

## Does Surgical Technique Significantly Change the Rate of Post-Tonsillectomy Hemorrhage?

Cerrahi Teknik Post Tonsillektomi Hemoraji Oranını Anlamlı Olarak Değiştirir mi?

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### ABSTRACT

**Aim:** Tonsillectomy is one of the most common surgical procedures in the pediatric population, as well as one of the first operations learned during otolaryngology residency. This study aims to evaluate the effect of surgical technique on the occurrence of post-tonsillectomy hemorrhage.

**Material and Methods:** This prospectively-designed clinical trial was conducted in a tertiary referral center between May 2012 and April 2015. A total of 608 patients had tonsillectomies performed by a single surgeon with three different surgical techniques used during the study period. Patients in group one were operated on using cold dissection; group two comprised patients who underwent bipolar cautery; group three had the posterior pillar mucosal suturing technique performed.

**Results:** 608 patients met inclusion criteria; 165 of them in group one, 274 in group two, and 169 in group three. The median age was 5 (2-14) years old. A total of five patients (0.82%) experienced post-operative bleeding. One of these patients (from group one) experienced primary hemorrhage. The four others were considered secondary hemorrhage; two from each the bipolar cautery and posterior pillar mucosal suturing groups. The rates of post-operative hemorrhage in each group were 0.61%, 0.73% and 1.18%, respectively (p=0.861). Only one of the five patients necessitated a return to the operating room to control the bleeding.

**Conclusion:** Our study findings suggest that the choice of surgical technique does not affect the post-tonsillectomy bleeding rate. There were no significant differences in bleeding rates between subgroups.

**Keywords:** Tonsillectomy; bipolar cautery; cold dissection; post-tonsillectomy hemorrhage.

### ÖZ

**Amaç:** Tonsillektomi pediatrik popülasyonda en sık uygulanan cerrahi girişimlerden biridir ve KBB eğitiminde ilk öğrenilen işlemlerdendir. Bu çalışma, tonsillektomi sonrası kanamada cerrahi tekniğin etkili olup olmadığını değerlendirmeyi amaçlamıştır.

**Gereç ve Yöntemler:** Bu prospektif planlı klinik çalışma, Mayıs 2012 ile Nisan 2015 arasında bir üçüncü basamak sağlık merkezinde gerçekleştirildi. Çalışma süresince, aynı cerrah tarafından 3 farklı teknikle toplam 608 hasta ameliyat edildi. Grup 1'de soğuk diseksiyon ile ameliyat edilen çocuklar, Grup 2'de bipolar koter ile opere edilen çocuklar, Grup 3'de ise posterior pillar mukozal sütür tekniği ile opere edilen çocuklar yer aldı.

**Bulgular:** Soğuk diseksiyon (n=165), bipolar koter (n=274) ve posterior pillar mukozal sütür (n=169) tekniklerine toplam 608 hasta dahil edildi. Yaş ortancası 5 (2-14) idi. Beş hastada (%0,82) ameliyat sonrası kanama oldu. Bu hastalardan sadece birinde primer hemoraji gözlenmiş olup, hasta soğuk diseksiyon grubunda yer almaktaydı. Beş hastanın dördünde sekonder kanama gözlemlendi ve bu hastalar bipolar koter grubu ve posterior pillar mukozal sütür gruplarındaydı. Postoperatif hemoraji oranları gruplar için sırasıyla %0,61, %0,73 ve %1,18 olarak tespit edildi (p=0,861). Kanamayı kontrol etmek için ameliyat odasına sadece beş hastadan biri transfer edildi.

**Sonuç:** Çalışmamızın bulguları, cerrahi tekniğin tonsillektomi sonrası kanama oranını etkilemediğini desteklemektedir. Farklı cerrahi teknikler arasında primer ve sekonder kanamada oranları açısından anlamlı fark olmadığı görüldü.

**Anahtar kelimeler:** Tonsillektomi; bipolar koter; soğuk diseksiyon; post-tonsillektomi hemoraji.

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## INTRODUCTION

Tonsillectomies are among the most commonly performed operations by otolaryngologists. This operation is often performed for recurrent tonsillar infections or obstructive symptoms, especially in pediatric patients. In the United States alone, approximately 500,000 tonsillectomies are performed annually on patients under the age of 15 (1). Although a relatively safe procedure with numerous benefits, complications are still possible and may include potentially life-threatening hemorrhage. Post-tonsillectomy hemorrhage (PTH) is categorized as primary or secondary. Primary hemorrhage is bleeding that occurs within 24 hours after the operation. It is often based on the surgical technique and results from reopening of a sealed or ligated vessel. Secondary hemorrhage emerges more than 24 hours after the operation, most often within the first week. It generally occurs as a result of injury to granulation tissue covering the tonsillar nest. The rates of primary and secondary hemorrhage are approximately 0.2% to 2.2% and 0.1% to 3%, respectively (2). In a large cohort study, Gysin et al. reported primary, secondary, and overall hemorrhage rates to be 1%, 2.5% and 3.5%, respectively (3). The literature contains several comparative studies analyzing the incidence of PTH. These studies have concentrated on surgical techniques such as cold dissection, bipolar-monopolar cauterization, thermal welding, ligation and chemical substances and so on (3). But studies composed of patients who were operated on by the same surgeon is very rare in the literature. The aim of this study is to compare the rate of PTH between patients undergoing different surgical techniques performed by a single surgeon.

## MATERIALS AND METHODS

This prospective study was conducted at Otolaryngology Department in Ankara Children's Hematology and Oncology Research and Training Hospital, Ankara, Turkey, between May 2012 and April 2015. Medical records of those patients who underwent tonsillectomy, adenotonsillectomy, and tonsillectomy with or without ventilation tube application were reviewed retrospectively after obtaining informed consent. A local ethics committee approval was obtained (Duzce University School of Medicine, 2018/79). Indications for tonsillectomy included chronic-recurrent tonsillitis (at least seven episodes of acute tonsillitis in one year or five episodes per year for two years or three episodes per year for three years) and tonsillar hypertrophy resulting in sleep disordered breathing (mouth breathing during sleep, snoring, or witnessed apnea). Diagnostic tonsillectomies performed for suspicion of malignancy were excluded. Patients with underlying coagulation disorders, such as hemophilia A or B and von-Willebrand disease, were also excluded.

Three different surgical techniques were utilized by the surgeon. During the first year of this study, the classical cold dissection technique was used (group one). During the second year, the bipolar cautery technique was used (group two). During the third year, bipolar cautery or cold dissection with suturing of the tonsillar fossa was used (group three). All procedures were performed by the same surgeon (FAA). In our practice, each patient was placed in the supine position with a shoulder roll in place and a Davis Boyle mouth gag inserted. When applicable, adenoidectomy was performed first and packed accordingly. Then the tonsils were grasped with tonsil-seizing forceps and retracted medially. An incision was then made to the tonsil anterior plica using a number 12 surgical blade. Next the tonsillar tissue was retracted medially and the tonsillar capsule was dissected from the surrounding tissues in a superior to inferior fashion using either cold dissection or bipolar cautery. To reduce the risk of thermal injury, a maximum of 500 Joules was used for the bipolar cautery. Intra-operative bleeding in group one patients was controlled by applying a wet gas tampon for at least four minutes. If bleeding persisted, the bleeding source was sutured with 4/0 vicryl. After hemostasis was achieved in group three patients, the remaining mucosa of the posterior pillar was sutured

to the lateral wall of the tonsillar fossa from the upper pole to the lower pole using 4/0 blunt-point absorbable suture (vicryl). All patients were observed in the hospital for at least 24 hours postoperatively. Patients whose overall condition improved and were able to tolerate adequate oral intake were discharged after 24 hours with antibiotics and analgesics. All patients were instructed to maintain a soft diet for ten days postoperatively. Bleeding that occurred within 24 hours of the operation was classified as primary hemorrhage; bleeding encountered more than 24 hours after the operation was classified as secondary hemorrhage. All study patients were re-evaluated at one week, two weeks, and one month post-operatively. Patients who did not follow-up accordingly were excluded from the study.

## Statistical Analysis

Group comparisons for age was done with Kruskal-Wallis test. Categorical data were analyzed with Pearson Chi-Square followed by z test with Bonferroni adjustment or Fisher-Freeman-Halton test depending on the expected count rule. Statistical analyses were done by SPSS v.22 statistical package and significance level was considered as 0.05.

## RESULTS

Groups one, two, and three had 165, 274, and 169 patients respectively. The median patient age was 5 (2-9), 5 (2-12), and 5 (2-14) years old in each group. There was no significant difference in age between the groups ( $p=0.065$ ). There were no significant differences among the groups according to sex, history, of recurrent infection. Patients' demographic and clinical characteristics are summarized in Table 1. History of sleep disordered breathing (SDB) was significantly lower in group one compared to groups two and three ( $p=0.003$ ). Table 1 summarizes the surgical techniques used in each group.

Five total patients (0.82%) experienced postoperative bleeding; one of which was primary hemorrhage and this patient was from group one. The four others experienced secondary hemorrhage; two were from each group two and group three. Only one of the five patients required transfer to the operating room to control bleeding. Postoperative bleeding rates amongst the groups were 0.61%, 0.73% and 1.18%, respectively ( $p=0.861$ ). Table 2 summarizes the demographic and clinical characteristics of patients with postoperative bleeding.

## DISCUSSION

Although tonsillectomy is the most commonly performed procedure in pediatric patients, complications (such as postoperative pain and bleeding) may lead to serious problems. Numerous tonsillectomy techniques have been performed to date and several studies have reviewed the advantages and disadvantages of each (4-7). The aims of these techniques are to reduce intraoperative and postoperative bleeding rates, postoperative pain, and recovery time. Despite the various surgical techniques, overall postoperative bleeding rates range from 2.1% to 12% (8-9).

The literature reports variable complication rates associated with each surgical technique (9-12). However, it is not clear whether surgical technique plays a direct role in development of PTH. In this study, complication rates of three different surgical techniques were evaluated. The surgical techniques included cold dissection (27% of patients), bipolar cautery (45%), and posterior mucosal suspension (28%). There were no significant differences in rates of PTH between subgroups. Based on our experience, the most important factor in reducing the risk of post-operative complications is appropriate use of electrocoagulation; excessive use may lead to higher rates of post-operative bleeding (10). Nevertheless, inappropriate use (excessive or inadequate) of electrocautery may explain the differences in complication rates between surgeons.

Above all else, the most effective way to minimize bleeding risk, regardless of surgical technique, is to perform a careful tonsillar

**Table 1.** Patients' demographic and clinical characteristics

	Cold Dissection	Bipolar Cautery	Mucosal Sealing	p	Total
Cases	165	274	169		608
Age (year), median (min-max)	5 (2-9)	5 (2-12)	5 (2-14)	0.065	5 (2-14)
Sex					
• Boy	106 (64.2%)	167 (60.9%)	105 (62.1%)	0.789	378 (62.2%)
• Girl	59 (35.8%)	107 (39.1%)	64 (37.9%)		230 (37.8%)
History of recurrent infection	118 (71.5%)	183 (66.8%)	109 (64.5%)	0.374	410 (67.4%)
History of SDB	123 (74.5%) <sup>a</sup>	230 (83.9%) <sup>b</sup>	149 (88.2%) <sup>b</sup>	<b>0.003</b>	502 (82.6%)
Surgical procedure					
• T	42 (25.5%) <sup>a</sup>	44 (16.1%) <sup>b</sup>	20 (11.8%) <sup>b</sup>	<b>&lt;0.001</b>	106 (17.4%)
• AT	123 (74.5%) <sup>a</sup>	210 (76.6%) <sup>a</sup>	141 (83.4%) <sup>a</sup>		474 (78.0%)
• AT+VT	0 (0.0%) <sup>a</sup>	20 (7.3%) <sup>b</sup>	8 (4.7%) <sup>b</sup>		28 (4.6%)
Hemorrhage					
• Primary	1 (0.61%)	0 (0.0%)	0 (0.0%)	0.271*	1 (0.16%)
• Secondary	0 (0.0%)	2 (0.73%)	2 (1.18%)	0.389*	4 (0.66%)
• Total	1 (0.61%)	2 (0.73%)	2 (1.18%)	0.861*	5 (0.82%)
Return to operating theatre	1 (0.61%)	0 (0.0%)	0 (0.0%)	0.271*	1 (0.16%)

SDB: Sleep disordered breathing; T: Tonsillectomy alone; AT: Adenotonsillectomy; AT+VT: Adenotonsillectomy and ventilation tube application; min: minimum; max: maximum; <sup>a,b</sup>: Each subscript letter denotes a subset of surgical techniques whose column proportions do not differ significantly from each other at the 0.05 level; \*: Fisher-Freeman-Halton test.

**Table 2.** Demographic and clinical characteristics of patients with hemorrhage

	Case 1	Case 2	Case 3	Case 4	Case 5
Age (year)	4	6	3	8	10
Sex	Girl	Boy	Boy	Girl	Boy
History of recurrent infection	Yes	Yes	No	Yes	No
History of SDB	Yes	No	Yes	No	No
Surgical procedure	AT	T	AT	T	T
Surgical technique	CD	BC	BC	MS	MS
Hemorrhage	P	S	S	S	S
Return to operating theatre	Yes	No	No	No	No

SDB: Sleep disordered breathing; T: Tonsillectomy alone; AT: Adenotonsillectomy; CD: Cold Dissection; BC: Bipolar Cautery; MS: Mucosal Sealing; P: Primary; S: Secondary

dissection and avoid excessive electrocoagulation (13,14). Soy FK et al. (15) found there to be higher rates of complications associated with tonsillectomies in which a higher energy level of bipolar cautery was used. Excessive use of bipolar cautery in these procedures is strongly associated with significant granulation tissue formation postoperatively. Granulation tissue may easily bleed, owing to its fragile, immature vascular structure. Therefore, postoperative bleeding rates can be significantly decreased by limiting the use of electrocautery in both cold dissection and bipolar tonsillectomy techniques. In our tonsillectomies, the bipolar cautery energy remained at the lowest possible level for dissection and coagulation.

The tonsillectomy wound is comprised of skeletal muscle and granulation tissue, over which epithelium grows inward from the periphery. The postoperative epithelization rate is inversely related to bleeding risk. The literature has shown secondary hemorrhage to be more common than primary hemorrhage (16). A recently published paper indicates an increased risk of epithelial separation between postoperative day six and nine (16,17). Neovascularization typically begins on postoperative day seven. Both factors, increased risk of epithelial separation and neovascularization, were reported as the main pathophysiologic mechanisms of secondary hemorrhage (17). Less traumatic surgical technique reduces postoperative edema, inflammation, and granulation tissue within the wound, which is associated with improved epithelization and lower risk of separation.

Surgeon experience may play a role in post-tonsillectomy bleeding rates however, there is insufficient data to definitively

explain this. Many studies report that surgical experience does not affect complication rates (18,19). However, a recent study reported a three-fold reduction of PTH rates when performed by experienced surgeons (20). In our study, there was no difference in PTH rates between surgical techniques utilized by the same surgeon; and overall, these rates were low compared to that reported in the literature. These results suggest that surgeon experience may play a role in the development of PTH, regardless of which surgical technique is used.

## CONCLUSION

Our study reveals that there are no significant differences in primary and secondary hemorrhage rates between three different surgical techniques used to perform tonsillectomies. Our study supports the careful use of technique.

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