Risk factors for secondary post-tonsillectomy hemorrhage in children

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ABSTRACT

Objective: The purpose of this study was to investigate the secondary post-tonsillectomy hemorrhage (PTH) rate in the pediatric population undergoing cold dissection tonsillectomy and to evaluate its clinical risk factors.

Methods: This retrospective case-control study comprised pediatric tonsillectomy cases admitted to the tertiary otolaryngology clinic between January 2007 and June 2017. Risk factors were compared between the PTH and non-PTH groups, including surgical diagnosis, pre-operative demographic and clinical characteristics, surgeon skill level, and hemostasis methods during tonsillectomy (intraoperative bipolar electrocautery and suture ligation).

Results: In the last decade, tonsillectomy had been performed in 4122 pediatric cases using the cold dissection method. The number of secondary PTH cases was 89 (2.16%), and significant risk factors for secondary PTH were male sex (p<0.021), age (≥13 years, p<0.008), environmental tobacco smoke exposure at home (p<0.000), attention deficit hyperactivity disorder (p<0.011), and hemostasis with intraoperative bipolar electrocautery (p<0.000).

Conclusion: Male children aged ≥13 years whose pre-tonsillectomy history included environmental tobacco smoke exposure at home and hyperactivity disorder and who had undergone hemostasis with bipolar electrocautery during tonsillectomy were at significant risk for secondary PTH.

Keywords: bleeding, pediatric tonsillectomy, risk factors, secondary tonsillectomy hemorrhage

Introduction

Tonsillectomy, one of the oldest and most frequently performed operations in otolaryngology, is performed alone or together with adenoidectomy. Post-tonsillectomy hemorrhage (PTH) after surgery in pediatric patients is a significant problem for both the family and the otolaryngologist. These patients are at risk of developing life-threatening complications and may sometimes even appear in the media. In the pediatric population, adenotonsillectomy or tonsillectomy is performed if adenotonsillar hypertrophy or chronic tonsillitis is diagnosed (1, 2). Some of the complications that develop after tonsillectomy are respiratory complications, hemorrhage, pain, oral intake restriction, dehydration, nausea, and vomiting. PTH is a common and serious complication and is classified into two groups: primary PTH (bleeding in first 24 h after surgery) or secondary PTH (bleeding > 24 h after surgery) (2-4). The prevalence of general PTH is 4.5%, and the prevalence of primary and secondary PTH varies from 0.2% to 2.2% and from 0.1% to 4%, respectively (2-7). Secondary PTH is still a popular topic in the current literature owing to the high number of risk factors and varied results. Studies mostly focus on the epidemiology, surgical method, and surgeon’s skill level (4-6).

The aim of the present study was to determine the risk factors associated with the development of secondary PTH in the pediatric population after tonsillectomy performed at a single center a single surgical method.

Methods

Preparation of the data

The study data were obtained by screening the files of pediatric patients aged 1-17 years who had undergone adenotonsillectomy or tonsillectomy at the otolaryngology-head and neck surgery clinic of a Health Sciences University Hospital.

Surgical technique

All children had undergone cold dissection tonsillectomy at the same center, performed by various surgeons with different surgical skill levels under general anesthesia. During tonsillec-
tomography, intraoperative bleeding control was achieved using bipolar electrocautery or the suture ligation method.

The parents of the children, who were monitored at the hospital for one day after the operation, were informed about oral nutrition and possible complications before the patients were discharged home. The parents were also given a follow-up card containing the telephone numbers to call in the case of bleeding.

Study design
This retrospective case-control study comprised pediatric tonsillectomy patients admitted to the tertiary otorhinolaryngology clinic between January 2007 and June 2017 who had undergone cold dissection tonsillectomy. If the pediatric patients presented with a complaint of bleeding > 24 hours after the tonsillectomy, they were included in the study in the secondary PTH group (n=89). The children who did not develop hemorrhage (n=4033) were assigned to the control group.

Risk factors
The following risk factors were evaluated: preoperative demographic features (age: 1-6 years, 7-12 years, and ≥13 years; sex: male, female; diagnosis: adenotonsillar hypertrophy, chronic tonsillitis), medical history (allergic rhinitis, asthma, attention deficit hyperactivity disorder [ADHD]), environmental tobacco smoke exposure at home), and surgical features (surgeon’s skill level: 1-2 years, 3-5 years, ≥6 years; bleeding control during tonsillectomy: bipolar diathermy, suture ligation).

Exclusion criteria
Patients with abnormal results for complete blood count, prothrombin time, or active partial thromboplastin time were excluded. In addition, patients with coagulopathy or receiving anticoagulant therapy, who had undergone tonsillectomy at centers other than the clinic at which the study was conducted, had tonsillar malignancy (tonsil cancer/carcinoma) or a history of emergency tonsillectomy, or had primary PTH were also excluded from the study. We also excluded children whose files did not include adequate data.

Ethical considerations
The research was performed in accordance with the principles of the Declaration of Helsinki. Scientific ethics committee approval was obtained from the University of Health Sciences, Training and Research Hospital, before the study (approval number: 2017/5/9). Institutional guidelines for retrospective studies, acclaimed by the institutional review board, were followed for the research. Informed patient consent was not required because of the retrospective nature of the study.

Main Points:

- Tonsillectomy is a procedure with significant morbidity and mortality.
- The most frequent complication after tonsillectomy includes secondary hemorrhage.
- Significant risk factors for secondary post tonsillectomy hemorrhage were as follows: Male sex, age ≥13 years, environmental tobacco smoke exposure at home, ADHD, and hemostasis with intraoperative bipolar diathermy.

Statistical analysis
The Statistical Package for Social Sciences version 23.0 software (IBM Corp.; Armonk, NY, USA) was used for statistical analysis. On data analysis, the descriptive information about the patients included in the study was presented as number percentage distribution and average. The chi-squared test was used to evaluate the relationship between the independent variables in the study. The findings were evaluated with a 95% confidence interval and significance, assessed as p<0.05.

Results
In the present study, among 4279 children who underwent tonsillectomy in the last 10 years, 4122 met the inclusion criteria and were analyzed, including 89 (2.16%) cases of secondary PTH 24 hours after tonsillectomy. A comparison of the hemorrhage group and control group in terms of sex revealed that male sex was a significant risk factor for bleeding (p<0.021; Table 1). The median age of the children in the hemorrhage group was 10 years. The youngest patient was 4 years old and the oldest 17 years old (Table 1). A comparison of the hemorrhage group and control group in terms of age revealed that those who were aged ≥13 years were at a high risk of hemorrhage (p<0.021). Secondary PTH was most frequent on the 7th postoperative day (Figure 1).

A comparison of the two groups in terms of indication demonstrated no significant difference (p=0.463). An analysis of the children’s medical history before tonsillectomy revealed no significant relationship between the groups in terms of the diagnosis of allergic rhinitis (p>0.263) or asthma (p=0.985). However, the presence of attention deficit hyperactivity disorder before the tonsillectomy was a significant risk factor for hemorrhage (p<0.011). An analysis of the children’s medical history in terms of exposure to environmental tobacco smoke (parental smoking) revealed that 58 (65.2%) children were exposed to household tobacco smoke at home, which was significant in terms of the risk of hemorrhage in children (p<0.000). In 73.21% of the 58 children exposed to tobacco smoke, the preoperative indication was chronic tonsillitis.

An analysis of the surgical skill level of the surgeons by experience indicated no significant difference between the two groups in terms of bleeding (p>0.242). The comparison of the two groups in terms of the use of bipolar electrocautery or suture ligation for intraoperative hemostasis when performing cold dissection tonsillectomy showed that bipolar electrocautery increased the risk of secondary PTH (p<0.000).

Discussion
The focus in the present study was on the effects of potential pre-operative risk factors on secondary PTH in children. In a retrospective, single-center study conducted by Windfuhr et al (2), the rate of PTH was 2.86% for 7132 tonsillectomies. However, Spektor et al (7) reported a rate of secondary PTH of 4.07% for 2237 tonsillectomies performed over 5 years. The secondary PTH rate varies between 0.1% and 4% in different publications (2–7), but the rate in the present study is consistent with that in the literature.
Table 1. Demographic data for patients included in the study

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Hemorrhage Group</th>
<th>Control Group</th>
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<td>%</td>
<td>n</td>
<td>%</td>
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*p<0.05

Kshirsagar et al (13), found that PTH was more common in the age group of 9-18 years. In another study, the probability of secondary PTH was reported to be 3-times higher in children aged 12 years or older (4). Consistent with the previous reports, in the present study, being ≥13 years old was found to be a significant factor for secondary PTH. Regarding the theory that the risk of hemorrhage increases with age, our theory is that hemorrhage occurs due to increased vascularity caused by chronic tonsillitis (persistent infection of the tonsils).

Thus far, smoking has not been clearly shown to be a risk factor for PTH. However, there are surgical interventions performed in the abdominal area, thyroids, and kidneys for which smoking is indicated to increase the post-operative hemorrhage rates (14). In the present study, exposure to environmental tobacco smoke (parental smoking) at home was found to be a significant risk factor for hemorrhage in the children. In a systematic review and meta-analysis investigating the effect of environmental tobacco smoke exposure on anesthesia and surgical outcomes in children (15), children living in households in which family members smoked were at a higher risk of cough after tonsillectomy and adenoidectomy. Environmental tobacco smoke exposure may affect the success of surgical procedures, especially in otorhinolaryngology (ENT surgery). In addition, passive exposure to tobacco smoke increases the risk of respiratory complications during anesthesia in children undergoing surgery. Another study concluded that the rate of tonsillectomy due to chronic tonsillitis was 2.49-times higher in children exposed to smoke than in children not exposed to smoke (16). In a study investigating the relationship between smokers and hemorrhage in adult patients, the reason for the high rate of recurrent acute or chronic tonsillitis was explained by the fact that smoking impairs tissue oxygenation by affecting systemic and local factors. Tobacco smoke not only causes dryness and irritation of the pharynx but also changes the oropharyngeal microflora (14, 17). Similarly, in the present study, the preoperative indication was chronic tonsillitis in 73.21% of the 56 children exposed to tobacco smoke, which is considered to be rather high. Exposure to tobacco smoke may cause chronic tonsillitis episodes in children just as it does in adults. Therefore, families should be warned that they should not smoke in environments that include their children.

Attention deficit hyperactivity disorder is a psychiatric disorder that affects 9-16% of school-aged children and is characterized by attention deficit disorder, impulsivity, and hyperactivity. ADHD symptoms in children with adenotonsillar hypertrophy and sleep disordered breathing have been reported to be improved by correcting airway obstruction after adenotonsillectomy (18). In a prospective study evaluating the clinical behaviors of children with ADHD after surgery and anesthesia, 134 children, 36 (26.9%) of whom were anesthetized and operated upon by an otorhinolaryngologist (ENT) and the remaining who were anesthetized and operated upon by surgeons of different disciplines, exhibited symptoms of appetite reduction, increased anger attacks, and adaptation problems (19). Only one publication has stated that tonsillectomy patients with a history of ADHD are 8.7 times more likely to have a risk for postoperative hemorrhage (7). In the present study, the children with ADHD were at significant risk of postoperative hemorrhage, and the pre-tonsillectomy diagnosis of the

Although the male sex has been found in some studies to be a significant risk factor for secondary PTH (2, 4, 8, 9), other studies have not found it to be a significant risk factor (10, 11). However, in their study of 17,480 patients, Tomkinson et al (4). reported that male sex was a risk factor for PTH. Thus, the finding of the present study is consistent with the reported literature that the male sex is a significant risk factor for hemorrhage.

Many studies have found age to be a risk factor for bleeding (2, 4, 7, 8, 12) In a study conducted between 2005 and 2011,
3 children diagnosed with ADHD was adenotonsillar hypertrophy. This result is consistent with the literature. The results of the present study and the literature findings clearly reveal the need to inform the families about the possibility of secondary PTH in children due to oral dietary (food) intake disorder, lack of appetite, and anger attacks occurring during the recovery process in addition to the adverse post-tonsillectomy behaviors and decreased compliance.

In the present study, hemorrhage control with bipolar electrocautery increased the risk of secondary PTH compared to suture ligation. Uluyol et al (20) studied the effectiveness of suture ligation for bleeding control in a total of 315 pediatric tonsillectomy cases and reported that no bleeding occurred in the early and late periods in children. In a retrospective study including 3658 patients whose intraoperative hemorrhage control was maintained through bipolar electrocautery vs. suture ligation, ‘hot’ techniques for tonsillectomy were found to pose a higher risk for secondary PTH than the conventional ‘cold’ technique, and the PTH rates were 5.2% and 4.5% in the bipolar electrocautery and suture ligation groups, respectively (21). In a large scale study that screened the National Tonsil Surgery Records in Sweden in 2015, the secondary PTH rate after cold tonsillectomy was 12% compared to 13.4% with the bipolar diathermy, ‘hot’ techniques for tonsillectomy were found to increase the risk of secondary PTH compared to bipolar electrocautery increased the risk of secondary PTH compared to su.

In the present study, 4122 pediatric patients underwent cold dissection tonsillectomy between January 2007 and June 2017 at a single center. The number of secondary PTH cases was 89 (2.16%), and the significant risk factors were male sex, age ≥13 years, environmental tobacco smoke exposure at home, ADHD, and hemostasis with intraoperative bipolar diathermy. In pediatric patients, environmental tobacco smoke exposure at home not only poses a significant risk for hemorrhage, but also leads to tonsillitis attacks. In addition, parents of children with ADHD should be informed of the possibility of changes in their postoperative behavior after tonsillectomy that may cause problems in appetite and nutrition behaviors, and these children should be followed up closely. Furthermore, the suture ligation method for hemostasis during tonsillectomy is a conventional and valid method.

Ethics Committee Approval: Scientific ethics committee approval was obtained from the University of Health Sciences, Training and Research Hospital, before the study (approval number: 2017/5/9).

Informed Consent: Informed patient consent was not required because of the retrospective nature of the study.

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