



The Use of Bipolar Electrocautery Tonsillectomy in Patients with Pediatric Respiratory Tract Obstruction

Pediyatrik Solunum Yolu Obstrüksiyonu Olan Hastalarda Bipolar Elektroter Tonsillektomi Kullanımı

Obstruktif Uyku Apnesi / Obstructive Sleep Apnea

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Özet

Amaç: Bu çalışmada tonsiller hipertrofi nedeni ile solunum yolu obstrüksiyonu olan çocuklarda uygulanan bipolar elektrokoter tonsillektomi ve klasik tonsillektomi tekniklerinin ameliyat sırasında ve sonrasındaki klinik sonuçları karşılaştırılmalı olarak değerlendirildi. **Gereç ve Yöntem:** Bipolar elektrokoter ile tonsillotomi yapılan 31 çocuk hasta ile konvansiyonel soğuk disseksiyon tonsillektomi yapılan 45 çocuk hasta karşılaştırıldı. Postoperatif ağrı skorları erken postoperatif dönemde 'Modifiye Hannalah Skalası' ile ve geç postoperatif dönemde 'Vizüel Analog Skoru' ile ölçüldü. Bu iki grup operasyon sırasındaki kan kaybı, operasyon süresi, oral alım süresi, ağrı kesici alımı, iyileşme zamanı ve postoperatif ağrı skorları açısından karşılaştırıldı. **Bulgular:** Bipolar elektrokoter ile tonsillotomi yapılan çocuklarda iyileşme sürecinde konvansiyonel tonsillektomi uygulanan gruba göre belirgin olarak daha az ağrı olduğu görüldü. Bipolar elektrokoter tonsillotomi yapılan grupta intraoperatif kan kaybı, operasyon süresi, oral alım süresi, ağrı kesici alımı, iyileşme süresi ve postoperatif ağrı skorları konvansiyonel tonsillektomi uygulanan gruba göre daha az olduğu tespit edildi. **Sonuç:** Bipolar elektrokoter tonsillotominin obstruktif uyku apnesi olan çocukların iyileşmesinde konvansiyonel tonsillektomi ile eşit etkinlikte ve güvenilirlikte olduğu görüldü. Bipolar elektrokoter tonsillotomi yöntemi ile postoperatif ağrı daha az olmakta, yaşam kalitesini arttırmakta ve iyileşme sürecini kısaltmaktadır. Bu nedenlerle bipolar elektrokoter tonsillotomi yöntemi çocuklarda konvansiyonel tonsillektomiden daha kabul edilebilir bir yöntem olabilir.

Anahtar Kelimeler

Obstruktif Uyku Apnesi; Palatin Tonsil; Tonsillektomi; Çocuk

Abstract

Aim: This study offers a comparative analysis of the intraoperative and postoperative clinical results of bipolar electrocautery tonsillectomy and conventional tonsillectomy techniques in children with respiratory tract obstruction because of tonsillar hypertrophy. **Material and Method:** Results in 31 children who underwent bipolar electrocautery tonsillectomy were compared with those in 45 children who had conventional cold dissection tonsillectomy. Postoperative pain scores were measured in the early postoperative period by the "Modified Hannalah Scale" and in the late postoperative period by the "Visual Analog Score." Intraoperative blood loss, operation time, duration of oral intake, intake of painkillers, recovery time, and postoperative pain scores of the two groups are also compared. **Result:** Children who underwent bipolar electrocautery tonsillectomy group had significantly less scores in pain throughout their recovery period, intraoperative blood loss, operation time, duration of oral intake, intake of painkiller, recovery time, and postoperative pain than those who had conventional tonsillectomy. **Discussion:** Bipolar electrocautery tonsillectomy is as effective and safe as conventional tonsillectomy to relieve obstructive sleep apnea in pediatric patients. Bipolar electrocautery tonsillectomy reduces postoperative pain, improves the quality of life and shortens the recovery time. Therefore, this procedure is more tolerable in children than conventional tonsillectomy.

Keywords

Obstructive Sleep Apnea; Palatine Tonsil; Tonsillectomy; Child

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Introduction

Tonsillectomy is one of the oldest and most frequent procedures of the ear, nose and throat surgery [1, 2]. Cautery use in tonsillectomy was first defined in 1962 [3, 4]. Further, Andrea defined the first microsurgical bipolar cautery technique in 1993 [5].

Conventional tonsillectomy and bipolar tonsillectomy are the techniques used in the pediatric population with different indications. Our purpose in this study is to offer a comparative evaluation of the intraoperative and postoperative effects of these techniques in pediatric patients with respiratory tract obstruction.

The fact that tonsillectomy procedures do not take much time is of utmost significance regarding reduced intraoperative blood loss, easier completion of the procedure without complications, and less occurrence of postoperative complications.

One of the most important problems seen following tonsillectomy procedures is postoperative pain. Direct (dissection) or indirect (thermal effects, postoperative inflammation) trauma of the pharyngeal muscles where the venous plexus resides is the cause of pain complaints.

Especially postoperative pain in pediatric patients gives way to dehydration and delays in oral intake, and these in turn have a negative effect on the patients' analgesic use and the period of normalization.

Local/systemic analgesic use [6, 7], different instruments and techniques (unipolar cautery, bipolar cautery, dissection) [1], and the recent subtotal removal of the tonsils, "tonsillotomy," (microdebrider, CO₂ laser, low temperature plasma knife, radiofrequency) in selected cases are among the ways that are currently under consideration in order to solve the problem of postoperative pain [2, 3, 4, 6].

Material and Method

This study covers 8 children with only tonsillar hypertrophy and 68 children with tonsillar and adenoid hypertrophy who have open mouth sleeping, snoring, and witnessed apnea complaints. These patients did not undergo polysomnographic evaluation but were diagnosed with respiratory tract obstruction based on information gathered from their parents and clinical examination.

45 randomly selected patients went into surgery using the conventional dissection technique, and the remaining 31 patients were operated on using the bipolar electrocautery technique.

Children who had more than 3 consecutive streptococcal tonsillitis attacks in the last two years, those with a history of peritonsillar abscess, those who were suspected to have chronic infective tonsillitis (upon compressing the tonsil pus-magma comes out) during the examination, overweight children who are thought to have "complex OSAS," those with craniofacial anomaly, and those with suspected coagulopathy were not included in the study. The children's parents were informed about the procedure and were asked to sign consent forms.

The surgical procedures were completed under general anesthesia with endotracheal intubation, using the standard Rose position and the Lawton (80-0218) mouth gag. All the patients first underwent tonsillectomy, and adenoidectomy by classic curettage method was done for patients who needed one. In these patients, bleeding was controlled through aspiration and bipolar cautery, and suture and ligation were applied when necessary. In the conventional dissection group, the tonsil tissue was dissected from the anterior tonsillar plica by a tonsil knife, and following the total sectioning of the tonsil tissue from fossa

tonsillaris, from the superior pole to the inferior, through obtuse dissection method, bleeding was controlled by placing a dry gauze tampon on the tonsillar region. Bleedings that could not be controlled by buffering were coagulated by bipolar cautery at 30 watts.

Bipolar cautery tonsillectomy procedures were done in accordance with the technique from the inferior to the superior and from the medial to the lateral after the medialization of the tonsillar tissue. Bleedings on the surface of the tonsillar region were coagulated with bipolar cautery at 30 watts.

In case of a bleeding, the bleeding source was cauterized. The operation time was started after the placement of the mouth gag and the period between the placement and the removal of the mouth gag was recorded as the operation time. The amount of intraoperative bleeding was also recorded by measuring the vacuum aspirator bottle where the blood accumulated. Should adenoidectomy be performed, it was carried out for both groups using an identical method following the tonsillectomy and the blood was collected in a different bottle. After the removal of the tonsils, their volumes were measured and recorded in milliliters in a graduated bowl containing saline. As a premedication agent midazolam ampoule was orally administered half an hour before the surgery in accordance with the patient's weight / 2 (kg/mg) diluted with 10 cc of fruit juice. No additional medicine was used by the anesthesiologist during the surgery.

Pain scores were recorded by the anesthesiologist at minutes 15, 30, 60, and 120 by using the Modified Hannallah Pain Scale (MHPS) system in the postoperative waking room. Modified Hannallah pain scale (MHPS) is an observational pain scoring system. It is a method devised to ensure that the pain evaluation in children is valid and safe [9].

10 mg/kg intravenous paracetamol infusion and tramadol Hcl 1 mg/kg were administered so as to be effective in the first postoperative hour in order to secure pain control. As of the 4th hour, when oral intake was initiated, pain scoring was carried out every 6 hours according to the VAS system [10]. 15 mg/kg paracetamol was orally administered (at 6 hour intervals) for those who had a pain score of 6 or higher.

All the patients received prophylactic antibiotic therapy in the postoperative period; amoxicillin/clavulanic acid suspension 30 mg/kg three times a day for 7 days was administered orally and those who were suspected to have allergies received clarithromycin 25 mg/day. The patients were given their first oral food intake—water, milk, and ice-cream— in the postoperative 4th hour.

The patients remained in 24 hours of observation to be discharged the following day. Until the 5th day, which is the first control day, patients' information was collected through the phone. On days 5, 10, and 14 patients were examined by the physician and their VAS scores were recorded. Within the postoperative 2 weeks the patients were followed up regarding their need for analgesics, throat pain, otalgia, the period of oral intake of food, and bleeding.

Result

Out of a total of 76 patients included in the study, 44 were male and 32 were female. 45 patients underwent conventional dissection, while 31 underwent surgery using the bipolar electrocautery method. The surgical method was randomly chosen. No criteria were taken into consideration. While 8 patients underwent only tonsillectomy, 68 patients also received adenotonsillectomy.

An improvement in the symptoms based on obstruction was observed in all patients. None of the patients presented to the hospital with complaints of pain, not being able to start intake of food, or dehydration before the scheduled control examination. Postoperative bleeding was seen only in 2 of the electrocautery tonsillectomy patients and in 1 of the conventional tonsillectomy patients. All the bleedings were in the form of mucosal leaks and all were taken under control by cold application. None of the patients had a relapse in the postoperative period within a year of follow-up.

The relationship between the mean intraoperative periods of the patients was evaluated by the t test. The results of the test revealed that the time of operation using the bipolar electrocautery method was shorter in a statistically significant fashion ($p<0,05$) (Table 1). The relationship among the amount of intraoperative bleeding, the period of postoperative recovery, postoperative MHS and VAS values was evaluated by the Mann Whitney U test because of the irregular distribution of the groups. When the results of both surgical procedures were compared, it was seen that the amount of bleeding, the amount of analgesic intake in the postoperative period, and the postoperative recovery period for the bipolar electrocautery method were statistically less than the conventional method ($p<0,05$). Within the first 120 minutes of the postoperative period the MHS values for the conventional tonsillectomy patients were seen to be higher ($p<0,05$) (Table 2). The VAS scores for the conventional tonsillectomy patients were found to be high between hours 4-22, at days 5, 10, and 14 during bed rest and oral intake ($p<0,05$) (Graphics 1,2,3,4). During the follow-ups there was a characteristic improvement in the respiratory tract obstruction complaints and no recurrences were seen in 1 year of postoperative period.

Table 1. Demographic results of patients in both groups.

Operation Type		Age	Weight	Operation Time (min)	Blood Loss (cc)	Recovery Day	Numbers of paracetamol intake
Conventional Tonsillectomy	N	45	45	45	45	45	45
	Mean $\pm$ S.D.	8,24 $\pm$ 3,71	27,47 $\pm$ 9,10	29,53 $\pm$ 7,27	113,87 $\pm$ 75,96	12,27 $\pm$ 2,40	3,93 $\pm$ 0,33
	Min	3	13	15	15	8	2
	Max	17	52	46	300	16	4
	N	31	31	31	31	31	31
Bipolar Electrodissection	Mean $\pm$ S.D.	7,77 $\pm$ 2,28	25,81 $\pm$ 8,11	20,33 $\pm$ 5,62	22,84 $\pm$ 13,04	7,45 $\pm$ 1,15	2,77 $\pm$ 0,76
	Min	5	13	12	10	5	2
	Max	14	51	40	71	9	4

CT: Conventional Tonsillectomy, BE: Bipolar Electrodissection, N: Number of patients.

Table 2. Early postoperative (120 mins) Modified Hannallah Pain Scale (MHPS) results of tonsillectomy patients in both groups.

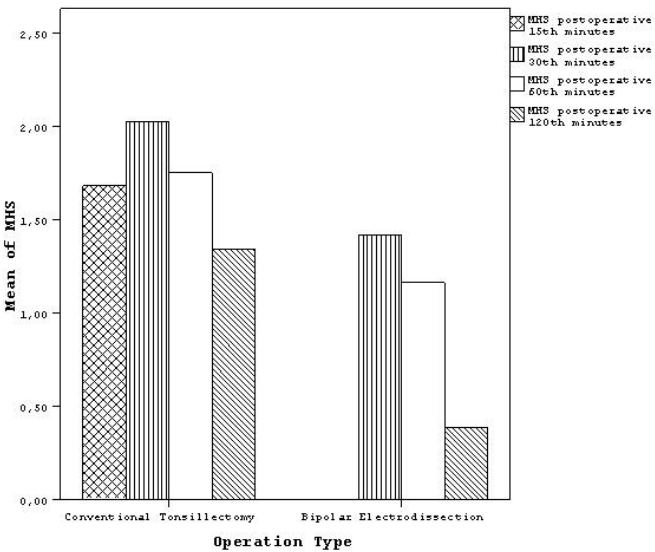
Operation Type		MHSP 15th minutes	MHSP 30th minutes	MHSP 60th minutes	MHSP 120th minutes
CT	N	45	45	45	44
	Mean $\pm$ S.D.	1,69 $\pm$ 0,87	2,02 $\pm$ 0,97	1,76 $\pm$ 1,26	1,34 $\pm$ 1,18
	Min	0	0	0	0
	Max	3	4	4	3
	N	31	31	31	31
BE	Mean $\pm$ S.D.	0,00 $\pm$ 0,00	1,42 $\pm$ 1,03	1,16 $\pm$ 1,42	0,39 $\pm$ 1,09
	Min	0	0	0	0
	Max	0	3	4	4

CT: Conventional Tonsillectomy, BE: Bipolar Electrodissection, N: Number of patients.

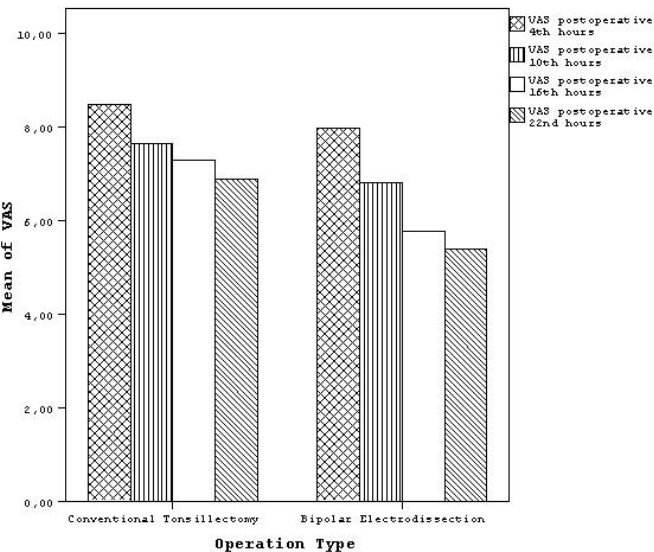
Table 3. Postoperative (from 4 hours to 14 days) Visual Analog Scale (VAS) results of tonsillectomy patients in both groups

Operation Type	VASP 4th hours	VASP 10th hours	VASP 16th hours	VASP 22nd hours	VASP 5th days at rest	VASP 5th days during oral intake	VASP 10th days at rest	VASP 10th days during oral intake	VASP 14th days at rest	VASP 14th days during oral intake
C	N	45	45	45	45	45	45	45	45	45
	Mea	8,49 $\pm$ 0,5	7,64 $\pm$ 0,5	7,29 $\pm$ 0,6	6,90 $\pm$ 0,6	4,09 $\pm$ 1,2	5,00 $\pm$ 0,9	1,36 $\pm$ 1,3	2,04 $\pm$ 1,6	0,18 $\pm$ 0,4
	n	1	7	6	1	8	8	7	4	5
	$\pm$ S.D									
	Min	8	7	6	6	2	3	0	0	0
B	N	31	31	31	31	31	31	31	31	31
	Mea	7,97 $\pm$ 0,7	6,81 $\pm$ 0,7	5,77 $\pm$ 0,6	5,39 $\pm$ 0,7	1,71 $\pm$ 1,1	2,42 $\pm$ 1,0	0,06 $\pm$ 0,3	0,00 $\pm$ 0,0	0,00 $\pm$ 0,0
	n	1	9	2	2	6	3	6	0	0
	$\pm$ S.D									
	Min	7	6	5	4	0	0	0	0	0
E	Max	9	8	7	7	6	5	2	0	0

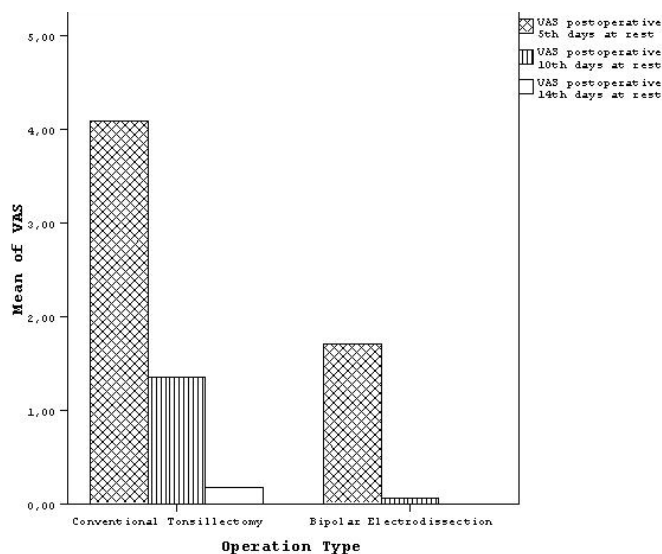
CT: Conventional Tonsillectomy, BE: Bipolar Electrodissection, N: Number of patients.



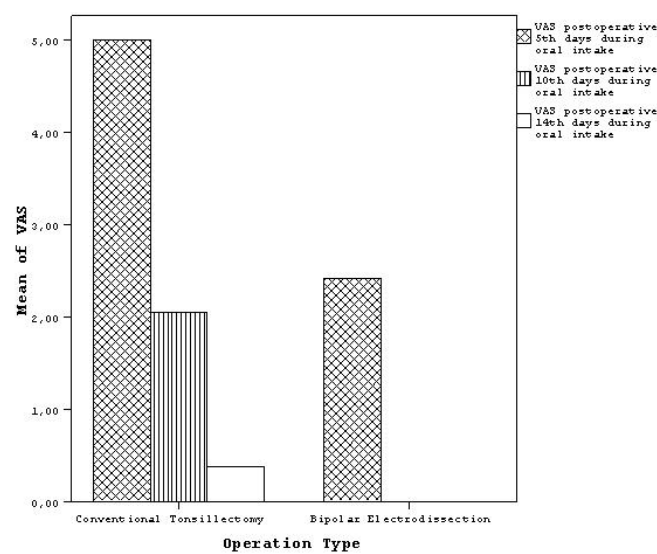
Graphic 1. The comparison of the mean MHS values at postoperative 120 minutes for both surgical methods



Graphic 2. The comparison of the mean VAS values at postoperative 22 hours for both surgical methods



Graphic 3. The comparison of the mean VAS values during resting at the first 14 days of postoperative period for both surgical methods.



Graphic 4. The comparison of the mean VAS values during oral intake at the first 14 days of postoperative period for both surgical methods.

Discussion

Tonsillectomy surgeries are of utmost significance regarding the loss of vital functions of both respiratory and digestive systems since the surgical region under consideration are the starting point of both systems. The search for new methods in tonsillectomy is still under way because of its functional importance and high morbidity rates.

Today bipolar electrodissection method, which was defined in 1993, is also being widely used as well as the conventional dissection method [11]. This method has been shown to shorten operation time because it enables the simultaneous realization of dissection and coagulation [12, 13, 14, 15, 16, 17, 18]. Although there are studies pointing to an opposite direction [19, 20] the former have been generally accepted by the medical community. Within the scope of our study we also found that the mean operation time for bipolar electrocautery method was 20,33 5,62 mins, while it was 29,53 7,27 mins for the conventional tonsillectomy method. The fact that the surgical procedure takes less time with the bipolar electrocautery technique means lesser use of anesthetic agents. Thus, cautery tonsillectomy may be preferred in cases where the period of anesthesia is important. Therefore, the risk of morbidity caused by anesthesia decreases [21].

In our study we have found that the mean intraoperative blood loss was 22,84+-13,04 ml for bipolar electrocautery tonsillectomy, while it was 113,87+-75,96 ml for conventional tonsillectomy. We have also found that the amount of intraoperative blood loss with bipolar electrocautery technique was less in a statistically significant manner. The literature on the subject also supports our result [14, 16, 18]. The possible reason for this might be the immediate coagulation, the immediate stopping of bleeding. This makes the job of the surgeon easier during the procedure and also contributes to the shortening of surgery time.

The bipolar cautery tonsillectomy method seems advantageous because of lesser bleeding for children younger than three years old with limited blood volume and thus with a higher risk of hypovolemic shock. In studies conducted with a large patient population the bleeding rates following conventional tonsillectomy were found to be less than 1% [17, 22]. Various authors have offered different interpretations on the bleeding rate re-

lated to tonsillectomy using the bipolar electrocautery method. While there are authors who have argued that electrocautery technique reduces postoperative blood loss [22], there are also those who have put forward the idea that there was no significant difference between the two [23, 24]. In all the studies, however, the rates shown are quite similar [13, 19]. Postoperative bleeding rates are reported to be between 0.2% and 7.7% for conventional dissection, while they were between 0.3% and 12.1% following bipolar cautery tonsillectomy [23, 24].

Within our study, postoperative bleeding occurred in only one patient on postoperative day 3 in the conventional dissection group, while it occurred in two patients on days 5 and 7 in the bipolar electrocautery tonsillectomy group. The bleeding was in the form of a minimal leak from the tonsillar region and was controlled by cold application.

Postoperative complaints of pain are of utmost importance regarding painkiller intake, the patient's nutrition, his/her and his/her family's returning to normal life. There is an ample amount of studies conducted on the postoperative pain complaints of bipolar electrocautery and conventional tonsillectomy patients. These studies reveal different results and argue that each technique causes less pain based on various different reasons. The following studies exemplify the point.

Some of the studies argue that postoperative pain increases with bipolar electrocautery. The tonsil bed healed later in these patients and the increase in pain was seen to be related to this [12]. Again the same patient underwent surgery receiving different surgical techniques on the right and left tonsils, and eventually it was seen that the bipolar cautery side had more pain than the conventionally operated one (15). Another study offers results pointing out that on the first two postoperative days conventional tonsillectomy side, on the 3rd day and the following the electrocautery side had more pain and it peaked on the 5th and 6th days [21]. Still in another study the authors have found an increase in pain and a related prolongation of oral intake time in the postoperative period in bipolar cautery tonsillectomy group [22].

A study conducted with pediatric population shows that the bipolar dissection group began a normal diet on the 7th day, while the conventional dissection group started having a normal diet on the 5th day, throat pain was the most frequent reason for physician visits following the surgery, and the analgesic use

was more in bipolar electrocautery when compared to the conventional dissection method [23]. Further, another study asserts that the electrocautery method causes otalgia and increases the need for analgesics [24].

Moreover, some studies argue that both methods have similar effects on postoperative pain or that bipolar electrocautery causes less pain. One of these shows that there was no difference in pediatric patients in the first 24 hours, whereas the bipolar electrocautery method gave way to less pain in adults [25]. Another study done with children reports that the bipolar group started feeding in a shorter period and there was no difference in the need for analgesics [14]. In another study the authors found no difference in pain on days 1, 3, 7, and 15 and argued that the bipolar group had thermal temperature injury on a less deep level, less scar, and less pain [13]. Some other authors were not able to find a difference between the two methods regarding pain at the end of the 1st week in adults [16]. There are also authors who defend the idea that the need for analgesics and postoperative pain decrease, and the period for transition to normal diet shortens with the bipolar method [20].

In our study, the mean MHS values in the first postoperative 120 minutes, VAS scores in the first postoperative 24 hours, VAS scores during feeding and resting in the postoperative 15 days, and the amount of paracetamol use before the discharge were found to be less with the bipolar electrocautery method than the conventional method. These advantages are possibly based on the facts that this surgical procedure is technically easier and shorter, causes less tissue damage, and the lesser existence of neuronal stimulants in the tonsillar region through the lesser release of inflammatory mediators.

Pain prevents oral intake for patients and causes a related increase in volume, fever, and delay in recovery. Having less pain after surgery gives way to less food intake and a delay in the initiation of solid foods. Bipolar cautery tonsillectomy should be the chosen method especially for young children who have preoperative nutritional problems, who are underweight, and who have delayed injury recovery because they will have an increased risk of morbidity in the postoperative period.

We think that postoperative morbidity and specifically pain are significantly reduced with bipolar tonsillectomy when the plica mucosae and the tonsillar region are protected from damage as much as possible, and unnecessary coagulation is abstained.

Consequently, bipolar cautery tonsillectomy is a rapid and safe technique. In line with literature on the subject, the study at hand also shows that both the operation time and intraoperative blood loss are less with the bipolar cautery method. Therefore, we think that it might be useful for children under 3 years of age with coagulopathy who need shorter anesthetic time, who are inclined to bleeding, and who have limited blood volume.

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