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**Title:** Effects of the Valsalva maneuver on intraoperative bleeding during tonsillectomy

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## Effects of the Valsalva maneuver on intraoperative bleeding during tonsillectomy

### Abstract

**Objective:** We investigated whether the Valsalva maneuver helps determine more bleeding points after adequate hemostasis during tonsillectomy.

**Material and method:** This is a prospective research of consecutive patients who undergone tonsillectomy performed at a tertiary medical center. The collected data included patient identity, age, gender, method of operation, and hemorrhage (if any). Immediately after completing the surgery, hemostasis was performed by an anesthesiologist using the Valsalva maneuver to identify bleeding points. Intraoperative and postoperative hemorrhage, as well as the treatment applied, were recorded.

**Results:** 120 patients underwent tonsillectomy during the period (53 males and 67 females). Tonsillectomy was performed using cold dissection in 59 patients (26 males and 33 females) and bipolar diathermy in 61 patients (34 females and 27 males). The differences in intraoperative hemorrhage following Valsalva were significantly higher in the cold dissection group than in the hot (bipolar) group ( $p = 0.044$ ). Tonsillectomy using bipolar cautery has a statistically significantly higher postoperative hemorrhage rate over using cold dissection ( $p < 0.05$ ).

**Conclusion:** The Valsalva maneuver is useful for identifying subtle bleeding vessels in tonsillectomy wound bed. We suggest applying the procedure for final verification of hemostasis before ending the surgery.

**Key Words:** Valsalva maneuver, tonsillectomy, bipolar cautery, cold dissection, hemorrhage

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## Valsalva manevrasının tonsillektomi sırasında kanama üzerine etkisi

### Öz

**Amaç:** Tonsillektomide yeterli hemostazı takiben Valsalva manevrasının başka kanama noktalarını bulmasına yardımcı olup olmadığını araştırdık.

**Yöntemler:** Üçüncül tıp merkezinde yapılan tonsillektomi uygulanan ardışık hastaların prospektif bir çalışmasıdır. Toplanan veriler arasında hasta kimliği, yaş, cinsiyet, operasyon yöntemi ve kanama (varsa) mevcuttu. Ameliyatı tamamladıktan hemen sonra kanama noktalarını belirlemek için anestezi uzmanı tarafından Valsalva manevrası ile hemostaz uygulandı. İntraoperatif ve postoperatif kanama ve uygulanan tedavi kaydedildi.

**Bulgular:** Bu dönemde 120 hastaya tonsillektomi yapıldı (53 erkek ve 67 kadın). Tonsillektomi 59 hastada (26 erkek 33 kadın) soğuk diseksiyon ve 61 hastada (27 erkek ve 34 kadın) bipolar diatermi kullanılarak yapıldı. Valsalva'yı takiben intraoperatif kanama farklılıkları, soğuk diseksiyon grubunda sıcak (bipolar) gruba göre anlamlı derecede yüksekti ( $p = 0.044$ ). Bipolar koteri kullanarak yapılan tonsillektomi, soğuk diseksiyon kullanılan postoperatif kanama oranına göre istatistiksel olarak anlamlı yüksek saptandı ( $p < 0.05$ ).

**Sonuç:** Valsalva manevrası, tonsillektomi yara yatağında ince kanayan damarların belirlenmesinde yararlıdır. Ameliyatı bitirmeden önce hemostazın nihai doğrulaması için prosedürün uygulanmasını öneriyoruz.

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## Introduction

Tonsillectomy is one of the most widespread operations applied in pediatric populations<sup>1</sup>.

Tonsillectomy has important health advantages, such as avoidance of obstructive breathing and behavioral issues, and improving life quality and neuro-cognition in children<sup>1</sup>. Recurrent tonsillitis and/or large tonsil-induced snoring and even obstructive sleep apnea are the most common indications for tonsillectomy<sup>1</sup>.

Meticulous hemostasis is important for whole surgical techniques. However, the tonsil area is especially responsive to bleeding because of its rich vascular supply. The tonsil is inclined to bleeding, which might have severe sequels such as bleeding aspiration that could lead to a lethal outcome<sup>2</sup>.

Different methods have been defended to optimize intraoperative hemostasis, including the Valsalva maneuver, which may display latent bleeding vessels by increasing the venous pressure. This is particularly important in tonsillectomy practice where surgical drains cannot be used.

Tonsillectomy complications include intraoperative and postoperative hemorrhage, respiratory complications, nausea, vomiting, pain, and burn injuries. Post-tonsillectomy hemorrhage, which occurs in 2.7–5% of children<sup>3</sup>, can be a life-threatening complication that requires emergency surgery.

Furthermore, risks of anesthesia- and opioid-related respiratory depression are other mortal complications that may occur during or after tonsillectomy. Control of post-tonsillectomy hemorrhage usually can be performed easily; however, in a few patients, this may be a challenge<sup>4</sup>.

The Valsalva maneuver is performed by forceful attempted exhalation against a closed glottis.

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During the maneuver, the intra-thoracic pressure becomes very positive and impedes venous return into the thorax. These changes increase the peripheral venous pressure. In our study, the Valsalva maneuver was performed intra-operatively by the attending anesthetist.

We assessed the effectiveness of the Valsalva maneuver for preventing bleeding in the tonsillar wound bed intra-operatively and postoperatively following cold dissection and bipolar diathermy. In addition, we determined whether there was any difference in the intraoperative and postoperative hemorrhage rates between the two methods.

## **Materials and Methods**

A prospective, self-controlled clinical study was conducted to confront the influences of cold towards bipolar electro cautery tonsillectomy procedures in patients with recurrent chronic tonsillitis. One hundred twenty patients aged less than 16 years, who were admitted for tonsillectomy were enrolled. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study protocol was confirmed by the institutional ethics committee. Informed consent was acquired from all individual subscribers included from the parents of the patients. Patients were excluded if the procedure was a tonsillar biopsy, the procedure was performed with palatal surgery, the children had known hematological abnormalities or hypertension, or general anesthesia was contraindicated.

Before surgery, antibiotic and dexamethasone (0.15 mg/kg) treatments were given parenterally to all patients. Surgery was applied under general anesthesia. Patients were grouped according to the methods of dissection and hemostasis. In the first method, bipolar diathermy was used for both dissection and hemostasis. Both tonsils were dissected together with its capsule and the tonsils were removed using a bipolar electro cautery instrument (ME 411; KLS Martin, Tuttlingen, Germany) set in

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the cutting mode by power of 20–35 W. The second method involved a cold dissection technique (scissors and raspatory) with hemostasis using packs; however, if bleeding continued, diathermy was used for hemostasis. After the completion of tonsillectomy and performing hemostasis using a bipolar diathermy technique, the Valsalva maneuver was performed, at least twice, for 30 s by applying 30 cm of PEEP (Positive end-expiratory pressure) to the ventilator circuit. Meanwhile, bleeding points were identified and treated using bipolar diathermy. Complications included early bleeding within 24 h and late postoperative bleeding supposing readmission for surveillance, and return to the operation theater, and blood transfusion. In addition, on the postoperative first day, the patients were examined to reveal any bleeding before hospital discharge.

All of the patients roomed at the hospital postoperative one day. Peroral analgesics and antibiotics were given during postoperatively 10 days. After discharge, the patients were demanded to return to the hospital if hemorrhage emerged. The patients were examined after 10 days. Patients or their relatives were asked whether any postoperative bleeding had occurred within 10 days after discharge.

### **Statistical analysis**

All of the statistical analyses were applied using the SPSS 12.0. Descriptive statistics (median, standard deviation [SD], mean and minimum and maximum rates) and frequency tables were calculated for numerical and categorical variants, respectively. The Mann–Whitney *U*-test was used to confront intraoperative and postoperative hemorrhage between two methods. Variance analysis was used to evaluate the relationship between hemorrhage and age. A significance level of *p* less than 0.05 was accepted.

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## Results

One hundred twenty patients underwent tonsillectomy during the study period (53 males and 67 females; mean age, 9.4 years). Tonsillectomy was performed using cold dissection in 59 patients (26 males and 33 females; mean age,  $9.5 \pm 5.2$  years) and bipolar diathermy in 61 patients (34 females and 27 males; mean age,  $8.9 \pm 5.4$  years).

The prevalence of females was greater than that of males; however, the two-group distribution in gender showed no statistically significant difference ( $p = 0.70$ ). No significant difference was considered between the two groups in terms of age and early hemorrhage (first day of surgery). The differences in intraoperative hemorrhage following Valsalva were significantly higher in the cold dissection group than in the hot (bipolar) group ( $p = 0.044$ ; Table 1, Figure 1). The differences in postoperative hemorrhage were significantly higher in the hot (bipolar) group than in the cold dissection group ( $p = 0.05$ ; Figure 2).

## Discussion

Previous studies have shown that, after tonsillectomy, postoperative hemorrhage is higher when using hot dissection (monopolar, bipolar, or coblation) than when using cold dissection, and that there is a dose-response relationship between postoperative hemorrhage and the bipolar diathermy power setting<sup>5</sup>. The Valsalva maneuver has been used to check bleeding points after hemostasis in thyroidectomy procedures<sup>6</sup>; however, a review of the literature revealed no information concerning the relationship between the Valsalva maneuver and the threat of post-tonsillectomy bleeding. In the present study, after adequate hemostasis, we performed the Valsalva maneuver intraoperatively and compared the risk of hemorrhage between cold and hot dissection tonsillectomy. We found that the risk of intraoperative hemorrhage was statistically significantly higher in the cold

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dissection group than in the bipolar diathermy group. Conversely, the risk of postoperative hemorrhage was higher in the bipolar diathermy group. The cold dissection group was subjected to the cold dissection technique (scissors and raspatory) with hemostasis using packs; however, bleeding continued, and diathermy was used for hemostasis. After hemostasis, the Valsalva maneuver was performed.

Tonsillectomy dissection is commonly applied by cold or diathermy dissections. Hemostasis may be applied using diathermy, ligature bonds to bleeding vessels, or both of them. Diathermy devices may be unipolar or bipolar. While the reported post-tonsillectomy hemorrhage rates vary with the effort of postoperative examination, the published rates for primary hemorrhage during the first 24 h after tonsillectomy vary from 0.3% to 2.1%, and secondary bleed rates necessitating at least incoming to the hospital vary from 2% to 10.3%<sup>7</sup>. Many publications have defined<sup>8</sup> varied ratios of postoperative hemorrhage between “cold” tonsillectomy procedures and “hot” tonsillectomy procedures, usually identifying lower bleeding rates after cold techniques. In the present study, postoperative hemorrhage was significantly higher in the hot (bipolar) group than in the cold dissection group.

The differences among articles regarding bleeding rates after tonsillectomy using varied procedures need to be discussed. Higher post-tonsillectomy bleeding rates following diathermy techniques may be related to more thermal damage because of extremely high power settings or more frequent or prevalent application of diathermy<sup>5</sup>.

The United Kingdom National Prospective Tonsillectomy Audit (NPTA) announced its final survey of tonsillectomies in 2005<sup>8</sup>. According to the NPTA report, cold dissection plus hemostasis using bonds or packs had the lowest risk of post-tonsillectomy bleeding. If the odds ratio for post-tonsillectomy bleeding using this technique is set at 1, then cold dissection plus hemostasis using unipolar or bipolar diathermy has a 1.6 times greater risk for hemorrhage (adjusted odds ratio). Unipolar cautery

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or bipolar diathermy dissection and hemostasis showed a 2.5- to 3.2-times greater risk for bleeding. All of these differences achieved statistical significance. Only diathermy method had a lower risk for primary bleeding than that techniques<sup>9</sup>. This present study aimed to reduce intraoperative and postoperative bleeding by performing the Valsalva maneuver. However, similar to other studies reported in the literature, intraoperative hemorrhage was significantly higher in the cold dissection group than in the hot (bipolar) group.

## **Conclusion**

An obvious difference in intraoperative bleeding was observed between the two methods in response to the Valsalva maneuver. Our results show that the Valsalva maneuver is useful for identifying bleeding vessels for thorough tonsillectomy homeostasis. The procedure may become a helpful addition for final verification of hemostasis before ending surgery.

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### Figure Legends

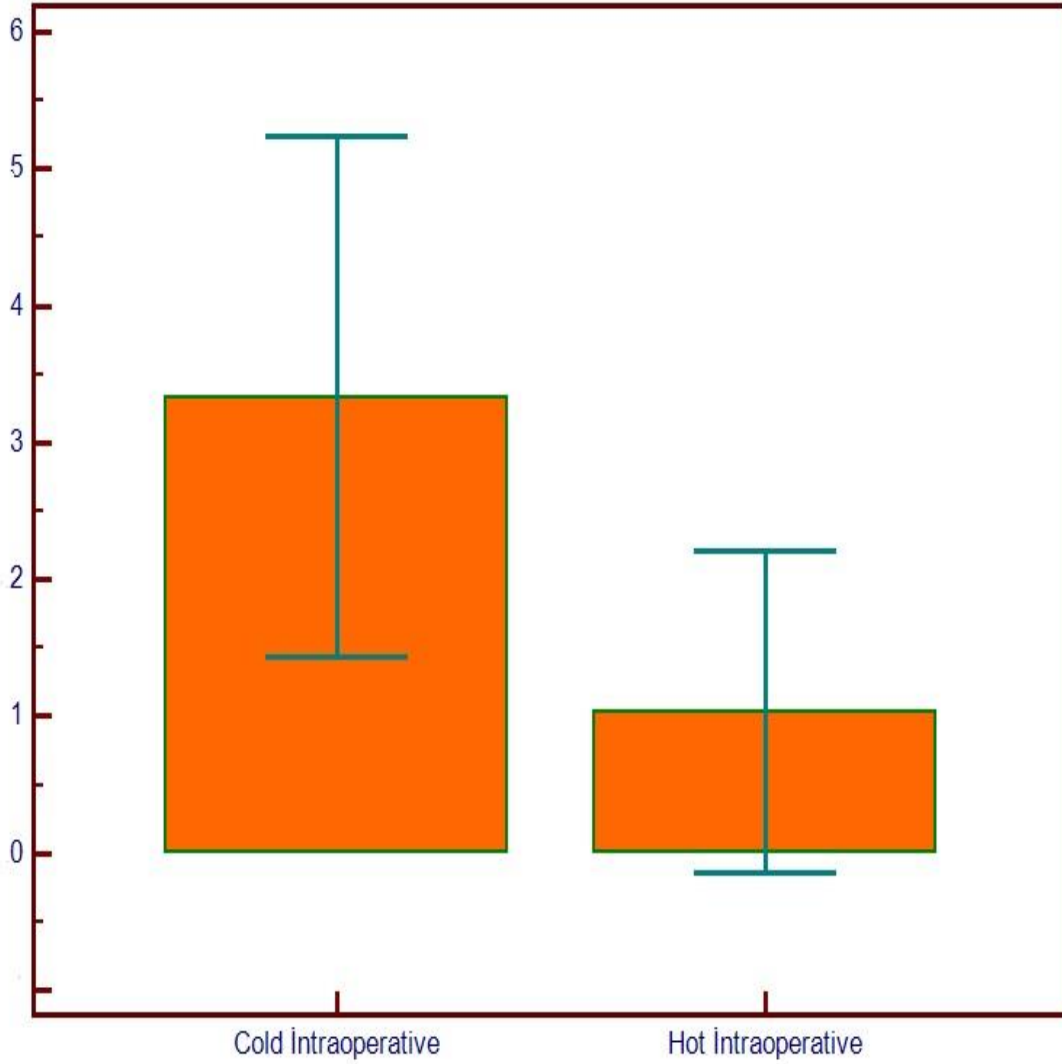
**Figure 1:** After the Valsalva maneuver comparison between two group intraoperative haemorrhage rate

**Figure 2:** The comparison of intraoperative and postoperative haemorrhage rate

### Table Legend

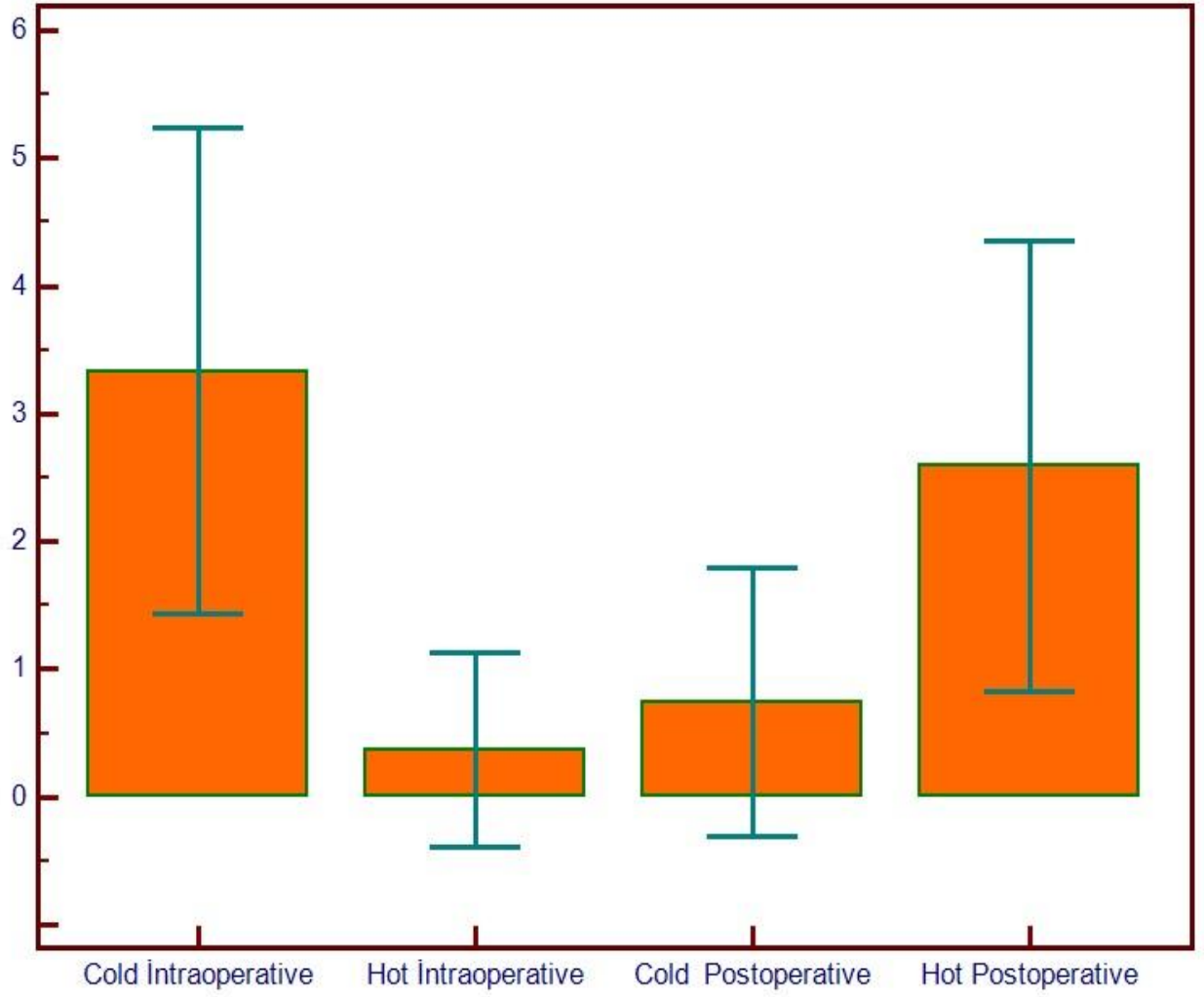
**Table 1:** Using the Valsalva maneuver to identify bleeding points patient number.

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Şekil 1

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**Table 1:** Using the Valsalva maneuver to identify bleeding points patient number.

Table 1	Intraoperative bleeding	Postoperative bleeding (10 days)
Cold dissection group (n)	9	2
Hot dissection group (n)	3	7

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