

Evaluation of Factors Associated with Post-Tonsillectomy Bleeding in Adults

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Abstract

Introduction:

Post-tonsillectomy hemorrhage is one of the most common and potentially life-threatening complications of tonsillectomy in adults and may result in readmission or reoperation. Adults are known to have a higher bleeding risk compared with children due to increased inflammation, comorbid factors, and surgical complexity. Identification of factors associated with postoperative bleeding is essential for optimizing surgical technique, postoperative care, and patient counseling.

Materials and Methods:

This retrospective case-control study included adult patients (≥ 18 years) who underwent bilateral tonsillectomy at two tertiary referral hospitals between March 2021 and March 2023. Patients who developed post-tonsillectomy hemorrhage were compared with a matched control group without bleeding. Demographic characteristics, surgical indications, operative variables, and surgeon-related factors were evaluated. Post-tonsillectomy hemorrhage was defined as any postoperative pharyngeal bleeding confirmed by an otolaryngologist.

Results:

Among 350 adult tonsillectomies, post-tonsillectomy hemorrhage occurred in 54 patients (15.4%), predominantly secondary bleeding. In multivariate analysis, halitosis ($p < 0.001$), chronic recurrent tonsillitis ($p = 0.001$), sleep disturbances ($p = 0.001$), use of sutures during the primary procedure ($p = 0.002$), and surgeon experience ($p = 0.013$) were independently associated with post-tonsillectomy hemorrhage. Tonsillolith showed a borderline association ($p = 0.054$), while body mass index was not significant ($p = 0.748$). No significant differences were observed in age, sex, smoking status, tonsillar hypertrophy grade, or operative duration ($p > 0.05$). Most bleeding episodes occurred spontaneously (59.3%), and bleeding resolved without surgical intervention in 66.7% of cases.

Conclusion:

Several patient- and surgery-related factors were associated with post-tonsillectomy hemorrhage in adults. Recognition of these associations may aid in perioperative risk assessment and postoperative management.

Keywords: Tonsillectomy, Hemorrhage, Tonsillitis, Adult.


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Introduction

Tonsillectomy, the surgical removal of tonsils, is a commonly performed procedure in adults to alleviate chronic tonsillitis, sleep-disordered breathing, and other related conditions (1).

Though generally safe, it carries the risk of post-operative bleeding, which can lead to complications and potentially necessitate further intervention. Identifying the risk factors associated with post-tonsillectomy bleeding (PTH) in adults is essential for optimizing patient outcomes and enhancing the surgical decision-making process (2).

PTH can be categorized into two types: primary and secondary bleeding. Primary bleeding occurs within the first 24 hours after surgery and is often attributed to surgical technique or immediate post-operative complications. Secondary bleeding, on the other hand, typically occurs after 24 hours and can be linked to delayed healing, infection, or inadvertent injury to adjacent structures during the procedure (3). As adults tend to have a higher incidence of comorbidities, such as hypertension, diabetes, and smoking, it is crucial to evaluate the risk factors that may predispose them to postoperative bleeding (4).

Previous reports have attributed increased postoperative bleeding in chronic tonsillitis patients to long-term inflammation (4). This study did not show a significant difference in indications. However, in patients who do not complain of tonsillitis, the tonsils may have subclinical inflammation. Several reports support this theory. Kim et al showed that inflammatory cytokines are more expressed in the tonsils of Obstructive sleep apnea patients (5). Also, tonsilloliths contain a biofilm structure with mild inflammation (6) and are more common in adults (4).

However, patients with tonsilloliths usually have no symptoms and are randomly diagnosed (7). In addition, the selection of the study population, which included adult patients, shows that inflammation of the tonsils occurs simultaneously with other important risk factors such as smoking. Consequently, it cannot be shown that the indication of tonsillectomy is one of the risk factors of PTH (4). Previous studies have reported an overall incidence of PTH between 2.2% and 10%, and PTH was treated surgically in 1%–6% of cases (1,8,9). Regarding perioperative management of patients, patients

undergoing tonsillectomy in Japan were hospitalized for about 1 week, while in other countries most patients are hospitalized for only a few days (1,8).

Patients with minor bleeding and spontaneous hemostasis may not come for a visit. Therefore, bleeding cases may have been underrated in former studies. This article aims to investigate the factors associated with PTH in adults.

Materials and Methods

Study design and ethical considerations

This is a case-control study. The institutional review board (IRB) of Shiraz University of Medical Sciences approved the study design and the approval of the Ethics Committee was also obtained (ethics code: IR. SUMS.MED. REC.1402.508).

Data gathering and patient recruitment

The study included adult patients aged 18 years and older who underwent bilateral tonsillectomy at Khalili and Dastgheib teaching hospitals, Shiraz University of Medical Sciences, Shiraz, Iran for 2 years from March 2021 to March 2023. Retrospective data from the patient's medical records were obtained for analysis.

Inclusion and Exclusion Criteria

Tonsillectomies were considered for patients with the following indications:

- Chronic or relapsing tonsillitis (three or more episodes per year for more than one year)
- Tonsil hypertrophy causes sleep disturbances.
- Obstructive sleep apnea syndrome (OSAS) with an apnea-hypopnea index of 20 or more.
- Recurrent or chronic respiratory infection
- Halitosis.
- Tonsillolith.

Patients who underwent tonsillectomy due to malignant tumors, systemic diseases that cause local tonsil inflammation (e.g., IgA nephropathy, palmoplantar pustulosis), peritonsillar abscess), those who had concurrent surgery, or hematological diseases were excluded from the study.

No patients underwent tonsillectomy in the presence of an active respiratory infection at the time of surgery.

Surgical Procedure

All tonsillectomies were performed under general anesthesia. Following intubation, the pharyngeal surgical field was stabilized using a

Davis-Boyle Mouth Gag, and the mucosa was incised and released using bipolar electrocautery in the direction of the tendon capsule. Bipolar electrocautery (26 W) was employed to control bleeding, with no other electrical or ultrasonic devices used. In cases where bleeding persisted despite electrocautery, absorbable sutures (chromic 2.0 thread) were used to close the bleeding points.

PTH was defined as the presence of pharyngeal hemorrhage or bleeding/clot in the tonsillar bed confirmed by an ENT specialist. PTH events were classified into primary bleeding (within the first 24 postoperative hours) and secondary bleeding (occurring on the second postoperative day or later).

Data Collection and Analysis

Patient information, including age, gender, BMI, smoking status, surgical duration, and analgesic types, was collected. The patients were divided into PTH and non-PTH groups, and a comparison was conducted between the two groups. The expertise level of the surgeon (attending physician or resident, senior or junior) was also recorded. For patients with PTH, additional perioperative and postoperative variables were documented, including length of hospitalization after bleeding, estimated bleeding volume, duration of secondary surgery, identified risk factors (spontaneous, dietary, or cough-related), side and site of bleeding, correspondence of the bleeding side with the patient's dominant hand, and the presence of major complications (readmission, reoperation, or death).

The timing of PTH (primary or secondary), use of sutures or bipolar cautery, bleeding grade, and the need for advanced interventions (treatment under general anesthesia or ligation of the external carotid artery) were also recorded.

Bleeding Grading System

The amount of bleeding was assessed using the following grading system:

- Grade 1: Spontaneous cessation of bleeding
- Grade 2: Treatment with local anesthesia
- Grade 3: Treatment with general anesthesia
- Grade 4: External carotid artery ligation
- Grade 5: Death

Sample Size

The case group encompassed the entire population of patients (census sampling)

referred to the hospital during the 2-year period who experienced PTH. The case group was selected from patients with the same age, gender and BMI who underwent bilateral tonsillectomy.

Statistical Analysis

Descriptive statistics, such as mean, standard deviation, and frequency distribution, were used to summarize patient characteristics. The chi-square test and t-test were employed to compare categorical and continuous variables, respectively, between the PTH and non-PTH groups. Variables demonstrating a potential association with post-tonsillectomy hemorrhage in univariate analysis ($p < 0.20$) were selected for inclusion in the multivariate logistic regression model. Multivariate binary logistic regression was then performed to identify independent predictors of PTH while adjusting for potential confounding factors. Results were reported as odds ratios with corresponding 95% confidence intervals. A p -value < 0.05 was considered statistically significant. Statistical analyses were conducted using SPSS software (version 23).

Results

A total of 350 adult tonsillectomies were performed during the study period, yielding a PTH rate of 15.42% ($n = 54$). The case group included 25 males and 29 females. The most common indication for tonsillectomy was Chronic recurrent tonsillitis (68.5%).

There was no statistically significant difference in age, gender, BMI, or duration of tonsillectomy. There was a significantly higher rate of chronic recurrent tonsillitis (68.5% vs 42.3%; p -value= 0.011) and halitosis (63.0% vs 13.5%; p -value<0.001) in the case group. The rate of using sutures in the primary surgery was significantly higher (31.5% vs 5.8%; p -value<0.001) in the case group. Interestingly, in the case group, the surgeon's experience was higher than the control group.

There was no difference in the rate of other indications of tonsillectomy, smoking status, alcohol consumption, grade of tonsillar hypertrophy, and surgeon's dominant hand. No patient in the case and control groups reported comorbidity and use of anticoagulants, antihypertensive medication, glucocorticoids, and opioids (Table 1).

Table 1: Demographic data and risk factors of patients

Variable	Group		p-value
	Case	Control	
Age (years); Mean (SD)	28.0 (7.9)	29.5 (7.8)	0.264*
BMI (kg/m ²); Mean (SD)	24.98 (4.21)	26.32 (5.72)	0.173^
Duration of tonsillectomy (min); Mean (SD)	47 (28)	48 (20)	0.459*
Gender; N (%)	Male	25 (46.30%)	0.848#
	Female	29 (53.70%)	
Halitosis; N (%)	34 (63.00%)	7 (13.50%)	<0.001#
Chronic recurrent tonsillitis; N (%)	37 (68.50%)	22 (42.30%)	0.011#
Tonsillar hypertrophy; N (%)	38 (70.37%)	40 (76.92%)	0.293#
Respiratory infection; N (%)	3 (5.60%)	1 (1.90%)	0.618#
Sleep disturbances; N (%)	20 (37.00%)	11 (21.20%)	0.089#
Snoring; N (%)	16 (29.60%)	13 (25.00%)	0.666#
Tonsillolith; N (%)	21 (38.90%)	11 (21.20%)	0.058#
Smoking status; N (%)	Current	7 (13.00%)	0.785#
	Never	47 (87.00%)	
Alcohol consumption; N (%)	None	44 (81.50%)	1.000#
	Occasional	10 (18.50%)	
	1	2 (3.70%)	
Grade of tonsillar hypertrophy; N (%)	2	14 (25.90%)	0.470#
	3	26 (48.10%)	
	4	12 (22.20%)	
	4	10 (19.20%)	
Suture; N (%)	Yes	17 (31.50%)	<0.001#
	No	37 (68.50%)	
Surgeon's experience; N (%)	Attending	4 (7.40%)	0.001#
	Senior resident	37 (68.50%)	
	Junior resident	13 (24.10%)	
Surgeon's dominant hand; N (%)	Right-handed	49 (90.70%)	0.759#
	Left-handed	5 (9.30%)	

* Mann-Whitney U test

^ Independent Samples Test

Fisher's exact test

Multivariate logistic regression analysis was performed to identify independent predictors of post-tonsillectomy hemorrhage. Halitosis was independently associated with an increased risk of hemorrhage (OR=15.34; 95% CI: 3.99–59.01; $p<0.001$). Chronic recurrent tonsillitis also remained a significant predictor (OR=9.46; 95% CI: 2.48–36.11; $p=0.001$), as did obstructive sleep apnea syndrome (OR=15.58; 95% CI: 2.96–82.12; $p=0.001$). The use of sutures during the primary procedure was independently associated with post-tonsillectomy hemorrhage (OR=19.97; 95% CI:

2.96–134.71; $p=0.002$). Regarding surgeon experience, procedures performed by senior surgeons were associated with a higher risk of hemorrhage compared with those performed by junior surgeons (OR=4.85; 95% CI: 1.39–16.88; $p=0.013$). Tonsillolith showed a borderline association that did not reach statistical significance (OR=3.78; 95% CI: 0.98–14.67; $p=0.054$). Body mass index was not associated with post-tonsillectomy hemorrhage (OR=1.02; 95% CI: 0.90–1.16; $p=0.748$) (Table 2).

Table 2. Multivariate logistic regression analysis of factors associated with PTH.

Variable	Odds Ratio (OR)	95% CI	p-value
Body mass index	1.02	0.90 – 1.16	0.748
Halitosis	15.34	3.99 – 59.01	<0.001
Chronic recurrent tonsillitis	9.46	2.48 – 36.11	0.001
Sleep disturbances	15.58	2.96 – 82.12	0.001
Tonsillolith	3.78	0.98 – 14.67	0.054
Use of suture	19.97	2.96 – 134.71	0.002
Surgeon experience	4.85	1.39 – 16.88	0.013

Associated factors with PTH

Most bleeding occurred spontaneously (59.30%) without any specific trigger. Cough was the most well-known risk factor (22.20%). Bleeding occurred mostly on the same side with the dominant hand (64.81% vs 35.19%). The most common site of bleeding was the upper

and middle pole of the tonsil. In 36 (66.70%) PTH ceased spontaneously. In the rest of the patients (18 (33.30%)), reoperation was done. Bleeding stopped by using suture and bipolar cautery (Table 3). No patient with PTH needed critical care.

Table 3. Data of patients with PTH.

Variable		
Length of hospitalization after bleeding (day); Mean (SD)		1.75 (0.91)
Bleeding volume (CC); Mean (SD)		201 (170)
Secondary operation duration (min); Mean (SD)		64 (23)
Risk factors; N (%)	Spontaneous	32 (59.30%)
	Diet (Eating solid food)	10 (18.50%)
	Cough	12 (22.20%)
Side of bleeding; N (%)	Bilateral	6 (11.11%)
	Right	31 (57.41%)
	Left	17 (31.48%)
Same side with the dominant hand; N (%)	Yes	35 (64.81%)
	No	19 (35.19%)
Site of bleeding; N (%)	Upper pole	23 (42.59%)
	Middle pole	23 (42.59%)
	Lower pole	8 (14.81%)
Major complication; N (%)	Readmission due to bleeding	36 (66.70%)
	Reoperation	18 (33.30%)
	In hospital death	0 (0.00%)
PTH time after operation; N (%)	Primary (<24h)	1 (1.85%)
	Secondary (>24hr)	53 (98.15%)
Suture; N (%)	Yes	18 (33.30%)
	No	36 (66.70%)
Bipolar cautery; N (%)	Yes	17 (31.50%)
	No	37 (68.50%)
Bleeding grade; N (%)	Bleeding with a spontaneous cessation	36 (66.70%)
	Treatment under local anaesthesia	0 (0.00%)
	Treatment under general anesthesia	18 (33.30%)
	Ligation of external carotid artery	0 (0.00%)
	Death	0 (0.00%)

Discussion

In this study, several clinical and surgical factors were identified as independent predictors of post-tonsillectomy hemorrhage in adults. Multivariate analysis demonstrated that halitosis, chronic recurrent tonsillitis, obstructive sleep apnea syndrome, use of sutures during the primary procedure, and surgeon experience were independently associated with an increased risk of postoperative bleeding. These findings highlight the multifactorial nature of post-tonsillectomy hemorrhage and emphasize the importance of both patient-related and procedural factors. While tonsillectomy is

generally considered safe, postoperative bleeding can occur in some cases, which can be a serious complication that may require medical and surgical intervention. Understanding the risk factors associated with post-tonsillectomy bleeding is essential for surgeons to effectively manage and reduce the occurrence of this complication (10).

According to a variety of previous studies, the incidence rates of post-tonsillectomy hemorrhage (PTH) can vary significantly, ranging from 0.12% to 18%. These discrepancies are often attributed to differing definitions of PTH used in various studies. Some authors only count instances of

readmission or reoperation when calculating PTH rates, while others include all cases of bleeding, even those that do not require treatment (11).

In this study, the incidence rate of PTH was found to be 15.42%, slightly exceeding the maximum acceptable rate reported in previous research. The higher rate in this study can be partly attributed to the fact that PTH was defined as any presence of bleeding or blood clots at the open wound site, as well as the focus on adult patients. Previous studies have indicated that PTH is more common in adults compared to children, which may explain the higher incidence rate observed in this study. Notably, 66.7% of patients required only conservative management, with bleeding stopping spontaneously without the need for surgical intervention under general anesthesia.

The study findings revealed several interesting associations between patient characteristics, surgical factors, and PTH occurrence. Notably, the most common indication for tonsillectomy in both groups was chronic recurrent tonsillitis, although it was significantly higher in the case group. This suggests that patients with chronic recurrent tonsillitis may be at increased risk for PTH compared to those with other indications for tonsillectomy. Additionally, the presence of halitosis was significantly more common in the case group. In a study conducted by Patel et al, it was found that among 574 adults, tonsilloliths had the highest frequency of PTH at 17.9%. Despite this, the indication for surgery was not a significant predictor in multivariate analysis. The study reported that infectious etiology was the most common reason for tonsillectomy. While the indication for surgery did not predict postoperative bleeding, male sex and younger age were associated with higher odds of experiencing bleeding after surgery (12). Inuzuka et al. evaluated risk factors of post-tonsillectomy hemorrhage in adults in a retrospective study. Their results showed that 21.8% of 325 adult patients experienced post-tonsillectomy hemorrhage, with 1.5% requiring a second surgery for hemostasis. Risk factors identified through logistic regression analysis included current smoking status, male gender, and perioperative non-steroidal anti-inflammatory drug administration. Additionally, older age and status of smoking were risk factors for primary hemorrhage, while

smoking status and male gender were risk factors for secondary hemorrhage (4). In a study conducted by Seyhun et al., the impact of smoking on PTH was examined. The researchers found that a patient's smoking history and history of tonsillitis were closely linked to a higher likelihood of PTH. Additionally, factors such as age and gender were also identified as contributing to the risk of developing PTH. However, no specific risk factors for re-bleeding or factors impacting the severity of hemorrhage in patients with PTH were identified (13).

Interestingly, the use of sutures in primary surgery was significantly higher in the case group, raising the question of whether certain surgical techniques or interventions may contribute to an increased risk of post-operative bleeding. Furthermore, the study revealed that the surgeon's experience was higher in the case group, which seems counterintuitive but could be explained by other confounding factors not accounted for in the analysis. The association between a surgeon's experience and postoperative primary and secondary hemorrhage has been a topic of debate in literature. Some studies suggest that the risk of hemorrhage increases with a surgeon's inexperience (14), while others have found no significant association (15). In a study by Peça et al., they discovered a strong correlation between a surgeon's experience and the type of hemorrhage. Primary hemorrhages were more common in surgeries performed by less experienced surgeons and secondary hemorrhages were more frequent in those performed by experienced surgeons (16). These results align with previous research in the pediatric population (17). This finding could reflect case selection bias, as more complex or high-risk cases are often managed by more experienced surgeons.

The study also examined potential triggers for PTH, with most cases occurring spontaneously without any specific trigger. Cough was identified as the most common risk factor for bleeding, highlighting the importance of post-operative cough management in reducing PTH risk. Moreover, the location of bleeding was predominantly on the same side as the surgeon's dominant hand.

In terms of management, the majority of PTH cases ceased spontaneously, while a minority

required reoperation using sutures and bipolar cautery. Importantly, no patient with PTH required critical care, indicating that prompt recognition and intervention can effectively manage this complication without escalating to more serious consequences. Fushimi et al, analyzed risk factors for post-tonsillectomy hemorrhage in adults. They aimed to determine the risk factors for PTH in adult patients aged over 19. A total of 275 adult patients who underwent tonsillectomy between 2009 and 2019 were analyzed retrospectively. The results showed that PTH occurred in 39 patients (14.2%), with focal infection of IgA nephropathy and the use of bipolar electrocautery recognized as significant risk factors for PTH. They mentioned that electrocautery involves using heat to remove tissue, which may increase the risk of tissue damage and bleeding. In contrast, coblation uses radiofrequency energy to remove tissue, which is associated with less tissue damage and reduced bleeding (11). In our study, we did not include patients with IgA nephropathy. In addition, we used bipolar electrocautery in all cases as routine, so we cannot give any comment regarding this issue.

The use of sutures during the primary procedure was also independently associated with post-tonsillectomy hemorrhage. While suturing is often employed to achieve hemostasis in difficult cases, it may represent a surrogate marker of intraoperative bleeding severity or more extensive tissue manipulation rather than a direct causal factor. Additionally, suture material itself may contribute to local tissue irritation and delayed healing, thereby increasing the risk of secondary hemorrhage.

Infection is a well-recognized contributor to secondary post-tonsillectomy hemorrhage through delayed wound healing and persistent tissue inflammation. Several peri-operative infective conditions, including recurrent or chronic tonsillitis, have been suggested to predispose patients to postoperative bleeding. However, despite the established theoretical role of infection, only a limited number of studies have demonstrated a clear association between post-tonsillectomy hemorrhage and objective markers of infection such as fever, elevated inflammatory markers, or positive microbiological cultures (18). In the present study, postoperative infection could not be

directly assessed due to the retrospective design and the absence of standardized postoperative infection documentation. Future prospective studies incorporating objective infectious markers are required to better clarify the independent role of infection in secondary post-tonsillectomy hemorrhage.

Overall, the findings of this study provide valuable insights into the factors associated with PTH in adult patients undergoing tonsillectomy. However, some limitations should be acknowledged, including the retrospective nature of the study, potential selection bias, and the relatively small sample size. Despite these limitations, the use of multivariate analysis strengthens the validity of our findings by accounting for potential confounding factors.

Future research should aim to further investigate the identified risk factors and potential interventions to reduce the incidence of PTH and improve patient outcomes following tonsillectomy.

Conclusion

Ultimately, the findings from this evaluation will help clinicians and surgeons make informed decisions about managing adult patients undergoing tonsillectomy, taking into account their risk profiles. By recognizing the risk factors and their significance, otolaryngologists can optimize patient safety, minimize post-operative complications, and ensure positive outcomes in this specific population.

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