

Efficacy of Ligation versus Bipolar Diathermy for Management of Intraoperative Haemostasis in Tonsillectomy: A Prospective Interventional Study

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ABSTRACT

Introduction: Tonsillitis is a highly prevalent condition and represents a significant proportion of outpatient visits. Tonsillectomy, when indicated, is considered a high-risk procedure owing to the postoperative complications. Bipolar diathermy coagulation has gained popularity due to its potential advantages, including reduced intraoperative blood loss, fewer postoperative complications, shorter operative time, and improved postoperative recovery.

Aim: To compare the efficacy of ligation and bipolar diathermy for haemostasis in tonsillectomy.

Materials and Methods: The present prospective interventional study was conducted from October 2023 to March 2025, in the Department of Otorhinolaryngology at a tertiary care hospital, involving 40 patients undergoing elective tonsillectomy. Patients were randomly allocated into two equal groups (n=20 each) based on the method of haemostasis: Group A underwent tonsillectomy with haemostasis achieved using ligation with 3-0 vicryl sutures. In contrast, group B underwent haemostasis using bipolar diathermy coagulation. Both groups were evaluated for intraoperative time (measured in minutes using a stopwatch), intraoperative blood loss (calculated by measuring suction volume and gauze weight), postoperative pain (assessed using the Visual Analog Scale (VAS) on postoperative days 0, 3, and 5), and postoperative complications such as secondary haemorrhage, infection, and delayed healing. Intergroup comparisons were performed using the independent samples student's t-test for continuous variables and the Chi-square test or Fisher's-exact test for categorical variables. A p-value of <0.05 was considered statistically significant.

Results: The mean age was 18.6±4.2 years in group A and 19.1±3.8 years in group B (p=0.612). Gender distribution was similar, with a male-to-female ratio of 12:8 in group A and 11:9 in group B (p=0.748). Patients in group B, demonstrated a significantly shorter mean haemostasis time (8.4±2.9 minutes) in comparison to group A (10.9±3.8 minutes), (p=0.02). The mean intraoperative blood loss was also significantly reduced in group B (23.8±6.1 mL) compared to group A (34.5±6.6 mL), p-value of <0.001. On postoperative day 0 (POD 0), the mean pain score in group B was 4.9±1.4, compared to 3.2±1.0 in group A (p<0.001). On POD 3, the mean scores were 2.7±0.8 in group B and 2.2±0.7 in group A (p=0.04), while on POD 5, group B reported a score of 1.8±0.6, which remained significantly higher than 1.3±0.4 in group A (p=0.003). Although postoperative pain scores decreased progressively in both groups, the differences persisted across the observation period, indicating a higher early postoperative pain burden associated with bipolar diathermy. Group A had complications in 5 cases (25%), comprising 2 cases (10%) of primary haemorrhage, 1 case (5%) of injury to the posterior pharyngeal wall, 1 case (5%) of soft palate injury, and 1 case (5%) of reactionary haemorrhage. In contrast, group B exhibited a lower complication rate in 3 cases (15%), which included 1 case (5%) of hypernasal speech, 1 case (5%) of injury to the anterior tonsillar pillar, and 1 case (5%) of transient velopharyngeal insufficiency.

Conclusion: Haemostasis using bipolar diathermy appears to be more efficient and safer technique for tonsillectomy with reduced operative time and quicker recovery, making it a favourable alternative to traditional ligation.

Keywords: Lymphoid tissue, Palatine tonsil, Tonsillitis

INTRODUCTION

The palatine tonsil is a mass of lymphoid tissue situated in the lateral wall of the oropharynx [1]. Tonsillitis is a prevalent medical condition characterised by the inflammation of the tonsils, typically resulting from bacterial or viral infections [2]. The lymphoid tissue of Waldeyer's tonsillar ring contains B-cell lymphocytes, T-cell lymphocytes, and a few mature plasma cells [3].

When indicated, the surgery for chronic tonsillitis is known as tonsillectomy or adenotonsillectomy if the adenoids are removed in the same setting. It is a very commonly performed surgery and represents approximately 20 to 40% of all surgeries performed in the field of otolaryngology [4]. While tonsillectomy is generally regarded as a straightforward procedure, it is classified as a major surgery due to the potential risks of postoperative bleeding and complications related to anaesthesia [5]. Pain and bleeding are two of the tonsillectomy's side-effects. Post tonsillectomy haemorrhage

can be severe and lead to death. Reactionary post tonsillectomy haemorrhage rates of less than 1 to 3% and secondary haemorrhage rates of 1 to 5% have been published in the literature [6].

To reduce postoperative bleeding, tonsillectomies have been carried out utilising a variety of haemostatic drugs and advanced surgical techniques. Ligating blood vessels or bleeding sites has long been a key component of haemostasis. For the treatment of postoperative bleeding, astringents such as tannic acid, silver nitrate, and diluted adrenaline solution have been suggested [7]. Bipolar diathermy minimises tissue injury in a controlled and targeted way by concentrating coagulation between the fine tips of the forceps, which leads to more consistent and reduced postoperative pain. Ligaments may trap muscle fibres on the tonsillar fossa floor, increasing postoperative pain, but they do not cause deep tissue injury [8].

Existing studies comparing ligation and bipolar diathermy show significant variability due to differences in geographic region, patient

age groups, and surgical techniques [5,9]. Many lack comprehensive evaluation of both intraoperative efficiency and postoperative morbidity, and few provide standardised pain assessments across multiple postoperative days [3,10]. Additionally, data from South Asian populations remain limited, thereby restricting the generalisability of existing evidence to regional clinical practice settings. With this background, the present study was conducted with the aim to compare the efficacy of ligation and bipolar diathermy for haemostasis in tonsillectomy.

MATERIALS AND METHODS

The present prospective interventional study was conducted in the Department of Otorhinolaryngology, Dr. DY Patil Medical College, Hospital and Research Centre, Pimpri, Pune, Maharashtra, India, from October 2023 to March 2025. The study was ethically approved by the Institutional Ethics Sub-committee (Ref No: IESC/317/2023).

A total of 40 patients diagnosed with chronic tonsillitis were included in the study.

Inclusion criteria:

- Patients aged 5 to 40 years undergoing elective tonsillectomy, with or without adenoid hypertrophy.
- Patients who provided written informed consent for participation.

Exclusion criteria:

- Patients aged <5 years or >40 years.
- Presence of peritonsillar abscess, acute tonsillitis, or chronic systemic illness.
- Patients with anaemia, immunocompromised status, or those undergoing concomitant surgical procedures such as myringotomy, grommet insertion, or lymph node biopsy.
- Patients unwilling to undergo surgery.

Study Procedure

Patients were randomly allocated into two equal groups (n=20 each) using a table of random numbers, where even numbers were assigned to group A (ligation with 3-0 vicryl) and odd numbers to group B (bipolar diathermy).

Data were collected for intraoperative blood loss, measured by calculating the volume in the suction container and gauze absorption; intraoperative time, measured from incision to haemostasis using a stopwatch; postoperative pain, assessed using the VAS on POD 0, 3, and 5; and postoperative complications, including primary, reactionary, haemorrhage, as well as mucosal injuries.

STATISTICAL ANALYSIS

All collected data were initially recorded in structured case record forms and subsequently entered into Microsoft Excel for data cleaning and verification. The cleaned dataset was then imported into Statistical Package for Social Sciences (SPSS) version 26.0 for statistical analysis. Descriptive statistics were employed to summarise the data; continuous variables were presented as mean±SD, while categorical variables were expressed as frequency and percentages. The normality of continuous variables was assessed using the Shapiro-Wilk test. Since the constant variables were found to follow a normal distribution, comparisons between the two groups were performed using the student's t-test. For categorical variables, group comparisons were conducted using the Chi-square test. A p-value of <0.05 was considered statistically significant. No missing data points were encountered during the study, and all variables were complete for the final analysis.

RESULTS

Both groups were demographically and clinically comparable. The mean age was 18.6±4.2 years in group A and 19.1±3.8 years in group B (p=0.612). Gender distribution was similar, with a male-to-female ratio of 12:8 in group A and 11:9 in group B (p=0.748) [Table/Fig-1].

Group A had significantly higher intraoperative blood loss (mean 34.5 mL) compared to group B (mean 23.8 mL) [Table/Fig-2]. Time taken to achieve haemostasis was longer in group A (mean 10.9 minutes) than in group B (mean 8.4 minutes) [Table/Fig-3]. Pain scores were initially higher in group B on the day of surgery (POD 0) but gradually declined over time. On POD 0, the mean pain score in group B was significantly greater than in group A (4.9 vs. 3.2, p=0.0007). Although group B continued to report slightly higher pain levels on POD 3 and POD 5, the differences remained statistically significant (p=0.04 and p=0.003, respectively), indicating that the ligation method may be associated with reduced postoperative pain [Table/Fig-4].

Variables	Group A (n=20)	Group B (n=20)	p-value
Mean age (years±SD)	18.6±4.2	19.1±3.8	0.612*
Sex (Male: Female)	12:8	11:9	0.748#
Indication for tonsillectomy	Recurrent tonsillitis: 18 (90%) Sleep apnea: 2 (10%)	Recurrent tonsillitis: 17 (85%) Sleep apnea: 3 (15%)	0.99# NS
Co-morbidities	None reported	None reported	NA

[Table/Fig-1]: Sociodemographic profile and clinical characteristics of study participants in group A and group B.

*- Student t-test was used, #- Chi-square test was used

Intraoperative blood loss	Group A	Group B	p-value
Mean	34.5±6.6	23.8±6.1	<0.001
Range	25 to 50	15 to 38	S

[Table/Fig-2]: Distribution depending on intra-operative blood loss.

Student t-test was used

Time taken for haemostasis in minutes	Group A	Group B	p-value
Mean	10.9±3.8	8.4±2.9	0.02
Range	5 to 20	3 to 13	

[Table/Fig-3]: Distribution depending on time taken for haemostasis.

Student t-test was used

Pain score	Group A		Group B		p-value
	Mean	SD	Mean	SD	
POD 0	3.2	1	4.9	1.4	<0.001
POD 3	2.2	0.7	2.7	0.8	0.04
POD 5	1.3	0.4	1.8	0.6	0.003

[Table/Fig-4]: Distribution depending on pain score.

Student t-test was used

Postoperative complications were observed in both groups, with 5 patients (25%) in group A and 3 patients (15%) in group B. However, the difference in overall complication rate between the two groups was not statistically significant (p=0.64) [Table/Fig-5].

Complication type	Group A (n=20)	Group B (n=20)	p-value
No complications	15 (75%)	17 (85%)	0.64
Primary haemorrhage	2 (10%)	0 (0%)	
Reactionary haemorrhage	1 (5%)	0 (0%)	
Injury to posterior pharyngeal wall	1 (5%)	0 (0%)	
Injury to soft palate	1 (5%)	0 (0%)	
Hypernasal speech	0 (0%)	1 (5%)	
Injury to anterior pillar	0 (0%)	1 (5%)	
Velopharyngeal insufficiency	0 (0%)	1 (5%)	
Total	20 (100%)	20 (100%)	

[Table/Fig-5]: Postoperative complications in group A vs group B.

Chi-square test

DISCUSSION

In the present study, group A (ligation with 3-0 vicryl sutures) and group B (bipolar diathermy coagulation) were comparable in terms

of baseline demographic and clinical parameters. These findings align with Hezam MA et al., (2020), who reported mean ages of 19.6±5.4 and 18.9±5.1 years in the ligation and diathermy groups, respectively ($p>0.05$), and with Sheikh MS et al., who also found no significant demographic variation between groups [3,5].

The mean intraoperative blood loss was significantly greater in the ligation group compared to the bipolar diathermy group. This demonstrates the superior haemostatic efficacy of bipolar diathermy, likely due to its ability to deliver focused thermal energy that effectively seals blood vessels with minimal collateral tissue damage [11]. In contrast, suture ligation necessitates mechanical handling, vessel identification, and knot application, which may delay haemostasis and result in continued oozing from small-caliber vessels, particularly in hyperemic tonsils [12].

These findings are consistent with those of Ahmed EE et al., who observed a statistically significant relationship between surgical technique and intraoperative bleeding with Cold Dissection Tonsillectomy (CDT) showing the highest incidence of bleeding [1]. However, Hezam MA et al., reported higher mean blood loss in their bipolar diathermy group (42.82±13.36 mL) compared to the ligation group (28.02±8.62 mL), suggesting that technique-related outcomes may vary due to electrosurgical settings, surgeon proficiency, intraoperative bleeding tendency, and individual patient characteristics [3]. These inter-study variations highlight the importance of surgical standardisation and proper training in energy-based modalities.

In the present study, the bipolar diathermy group (group B) exhibited significantly higher mean pain scores compared to the ligation group (group A) at all-time intervals. The increased postoperative discomfort in the bipolar diathermy group is attributed to thermal injury to peritonsillar tissues, resulting in local inflammation, nerve terminal irritation, and oedema, thereby enhancing nociceptive stimuli. In contrast, suture ligation involves mechanical trauma, which may induce less inflammatory response and tissue necrosis.

Similarly, Aljabr IK et al., compared bipolar diathermy and CDT in 94 patients and reported that on POD 1, the bipolar diathermy group had a significantly higher mean VAS score of 5.34±1.21 versus 3.91±1.03 in the cold dissection group ($p<0.05$) [10]. The pain scores remained elevated in the electrosurgical group through POD 3 and POD 7, reflecting sustained postoperative discomfort. [Table/ Fig-6] [3,11,12] shows the summary of findings from literature.

Author and year	Study design and population	Haemostasis time (mean±SD)	Intraoperative blood loss (Mean±SD)	Postoperative pain trend
Present study (2025)	Prospective interventional, 40 patients (20 per group)	Ligation: 10.9 min Bipolar: 8.4 min	Ligation: Higher (exact mL not specified) Bipolar: Significantly less	Higher VAS in bipolar group on POD 0, 3, 5
Bashir S et al., 2023 [11]	Prospective, 50 patients, randomised by tonsillar side	Ligation: 40.5±4.4 min Bipolar: 25.3±6.2 min	Ligation: 68.6±5.3 mL Bipolar: 49.5±4.5 mL	Higher VAS in bipolar group on POD 1, 3, 7

Javed Iqbal et al., 2021 [12]	Prospective comparative, 98 patients	Shorter in bipolar group (exact mean not provided)	Slightly less in bipolar group	Slightly more pain in ligation group (NS)
Hezam MA et al., 2020 [3]	Prospective, 60 patients	Ligation: 10.62±1.76 min Bipolar: 14.32±2.81 min (longer in bipolar in this study)	Bipolar: 42.82±13.36 mL Ligation: 28.02±8.62 mL (more blood loss in bipolar)	Pain scores not detailed

[Table/Fig-6]: Comparative analysis of present study with previous studies on bipolar diathermy vs ligation in tonsillectomy [3,11,12].

Limitation(s)

Besides the technique itself, patient-specific factors such as age, pain threshold, anxiety level, tissue vascularity, and hydration status, along with surgical factors such as duration of procedure, energy settings, and dissection depth, can influence pain perception and outcomes, which were not considered.

CONCLUSION(S)

According to the present study, diathermy appears to be a more efficient and safer technique for tonsillectomy with reduced operative time and quicker recovery, making it a favourable alternative to traditional ligation.

REFERENCES

- Ahmed EE, Ahmed FB. Post tonsillectomy haemorrhage in bipolar diathermy versus conventional technique. *Clin Med Res.* 2015;4(6):189-94.
- Bukhari HQ, Madloul MH, Alorinan BI, Albarak NK, Alotaibi WH, El-Sayed SA. Prevalence study of acute tonsillitis among pediatrics age groups. *International Journal of Medical Reviews and Case Reports.* 2019;3(1):1.
- Hezam MA, Nasir A, Afridi AU, Rafiq F, Arsalan D, Ahmed Z. Comparison of bipolar diathermy and suture ligation for haemostasis in tonsillectomy. *Pakistan J Med Health Sci.* 2020;14(3):1434-38.
- Anwar K, Ahmad R, Khan M. Control of bleeding by silk ligation and diathermy coagulation during tonsillectomy: A comparison of efficacy of the two techniques in the first 24 hours after surgery. *Pakistan Journal of Medical Sciences.* 2015;31(4):961.
- Sheikh MS, Shahid MS, Bhatti S, Nisar MH. Comparison between bipolar diathermy and silk ligation technique during tonsillectomy. *Med Forum Mon.* 2019;30(2):112-15.
- Yadav JS. A comparative study of ligation versus bipolar diathermy for hemostasis in tonsillectomy. *J Adv Med Dent Sci Res.* 2013;1(2).
- Al AS, Ahmed HS. Haemostasis during tonsillectomy silk ligation versus bipolar diathermy. *Med J Babylon.* 2010;7(1):274-80.
- Watson MG, Dawes PJ, Samuel PR, Marshall HF, Rayappa C, Hill J, et al. A study of haemostasis following tonsillectomy comparing ligatures with diathermy. *The Journal of Laryngology & Otology.* 1993;107(8):711-15.
- Sharma K, Kumar D. Ligation versus bipolar diathermy for hemostasis in tonsillectomy: A comparative study. *Indian Journal of Otolaryngology and Head & Neck Surgery.* 2011;63(1):15-19.
- Aljabr IK, Hassan FM, Alyahya KA. Post-tonsillectomy hemorrhage after bipolar diathermy vs. cold dissection surgical techniques in Alahsa region, Saudi Arabia. *Alexandria Journal of Medicine.* 2016;52(2):169-72.
- Bashir S, Swami G. Comparative study of bipolar electrocautery versus silk ligation for hemostasis during tonsillectomy. *Indian J Otolaryngol Head Neck Surg.* 2023;75(3):2025-28. Doi: 10.1007/s12070-023-03778-2. Epub 2023 Apr 25. PMID: 37636634; PMCID: PMC10447304.
- Iqbal J, Raahat ZM, Chaudhry K, Gul AA, Zaheer UI Hassan Akhtar R. Bipolar diathermy versus ligation for hemostasis in conventional tonsillectomy: A comparative study. *Med Forum.* 2021;32(5):18-21.

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