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ORIGINAL ARTICLE

Postoperative Outcomes in Cold Dissection Versus Bipolar Electrocautery Tonsillectomy: A Randomized Double-Blind Controlled Study

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Abstract Tonsillectomy is one of the oldest and most common procedures worldwide. This surgery is performed by different methods include cold dissection technique (CDT) and bipolar electrocautery technique (BET). Assessment and comparison of postoperative outcomes in cold dissection and bipolar electrocautery is the aim of present study. This randomized controlled clinical trial study was conducted as double-blind on 534 patients. The enrolled patients underwent tonsillectomy in Vali-e-Asr Hospital of Birjand city from Oct. 2013–Oct. 2015. Al patients systematically allocated into two groups treated with cold dissection or bipolar electrocautery methods. Intensity of throat pain scores, Otalgia, analgesic consumption, resume normal diet, body temperature and also wound healing on 10th day after operation were measured and compared between the two groups. The gathered data were analyzed by SPSS software (Ver-22) and using necessary tests. The differences between studied groups less than 0.5 ($p < 0.05$) considered significant statically. 51.7 and 50.6% in the CDT and the BET groups were male respectively. In comparison between the groups the mean of pain scores 4 and 24 h after operation in the BET group were higher significantly ($p < 0.001$). Otalgia only 4 h after surgery was higher significantly in the BET group ($p = 0.008$). All the other studied parameters were significantly more desirable in the CDT group ($p < 0.001$). According to the findings of present study it seems that the CDT is safer and more favorable than the BET in tonsillectomy.

Keywords Tonsillectomy · Pain · Otalgia · Analgesic drug · Bipolar · Cold dissection

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Introduction

Tonsillectomy is one of the commonest surgical procedures around the world and is carried out by various techniques [1]. The most frequent of these techniques include conventional cold dissection technique (CDT) and electrocautery the latter of which is performed as monopolar and bipolar electrocautery technique (BET) [2]. The aim of all applied procedures in tonsillectomy is to reduce perioperative bleeding, severity of experienced pain, and postoperative morbidities [3]. However, up to date, none of the different applied techniques has been accepted as the best and ideal one for tonsillectomy. On the other hand, there is no conclusive evidence about superiority of one method over the other applied techniques for tonsillectomy [4–6]. Moreover, each procedure has advantages and

disadvantages which have been assessed and compared through different investigations worldwide [7].

Some investigators believe that mechanical methods of tonsillectomy like CDT are safer and more effective and have a lower incidence of postoperative morbidity. In this regard, CDT can have less damage to the tissue because of providing more protection. On the contrary, hot methods damage tissues and create burning wounds that can lead to increased postoperative pain as well as delayed epithelialization in the surgical bed. Therefore, this procedure is favored over other methods [2, 3, 8]. Nonetheless, another group of otorhinolaryngologists prefers thermal methods. They suggest that hot methods like BET are applicable to a smaller area and less depth on the involved tonsil. Thereby, they are associated with a minimal amount of collateral thermal damage and less degrees of subsequent pain [6, 9–11].

Findings of applying different methods of tonsillectomy are very diverse possibly due to the effect of some factors such as the race, number of studied cases, ecological conditions, lifestyle, skill of the surgeon, the time of investigation, etc. Hence, we decided to measure and compare outcomes in cold dissection and bipolar electrocautery of two different and most commonly used techniques of tonsillectomy, namely CDT and BET, on admitted patients in Vali-e-Asr Hospital of Birjand city (east of Iran) from Oct. 2013 to Oct. 2015.

Materials and Methods

This prospective and randomized controlled clinical trial study (RCT) was performed double-blindedly at the department of Ear, Nose and Throat (ENT) in Vali-e-Asr Hospital of Birjand city from Oct 2013 to Oct 2015. The participants included a total of 534 patients with obstructive upper airway, chronic or recurrent tonsillitis, or symptomatic adenotonsillar hypertrophy who underwent tonsillectomy or adenotonsillectomy. The patients were randomized alternately into two treatment groups so that per every case who was candidate for the CDT, two cases with similar conditions (age and gender) were operated by the BET. (The adult patients, parents of pediatric patients, and the instructed nurse who measured and recorded complications were not informed of the technique applied for tonsil removal).

Exclusion criteria were as follows: a history of tonsillitis within the past two weeks, hemorrhagic diathesis, hematological disorders, congenital malformed tonsils, craniofacial malformations, asymmetric tonsil appearance, neurological disorders, sensitive to anesthetic drugs, peritonsillar abscess, suspected or confirmed tonsillar malignancy, and diabetes.

The approval for research protocol was obtained from the Ethical Committee in Birjand University of Medical Sciences (BUMS) (code 1393-09-01) and RCT code received from the Iranian Registry of Clinical Trials (IRCT2015012911637N2). Furthermore, informed consent was received from the patients (above 18 years old) and parents of children (less than 18 years old).

All enrolled patients admitted to the ENT Department in Vali-e-Asr Hospital and hospitalized at the night before operation and became NPO (nil per os) for 8 h and received dextrose-water 5% in ratio 350 mg/kg for adult and 100 mg/kg for pediatric, as patient's status maintenance. All participants were medically assessed by a consultant anesthetist and ENT specialist. The medical history and the data concerning their gender and age were recorded, and their vital signs (i.e., temperature, blood pressure, heart rate, etc.) were checked by the nurses who were employed in the ENT department. Lateral graphy of nasopharynx and routine experiments such as Cell blood count (CBC), erythrocyte sedimentation rate (ESR), hemoglobin (HB), partial thrombin (PT), partial thrombin time (PTT), were taken. ECG and chest X-ray for aged patients (above 40 years) were also requested.

Thereafter, all candidates for tonsillectomy or adenotonsillectomy were placed on the operating table in Rose's position (supine with shoulder roll, neck extension and head support) and anesthetized generally by a standard protocol. Afterwards, orotracheal intubation was performed. The patient's mouth was held open with Boyle–Davis gag. They were operated by the CDT or the BET, and their tonsils and adenoid were removed. All surgeries were performed by the same surgeon.

As for the cases that needed adenotonsillectomy, their adenoid was initially removed after which tonsillectomy was carried out. For adenoidectomy, the presence of adenoid was first confirmed by digital examination in the nasopharynx. Later, by excluding abnormal palsation, the adenoid was swept away from the Eustachian towards the midline and removed with a set of appropriate-sized Bekham adenoidal currets. Digital examination confirmed clearance of adenoidal tissues. After operation, a swab gaze was left in the nasopharynx while the ensuing tonsillectomy in either CDT or BET was taking place.

Tonsillectomy in the CDT group was performed by incision of palatoglossal fold with a 12 bisturi blade. The peritonsillar connective tissue was encountered and the tonsil was dissected toward the lower pole. This procedure was completed using an Eve's wire snare. The tonsillar fossa was lampooned with a swab and the other tonsil was similarly removed. After operation, swabs were removed and when necessary, absorbable ties were used to secure haemostasis.

In the BET group, Bayonet bipolar forceps (Martin, made in Germany) (set on 40–50 W) was applied. First, the

anterior pillar was dissected by the tip of bipolar forceps from the superior towards the inferior. Then, the connective tissue beneath the tonsil was encountered, and the tonsil was completely removed. The encountered vessels were cauterized simultaneously, and only thereafter, they were separated from the tonsil. Any further haemostasis of the tonsillar fossa was secured with bipolar forceps. Only after complete haemostasis of both tonsillar fossae was achieved, the nasopharynx swab was removed.

As the surgery finalized, assessment of different variables was initiated by an expert, instructed nurse blindly (during the first 24 h in the department of ENT while the staff nurse was unaware of the group allocation).

The studied variables included intensity of postoperative throat pain and Otalgia recorded 4 and 24 h after operation, body temperature, application of analgesic drugs, return to normal diet and wound healing on 10th day after operation.

Pain intensity was estimated using a visual analog scale (VAS) at 4 and 24 h postoperatively. For adult patients, numerical pain score ladder was used to express their pain intensity whereas the face pain scale (Wong–Baker Faces Scale) was shown to young pediatric patients to describe their sore throat or Otalgia.

Analgesic drug (acetaminophen) was administrated as 625 mg every 6 h for adult and 15 mg/kg for pediatric patients. In those who needed more analgesic drug, pethidine was injected intramuscularly (IM) as 0.7 mg/kg daily in hospital.

The patients were discharged the day after surgery with an acetaminophen prescription for pain control orally every 8 h from the first postoperative day and thereafter, as needed. All the patients were given a follow-up chart on which they were instructed to record daily changes such as body temperature, analgesic consumption, nausea and/or vomiting, etc. for the next 10 days.

Finally, all patients were examined on the 10th day to estimate healing within the tonsillar fossae by calculation of the amount of reepithelialization. A fully healed fossa was characterized as one with 100% remucosalizied.

All patients' data, including demographic characteristics (age, gender) and the measured outcomes were entered in a database and analyzed with SPSS software (Ver-22) using ANOVA, t test, Tukey and Fisher exact test. To compare group difference, p values less than 0.05 ($p < 0.05$) was considered significant.

Results

This study was performed on 534 patients who were candidate for elective tonsillectomy or adenotonsillectomy by cold dissection or bipolar electrocautery methods.

A total of 178 patients were operated with the CDT and 356 cases with the BET. Their age ranged between 3 and 52 years. The mean ages of patients were 11.74 ± 8.8 and 11.87 ± 8.8 years in the CDT and the BET groups respectively ($p = 0.59$). Furthermore, 92 patients (51.7%) in the CDT group and 180 patients (50.6%) in the BET group were male ($p = 0.81$) with no significant differences in any of these demographic characteristics between the two groups. The main indications for surgery are displayed in Table 1.

Intensity of throat pain 4 and 24 h after operation increased significantly more in both time points in the BET group than the CDT group ($p < 0.001$), while Otalgia was higher in the BET group only 4 h after operation ($p = 0.008$) (Tables 2).

The results of the other variables have been summarized in Table 2.

Discussion

The morbidities of conventional cold dissection and bipolar electrocautery methods of tonsillectomy were previously and separately studied by our research team [12, 13].

As the tonsil is removed, the surrounding tissue undergoes mechanical or thermal damage resulting in severe pain in the throat due to inflammation, irritation of the nerves (9 and 10 cranial nerves) that supply this region, and spasm of the exposed pharyngeal muscles [6].

The throat pain intensity was a variable assessed and compared between the BET and the CDT groups in two occasions, 4 and 24 h after operation. In both time points, the patients who underwent tonsillectomy with the BET experienced significantly higher pain intensity than the CDT group ($p < 0.001$). Higher pain intensity scores in our results correspond with other studies with a BET group including Gendy et al. [14], Silveria et al. [15] and Khan et al. [2]. In researches carried out by Chettri et al. [16, 17], Adoga [3] and Bukhari and Al-Ammar [18] a significantly higher percentage of patients in the BET group complained of greater pain intensity than the CDT group, which is consistent with our findings. Fida and Sendi [19], Yilmaz et al. [20] and Stavroulaki et al. [6] assessed and compared pain intensity between cold dissection and thermal welding (TW). Their findings showed that severity of pain was lower in the CDT group when compared with TW group, which is inconsistent with our results.

Otalgia was another complication studied in the present investigation. This complication can occur following tonsillectomy in patients. The reason for this complication is common innervations of the palatine tonsil and the middle ear, so that, both supplied by the glossopharyngeal nerve. Therefore, any irritation of the palatine tonsil can be

Table 1 Frequency and percentage of different indications for patients underwent tonsillectomy

Indications of surgery	Groups		Total
	Cold dissection	Bipolar electrocautery	
Obstructive	49 (27.5%)	98 (27.5%)	147 (27.5%)
Infectious	62 (34.8%)	121 (34.0%)	183 (34.3%)
Obstructive + infectious	58 (32.6%)	126 (35.4%)	184 (34.5%)
Other	4 (2.2%)	11 (3.1%)	15 (2.8%)
Total	178 (100%)	356 (100%)	534 (100%)

Table 2 Comparison of the mean ± SD of studied variables in two operated groups with CDT and BET

Variables	Studied groups		Mann–Whitney p value
	BET group N = 356 X ± SD	CDT group N = 178 X ± SD	
Throat pain			
4 h after operation	1.93 ± 0.99	1.59 ± 0.57	$p < 0/001$
24 h after operation	2.72 ± 1	1.93 ± 0.78	$p < 0/001$
Otalgia			
4 h after operation	2.04 ± 0.77	1.87 ± 0.38	$p = 0/008$
24 h after operation	1.84 ± 0.76	1.76 ± 0.46	$p = 0/54$
Body temperature (centigrade)			
4 h after operation	37.38 ± 0.62	37.26 ± 0.22	$p < 0/001$
24 h after operation	37.64 ± 0.23	37.51 ± 0.17	$p < 0/001$
Analgesic consumption			
Normal	320 (89.9%)	175 (98.3%)	$p < 0/001$
Excess	36 (10.1%)	3 (1.7%)	
Wound healing			
Yes	312 (87.6%)	177 (99.4%)	$p < 0/001$
No	44 (12/4%)	1 (0/6%)	
Speech status			
Normal	309 (86/8%)	161 (90/4%)	$p = 0/22$
Hypernasal	47 (13/2%)	17 (9/6%)	
Return to normal diet (h)	2.84 ± 0.48	2.51 ± 0.44	$p < 0/001$

referred to the tympanic cavity [12, 13]. In this study, Otalgia in the BET group 4 h after operation showed a significantly higher severity than the CDT group ($p = 0.008$). Twenty-four hours after operation, although severity of Otalgia was greater in the BET group than the CDT, the difference was not significant statically. In accordance with our results, the incidence of this parameter in Hashemi et al's research (2002) was 26% in the BET group compared with 6% for the CDT group and their difference was significant statistically ($p < 0.01$) [21]. In contrast to our study, however, in Kousha and colleagues' study (2007), 15% of the cases had referral Otalgia in the cauterized group and 16.67% in the cold dissection group while 68.33% patients had no referral Otalgia [9].

Upon tonsillectomy and the onset of pain, analgesic drugs such as acetaminophen and ibuprofen are usually prescribed in order to reduce severity of the induced pain. In this study, the patients who needed more analgesic drugs, received 0.7 mg/kg of pethidine IM in the first 24 h after surgery in the hospital; and after discharge, they received more doses of acetaminophen at home. The amount of analgesic drug prescribed in this study was

different significantly in two studied groups ($p < 0.001$) so that 10.1% of patients in the BET group and 1.7% in the CDT group required more analgesic agent. In Nunez et al's study (2000), although there was no significant difference between BET and CDT groups in terms of analgesic application initially, but thereafter, until the 12th day after operation, the BET group consumed significantly more analgesic than the CDT group, which corresponds with our finding [22]. In comparing postoperative morbidity between coblation and electrocautery methods of tonsillectomy, Pham and colleagues (2014) concluded that the pain medication administered was significantly higher in the electrocautery method which was in consonance to our finding [23] In contrast, Stavroulaki et al's study (2007) showed that consumption of analgesic drug was higher in the CDT group than the BET but insignificantly [6].

Return to normal diet was another parameter in our research. The findings of the present study showed that the patients in the BET group returned to normal diet at a significantly later time than the CDT members ($p < 0.001$). In consonance with our findings, Nunez et al. (2000) showed that the hot tonsillectomied group of patients resumed normal diet later than the cold dissection group In Hashemi et al's study (2002), drinking liquid in the electrocautery and cold dissection methods of tonsillectomy initiated 3.4 and 3 h after operation respectively, where the difference was significant similar to our study [21]. Alam et al's (2011) research showed that returning to normal diet in bipolar electrocautery tonsillectomied patients during the first 24 h of operation was longer than in the cold dissected group although the difference was not significant statistically [24].

Body temperature as one of the variables in the current study was assessed and compared. The mean temperatures 4 and 24 h after surgery were higher significantly in the BET group than the CDT ($p < 0.001$). More inflammation in cauterized cases may be the reason of these findings. This parameter was not measured in similar previous studies.

Our results provided evidence that patients who were treated with the CDT experienced improved and higher quality recovery in tonsillar fossae so that the difference between the frequency of healed tonsillar beds was significantly higher in the CDT than the BET group ($p < 0.001$). Similar to our study, in Silveria et al's study (2003), a markedly delayed healing in the BET group was found, which was directly assessed by observing the tonsillar fossae on the 10th day after operation, so that 70% of the patients in the CDT group had completely healed tonsillar fossae, while only 3% of the BET group members presented the tonsillar fossae covered by normal mucosa [15]. In Adoga's research (2011), greater cases of scar upon the diathermy method were observed on the tonsil bed [3]. In contrast to our study, Kousha et al. (2007) reported that in their investigation in the cauterized cases, on the 8th day, the operated bed was completely similar to normal tissue and pseudomembrane had been disappeared in 100% of the patients. However, in cold dissection cases, 80% of the patients had pseudomembrane on the 8th day after operation [9].

Conclusion

In this investigation all assessed variables were significantly more desirable in the CDT group compared to the BET group. Therefore, based on these findings it can be concluded that the CDT is safer and more favorable than the BET in tonsillectomy.

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Compliance with Ethical Standards

Conflict of interest The authors declare that there is no conflict of interest for this article.

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