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Comparison of Surgical Complications between Cold Steel Dissection Method and Bipolar Electro Dissection Method in Tonsillectomy

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Abstract **Original Research Article**

Objectives: To assess whether bipolar electro dissection tonsillectomy has better surgical outcome compared to traditional cold steel dissection followed by silk ligature. ***Methodology:*** A Randomized Control Trial (RCT) was conducted at Department of ENT and Head-Neck surgery, Dhaka Medical College Hospital, from 1st January, 2020 to 30th July, 2021 Total 100 patients were enrolled through non- probability consecutive sampling and according to the selection criteria, who were admitted for elective tonsillectomy. They were randomly allocated into two groups of 50 persons each Bipolar electro dissection' (BED) and 'Cold Steel Dissection (CSD) group according to surgical method applied on them. The parameters of comparison were-duration of surgical technique, intraoperative blood loss, post-operative hemorrhage, pain, time taken returning to solid diet and healing rate of tonsillar fossac. ***Results:*** The mean operative time was 23.7±4.4 minutes in BED whereas 47.2±48.1 minutes in CSD method ($p<0.0001$). Mean intra operative blood loss was less in BED (16.4±6.6ml) than in CSD (37.8±6.6ml) technique ($p<0.001$). Overall reactionary hemorrhage rate was 12% and overall secondary hemorrhage rate was 18%. There was no statistically significant difference in post-operative hemorrhage incidence between two methods ($p=0.373$). Moderate to severe post- operative pain is more common bipolar method (68% & 12%) than dissection method (46% & 6%) which was significant ($p=0.012$). Mean time taken to return to solid diet for BED group was 8.12 days (range 3-16 days) and for the CSD group was 4.23 days (range 3-15 days) ($p>0.05$). Regarding aspect of the tonsillar fossa in the CSD group healing was faster than BED group ($p>0.05$). ***Conclusion:*** Operative time and intraoperative blood loss was significantly less in the bipolar electro dissection tonsillectomy (BED) group. Postoperative pain was significantly less in cold steel dissection tonsillectomy (CSD) group. Time taken to return to solid diet was less in CSD group and healing of tonsillar fossa was also faster in the CSD group. So, from this study it appears that cold dissection method is better than bipolar dissection method in respect of postoperative morbidity but operative time and blood loss is low in BED group.

Keywords: Cold Steel Dissection Method, Bipolar Electro Dissection Method, Tonsillectomy.

INTRODUCTION

The palatine tonsils are lymphoid organs strategically located at the entrance of the digestive and respiratory systems. Each tonsil is composed of tissue similar to lymph nodes, covered by pink mucosa like on the adjacent mouth lining [1]. Each tonsil has free medial surface which projects into the pharynx. Tonsils are the first lymphoid organs in the body to encounter the ingested pathogens and are involved in immunologic activity [2]. They play an important role in defence of body against various infections. They are prone to become inflamed and enlarged, in a clinical condition called tonsillitis. When these conditions become frequent (chronic tonsillitis), or cause complications that affect the patients' breathing and swallowing, obstructing the upper airway (hypertrophied tonsil), the physician usually suggests surgical removal of the tonsils [3]. Tonsillectomy is one of the most frequently performed surgical procedures in otolaryngology representing approximately 20%-40% of this field. Various surgical techniques are used to perform tonsillectomy, including blunt dissection, guillotine excision, electrocautery, cryosurgery, coblation, ultrasonic removal, laser removal, and

ligasure tonsillectomy [4]. These techniques have evolved over the years aiming to make the procedure safe and decrease surgical time, intra operative blood loss and post-operative complications [5]. A number of post-operative complications have been well documented in the literature. Intraoperative bleeding and postoperative pain & haemorrhage are the issues which are usually discussed when comparing different surgical methods of tonsillectomy. The most common and potentially life-threatening complication of tonsillectomy is post-operative haemorrhage [6]. Haemorrhage has been divided into three broad categories: a) primary, occurring at the time of surgery, b) reactionary, occurring within 24 hours after surgery and c) secondary, occurring any time after 24 hours of surgery up to healing of fossa which is usually completed within two weeks. Primary and reactionary bleeding is generally considered to be related to surgical technique whereas environmental factors that influence oropharyngeal healing contribute to secondary haemorrhage. Reactionary haemorrhage has been reported to be 0.2% to 2.2% and secondary haemorrhage has been reported to be 0.1 to 3% [7]. The Main cause of morbidity after tonsillectomy is oropharyngeal pain, which may result in decreased oral intake, dysphagia, dehydration and weight loss. After tonsillectomy, about 1.3% of patients experience delayed discharge during the initial hospital stay, and up to 3.9% has secondary complications requiring readmission [8]. Ideally tonsillectomy should be fast and associated with minimum blood loss as well as rapid and uncomplicated recovery [9]. Various methods have frequently been compared with each other by different investigators around the world, addressing especially the conventional cold dissection technique versus the bipolar electro dissection technique. However, findings vary in this regard, possibly due to differences of such parameters as: race, number of cases under study, ecological conditions, lifestyle, the skill of the surgeon, the time of investigation, etc. [3].

MATERIAL AND METHODS

A Randomized Control Trial (RCT) was conducted at Department of ENT and Head-Neck surgery, Dhaka Medical College Hospital, from 1st January, 2020 to 30th July, 2021 Total 100 patients were enrolled through non- probability consecutive sampling and according to the selection criteria, who were admitted for elective tonsillectomy. They were randomly allocated into two groups of 50 persons each Bipolar electro dissection' (BED) and 'Cold Steel Dissection (CSD) group according to surgical method applied on them. The parameters of comparison were- duration of surgical technique, intraoperative blood loss, post-operative hemorrhage, pain, time taken returning to solid diet and healing rate of tonsillar fossac.

Inclusion Criteria: Patients aged between 3 to 30 years and of both male and female gender admitted in Department of ENT and Head-neck surgery, DMCH for elective tonsillectomy.

Exclusion Criteria:

1. Patients requiring adenotonsillectomy.
2. Patients with anemia (hemoglobin<10gm/dl) and bleeding or clotting disorders.
3. Patients with overt or submucous cleft palate.
4. Systemic illness e.g.: Liver disease, renal disease, diabetes, hypertension etc. that affect general anesthesia.
5. Patients requiring tonsillectomy as a part of other operation (e.g.: Removal of elongated styloid process, uvulo-palato-pharyngoplasty etc.)
6. Patients unwilling to participate in this study.

Study Procedure:

Enrolment: Total 100 patients were enrolled through non-probability consecutive sampling and according to the inclusion and exclusion criteria, who were admitted into ENT & Head-Neck Surgery Department of Dhaka Medical College Hospital for elective tonsillectomy. Informed written consent was obtained and all the basic demographic information of each patient (name, age, sex, address and contact no.) was noted.

Randomization & Allocation: Two groups were assembled each containing 50 patients. Those planned for tonsillectomy with bipolar electro dissection (BED) technique were labelled as BED group. The second group, containing patients planned for tonsillectomy with the conventional cold steel dissection (CSD) followed by silk ligature, was named as CSD group. Patients were randomly allocated to either the BED or CSD group using block randomization. A block of two patients were selected and the first one was allocated to any one group by lottery. The next patient was automatically allocated to the other group.

Blinding: Participants and assessors (different surgeons and nurses) were blinded about the particular surgical method applied on them i.e. double blinding was done to overcome bias.

Evaluation of the Patients: Before operation, a detailed clinical history regarding the duration, onset, frequency of sore throat and any predisposing factors or co existing systemic disease was taken and examination of ear, nose, throat and neck were done. Basic investigations for surgery under general anesthesia were completed e.g., CBC, ESR, BT, CT, PT blood grouping & Rh typing, Urine R/E, RBS, Serum creatinine, ECG, chest X-ray, HBsAg and Anti-HCV.

Interventions: All the surgery were done under general anaesthesia and performed by different surgeons who were all familiar with both methods of tonsillectomy.

After endotracheal intubation sand bag was applied between the shoulders to assume Roses Position and Boyle-Davis mouth gag applied. Tonsillectomy in the CSD group was performed by incision of the anterior pillar with a tonsillar scissor. The peritonsillar plane was encountered and the tonsil then dissected towards the lower pole. Tonsillectomy was completed using a wire snare. The fossa was packed with a prepared standard size gauze and the other tonsil was similarly removed. Gauzes were removed in the order they were placed and when necessary absorbable ties were used to secure hemostasis. In the BED group, Bayonet bipolar forceps and a Valley lab bipolar coagulator (set at 30 W) were used. The superior pole of the tonsil was dissected first and continuing downwards until the tonsil was completely removed. The vessels encountered were cauterized and only after this was separated from the tonsil. Any further hemostasis of the tonsillar fossa was secured by point hemostasis with bipolar forceps.

Assessment of Operative Time: Operating time was measured from the time of insertion of Boyle-Davis mouth gag to its removal.

Assessment of Intraoperative Blood Loss: Intra-operative blood loss was measured by adding the amount of blood collected in the suction bottle and the number of prepared gauges (19/14cm size) used in moping the surgical field. The blood loss will be taken as 5 ml if the gauze is fully soaked and 2.5 ml if partially soaked.

Post-operative Care: All patients were given intravenous antibiotics and standard analgesics (diclofenac sodium) orally and per rectally according to age and body weight after the procedure and were observed for complications in the post-operative ward.

Assessment of Postoperative Hemorrhage: In immediate postoperative period patients were positioned in left lateral supine position facing the attending nurse. They were monitored for any collection in the gingivo-buccal gutter. After regaining full consciousness tonsillar fossa was assessed by visual inspection using head light after depressing the tongue with tongue depressor for any sign of hemorrhage.

Follow Up: Patients were discharged on the first post-operative day after proper follow up unless indicated otherwise. They were advised oral broad-spectrum antibiotics, oral analgesics and gurgling with 1% povidone iodin solution (diluted) thrice daily at the time of discharge and ask to report early if any bleeding from mouth at home. They were followed in ENT OPD at 7th and 14th post-operative day. At this time, tonsillar fossae were examined carefully for any bleeding point, blood clot or slough and a history of bleeding per mouth will be elicited. Patients who cannot attend to hospital interviewed over telephone. Patients who had post tonsillectomy haemorrhage were readmitted and managed according to the protocol under strict observation. Patients' throats were examined thrice in the ENT OPD, at 7th and 14th days postoperatively, by different surgeons (assessors) who had not been involved in the tonsillectomy and who were blinded to the technique of operation. The size of the post-tonsillectomy slough was taken as an arbitrary sign denoting the rate of healing. As previously described by Magdy et al [10] and Noordzij et al [11] five grades were considered: 0, 25, 50, 75 and 100 per cent, according to the size of the slough in comparison with the aerial size of the post-operative tonsillar bed.

Interview of the Respondents:

The respondents were interviewed at the study place ensuring proper privacy and confidentiality. Those who could not attend on OPD for post-operative follow up, were interviewed over telephone using the questionnaire. On an average it may take around 20 minutes for data collection from every respondent. Data were collected in 04 occasions from a patient: prior surgery, on 1st, 7th and 14th post-operative day.

Statistical Analysis

All data were analysed after thorough checking, cleaning, editing and compiling by the 25th version of SPSS. Descriptive statistics were done first; frequency tables and figures are presented accordingly. Inferential analysis was done by chi-square test and used to compare between CSD and BED group of patients. A p values <0.05 was considered significant.

RESULTS

In this comparative study, total number of patients was 100 who were admitted in Department of ENT and Head-Neck Surgery, DMCH for elective tonsillectomy. These patients were randomly allocated in two groups of 50 each. Those undergone for bipolar electro dissection (BED) tonsillectomy were named BED group and those undergone for Cold steel dissection (CSD) method of tonsillectomy were named CSD group.

Table I: Comparison of operative time between two groups (in minutes) n=100

Operating time (minutes)	BED group (n1=50)		CSD group (n2=50)		Total
	frequency	percentage	frequency	percentage	
15-30	47	94.0	0	0.00	47
31-45	3	6.0	26	52.00	29
46-65	0	0.0	24	48.00	24
Total	50	100.0	50	100.00	100

Chi-square(x^2)-89.24, df =2, p<0.0001, significant at 5% level of significance

In BED group maximum (94%) patients were operated within 15-30 minutes, whereas in CSD group maximum (52%) operating time was within 31-45 minutes. Average operative time was 23.7(±4.4) minutes in BED group and 47.2(±8.1) minutes in CSD group. The chi-square test suggests that, the duration of surgery is significantly associated with the surgical technique used, i.e., significantly less in the bipolar electro dissection method than in the cold dissection method (x2=89.24, p <0.0001).

Table II: Comparison of intra operative blood loss between two groups (in ml). n=100

Blood loss (in ml)	BED group (n1=50)		CSD group (n2-50)		Total
	Frequency	percentage	Frequency	percentage	
<=20	38	76.0	0	0.0	38
21-40	12	24.0	36	72.0	48
>40	0	0.0	14	28.0	14
Total	50	100.0	50	100.0	100

Chi-square(x^2) = 64.0, df =2, p<0.001, significant at 5% level of significance

Out of 50 surgeries done in BED group, 38 (76%) had less than 20 ml blood loss, 12 (24%) had between 20-40 ml blood loss and none had more than 40 ml blood loss. Average blood loss was 16.4(±6.6) ml. On the other hand, in CSD group, none had less than 20 ml blood loss, 36 (72%) had between 20-40 ml blood loss, and 14 (28%) had greater than 40 ml blood loss. Average blood loss was 37.8(±6.6) ml. Quantity of blood loss is significantly less in bipolar electro dissection method than in cold dissection method (p <0.001).

Table III: Distribution of patient according to post-operative hemorrhage (n=100)

Post-operative haemorrhage	BED group (n1=50)		CSD group (n2-50)		Total
	frequency	percentage	frequency	percentage	
No Haemorrhage	46	92.0	39	78.00	85
Reactionary	1	2.0	5	10.00	6
Secondary	3	6.0	6	12.00	9
Total	50	100.0	50	100.00	100

Chi-square(X^2) =4.16, df =2, p=0.373, not significant at 5% level of significance.

Post-operative hemorrhage is more common in CSD group (22%) than BED group (08%). But there is no significant relationship between post-operative bleeding and methods of operation (p=0.373).

Table IV: Comparison of post-operative pain between two groups (n=100)

Post-operative pain score	BED group		CSD group		Total
	Frequency	Percentage	Frequency	Percentage	
Mild	10	20.00	24	48.00	34
Moderate	34	68.00	23	46.00	57
Severe	6	12.00	3	6.00	9
Total	50	100.00	50	100.00	100

Chi-square(X^2) =8.9, df=2, p<0.01, significant at 5% level of significance.

Moderate to severe post-operative pain is more common bipolar method (68% & 12%) than dissection method (46% & 6%). There is significant relationship between post- operative pain and methods of operation (p=0.012). Severity of pain is more in bipolar method.

Table-V: Comparison of time taken to return to solid diet between two groups (in days). n=100

Time (Days)	BED group (n=50)		CSD group (n=50)		Total
	Frequency	Percentage	Frequency	Percentage	
1-3	3	6.00	6	12.00	9
4-7	14	28.00	33	66.00	47
8-14	23	46.00	9	18.00	32
15-21	10	20.00	2	4.00	12
Total	50	100.00	50	100.00	100

Chi-square(X^2) =20.14, df=3, p<0.001, significant at 5% level of significance.

The mean time taken to return to solid diet in BED group was 8.12 days (range 3-16 days) and in CSD group was 4.23 days (range 3-15 days). Maximum (46%) patients in BED group needed 8 to 14 days to return to solid diet, whereas maximum (66%) patients needed only 4 to 7 days in CSD group. Return to solid diet is earlier in bipolar electro dissection method than in cold dissection method (p<0.001).

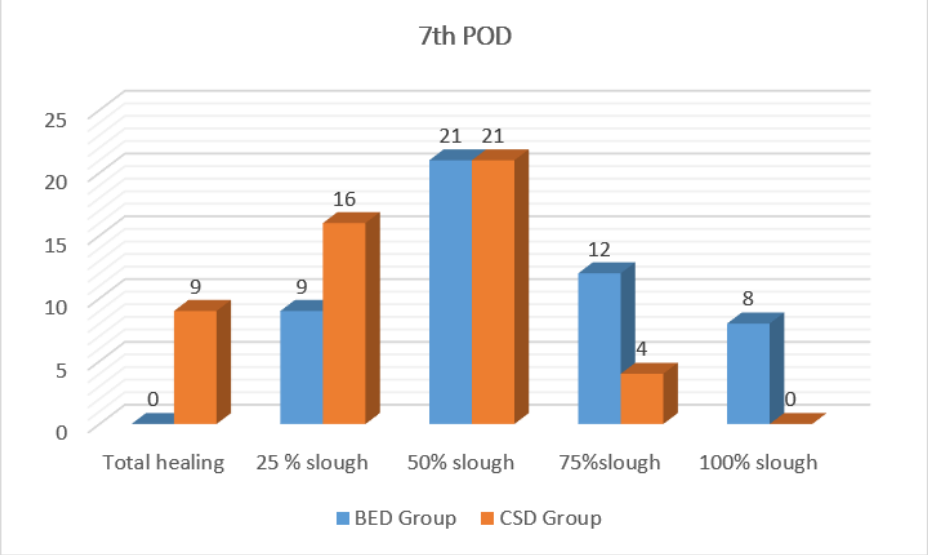

Figure-1: Aspect of tonsillar fossae healing at 7th post-operative day.

No patient from BED group showed total healing whereas 18% patients from CSD group showed total healing i.e. no slough on fossae. Although equal number (42%) of patients from both group showed 50% healing of fossae on 7th post-opetative day (p>0.05).

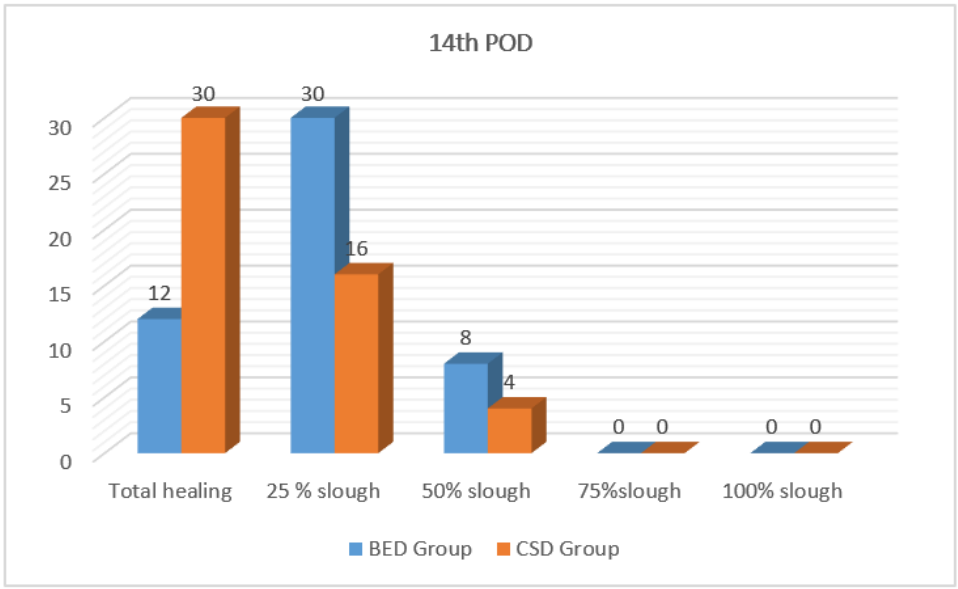

Figure-2: Aspect of tonsillar fossae healing at 14th post-operative day.

At 14th post-operative day 60% patients had total healing of tonsillar fossae from CSD group, whereas only 24% patients from BED group showed total healing. (p>0.05).

Other Morbidity:

There was no major complication observed in both BED and CSD group. However, in few cases there was other morbidity. Postoperative nausea and vomiting occur in 11 patients in BED group were 8 patients in CSD group. There was postoperative pyrexia in 3 patients in CSD group and 2 patients in BED group. There was associated otalgia in 3 patients in CSD group and 5 patients in BED group.

DISCUSSION

The current randomized controlled trial study was intended to compare between bipolar electro dissection method and cold steel dissection method of tonsillectomy in terms of surgical complications as well as some post-operative morbidity e.g., operative time, intra operative blood loss, post-operative hemorrhage, pain, time taken to return to solid diet, assessment of healing of tonsillar fossae. A total of 100 patients were selected fulfilling the inclusion and exclusion criteria. They were randomly allocated into two groups containing 50 patients each, according to the surgical technique applied on them and named accordingly. BED group for patients gone through bipolar electro dissection method of operation and CSD group for patients operated by cold steel dissection method. In this study, we found that cold steel dissection method took longer time (average 47.22±8.16 minutes) than bipolar electro dissection method (average 23.77±4.4 minutes). The chi-square test suggests that, the duration of surgery is significantly associated with the surgical technique used, i.e., significantly less in the bipolar electro dissection method than in the cold dissection method ($x2=89.24$, $p <0.0001$). During cold dissection gauge pieces were used to pack the tonsillar fossae to control hemorrhage and the significant bleeders were ligated which took longer time. This finding has been collaborated by studies done by Niaz et al., [12], Sing et al., [13] and Chettri et al., [9]. Niaz et al., [12] showed, mean operating time in Bipolar technique was 13.09±1.66 minutes whereas 24.94±2.26 minutes in cold dissection technique. A study conducted in Bangladesh by Islam et al., [14] found, the average operative time was 16.75 minutes for diathermy tonsillectomy and 24.50 minutes for dissection method. In this study, the intraoperative blood loss was found to be more in cold steel dissection Whereas the bipolar electro dissection method had very minimal blood loss; 76% method. Maximum patients (72%) of this group had an average 21-40 ml blood loss. losing less than 20 ml. No patient in BED group had more than 40 ml blood loss in contrary to 28% patients had over 40 ml blood loss during surgery in CSD group. Quantity of blood loss is significantly associated with the surgical technique used, i.e., significantly less in the bipolar electro dissection method than in the cold dissection method ($p <0.001$). This could be due to the cauterization of the blood vessels while dissecting by the bipolar technique while the blood vessels were cut during the cold dissection method. Similar result was found in Vithayathil et al., [5]. That study showed that average amount of bleeding on electrocautery method was 47.13±8.24 ml compared to 52.96±68 ml on the cold dissection method. Alzuwayed and Qattan [15] elaborated that bipolar diathermy had less intraoperative bleeding than dissection method. Another study showed that intraoperative bleeding for bipolar scissors tonsillectomy was 5 mL (range, 0-397 mL) compared with 115 mL for cold dissection tonsillectomy (range, 16-642 mL) [16]. Post-operative hemorrhage is the most common complications after tonsillectomy in any method. In our study total 15 patients complained post-operative hemorrhage, out of which 06 was reactionary and 09 was secondary. All of them were managed conservatively except 01 patients from CSD group, who had severe reactionary hemorrhage and needed to take back in operation theatre and re-ligation done. This hemorrhage was due to slipping of ligature. Among 06 patients with reactionary hemorrhage only 01 from BED group and rest of 05 from CSD group. Out of 09 patients with secondary hemorrhage 03 from BED group and 06 from CSD group. All the secondary hemorrhages were within 03-10 days of surgery. Overall post-operative hemorrhage was more in CSD group (22%) than in BED group (08%) but there is no significant relationship between post-operative bleeding and methods of operation (p 0.373). Sing et al., [13] support this result. There was no post-operative hemorrhage in bipolar diathermy method whereas 03 cases of reactionary hemorrhage were seen in cold steel dissection method. All the three cases were due to slipping of ligature. Mofatteh et al., [3] also showed similarity. Here post-operative hemorrhage was 0.56% in Cold steel dissection method and 0.28% in Bipolar electro dissection method, which was not statistically significant. Alzuwayed and Qattan [15] showed postoperative haemorrhage was experienced by 6 cases who underwent cold dissection tonsillectomy (6.2%) and 2 cases who underwent tonsillectomy by electro dissection (2.2%). Difference between both study groups regarding postoperative hemorrhage was not statistically significant. Khan et al., [1] oppose this result. In that study, bipolar method (4.76%) had most post-operative bleeding than cold dissection method (1.58%), but the result was insignificant ($p=0.31$). Faramarzi et al., [4] also showed difference from current study. Here 3 cases of cold dissection showed post-operative hemorrhage, where bipolar method had 4 cases of such incident. There was no statistically significant difference in the rate of postoperative hemorrhage ($P=0.9$) between the two groups. Vithayathil et al., [5] showed more post-operative bleeding in bipolar method than cold dissection method. Moderate to severe post-operative pain is more common bipolar method (68% & 12%) than dissection method (46% & 6%). There is significant relationship between post- operative pain and methods of operation (-0.012). This may be due to the thermal injury to surrounding tissue. Khan et al., [1] showed that all the children of both study groups, had postoperative pain but the children operated by bipolar diathermy technique group had more pain as compared to children operated by cold steel dissection method and this was significant (-0.015). The mean time taken to return to solid diet in BED group was 8.12 days (range 3-16 days) and in CSD group was 4.23 days (range 3-15 days) in this study. Maximum (46%) patients in BED group needed 8 to 14 days to return to solid diet, whereas maximum (66%) patients needed only 4 to 7

days in CSD group. Return to solid diet is earlier in bipolar electro dissection method than in cold dissection method ($p<0.001$). It is generally believed that bipolar dissection resulted in more delay in resuming normal diet which was also reflected in our study. Patients were advised to start taking liquid diet within few hours after tonsillectomy and encouraged to resume normal diet as soon as possible. Sara and Carney, 2020 showed in their study, return to normal diet and activities occurred at a mean of 11.1 days versus 4.6 days, respectively for bipolar versus cold dissection technique ($P<0.0001$). In our study healing of tonsillar fossa was assessed in 7th and 14th postoperative day. No patient from BED group showed total healing whereas 18% patients from CSD group showed total healing i.e., no slough on fossae. Although equal number (42%) of patients from both groups showed 50% healing of fossae on 7th post-operative day ($p>0.05$). At 14th post-operative day 60% patients had total healing of tonsillar fossae from CSD group, whereas only 24% patients from BED group showed total healing. ($p>0.05$). This result shows similarity with Hasan et al., 2015. In the BDT group tonsillar fossa was covered with whitish slough in 32%, greyish slough in 24% and reddish in 44% patients. On the other hand, in CDT group whitish slough was found in 54%, greyish slough in 20% and reddish in 26% patients. Aspects of tonsillar fossa in CDT group indicate faster healing and less sign of inflammation. p ($=0.081>0.05$. The reason for this may be thermal injury of tonsillar bed during bipolar dissection. Our study is also mirrored by Silviera et al., [17]. In her study, she has compared the aspect of tonsillar fossa between the two groups. Ten days after surgery 70% of patient in CDT group had their tonsillar fossa completely healed while in BDT group only 3% presented the with fossa covered with normal mucosa. In BDT group 83% patients still presented with granulation tissue and 14% had their tonsillar fossa covered by mucopurulent exudates which did not happen in any children of CDT group.

CONCLUSION

The duration of operation and intra operative blood loss were significantly lower in bipolar electro dissection method. These two characteristics seems to be the major advantages of this method. Post-operative hemorrhage risk was higher in the cold dissection method which was not significant. However bipolar electro dissection method increases postoperative morbidity. Post-operative pain was significantly higher with this technique. Time to return to solid diet and healing of tonsillar fossae are also delayed. So, we believe that the best patient indication for bipolar dissection tonsillectomy is small children where total circulatory blood volume is small. Cold dissection method is better than bipolar dissection method regarding postoperative morbidity. So, surgeons should give preference to cold dissection method in their learning process before bipolar dissection method.

Limitations of the study

1. Sample size of the study was small.
2. Study period was short.
3. There is a chance of bias as different surgeons performed the surgeries.
4. Pain was measured using numerical rating scale. This is a subjective scoring system which may vary due to interpersonal pain threshold, attitude and mood.
5. Only one institution was involved.

Recommendations

1. Further multi-Centre large population-based study should be conducted.
2. Surgery performed by a single surgeon may eliminate skill bias
3. It is possible to perform both techniques in same person and see the result; it may remove the difference in age, gender and subjective response to surgical trauma.
4. Other techniques should be compared with these two methods to assess most safer technique of tonsillectomy operation.

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