Risk Factors of Post-Tonsillectomy Bleeding and Differences Between Children and Adults: Implications for Risk Assessment

Original Investigation

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Abstract

Objective: To investigate the association between clinical factors and post-tonsillectomy hemorrhage (PTH) including rebleeding episodes.

Methods: The medical records of 1082 patients who underwent tonsillectomy between May 2018 and April 2019 were reviewed. The entire study cohort included 431 (39.7%) children aged less than six years and 292 (26.9%) adults older than 15 years. Data on patient demographics, surgical indication, dissection technique, tonsils' grade, postoperative analgesia, surgeon's experience, the season of surgery, management of hemorrhage, length of hospital stay, and rebleeding episode were noted.

Results: Postoperative hemorrhage occurred in 87 cases (8.0%) including 32 children (4.0% of children) and 55 adults (18.8% of adults). Age, surgical indication, tonsils' grade, and postoperative use of non-steroidal anti-inflammatory drugs (NSAIDs) were risk factors found to be statistically significant for PTH in univariate analysis ($p<0.05$). Multivariable analyses identified patients older than 15 years and those who received postoperative NSAIDs to be risk factors of PTH [Odds ratio (OR): 15.5, 95% confidence interval (CI): 7.68-31.27, $p<0.001$, OR: 0.22, 95% CI: 0.11-0.44, $p<0.001$, respectively]. About one out of every 60 (1.5%) children had severe oropharyngeal bleeding, whereas every 12th (8.2%) patient of those aged >15 years had severe hemorrhages that warranted surgical hemostasis in the operating room ($p<0.001$).

Conclusion: The risk of bleeding after tonsillectomy was significantly higher in adults and users of NSAIDs postoperatively. Also, the evidence of minor bleeding increased the risk of a second bleeding episode in adulthood.

Keywords: Tonsillectomy, complications, postoperative hemorrhages, oral hemorrhage, risk factors, nonsteroidal anti-inflammatory agents.

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Introduction

Tonsillectomy is one of the most common surgical procedures performed in children worldwide and less common in adults. Postoperative hemorrhage remains the most significant complication of this surgery. Reported hemorrhage rates range from 0% to 20-30%, and this wide range has been attributed to several features

of patients (1, 2). The most widely used classification that differentiates bleeding episodes as primary (occurring in the first 24 hours) and secondary (occurring after >24 hours), does not refer to the severity or frequency of bleeding (3). Some patients may present with a history of blood-tinged mucus with a normal oropharyngeal exam, while others may have active bleeding that warrants surgical intervention. Several studies have reported postoperative hemorrhage among their inclusion criteria, whereas some only included patients who needed surgical interventions, while others included patients even with negative examinations (4, 5). There is no standardized approach especially to a non-active bleeding episode (including cases with normal oropharyngeal examination or blood clots in the tonsillar fossa without active bleeding) in which the management remains mostly institution-based (6-8). To develop a safe and accurate decision-making process, the risk of rebleeding should also be analyzed in patients being observed or undergoing surgical intervention.

This study primarily aimed to assess the association between clinical risk factors and post-tonsillectomy hemorrhage (PTH). Secondly, we attempted to describe the bleeding profiles and analyze the frequency of rebleeding episodes. Thus, we can define the characteristics of the patients who need surgical intervention or who can be managed by observation and conservative precautions.

Methods

A retrospective review was done of the medical records of all patients undergoing tonsillectomy (with or without adenoidectomy) from May 1, 2018, to April 1, 2019. This study was reviewed and approved by the institutional review board of Ankara Dışkapı Yıldırım Beyazıt Training and Research Hospital (no: 53/11, date: 06.08.2018). Informed consent was waived because of the retrospective nature of the study and the analysis used anonymous clinical data.

Our hospital is a tertiary care center where approximately 1000 tonsillectomies are performed annually in the pediatric otolaryngology department. Extracapsular tonsillectomy is done in all cases with cold steel, or bipolar cautery. Most patients are discharged the day after the surgical procedure. Standard pain medication regimens include paracetamol syrup (10-15 mg/kg/dose every 4-6 h) with or without ibuprofen syrup (5-10 mg/kg/dose every 6-8 h). We also suggest dexketoprofen effervescent tablet (25 mg three times) to adults as needed.

All patients presenting to the emergency department (ER) with PTH were referred to our department after the initial examination made by the ER physicians. Those patients were re-examined by ear, nose, and throat specialists in our department. Our clinical policy regarding PTH management is to admit almost all patients with a recent history of bleeding for an observation period of at least 24 hours, regardless of the absence of active bleeding. Oral intake was stopped for 24 hours. Intravenous access was maintained for fluid replacement and empiric antibiotic therapy. The history of hemorrhage varied among patients with PTH ranging from a blood-tinged mucus to severe arterial bleeding. Following our clinical policy, bleeding severity was stratified at the time of initial oropharyngeal examination as follows; grade 1: no bleeding or clot, grade 2: a clot in the tonsillectomy bed without active bleeding, grade 3: venous oozing, or grade 4: arterial bleeding (7). If the inspection revealed blood clots in the tonsillar fossa (grade 2), clots were removed to ensure that there is no ongoing bleeding underneath. If there was oozing or active bleeding (grade 3 or 4, respectively), a lidocaine %2 and epinephrine-soaked-gauze tampon were firmly applied to the tonsillar fossa. In cases of persistent hemorrhage, the patient was directed to the operating room (OR) to control the hemorrhage with bipolar diathermy and/or cautious ligature application under general anesthesia.

All patients, both children and adults, who presented to the ER with hemorrhage following tonsillectomy were included in the study. PTH was defined as any bleeding event after extubation. Patients were excluded if they did not have documented oropharyngeal examination. Also, patients with detected coagulopathy preoperatively, diagnosed, or suspected malignancy of the tonsils were excluded from the study.

Data on patient's demographic, infectious versus obstructive indication for tonsillectomy, dissection technique, the grade of tonsil size, postoperative analgesia, the experience of the surgeon, the season of surgery, management of hemorrhage, blood transfusion, length of hospital stay after an admission, rebleeding episodes were retrieved. Tonsil size was subjectively measured using a grading scale preoperatively. In grade 1, tonsils occupied less than 25% of the lateral dimension of the oropharynx, as measured between the medial borders of the anterior pillars. In grade 2, tonsils occupied 26% to 50% of the lateral dimension of the oropharynx. In grade 3, the tonsils occupied between 50% and 75% of the pharyngeal space. In grade 4, the tonsils occupied more than 75% of the pharyngeal space.

Statistical analysis

The database was built using the SPSS® software (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.), also the software used for data statistical analysis. Categorical variables are presented as frequencies and percentages, continuous variables as means and standard deviations, or as medians and interquartile amplitudes if variables were not normally distributed. Categorical variables were compared using Fisher's exact test or the Chi-square test.

Continuous and categorical variables were compared by the Mann-Whitney U test. Univariate and multivariate logistic regression analyses were done to examine the potential predictors of the bleeding event. The odds ratio (OR) and 95% confidence intervals [95% confidence interval (CI)] were also calculated. All reported p-values are two-tailed with a p-value of 0.05 indicating statistical significance.

Results

Of the 1,082 patients included, 607 (56.1%) were male and 475 (43.9%) were female; 431 (39.7%) patients were younger than 6 years, 359 (33.3%) aged between 7 to 15 years, and 292 (26.9%) were older than 15 years. Postoperative hemorrhage occurred in 87 cases (8.0%) including 32 children (4.0% of children) and 55 adults (18.8% of adults). The rates for primary and secondary bleeding were 1.4% and 6.6%, respectively. Primary bleeding occurred in 0.6% of the children and 3.4% of the adults, whereas secondary bleeding was observed in 3.4% of the children and 15.4% of the adults.

Association of Variables with PTH

Age, indication for tonsillectomy, grade of tonsil size, and postoperative use of nonsteroidal anti-inflammatory drugs (NSAIDs) were identified as the risk factors significantly related to PTH in univariate analysis. Patients aged >15 years had a higher incidence of PTH than those aged <15 years (18.8% vs 4.1%, p<0.001). Patients undergoing tonsillectomy for chronic recurrent tonsillitis had a higher risk than those who underwent the procedure for chronic upper airway obstructions (10.2% vs 5.0%, p=0.002). Patients who had smaller tonsils (grades 1, 2) experienced more frequent bleeding episodes compared to grades 3 and 4 tonsils (10.6% vs 5.5%, p=0.002). Patients receiving postoperative NSAIDs were more likely to have a tonsil bleed than those given paracetamol (13.9% vs 6.3%, p<0.001). Patients who were operated on by attendings had more frequent bleeding episodes compared to those operated on by resident doctors (14.4% vs 7.4%, p=0.049) (Table 1).

Table 1. Association of variables with post-tonsillectomy hemorrhage

	Post-tonsillectomy hemorrhage					
		Univariate			**Multivariate**	
	No. of patients (%)	**Yes (%)**	**No (%)**	**p-value**	**OR (%95 CI)**	**p-value**
Total	1082 (100)	87 (8)	995 (92)			
Age						
<6	431 (39.8)	15 (3.5)	416 (96.5)			
7-15	359 (33.3)	17 (4.7)	342 (95.3)	0.37		
>15	292 (26.9)	55 (18.8)	237 (81.2)	<0.001	15.41 (7.49-31.71)	<0.001
Sex						
Male	607 (56.1)	49 (8.1)	558 (91.9)			
Female	475 (43.9)	38 (8.0)	437 (92.0)	0.96		
Indication for surgery						
Recurrent tonsillitis	625 (57.8)	64 (10.2)	561 (89.8)			
Airway obstructions	457 (42.2)	23 (5.0)	434 (95.0)	0.002	0.71 (0.41-1.25)	0.24
Grade of tonsil size						
Smaller (grade 1, 2)	536 (49.5)	57 (10.6)	479 (89.4)			
Larger (grade 3, 4)	546 (50.5)	30 (5.5)	516 (94.5)	0.002	1.00 (0.59-1.69)	0.99
Dissection technique						
Cold steel	717 (66.3)	52 (7.3)	665 (92.7)			
Bipolar forceps	365 (33.7)	35 (9.6)	330 (90.4)	0.18		
Postoperative Analgesia						
Paracetamol	837 (77.4)	53 (6.3)	784 (93.7)			
NSAIDs	245 (22.6)	34 (13.9)	211 (86.1)	<0.001	0.23 (0.12- 0.47)	<0.001
Grade of surgeon						
Residents	985 (91.0)	73 (7.4)	912 (92.6)			
Attendings	97 (9.0)	14 (14.4)	83 (85.6)	0.0049	1.70 (0.86-3.34)	0.123
Season of surgery						
Summer-spring	675 (62.4)	56 (8.3)	619 (91.7)			
Autumn-winter	407 (37.6)	31 (7.6)	376 (92.4)	0.69		

Multivariable analyses identified that age >15 years and receiving postoperative NSAIDs were independent risk factors for PTH (OR: 15.5, 95% CI), 7.68-31.27, p<0.001, and OR: 0.22, 95% CI, 0.11-0.44, p<0.001, respectively) (Table 1).

Characteristics of PTH

Of the 87 patients with PTH, no active bleeding was observed in 50 patients (57.5%), including 31 patients aged >15 years (62.0%). These patients had a history of hemorrhage at home, but oropharyngeal examination at the initial presentation revealed normal findings (grade 1 bleeding, 10 patients, 20%) or only a blood clot (grade 2 bleeding, 40 patients, %80) in the tonsillar fossa without venous oozing or arterial bleeding. These patients were admitted for inpatient observation (conservative treatment group).

The remaining 37 (42.5%) patients (24 were >15 years (64.8%)) with active bleeding (either with venous oozing or arterial bleeding, grade 3 and 4 bleeding, respectively) underwent surgical hemostasis in the OR (operative treatment group).

At presentation with bleeding, the median postoperative day was six days (range, 1 to 17 days). The mean postoperative days for the conservative and operative treatment groups were 7.43 and 5.21 days, respectively (p=0.004).

The median initial hemoglobin level was 13.1 g/dL at the time of presentation with PTH. There were no significant differences between those conservatively treated and those managed with operative exploration (median 12.8 vs 12.9 g/dL, p>0.05).

Overall, children younger than school age (≤6 years) and children at the school age (7-15 years) were 5.3 and 4 times, respectively, less likely to have all bleeding episodes compared to adults.

About one out of every 60 children (1.5%) had important oropharyngeal bleeding, whereas every 12th (8.2%) patient aged >15 years had severe hemorrhages that warranted surgical hemostasis in the OR (p<0.001).

Rebleeding After Initial Management

Rebleeding episodes occurred in 18 out of 87 patients (20.6%). Among the patients who were observed after the first bleeding episode (n=50), about one out of every 19 children (5.3%) and every third adult (35.4%) experienced rebleeding (p=0.022). Of the 11 patients with a normal examination on admission, three (1 child, 2 adults) had rebleeding and were once again managed conservatively. Regarding the subset of patients with a clot in the tonsillar fossa, none of the children (n=13) had a recurrent bleeding episode, whereas 9/26 adults (35%) had rebleeding [4 (15.3%) needed surgical intervention in the OR] (p<0.01).

Of the 37 patients initially managed for active bleeding in the OR, six (16.2%) (including one child and five adults) experienced rebleeding. Of these, the child and two adults underwent a second surgical procedure to control the rebleeding episodes (Table 2).

The median rebleeding day after the initial bleeding episodes was four (range, 1-6). Similarly, the median rebleeding day was four (range, 3-6) in patients who needed surgical hemostasis for oropharyngeal bleeding. The characteristics of rebleeding patterns are shown in Table 3.

Discussion

The literature contains many ways of describing and labeling PTH. Although the frequency of readmissions or reoperations to control hemorrhage was reported generally to be below 5% in the literature, the frequency increased up to 20% when patients with minor bleedings (not requiring intervention) were included in the cohorts. In the presented study, we observed that the overall PTH risk was 8.0% (all forms of presentations) for all age groups. Considering bleeding episodes that necessitated surgical intervention, the overall PTH risk was 3.5% in our cohort which is parallel to the previous reports (9, 10).

Table 2. Hemorrhage classification according to the intensity of bleeding

	Bleeding			Rebleeding			
	No. of patients (%)	**≤15 years of age (%)**	**>15 years (%)**	**≤15 years of age (%)**	**>15 years (%)**	**Post-op day (mean)**	**Hb g/dL**
Non-active bleeding							
Total	50 (57.5)	19 (37.5)	31 (62.5)				
Clot (-)	11 (11.5)	6	5	1	2		
Clot (+)	39 (46.0)	13 (33)	26 (66)	0 (0)	9 (35)	7.43	12.8
Active bleeding							
Venous Oozing/ Arterial	37 (42.5)	13 (35)	24 (65)	1 (7)	5 (21)	**5.21**	12.9
brisk						**(p=0.004)**	

Hb: Hemoglobin, g/dL: grams per deciliter

Table 3. Characteristics of rebleeding episodes

Patient Number	Age	Day of first bleeding	Severity of first bleeding	Surgical homeostasis for the first bleeding	Severity of second bleeding	Day of second bleeding (after the first bleeding)	Surgical homeostasis for the second bleeding
1	23	5	3	Yes	3	5	Yes
2	24	5	2	No	3	4	Yes
3	45	1	3	Yes	2	6	No
4	18	9	2	No	2	4	No
5	8	4	1	No	1	1	No
6	19	1	4	Yes	4	5	Yes
7	28	6	2	No	3	3	Yes
8	38	10	3	Yes	2	6	No
9	24	7	2	No	4	6	Yes
10	38	5	2	No	2	2	No
11	7	10	4	Yes	3	4	Yes
12	31	1	4	Yes	2	5	No
13	36	8	2	No	1	2	No
14	24	6	2	No	1	3	No
15	34	8	1	No	1	6	No
16	27	6	2	No	4	4	Yes
17	48	7	1	No	1	5	No
18	30	3	2	No	1	4	No

*Severity of bleeding "1: Normal oropharyngeal exam, 2: Clot in tonsillar fossa without active bleeding, 3: Venous oozing, 4: Arterial brisk hemorrhage

Numerous studies have examined and found various risk factors for PTH including age, gender, surgical technique, surgeon's skill level, and tonsillectomy indication. Our univariate findings revealed that together with older age (>15 years), also the infectious indication, smaller tonsils, use of NSAIDs for pain relief after tonsillectomy, and tonsillectomies performed by attendings were associated with higher rates of PTH.

In the presented study, both the frequency and the severity of postoperative hemorrhage varied significantly among the age groups. The PTH risk (for all presentations) was 4.0% in children, whereas the risk was 4.7 times higher (18.8%) in adults. Similarly, when we consider only the patients undergoing surgical hemostasis, the rate of return to the OR was 1.6% for children and 8.5% for adults (5.3 times higher odds). As reported in previous reports, older age was consistently more associated with an increased risk of hemorrhage. Lee et al. (11) reported that the odds of having PTH were six times higher (0.5% vs 3.2%) in patients aged ≥12 years than in those patients aged <12 years. In a study by Tomkinson et al. (12) patients aged ≥12 years were 3.3 times more likely to have a secondary PTH than patients <12 years of age.Regarding tonsillectomy indication, many studies showed that patients with chronic tonsillitis are more likely to have PTH than patients with hypertrophic tonsils (9, 13, 14). Our univariate results support this finding. Recurrent and chronic inflammation may result in tissue adhesion and make tonsils dense, more fibrous, and smaller, and all can lead to difficulty in dissection from the tonsil bed. Furthermore, we found a relationship between the surgeon's skill level and hemorrhage. Univariate analysis revealed that the surgeries performed by attendings were associated with a higher risk of hemorrhage than those performed by resident doctors, as also described by Sarny et al. (6).

Nonsteroida lNSAIDs such as ibuprofen increase post-tonsillectomy bleeding. Although many studies have revealed that bleeding time does not change in patients using NSAIDs, recent meta-analyses have shown that particularly postoperative NSAIDs administration was associated with bleeding (15-18). Riggin et al. (17) concluded that in the general population (children and adults) NSAIDs affected the risk of bleeding if given only postoperatively. In our study, patients who received NSAIDs for pain control postoperatively had a two-fold bleeding risk than patients using paracetamol.

When, however, the variables significant in the univariate analysis were taken into account to reveal the independent predictors of PTH by multivariate logistic regression analysis, older age, and postoperative NSAID use came forth as significant risk factors for PTH (all presentations) with OR=15.5 and OR=0.22, respectively. In a few studies involving both adults and children, risk factors for PTH were calculated by logistic regression to get simultaneous coverage of all influencing factors (6, 11,12).

Rebleeding is another problem of PTH. Of the 87 patients with PTH, 18 (20.6 %) experienced a second bleeding episode which was also similar to the results of a large community-based database. In the presented study, we observed that about one out of every 6-7 adults (4/26) with clots in the tonsillar fossa at the initial presentation experienced rebleeding during hospitalization and were taken to the OR to control the bleeding. However, no rebleeding was observed in any of the children with blood clots in the tonsillar fossa. Three out of 11 patients (one out of 6 children and two out of five adults) with normal examination findings had bleeding and all were conservatively managed. In the literature, a few reports addressed the severity of rebleeding episodes in patients with PTH. A previous study (including patients <20 years of age) by Sethi et al. (18) reported that 46.3% of the patients presenting with a blood clot in the tonsillar fossa had rebled and returned to the OR, whereas 18.5% of the patients presenting without a blood clot rebled. Sarny et al. (6), conducting a study including children and adults, reported that severe hemorrhage had occurred following minor hemorrhage in 10.2% of the patients with PTH. However, the authors did not specify how many patients in the cohort with severe bleeding had normal oropharyngeal examination and how many had clots. This rebleeding rate was consistent with our results, as 8.0% of our patients with non-active bleeding at presentation experienced a severe rebleeding episode during follow-up. Whelan et al. (8) reported the results of a pediatric cohort, in which the severity of hemorrhage was classified similar to ours. Of the 130 patients who presented with a history of blood-tinged sputum and normal physical examination, 10.2% later had rebleeding episodes. Of the 94 patients with blood clots but no active bleeding, 17.3% experienced rebleeding. However, the children presenting with clots but having no active bleeding did not rebleed in our study. Similar to ours, few studies have also reported lower rates of rebleeding in patients with a normal oropharyngeal examination. They all classified a clot in the tonsillar fossa as a major risk for hemorrhage or active rebleeding. Peterson and Losek (19) noted that there was no recurrence of bleeding in the 14 pediatric patients who had an initial normal examination. In the pediatric cohort of Arora et al. (7), only two patients (4.7%) with a normal oropharyngeal examination experienced a second bleeding episode.

We also showed that the second bleeding episodes (either severe or all cases) medially occurred on the 4th day after the first bleeding. Similarly, Attner et al. (10) reported that the second rebleeding episode medially occurred on the 3rd day (range, 0-14). Conversely, Sarny et al. (6) reported that almost half of the second severe bleeding episodes had occurred on the day after the minor hemorrhage episodes.

The presented study has notable limitations. Its retrospective nature makes it difficult to control for various confounders. For example, because intraoperative details were not consistently available in operative reports, we could not assess the correlations between the degree of difficulty in surgery or intraoperative blood loss and the risk of postoperative bleeding.

Conclusion

In conclusion, adult age, and the use of postoperative NSAIDs were found to be independent clinical risk factors for PTH in the presented study. Besides, adult patients who presented without active bleeding showed an increased risk of developing severe rebleeding compared to children. Any of the children with a blood clot in the tonsillar fossa did not experience any form of rebleeding, whereas one out of three adults with blood clots rebled, and almost half of them underwent surgical homeostasis in the OR. In light of these findings, we conclude that adult patients are at greater risk of PTH than younger patients.

Ethics Committee Approval: This study was reviewed and approved by the institutional review board of Ankara Dışkapı Yıldırım Beyazıt Training and Research Hospital (no: 53/11, date: 06.08.2018)

Footnotes

Authorship Contributions

Surgical and Medical Practices: B.Ö., M.M.G., K.K., M.M., İ.A., C.S., E.Ç.T., M.H.K., Concept: B.Ö., M.M.G., K.K., M.M., İ.A., C.S., E.Ç.T., M.H.K., Design: B.Ö., M.M.G., K.K., M.M., İ.A., C.S., M.H.K., Data Collection and/or Processing: B.Ö., M.M.G., K.K., M.M., E.Ç.T., Analysis and/or Interpretation: M.M.G., İ.A., C.S., M.H.K., Literature Search: B.Ö., M.M.G., K.K., M.M., M.H.K., Writing: B.Ö., M.M.G., E.Ç.T.

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Main Points

- Adult age and the use of postoperative NSAIDs are found to be independent clinical risk factors for PTH.
- The PTH risk (for all presentations) was 4.0% in children, whereas the risk was 4.7 times higher (18.8%) in the adult population.
- For patients undergoing surgical hemostasis, the rate of return to the operating room is 1.6% for children and 8.5% for adults (5.3 times higher odds).
- Adult patients who presented without active bleeding showed an increased risk of developing severe rebleeding compared to children.
- The evidence of minor/light bleeding increased the risk of a second bleeding episode.

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