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Comparison of Ultrasonic Device Versus Bipolar Diathermy Tonsillectomy in Children

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ABSTRACT

Background: Intraoperative bleeding and postoperative pain are two commonest concerns for both patient and surgeon in tonsillectomy. This study was aimed to compare intraoperative blood loss and early postoperative pain between ultrasonic device and bipolar diathermy tonsillectomy in children.

Methods: Prospective, interventional, single blinded, comparative study was carried out from September 2016 to September 2017 including children up to age 15 years who underwent tonsillectomy either by bipolar diathermy or ultrasonic device. Intraoperative blood loss was recorded using standard sized gauge technique. Post-tonsillectomy pain on first five postoperative days (early postoperative pain) was assessed using Visual analog scale for children older than 5 years and FLACC score for children up to 5 years respectively. Means were compared.

Results: 38 children (76 tonsils) were included in the study out of which 31 were boys (62 tonsils) and 7 were girls (14 tonsils). The mean intraoperative blood loss in ultrasonic dissection group was 13.94 ml and 13.91 ml in bipolar diathermy group. This difference was not statistically significant ($p=0.974$). Post-operative pain on 1st, 2nd, 3rd and 4th days were significantly less ($p<0.05$) in ultrasonic device group compared to bipolar diathermy group. Post-operative pain was less also on 5th post-operative day in ultrasonic device but was not statistically significant ($p=0.172$).

Conclusions: Tonsillectomy in children using ultrasonic device did not differ from bipolar diathermy tonsillectomy in respect to intraoperative blood loss. However, early postoperative pain was significantly lower in ultrasonic device group.

Keywords: Bipolar diathermy; tonsillectomy; ultrasonic device.

INTRODUCTION

Tonsillectomy is one of the most common surgical procedures in otolaryngology. Both bipolar diathermy and ultrasonic dissection methods are popular and commonly practiced.

Bipolar diathermy (BD) technique is rapid, readily available, cheap, easy to handle and has good hemostatic control but it raises high temperature in the surgical field, resulting in delayed wound healing, more postoperative pain and secondary haemorrhage.^{1,2}

Ultrasonic dissection (UD) uses ultrasonically activated surgical device that cuts and coagulates tissues at low temperature hence causes less charring, minimal

smoke and greater precision. However, its high cost, handling difficulties, time consumption are notable disadvantages.

Two most important concerns of tonsillectomy are bleeding and pain.³ The choice of technique in tonsillectomy affects pain, haemorrhage and other complications. No definite consensus has been reached regarding the optimal technique with the lowest morbidity. This study was aimed to identify better device/ technique for tonsillectomy in children which causes less postoperative pain and bleeding by comparing ultrasonic device and bipolar diathermy which are commonly used for tonsillectomy.

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METHODS

This prospective, interventional, single blinded and comparative study was carried out in Ganesh Man Singh Memorial Academy of ENT, Head and Neck Studies, Tribhuvan University Teaching Hospital (TUTH), Institute of Medicine, Kathmandu, Nepal between September 2016 and September 2017. The study was approved by the Ethical Committee of Institutional Review Board (IRB) of Institute of Medicine (IOM).

All tonsillectomies including adenotonsillectomies upto age 15 years of both genders were included in the study. Children with bleeding disorders, craniofacial anomalies, acute infection, history of peritonsillar abscess, current or regular use of oral steroid or NSAIDs, suspected malignancy and tonsillectomy as an approach to other procedure were excluded because these might affect bleeding and pain.

All the patients were counseled regarding the surgery and explained about the pain scales. Informed consent was taken for the surgery and enrolment in the study. Dry gauge sheet of single fold measured by scale of size 19 cm x 14 cm was folded 8 times, then placed separately in box and marked as gauge pieces for pediatric tonsillectomy and sent for sterilization and these gauge only were used for the pediatric tonsillectomy. Intraoperatively partially soaked (gauge pieces having visible white areas) and completely soaked (completely reddened gauge) were counted and recorded. The completely soaked gauge piece carried 4ml of blood and partially soaked carried 2.5 ml of blood.^{4,5} Suctions were not used during the procedure. In cases of adenotonsillectomy, first adenoidectomy was performed and gauge pieces used during adenoidectomy were excluded.

Lottery method was used for randomization. All the patients underwent either ultrasonic device (Harmonic scalpel, Ethicon, USA) tonsillectomy or bipolar diathermy (BOWA, Germany) tonsillectomy according to lottery.

Each tonsil was grasped with Luc's forceps and retracted medially then dissection was carried out gently from the superior constrictor muscles, from the superior pole towards the inferior pole using either ultrasonic device or bipolar diathermy as per allocated group. In case of haemorrhage in ultrasonic device, compression using gauge piece was used if needed.

Number of gauge pieces used was counted separately for each tonsil. Amount of intraoperative blood loss for each tonsil operated and severity of pain at rest in the

morning 8-9 am, before using any analgesic for the first five post-operative days (early postoperative period by convention) were the outcome measured.

Pain was assessed using the translated Nepali version of VAS for children older than five years and FLACC scoring was used for children up to five years of age.

Results of study were analyzed in terms of amount of intraoperative blood loss and early postoperative pain for each tonsil. Independent t- test was used for this purpose. Mean pain score with standard deviation was obtained. SPSS 23 was used for data analysis.

RESULTS

A total of 38 patients (76 tonsils) fulfilled the enrollment criteria. All the cases were included in study. The age of patients included in this study ranged from 2 to 13 years. There were 20 patients (40 tonsils) of children up to 5 years of age (52.6%) and 18 patients (36 tonsils) of children more than 5 years of age (47.4%). Out of 38 cases (76 tonsils) there were 31 boys (81.6%) and 7 girls (18.4%).

Out of 38 patients (76 tonsils) enrolled in this study, indication of tonsillectomy in 32 patients (84.2 %) was Obstructive sleep apnea syndrome due to adenotonsillar hypertrophy. The remaining 6 patients (15.8%) were diagnosed as recurrent acute tonsillitis (Table 1).

Table 1. Indications of tonsillectomy (number of tonsils=76).

Indication	Frequency	Percent
OSAS (Adenotonsillar hypertrophy)	64 tonsils (32 patients)	84.2
Recurrent acute tonsillitis	12 tonsils (6 patients)	15.8
Total	76 tonsils (38 patients)	100.0

Number of patients who underwent tonsillectomies using bipolar diathermy were 22 (57.9%), slightly greater than the number of patients 16 (42.1%) who underwent tonsillectomies, using ultrasonic device

Table 2. Techniques of tonsillectomy (number of tonsils=76).

Technique	Frequency	Percent
Ultrasonic device	32 tonsils (16 patients)	42.1
Bipolar diathermy	44 tonsils (22 patients)	57.9
Total	76 tonsils (38 patients)	100.0

Intraoperative blood loss between two technique did

not differ significantly ($p=0.974$). Mean blood loss in UD group was 13.94 ml and in BD group it was 13.91 ml (Table 3).

Post-operative pain on 1st, 2nd, 3rd and 4th ($p<0.05$) days were significantly less in ultrasonic device group

compared to bipolar diathermy group. Post-operative pain was less also on 5th post-operative day in ultrasonic device but was not statistically significant ($p=0.172$). (Table 4).

Table 3. Intraoperative blood loss (number of tonsils=76).

Technique	Number of tonsils	Mean blood loss (ml)	Std. Deviation	Std. Error Mean	<i>p value</i> (Independent t test)
Ultrasonic device	32	13.94	3.202	.566	0.974 (not significant)
Bipolar diathermy	44	13.91	4.080	.615	

Table 4. Post-operative pain (number of tonsils=76).

POD	Technique	Number of tonsils	Mean pain score(VAS/FLACC)	Std. Deviation	Std. Error Mean	<i>p value</i> (Independent t test)
POD1	Ultrasonic device	32	3.38	1.561	.276	<0.001 (highly significant)
	Bipolar diathermy	44	4.77	1.492	.225	
POD2	Ultrasonic device	32	1.75	1.586	.280	0.002 (highly significant)
	Bipolar diathermy	44	2.95	1.628	.245	
POD3	Ultrasonic device	32	.81	.965	.171	<0.001 (highly significant)
	Bipolar diathermy	44	2.05	1.628	.245	
POD4	Ultrasonic device	32	.44	.801	.142	0.023 (significant)
	Bipolar diathermy	44	1.00	1.181	.178	
POD5	Ultrasonic device	32	.44	.801	.142	0.172 (not significant)
	Bipolar diathermy	44	.73	.973	.147	

DISCUSSION

Despite refinements in surgical technique, instrumentation, and anesthesia for tonsillectomy, two areas of concern “bleeding and postoperative pain” remain significant challenges for the surgeon and the patient.

Tonsillectomies as well as adenotonsillectomies were included in the study because in our pediatric ENT unit, commonest indication for tonsillectomy is obstructive sleep apnea syndrome (OSAS) secondary to adenotonsillar hypertrophy. Adenoidectomy was done before and hemostasis secured before tonsillectomy commenced, hence that didn’t hampered our estimation of blood loss in tonsillectomy. Regarding pain, adenoids being midline structure, pain arising from it would not lateralize to any particular side⁶ and moreover, in both comparison groups, technique of adenoidectomy was same; using adenoid curette and finger dissection.

Blood loss measurement tool was devised on the basis of its accuracy, ease, practical feasibility, and its successful

application in previous similar studies.

For postoperative pain measurement, Visual analogue scale was used in children older than 5 years and FLACC scoring system in younger; based on its accuracy, ease and same total maximum score of 10 that made the scoring homogenous in all age group. Two different scoring system was used because younger children cannot express their pain as older children. Hence behavioral pain scale FLACC scoring system was used in children up to 5 years of age.

Number of patients who underwent tonsillectomies using bipolar diathermy was 22(57.9%), slightly greater than the number of patients 16(42.1%) who underwent tonsillectomies, using ultrasonic device as even though lottery method was used for randomization some of the patient guardian were reluctant to try new surgical device during the preoperative counselling.

Indication of tonsillectomy in 84.2% cases were for adenotonsillar hypertrophy/OSAS that reveals the high incidence of the condition, similar to study done by

Ingram et al.⁷

Intraoperative blood loss between two techniques did not differ significantly ($p=0.974$). Mean blood loss in ultrasonic device group was 13.94 ml and slightly less 13.91 ml in bipolar diathermy group. This result is similar to study done by Walker and Syed,⁸ Leaper et al.⁹ and Potts et al.¹⁰ Cause for matching result was sought, however, none of the above studies had mentioned the method of intraoperative blood estimation, so relating factors could not be established. However, Wiatrak & Willging¹¹, in their study of 117 children comparing ultrasonic dissection and electrocautery in tonsillectomy, concluded intraoperative blood loss to be minimal in patients in whom the ultrasonic dissection was used for tonsillectomy. Similar results were obtained by Kamal et al.¹², Ahmed et al.³, Collison and Weiner¹³ and Roth et al.² in their studies.

Opposing results were observed by Kemal et al.¹⁴ in a similar study of 144 children with significantly less intraoperative bleeding in bipolar diathermy group (24 ± 13.03 cc vs 15 ± 9.61 cc; $p<0.05$). However, the amount of blood loss was higher in both groups compared to our study.

Considering pain, ultrasonic device was found to be superior, causing less pain to the children in our study. Mean post-operative pain on 1st, 2nd, 3rd and 4th days were significantly less ($p<0.05$) in ultrasonic device group compared to bipolar diathermy group. Post-operative pain was also less on 5th post-operative day in ultrasonic device but statistically insignificant ($p=0.172$). (Table 4). This result matches with the results of Wiatrak and Willging¹¹, Ahmad et al.³, Kamal et al.¹² and Kemal et al.¹⁴, which concluded that the harmonic scalpel appears to be associated with a reduced postoperative pain. They all are in unison that ultrasonic device is thought to be associated with less thermal damage in the surgical field and the healing in the ultrasonic device group was better than in the bipolar diathermy group.

On the other hand result of our study did not match with that of Parsons et al.¹⁵ Sheahan et al.¹⁶ and Potts et al.¹⁰ that showed no difference. In contrast to our study, Leaper et al.⁹ reported 204 cases which were operated with either ultrasonic scalpel or bipolar diathermy and concluded ultrasonic tonsillectomy increased post-operative pain.

The study possesses several potential limitations. Firstly, multiple surgeons were involved in the surgeries. Secondly, blood loss measurement tool used was a compromise between accuracy and feasibility, where

more accurate gravimetric measurement method was omitted due to complexity involved with it. The third limitation was the intelligence of patient to use the visual analogue scale; this drawback was tried to overcome by educating all the patients one day prior to surgery.

Intraoperative bleeding in children is a serious issue and pain is the major cause of post tonsillectomy morbidity besides bleeding. This study tried to address the importance of these two factors.

CONCLUSIONS

This study showed statistically significant less post-operative pain on 1st, 2nd, 3rd and 4th days ($p<0.05$) in ultrasonic device group as compared to bipolar diathermy group. Post-operative pain was also less on 5th post-operative day in ultrasonic device but it was not statistically significant ($p=0.172$). However, this study showed no statistically significant difference in intraoperative blood loss between ultrasonic device tonsillectomy and bipolar diathermy tonsillectomy in children ($p=0.974$).

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