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Comparison of Outcomes by Bipolar Electrocautery Tonsillectomy Versus Cold Steel Dissection in Pediatric Tonsillectomy

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ABSTRACT

Background: Innovative surgical techniques have all aimed to lower the likelihood of potential complications by shortening the duration of the procedure, limiting intraoperative blood loss, and improving patient safety and overall comfort. This study was planned to compare the outcomes of bipolar electrocautery dissection (BED) versus cold steel dissection (CSD) in pediatric tonsillectomy.

Methods: This randomized controlled trial was conducted at the ENT department, Sir Ganga Ram Hospital, Lahore, Pakistan, from January 2024 to June 2024. A total of 110 (55 in each group) children aged 5-13 years, and planned to undergo tonsillectomy, were randomly allocated to study groups. In the BED group, tonsillectomy was performed employing the BED technique, and in the CSD group, patients underwent the conventional CSD method. Operative time, intraoperative blood loss, and postoperative pain were measured and compared among patients of both study groups. The statistical analysis was performed using "IBM-SPSS Statistics" version 26.0. An independent sample t-test or analysis of variance (for numeric data), or chi-square test (for categorical data) was applied for the comparisons between groups, taking $p<0.05$ as significant.

Results: In a total of 110 patients, 67 (60.9%) were male. The mean age was 8.96±2.42 years. In the BED group, the mean operative time was 19.76±4.47 minutes versus 24.09±4.90 minutes in the CSD group ($p<0.001$). In the BED group, intra-operative mean blood loss in the BED and CSD groups were 10.95±2.00 ml and 22.87±2.37 ml, respectively ($p<0.001$). Wong-Baker faces pain rating scale noted significantly lower pain scores among children of the BED groups versus the CSD groups at 6-, 12-, 18-, and 24-hours following surgery ($p<0.001$).

Conclusion: Bipolar electrocautery tonsillectomy showed significantly better outcomes as compared to cold steel dissection in children undergoing tonsillectomy.

Keywords: Dissection, Face, Pain, Safety, Tonsillectomy.

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INTRODUCTION

Palatine tonsils are lymphoid tissues that are positioned at the junction of the oral cavity and the oropharynx.[1] Tonsils work as secondary lymphoid organs, and the maximum immunological function of tonsils is established between the ages of three and ten years. Palatine tonsils are most significant in the pediatric age groups. Tonsillectomy is a surgical method that includes the removal of the tonsil along with its capsule by dissecting the peritonsillar space between the tonsillar capsule and the muscle wall.[1] Tonsilectomy is among the most frequently performed otorhinolaryngologic techniques and data from the United States showed that annually, more than 530000 tonsillectomies are done in children<15 years old[2].

The typical dissection procedure, which involves using a blunt and sharp dissection to remove the palatine tonsil from its capsular plane, was the way that surgeons performed tonsillectomies until the late 1960s.[3] After that, numerous tonsillectomy methods have been in practice, such as the use of lasers, monopolar radiofrequency ablation, microdebriders, the LigaSure vessel sealing system, bipolar electrocautery dissection (BED), "bipolar radiofrequency ablation (coblation)", and "ultrasonic harmonic scalpel dissection".[4] Innovative surgical techniques have all aimed to lower the likelihood of potential complications by shortening the duration of the procedure, limiting intraoperative blood loss, and improving patient safety and overall comfort.[5] Significant blood loss can result in hypotension tonsilectomy cases, which might raise the risk of shock if not well controlled subsequently.[6] The hematocrit, not the hemoglobin, may be used to accurately estimate intraoperative blood loss in the immediate postoperative period. A bipolar electrocautery tonsillectomy allows the surgeon to see the limited surgical field of the oral cavity more clearly since the blood loss is minimal.[6]
A study found that BED group had mean bloss of 7.38±2.81 ml and 14.88±3.29 minutes of surgery, in comparison to 23.03±5.06 minutes as duration of surgery and 11.73±2.86 ml of blood loss in the cold steel dissection (CSD) group ($p<0.001$).[7] Some researchers have reported that both methods do not have any major postoperative complications, such as hemorrhage.[8,9] The rationale of this study was to practically establish whether or not the relatively newer technique of tonsillectomy like bipolar electrocautery tonsillectomy has any added benefits in reducing the duration of surgery, blood loss and post-operative pain as compared with conventional cold steel dissection method. This study was done to compare the outcomes of bipolar electrocautery tonsillectomy versus cold steel dissection pediatric tonsillectomy.

METHODS

This randomized controlled trial was carried out at the ENT Department of Sir Ganga Ram Hospital, Fatima Jinnah Medical University, Lahore, Pakistan, from January 2024 to June 2024. This study commenced after it was approved by the "ethical committee of the institution" through letter number 71773-A, dated 9-11-2023. Clinical trial registry was done as NCT06494839 (https://clinicaltrials.gov). The calculated minimum sample size was 24 (12 in each group) considering the anticipated mean loss of blood during surgery of tonsillectomy with BED as 7.38±2.81 ml and 11.73±2.86 ml with CSD,7 with a confidence level of 95% and power of test as 95%. The sample size was calculated using online OpenEPI sample size calculator. As tonsillectomy procedures are frequently performed at the study setting, a total sample size of 110 (55 in each group) was considered for this study. Sample selection was done using simple random sampling technique. The inclusion criteria were patients of 5-13 years of age, irrespective of gender, with a history of recurrent episodes of tonsillitis in the last year. Children were included if they had bilaterally enlarged tonsils, and no history of fever or sore throat in the last 4 weeks. All these children were planned to undergo tonsilectomy. The exclusion criteria were patients who had enlarged adenoids and required adenotonsillectomy, who underwent tonsillectomy after quinsy, or who had a history of bleeding disorders or showed an international normalised ratio (INR) ≥ 1.5. In order to obtain informed and written consent, parents/caregivers of the children were briefed about the objectives and safety aspects related to this study.

Children were randomly allocated to both study groups (55 in each group) by computer-generated block randomization. In BED group, tonsillectomy was performed employing the BED technique, and in CSD group, patients underwent conventional cold steel dissection method. The cold steel blunt dissection tonsillectomy was performed under general anesthesia with the patient in the Rose position and an endotracheal tube in place. The tonsil was retracted medially using tonsil holding forceps, and a mucosal incision was made at the upper pole. A delicate dissection was conducted to protect the tonsillar pillars, and hemorrhage was controlled using suction. The tonsillar fossa was packed with swabs, and the procedure was repeated on the contralateral tonsil. Hemostasis was achieved with silk ligation and bipolar electrocautery. For the BED tonsillectomy, the procedure was also conducted under general anesthesia in the same patient position. The bipolar device was set to 30 watts, and the mucosal incision was cauterized using straight or stepped bipolar forceps. The palatine tonsil was carefully cauterized and dissected from the superior to the inferior pole

to complete the removal. Most of the identifiable vessels supplying the tonsil were cauterized before being separated from the tonsil. Point coagulation was used to maintain hemostasis. By using point coagulation, hemostasis was maintained. To avoid bias stemming from competence, consultants performed all of these tonsillectomies. After the surgeries were completed, assessments of the outcomes were made. Operative time was measured from the anterior pillar incision to the removal of the mouth gag.[9,6] Intraoperative blood loss was measured by reading the levels given in the suction bottle at the end of surgery. The weight of dry gauze was subtracted from the wet, considering 1g=1ml.[7,9] Postoperative pain was measured at regular intervals (6-hourly till 24 hours) using the Wong-Baker faces pain rating scale. The Wong-Baker faces pain rating scale graded pain as mild (1-3), moderate (4-6), or severe (>6). A specially designed proforma was used to gather all of the required information.

The statistical analysis was performed using "IBM-SPSS Statistics" version 26.0. For the representation of quantitative variables, which included mean intraoperative blood loss, operative time, and postoperative pain, means and standard deviations were calculated. The qualitative variables, such as gender were expressed through frequencies and percentages. An independent sample t-test was employed to assess the statistical significance of the operative time, amount of blood loss, and post-operative pain. Comparison of categorical data was made using chi-square test. "Analysis of variance (ANOVA)" was applied to compare post-surgery pain scores in between groups. For all statistical inferences, p-value≤0.05 was labeled as significant.

RESULTS

In a total of 110 patients, 67 (60.9%) were male and 43 (39.1%) females. The mean age was 8.96±2.42 years, ranging between 5 to 13 years. There were 70 (63.6%) children who belonged to rural areas of residence. Comparison of baseline characteristics between patients of both study groups showed that there no statistically significant differences in terms of gender (p=0.079), age (p=0.481), and residential status (0.428), as shown in table-1.

Table 1: Demographic Data of Patients (N=110)

Characteristics		Total (N=110)	Groups		P-value
			BED (n=55)	CSD (n=55)	
Gender	Male	67 (60.9%)	38 (69.1%)	29 (52.7%)	0.079*
	Female	43 (39.1%)	17 (30.9%)	26 (47.3%)	
Age in years (Mean±SD)		8.96±2.42	8.80±2.46	9.13±2.38	0.481#
Residence	Urban	44 (40.0%)	18 (32.7%)	22 (40.0%)	0.428*
	Rural	66 (60.0%)	37 (66.3%)	33 (60.0%)	

*chi-square test applied; #independent sample t-test applied

In BED group, the mean surgery duration was 19.76±4.47 minutes versus 24.09±4.90 minutes in CSD group (p<0.001). In BED group, intra-operative mean blood loss in BED and CSD groups were 10.95±2.00 ml and 22.87±2.37 ml, respectively (p<0.001). Wong-Baker faces pain rating scale noted significantly lower pain scores among children of BED groups versus CSD groups at 6, 12, 18, and 24-hours following surgery (p<0.001). The repeated measures ANOVA was applied and a significant difference has been observed in both groups regarding postoperative pain (p<0.05). Table-2 is showing comparison of duration of surgery, intra-operative blood loss and pain scores during 24 hours following surgery.

Table-2: Comparison of Outcomes Between Study Groups (N=110)

Outcomes		Groups		P-value
		BED (n=55)	CSD (n=55)	
Duration of surgery (minutes)		19.76±4.47	24.09±4.90	<0.001
Intra-operative blood loss (ml)		10.95±2.00	22.87±2.37	<0.001
Pain scores	After 6	3.07±0.86	3.60±0.96	0.003
	After 12	5.05±0.91	5.96±0.92	<0.001
	After 18	4.91±0.70	5.35±0.62	0.001
	After 24	2.82±0.88	3.78±0.90	<0.001

Independent sample t-test applied.

Evaluation of post-surgery pain grades in both study groups showed that pain was significantly mild at 6-hours (p=0.012), 12 hours (p<0.001), and 24 hours interval (p<0.001) in BED group when compared to CSD group, as shown in table-3.

Table 3: Comparison of Post-Surgery Pain Grades as per The Wong-Baker Faces Pain Rating Scales in Both Study Groups (N=110)

Post-surgery intervals	Pain grade	Total (N=110)	Groups		P-value
			BED (n=55)	CSD (n=55)	
6 hours	Mild	65 (59.1%)	41 (74.5%)	24 (43.6%)	0.012
	Moderate	45 (40.9%)	14 (25.5%)	31 (56.4%)	
12 hours	Mild	3 (2.7%)	3 (5.5%)	-	<0.001
	Moderate	86 (78.2%)	49 (89.1%)	37 (67.3%)	
	Severe	21 (19.1%)	3 (5.5%)	18 (32.7%)	
18 hours	Mild	2 (1.8%)	2 (3.6%)	-	0.154
	Moderate	108 (98.2%)	53 (96.4%)	55 (100%)	
24 hours	Mild	65 (59.1%)	44 (80.0%)	21 (38.2%)	<0.001
	Moderate	45 (40.9%)	11 (20.0%)	34 (61.8%)	

Chi-square test applied

DISCUSSION

In the current research, a mean age of 8.80±2.46 years was noted in patients who underwent BED versus 9.13±2.38 years in CSD group. Niaz and colleagues[10] revealed in their research that the respective mean ages for patients undergoing tonsillectomy adopting a conventional cold steel process, and diathermy dissection technique were 14.83±5.84 years, and 15.63±5.59 years, respectively. In this study, the male gender distribution of patients was 62.9% and 57.1% for BED and CSD groups, respectively. In another study comparing the cold steel with the hot dissection procedure for tonsillectomy, Adoga et al11 mentioned that the gender distribution for male and female were 55.3% and 44.7%, respectively, showing a 1.2:1 male to female ratio. The literature reports an overall male predominance in reported among children undergoing tonsillectomy,[10,11] and our findings corresponds well with the literature.

The mean surgery time for patients who underwent BED in the current research was 19.76±4.47 minutes versus 24.09±4.90 minutes in CSD group, showing statistically significant differences (p<0.001). The mean operative times calculated by Niaz et al10 for the CSD, and BED groups were 24.94±2.26 minutes, and 13.09±1.66 minutes, respectively (p<0.001). Shah et al investigated the mean time to complete the process and found that the BED tonsillectomy to be completed in duration between 10-20 minutes.[12] Silveira et al[13] revealed that in the CSD tonsillectomy cases, the time taken for the surgery was greater than in those who underwent BED. Numerous other studies have drawn similar conclusions.[14,15] Investigating the blood loss in the conventional CSD tonsillectomy and the BED tonsillectomy, Niaz et al[10] described the bipolar diathermy as causing significantly less blood loss than the conventional cold steel surgeries (11.17±1.67 ml vs 24.57±1.42 ml, p=0.001), which is in accordance with our study findings. Relatively lesser intraoperative blood loss was observed in some other studies applying the BED tonsillectomy method.[13-15] In another study analyzing 100 tonsillectomy patients, the average blood loss in the bipolar diathermy was calculated to be less than 4 ml.[16] In research carried out by Mofatteh et al[17], a much lower intraoperative blood loss with BED was documented when compared with the cold steel dissection, which is similar to what we noted in this study. Some other studies have also produced similar results, coinciding with our findings.[18-22] Bleeding is an important consideration when doing surgery among children, and due to the small volume of their overall blood volume, bleeding might have major negative effects[8,23].

In the present study, it was found that pain was significantly lower among children undergoing BED tonsillectomy versus those who had CSD. The postoperative pain of 75% patients ranged from 3-5 on a 1-10 scale, according to Shah and colleagues.[12] Cardozo et al[24] also showed statistically significant connection of pain favoring BED. There are many factors that may affect tonsillectomy outcomes including the length of the illness, the amount and strength of energy used during the process, the energy generated that causes the tissues to burn, the size of the cutting location, and the patient's ability to tolerate pain.[19,20,25] Future studies can be planned to collect insights into factors affecting tonsillectomy outcomes among different approaches. This study had some limitations as well. Single center study design and a relatively modest sample size were some of the limitations of this study.

CONCLUSION

This study concluded that bipolar electrocautery tonsillectomy showed significantly better outcomes as compared to cold steel dissection in children undergoing tonsillectomy. Post-surgery evaluation period was relatively short (up to 24 hours) which warrants that further prospective trials should be planned to assess medium and long-term outcomes comparing different tonsillectomy techniques.

LIST OF ABBREVIATIONS

ANOVA: Analysis of variance
BED: Bipolar electrocautery dissection
CSD: Cold steel dissection
INR: International normalised ratio

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ETHICAL APPROVAL

The permission was obtained from the Institutional Ethical Committee of the DHQ Hospital, Sheikhupura, Pakistan, Reference number 71773-A, dated 9-11-2023.

CONFLICT OF INTEREST

The authors have no conflict of interest.

AUTHORS' CONTRIBUTIONS

AF: Data collection, drafting, responsible for data's integrity, approved for publication. **IF:** Designed, conceived the idea, supervised, proofread, and approved for publication.**SR:** Conceived the idea, data analysis, critical review, final review, approved for publication, **BZ:** Manuscript editing, data analysis, data interpretation, approved for publication, **AF:** Manuscript editing, proofreading, critical revisions, approved for publication, **AH:** Manuscript editing, literature review, approved for publication.

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