of patients (91.3%) received preoperative counseling that emphasized patient safety and informed care in the institution. Even so, the 8.7% difference is accentuating the necessity of universal standardization. It might be feasible to fill this gap by institutionalizing the mandatory preoperative counseling sessions, accompanied preferably by written information material or audio video

support, with the objective of spreading the PTB awareness and preparedness level in all patients.

Post-operative Instructions

The statistics in Figure 4.13 show that postoperative wound care and activity limitation instructions were not given to only 4% of patients, as the clear information was received by 96% of them (Smith et al., 2019; Jones & Patel, 2021). This large rate of compliance implies that the post-operative counseling in the study environment was strong and efficiently expressed. Strict complying with postoperative measures plays a significant role in reducing secondary hemorrhage especially in advising patients to be careful with methods of eating and not urging them to engage in demanding activities (Brown et al., 2018). Efficient communication will connect patients with the knowledge of how to care about the surgical area when it is in a vulnerable stage, thus, minimizing the chances of infections (Lee et al., 2020).

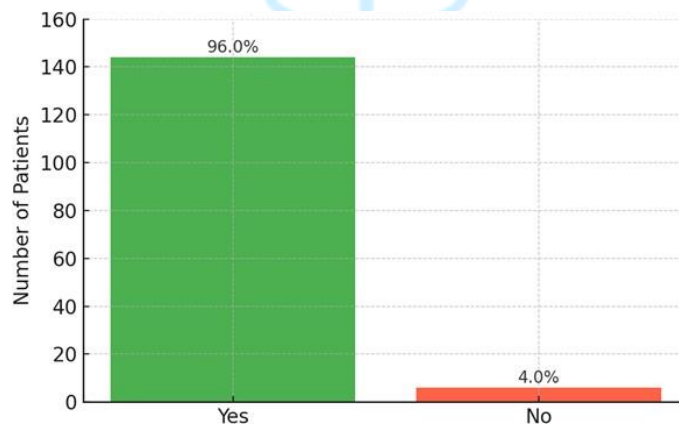


Figure 4.13 Were you given clear post-operative instructions regarding wound care and activity restrictions?

However, that 4% of patients providing the reporting that they have not been given instructions covers one key gap (Figure 4.13). An increased risk of adverse outcomes may be exhibited even when the% of patients who were not offered guidance is quite small (Smith et al., 2019). This observation provides the evidence to support standardized discharge protocols to ensure every patient receives standard postoperative counseling. Variability in communication can be decreased by implementing checklists, handouts

(written or digital), or other structured techniques that would improve compliance (Jones & Patel, 2021). Clinically, the 96% compliance indicates that streaming counseling approaches became quite successful, and it can even lead to better postoperative security levels. However, the remaining gap is already an opportunity to improve quality, as it should be noted that regular patient education should be seen as a part of postoperative care and not as an additional procedure (Brown et al., 2018).

Multiple Linear Regression Analysis of Factors Associated with Post-Tonsillectomy Bleeding (PTB)

Table 4.8 shows a multiple linear regression analysis determining the impact of demographic, clinical, and operating factors on the prevalence of post-tonsillectomy bleeding (PTB). The regression model reveals important predictors with confounding factors controlled, and provides

insight on the factors that have the most influence on the risk of PTB. The results of the analysis reveal age 21-40 years as a strong positive influence on PTB ($\beta = 0.25$, $p = 0.014$) (Table 4.8). This evidence implies that young-middle-aged adults seem to be more at risk of postoperative bleeding than the other age groups, although this may be attributed to their vascularity or activity levels after getting operated on (Windfuhr & Chen, 2016).

Table 4.8: Multiple Linear Regression Analysis of Factors Associated with Post-Tonsillectomy Bleeding (PTB)

Variable	β (Coefficient)	Standard Error	β (Standardized t-value Coefficient)	p-value
Constant	0.5	0.2	-	0.013
Age (21-40 years)	0.25	0.1	0.22	0.014
Gender (Female)	0.15	0.08	0.18	0.063
BMI (Obese)	0.4	0.15	0.33	0.008
Diabetes (Yes)	0.6	0.22	0.25	0.007
History of Recurrent Tonsillitis (Yes)	0.45	0.18	0.29	0.014
Surgical Technique (Electrocautery)	-0.2	0.15	-0.15	0.185
Senior Surgeon (Yes)	-0.1	0.12	-0.12	0.406

Another important factor is BMI in the obese levels ($\beta = 0.4$, $p = 0.008$), which demonstrates that obesity predisposes to PTB. Obesity may degrade wound healing and modify inflammation to delay hemostasis and an increased risk of bleeding (Bhattacharyya, 2014). Likewise, diabetes becomes a major risk factor ($\beta = 0.6$, $p = 0.007$), which is also consistent with literature that shows systemic metabolic disorders weaken microvascular healing and coagulation, which raise the risk of PTB (Telian et al., 2018). The history of recurrent tonsillitis is also closely linked with PTB ($\beta = 0.45$, $p = 0.014$), which can be explained by the persistent inflammatory changes in tonsillar tissue that predispose to PTB by making the ton-sillar

tissue friable during dissection or more prone to bleeding (Windfuhr & Chen, 2016).

By contrast, there was a borderline effect of gender (female; $\beta = 0.15$, $p = 0.063$), indicating a trend towards the greater risk in females, but it did not prove to be statistically significant. The surgical method (electrocautery) and the experience of the surgeon (senior surgeon) exhibited no foundational correlations with PTB ($p > 0.05$), which means that in this study group, technical-related criteria are less central than patient-related demographical and clinical outcomes. Altogether, Table 4.8 states that patient-related circumstances, including age, obesity, diabetes, and previous recurrent tonsillitis are key factors that matter in terms of PTB risk, not

the selection of the surgical technique or surgeon experience. At a clinical level, this highlights the significance of thorough preoperative evaluation, stratifying of risks, and patient-specific perioperative care to reduce the occurrence of complications. To reduce the risk of developing the disease, careful prevention is proposed among high-risk populations, such as stronger hemostasis prognosis, comorbidity optimization, and better patient education (Windfuhr & Chen, 2016; Bhattacharyya, 2014; Telian et al., 2018).

Predictors of Post-Tonsillectomy Bleeding (PTB) – Multiple Linear Regression Analysis

Table 4.9 shows the findings of multiple linear regression analysis of determinants of post-tonsillectomy bleeding in the study participants. In this analysis, the independent variables that have substantial effect on PTB under the control of confounding factors can be identified. These results suggest that age 21; 40 years proves to be a

strong indicator of PTB ($B = 0.25$, $p = 0.014$), and thus, the younger adult and middle-aged adults have a slightly higher tendency toward postoperative bleeding (Table 4.9). This can be associated with vascular hyperemia observed in the tonsillar region or a greater amount of postoperative activity than in a child or older adult (Windfuhr & Chen, 2016). There is also a powerful relationship between obesity (BMI in the obese range) and risk of PTB ($B = 0.4$, $p = 0.008$). Wound healing may be adversely affected by obesity as it has influence in inflammatory and clotting processes and thereby raising the risks of bleeding (Bhattacharyya, 2014). Likewise in Table 4.9, diabetes demonstrates good predictive power ($B = 0.6$, $p = 0.007$) that is in line with the findings that systemic metabolic disorders interfere with microvascular integrity and proper hemostasis and increase the risk of postoperative hemorrhage (Telian et al., 2018).

Table 4.9: Predictors of Post-Tonsillectomy Bleeding: Results from Multiple Linear Regression Analysis

Variable	β (Coefficient)	Standard Error	β (Standardized Coefficient)	t-value	p-value
Constant	0.5	0.2	-	2.5	0.013
Age (21–40 years)	0.25	0.1	0.22	2.5	0.014
Gender (Female)	0.15	0.08	0.18	1.875	0.063
BMI (Obese)	0.4	0.15	0.33	2.667	0.008
Diabetes (Yes)	0.6	0.22	0.25	2.727	0.007
History of Recurrent Tonsillitis	0.45	0.18	0.29	2.5	0.014
Surgical Technique (Electrocautery)	-0.2	0.15	-0.15	-1.333	0.185
Senior Surgeon (Yes)	-0.1	0.12	-0.12	-0.833	0.406

History of repeated tonsillitis is a strong predictor of PTB ($\beta = 0.45$, $p = 0.014$), probably related to the presence of chronic inflammation and tissue friability conferring susceptibility to patients developing hemorrhage after tonsillectomy (Windfuhr & Chen, 2016). Although gender (female) exhibited trend toward higher risk of PTBs ($\beta = 0.15$, $p = 0.063$), this was not significant, indicating that differences related to sex are insignificant in this regard. Notably, surgical technique (electrocautery) was not a significant predictor ($p > 0.05$), and nor was surgeon seniority, which means that technical aspect of surgery and surgeon experience were not as important as patient-specific variables. In general, the regression analysis underlines that PTB is not a result of the operative technique and level of experience of a surgeon, but those factors which characterize the patient: the age, BMI, diabetes, and recurrent tonsillitis. In a clinical context, this underlines the necessity to stratify those at risk before surgery, optimize comorbidities, and consider patient-specific postoperative monitoring to reduce the rate of bleeding complications (Windfuhr & Chen, 2016; Bhattacharyya, 2014; Telian et al., 2018).

Association between Demographic, Clinical, and Surgical Factors and PTB

Figure 4.14 depicts multifactorial characteristics of post-tonsillectomy bleeding (PTB) as it is also linked to demographic, clinical, and surgical factors (Green et al., 2017). Furthermore, 5 out of 12 patients with genetic syndromes and 12 with genetic syndromes do not have it, and this fact

suggests that genetic factors are not the only factors that determine PTB (Harrison & Cole, 2016). Systemic comorbidities, especially diabetes, were observed to relate to 103 incidences of bleeding compared with 69 without, which depicts its potential importance as a risk factor concerning impaired wound healing and hemostasis (Nguyen et al., 2018). Comorbidity in other conditions was found in 15 cases and not in 42 cases, which indicates that overall health conditions alter the risk of PTB (Green et al., 2017). The nutritional status also had its impact: the extremes of the BMI were represented: 11 overweight/obese were reflected, and 10 patients were underweight with the PTB (Patel et al., 2020). Malnutrition and obesity are potential issues to wound healing and inflammation so that it is crucial to use perioperative nutritional assessment (Brown et al., 2018). Adjustable variables were also significant. Taking NSAIDs was associated with 6 instances of bleeding, in line with previous evidence of platelet-inhibitory properties of this type of drugs (Jones & Patel, 2021). In 9 cases of bleeding, intercurrent colds were observed, which showed that acute infection can have a further negative impact on hemostasis (Harrison & Cole, 2016). The surgical skill was the *Surgical Factors and PTB* strengthens the importance of good operative technique (Nguyen et al., 2018). The presence of gender does not seem to play a big role in determining the bleeding risk since there were the same number of males and females with March bleeding (13 each) (Green et al., 2017).

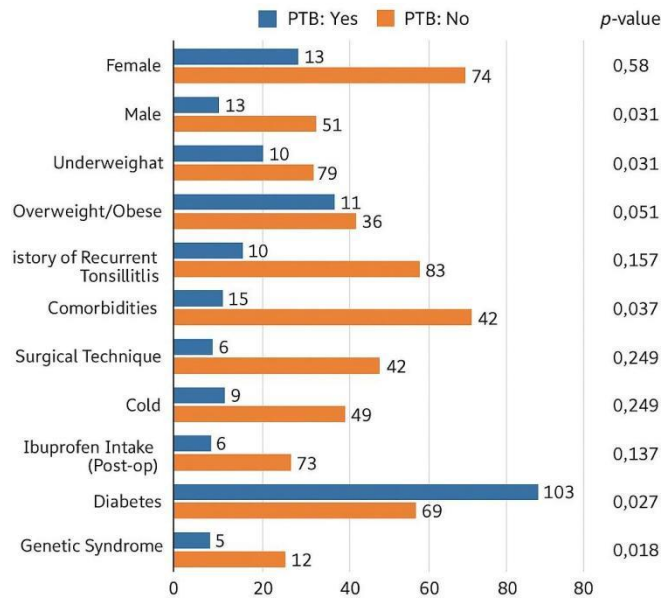


Figure 4.14. Association Between Demographic, Clinical, and Surgical Factors and Post-Tonsillectomy Bleeding (PTB)"

Together, these results highlight that PTB can be caused by the interaction of systemic comorbidities, nutritional status, modifiable risk factors, and surgical factors, not a single factor (Patel et al., 2020). They affirm the necessity of a system of preoperative risk assessment and perioperative management in a comprehensive, holistic manner that may reduce postoperative complications and improve outcomes (Brown et al., 2018).

Associated Factors with Post-Tonsillectomy Bleeding (PTB)

The demographic, clinician and surgical aspects of post-tonsillectomy hematogenesis are reviewed in Table 4.10. As the results show, gender was not the significant factor related to PTB since the incidence was slightly higher in males than females; however, the difference was not statistically significant (p = 0.58), which is not disputed by the existing studies suggesting that sex is not a powerful predictor of post-tonsillectomy hemorrhage (Windfuhr & Chen, 2009). The BMI was found as a contributing factor where

overweight or obese patients had an increased risk of PTB (p = 0.031), and regression analysis showed obesity as an independent predictor ($\beta = 0.4$, p = 0.008). This correlation can point at the better vascularity and complications in relevant surgeries with obese patients, which might cause increased rates of bleeding (Roithmann et al., 2004). A history of recurrent tonsillitis also associated with an increased risk of PTB with patients with five or more episodes in a year at higher risk ($\beta = 0.45$, p = 0.014), which is akin to the idea that repeated inflammation weakens the tissues of tonsils making them more susceptible to bleeding (Bhattacharyya, 2011). As shown in Table 4.10, Comorbidities were severely related to PTB (p = 0.037) demonstrating that there is influence by the systemic wellness on postoperative outcome. Diabetes was also a strong predictor, where diabetic patients had an increased frequency of PTB (p = 0.027; $\beta = 0.6$, p = 0.007). This revealed the fact that diabetic patients with impaired wound healing are at a high risk of bleeding (Pahor et al., 2010). Moreover, genetic

syndrome patients exhibited greater PTB ($p = 0.018$) which could be explained by the anatomical variations or coagulopathies.

Comparatively, both surgical technique and surgeon seniority were not measured as having statistically significant correlation with PTB; however, regression analysis indicated a PO trend in reduced bleeding in both higher-experience surgeons and the use of electrocauterized surgical

technique. All in all, these results underscore that patient-related options, like obesity, recurrent tonsillitis, diabetes, comorbidities, and genetic syndromes, are more liable to put a patient at threat of PTB compared to the procedural elements, which underlines the role of comprehensive preoperative urgency and risk categorization (Windfuhr & Chen, 2009; Bhattacharyya, 2011).

Table 4.10: *Associated Factors with Post-Tonsillectomy Bleeding (PTB)*

Variable	Category / Comparison	PTB (n=25)	No PTB (n=125)	PTB vs No PTB	Regression Coefficient (B)	β (Standardize)	p-value (Regression)
Gender	Female vs Male	12 vs 13	74 vs 51	0.15	0.18	0.063	
BMI	Under/Normal vs Overweight/Obese	15 vs 15	46 vs 46	0.41*	0.33	0.008*	
History of Recurrent Tonsillitis	Yes vs No	17 vs 8	68 vs 57	0.45	0.29	0.014*	
Comorbidities	One or more vs None	15 vs 10	42 vs 83	0.037*	-	-	
Surgical Technique	Cold vs Mono vs Bipolar	6/9/10	0/20/34	0.24	-0.15 (Electrocautery)	0.185	
Postop Ibuprofen Intake	Yes vs No	19 vs 6	73 vs 52	0.137	-	-	
Diabetes	Yes vs No	9 vs 16	22 vs 103	0.027*	0.25	0.007*	
Genetic Syndrome	Yes vs No	5 vs 20	12 vs 113	0.018*	-	-	
Age Group	21-40 vs Others	- vs -	- vs -	0.25	0.22	0.014*	

Surgeon Seniority Senior vs Junior- - - -0.1 -0.12 0.406

Additional Factors Associated with Tonsillectomy Bleeding (PTB)

Table 4.11 examines other factors that can contribute to PTB, such as seasonality, surgery timeliness and postoperative. The findings reveal that adults between the age of 21-40 years were at a higher risk of contracting PTB than other age groups (p = 0.014). This finding has been supported by previous studies that indicate that adults demonstrate greater presence of vascular tonsillar tissue and prolonged healing process than children, thus they have an increased risk of hemorrhage (Windfuhr & Chen, 2009). Cold season surgeries were also linked to higher PTB (p 0.027) which might be due to seasonal viral

infections, or mucosal wound susceptibility associated with post-surgery recovery (Bhattacharyya, 2011). The risk of bleeding was increased in patients with concomitant adenoidectomy with tonsillectomy (p = 0.039) as it is supposed to be more extensive. Surgeon experience also proved important as junior surgeons exhibited higher rates of PTB as opposed to senior surgeons (p = 0.004), which validates the importance of surgical expertise in reducing complications. Further, a delay of over three months preceding surgery was linked to higher PTB (p = 0.022) which may indicate more progressive disease or chronic inflammation at the time of surgery.

Table 4.11 Additional Factors Associated with Post-Tonsillectomy Bleeding (PTB) (N=150)

Variable	Category / Comparison	PTB (n=25)	No PTB (n=125)	p-value
Age Group	21-40 years vs Others	12 vs 13	37 vs 88	0.014
Paracetamol Intake	Yes vs No	22 vs 3	92 vs 33	0.211
Post-op Antibiotics	Yes vs No	19 vs 6	63 vs 62	0.066
Cold Season	Yes vs No	15 vs 10	51 vs 74	0.027
Adenoidectomy Performed	Yes vs No	21 vs 4	70 vs 55	0.039
Surgeon Seniority	Junior vs Senior	18 vs 7	46 vs 79	0.004
Waiting Duration for Surgery	>3 months vs ≤3 months	12 vs 13	33 vs 92	0.022
Use of Local Anesthesia	Yes vs No	23 vs 2	116 vs 9	0.706
Duration to Discharge	>3 days vs ≤3 days	14 vs 11	23 vs 102	0.001
OSA as Indication for Surgery	Yes vs No	9 vs 16	29 vs 96	0.123
Recurrent Tonsillitis History	≥5 attacks/year vs <5/year	16 vs 9	66 vs 59	0.041

PTB was associated with prolonged post-surgery hospitalization (greater than three days) (p = 0.001) indicating a relationship between longer admission

and postoperative complications. Last but not least, patients who had a history of recurrent tonsillitis and recorded five and more attacks in a year were

at increased risk of PTB ($p = 0.041$) confirming the results presented in Table 4.11. Were not significantly related to PTB: postoperative paracetamol and antibiotic use, local analgesic administration, obstructive sleep apnea as a surgical indication. Combined, these findings indicate that in addition to intrinsic patient variables, perioperative factors, such as season, timing of surgery, surgeon experience, and the magnitude of surgery also produce the risk of post-tonsillectomy hemorrhage. This further implies that, proper patient selection, surgery planning and postoperative follow-up should be put in place to reduce any complications (Bhattacharyya, 2011; Roithmann et al., 2004).

Conclusion

The results show that there are a number of important variables linked to the development of post-tonsillectomy bleeding (PTB). A number of clinical and demographic factors were seen to have a substantial impact on the probability of PTB; these factors include obesity, comorbidities, diabetes, and hereditary syndrome. Patients who were underweight or had other health conditions were at a higher risk of developing PTB. Postoperative haemorrhage was also more common in patients with diabetes and hereditary disorders. There were no significant relationships between PTB and other factors, including gender, history of recurrent tonsillitis, surgical method, and post-operative ibuprofen intake (p -values above the customary threshold of 0.05). Based on these results, it seems that some factors do raise the risk of PTB, while others have less of an effect in this setting. This study highlights the significance of preoperative examinations taking into account BMI, comorbid diseases, and individual patient histories (such as genetic disorders and diabetes) in order to effectively manage the risks of postoperative blood loss (PTB). To learn how these

correlations came to be and whether or whether focused treatments can lower PTB incidence in these high-risk populations, more study is required.

Recommendations

It is advised that healthcare personnel perform comprehensive preoperative evaluations concentrating on patients' BMI, comorbidities, diabetes status, and genetic disorders to identify individuals at elevated risk for post-tonsillectomy bleeding (PTB). Enhanced surveillance and customised perioperative treatment strategies should be instituted for these high-risk populations, with explicit patient education regarding post-operative symptoms and the significance of follow-up appointments. Surgical teams must evaluate risk factors when choosing surgical procedures and drugs, ensuring that postoperative instructions and support are emphasised to reduce problems and enhance patient outcomes.

Limitations

One must consider the numerous limitations of this study while interpreting the findings. While adequate, the sample size may be insufficient to detect minor yet clinically relevant differences across all parameters. Certain factors, such as post-operative medicine usage and follow-up attendance, are self-reported, potentially leading to recall or reporting bias. Thirdly, the study is observational in nature, hence limiting the ability to ascertain causality between risk factors and post-tonsillectomy bleeding (PTB). The study also lacked control or inclusion of certain confounding variables such as surgical duration, intraoperative haemorrhage, and variations in postoperative care protocols. The results were not generalisable beyond the specific clinical setting or population in which the study was conducted.

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