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COMPARISON OF INTRAOPERATIVE BLOOD LOSS BETWEEN LIGASURE AND DISSECTION METHOD TONSILLECTOMY

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Abstract

Objective: *To compare intraoperative blood loss between the LigaSure vessel sealing system and the dissection method of tonsillectomy*

Method: *This comparative cross-sectional study included 60 patients (4-40 years) undergoing elective bilateral tonsillectomy for recurrent tonsillitis and/or tonsillar hypertrophy causing sleep disturbance or dysphagia. Intraoperative blood loss was compared between the LigaSure (n=30) and dissection methods (n=30). SPSS version 25 was used for the data analysis. Age, sex, and surgical indications were also analyzed for their association with blood loss.*

Results: *The median blood loss in the dissection group was 60.0 mL, compared to 6.5 mL in the LigaSure group. The Mann-Whitney U test revealed a significant difference (p=0.000). The mean blood loss for the Dissection group was 69.8 mL, while the LigaSure group had a mean of 13.4 mL. An independent t-test showed a statistically significant difference between the means (p=0.001). Age, sex, and indications for surgery were not significantly correlated with blood loss in this study.*

Conclusion: *The LigaSure vessel sealing system causes significantly less intraoperative bleeding than the dissection method.*

INTRODUCTION

Tonsillectomy is one of the most common surgical procedures performed in children worldwide (1,2). In the United States, for example, an estimated 567,000 pediatric tonsillectomies were performed in 2019, and they remain among the most frequent operations in otolaryngology (3). Given the high volume of cases, investigators have increasingly focused on improving patient evaluation, surgical techniques, and postoperative care.

Common indications for tonsillectomy include recurrent tonsillitis, tonsillar hypertrophy causing obstructive sleep apnea, less common tonsillitis causing febrile seizures, suspected tonsillar malignancy, and more than one episode of peritonsillar abscess (1). As with any surgical procedure, it is associated with complications such as intraoperative blood loss, postoperative blood loss, and postoperative pain. Minimizing these complications is important to improve surgical outcomes, decrease morbidity, and improve patient safety and recovery.

A study by Prasad et al. showed that older age at tonsillectomy leads to higher blood loss (4). This could be due to increased vascularity or fibrosis caused by recurrent infections. However, other studies have shown no differences (5). Another

inconsistent difference between males and females is that males have higher blood loss, whereas other studies have shown no difference (4)(5). Few studies comparing indications and intraoperative blood loss suggest recurrent tonsillitis with greater blood loss (6).

No single tonsillectomy method has been universally accepted as superior, so frequent comparative studies of different approaches are deemed "paramount for improving safety, patient care, and cost-effectiveness" (7). Historically, cold-steel (cold knife and snare) dissection has been the gold standard of tonsillectomy technique. However, recent trials have consistently shown that energy-based methods can reduce bleeding. For example, a prospective series found that intraoperative blood loss was significantly lower when tonsils were removed with electrocautery rather than cold dissection (mean 18.8 mL vs. 44.3 mL, $p<0.05$) (8). Similarly, a randomized study using a novel electrosurgical divider on one tonsil and cold dissection on the other reported significantly less blood loss on the device side (9). In contrast, coblation tonsillectomy has been shown to produce far less intraoperative bleeding than cold steel dissection (8,10). In that study, patients with coblation had significantly lower mean blood loss, quicker return to diet, and reduced pain than those in the cold-dissection group. The recent introduction of LigaSure technology in the surgical field has opened doors for surgeons and patients. Studies have shown multiple benefits of this technology, one of them being decreased intraoperative blood loss (11)(12)(13). The LigaSure system is an advanced bipolar vessel-sealing device developed as an alternative to ligatures for vessel sealing to provide better hemostasis (14). It can seal blood vessels of up to 7 mm in diameter, providing simultaneous tissue dissection and hemostasis (15). Efficient vessel sealing often shortens the operative time (16). More recently, clinicians have begun to apply LigaSure technology to tonsillectomy. Early reports suggested excellent hemostasis with LigaSure in tonsil removal; one comparative trial noted no measurable bleeding on the LigaSure side, while the control side (cold dissection) had substantial blood loss (17). Very few studies are available that look at intraoperative bleeding in tonsillectomy by the LigaSure method. Still, those that are available look promising with regards to LigaSure tonsillectomy being a strong contender with other latest technologies like laser coblation, microdebrider, harmonic scalpel, and thermal welding. Kang et al reported that LigaSure tonsillectomy significantly reduced intraoperative blood loss and operative time compared to cold dissection (18), whereas Lachanas VA et al. showed no measurable intraoperative bleeding using the LigaSure method, whereas mean blood loss by cold knife technique was 125ml (19). LigaSure technology is increasingly used owing to its various advantages, including decreased intraoperative blood loss (16). Sufficient studies regarding using LigaSure technology for tonsillectomy are not available in Pakistan. This study provides useful information regarding its effect on intraoperative blood loss, which will allow surgeons and patients to decide whether this method should be chosen. Therefore, this study was conducted in a tertiary-care hospital to compare intraoperative blood loss in patients undergoing dissection and LigaSure tonsillectomy.

METHOD AND MATERIALS

A comparative cross-sectional study was conducted in the ENT Department of Kuwait Teaching Hospital, Peshawar. The data were collected between August 2024 and Jan 2025. The sample size was determined based on data from a previous study by Saleem et al., which reported a mean blood loss of 0.39±0.15 mL for the LigaSure method and 15.9±2.65 mL for the cold dissection method (13). With a 95% confidence level and 80% power, the calculated minimum sample size was two patients per group. However, to ensure adequate statistical power and account for variability, the study recruited a total of sixty patients, with 30 patients assigned to each group. A nonprobability consecutive sampling technique was used in this study.

Patients eligible for inclusion were aged between 4 and 40 years of either sex and underwent bilateral tonsillectomy for recurrent tonsillitis or tonsillar hypertrophy causing sleep disturbance or dysphagia. Exclusion criteria included patients with known bleeding disorders, positive hepatitis serology, those undergoing unilateral tonsillectomy, or those who would also undergo concurrent adenoidectomy. Eligible patients were assigned to one of two groups. Group A underwent the dissection method, while

Group B underwent the LigaSure method. Both groups adhered to institutional guidelines, ensuring patient confidentiality and informed consent.

All surgeries were performed under general anesthesia with the use of a Boyle-Davis mouth gag to provide optimal exposure of the tonsils. Before the procedure, the blood volume in the suction canister and the weight of dry surgical swabs were noted to facilitate accurate blood loss measurement.

In Group B (LigaSure method), the tonsils were retracted medially, and dissection proceeded in the avascular plane from the upper to lower pole using the LigaSure™ Maryland jaw device. This device both cuts tissue and seals vessels. Any bleeding vessels encountered were sealed using the LigaSure coagulation mode, with no additional cutting required. In Group A (Dissection method), the tonsillar mucosa was incised, and the tonsil was dissected from its bed using cold steel instruments or bipolar electrocautery. The lower pole was secured with a 1-0 silk tie, and any bleeding points were controlled using bipolar electrocautery or additional sutures, as necessary.

After tonsil removal, the mouth gag was removed, and the patient was awakened from anesthesia. The swabs were weighed immediately, and the suctioned blood volume was measured. Total intraoperative blood loss was calculated by adding the increase in swab weight (with 1 g corresponding to 1 mL of blood) to the suctioned blood volume.

Demographic information, clinical details, and blood loss measurements were recorded on a predesigned structured proforma. Data analysis was conducted using SPSS v.25. Continuous variables such as age and blood loss were assessed for normality using the Shapiro-Wilk test. These variables were summarized as median (IQR), as the data was not normally distributed. Mean±SD was also calculated. Categorical data, including gender and surgical indication, were reported as frequencies and percentages. To compare median intraoperative blood loss between the two groups, –Mann-Whitney U test was used, with a p-value of ≤0.05 considered statistically significant.

RESULTS

This study included sixty cases of tonsillectomy equally divided between LigaSure and Dissection methods. The mean age of the participants was 12.10 ± 4.7 years. There were 26 (43.3%) male patients and 34 (56.7%) female patients. 52 (86.7%) patients indicated recurrent tonsillitis, 5 (8.3%) with tonsillar hypertrophy, and 3(5%) with both. Regarding baseline hemoglobin levels, the mean hemoglobin concentration was 12.92 ± 1.21 g/dl.Details are shown in Table 1.

Table 1. Baseline demographic and clinical characteristics of patients.

S. No	Category		Count (n)	Frequency (%)
1	Total patients		60	100
2	Method	LigaSure method	30	50
		Dissection method	30	50
3	Indication	Recurrent tonsillitis	52	86.7
		Tonsillar hypertrophy	5	8.3
		Both	3	5
4	Gender	Male	26	43.3
		Female	34	56.7
5	Mean age		12.10 ± 4.7	
6	Hemoglobin	Hemoglobin (mean ± SD)	12.92 ± 1.21 g/dl	
		Hemoglobin (range)	8.9 – 15 g/dl	

Comparison of blood loss between the dissection and LigaSure methods

A comparison was made between the dissection and LigaSure methods in terms of intraoperative blood loss. The median blood loss was significantly higher in the dissection group (60.0 ml) compared to the LigaSure group (6.5 ml). Since the Shapiro-Wilk test indicated that blood loss data were not normally distributed for either group (p = 0.009 for dissection; p = 0.000 for LigaSure), a non-parametric Mann-Whitney U test was used. The test revealed a statistically significant difference in blood loss between the two methods (p 0.00), indicating that the LigaSure method is associated with significantly less bleeding during tonsillectomy compared to the dissection method. For the mean blood loss, the Dissection group had a mean of 69.8 mL (±50.5 mL), while the LigaSure group had a mean of 13.37 mL (±23.4 mL). The independent t-test showed that this difference in means was statistically significant (p=0.001), further supporting the reduced blood loss associated with the LigaSure technique. Details shown in Table 2

Analysis of age and blood loss showed a weak positive correlation (correlation coefficient: 0.116). Further analysis by age group (0–10, 11–20, 21–30 years) revealed a trend toward higher median blood loss with increasing age, but this was not statistically significant. Linear regression and correlation analyses showed no meaningful relationship between age and blood loss, either overall or within surgical method subgroups.

Blood loss comparison between genders showed Males having a median blood loss of 26.0 mL, while females had a median of 12.0 mL. However, the difference was not statistically significant (Mann-Whitney U = 501.5, p = 0.378), suggesting that gender does not play a significant role in determining intraoperative blood loss in this cohort.

Patients were grouped by surgical indication: recurrent tonsillitis, tonsillar hypertrophy, or both. The Kruskal-Wallis H-test showed no significant difference in blood loss among these groups (H = 0.46, p = 0.794). This suggests that the underlying reason for surgery does not significantly impact the amount of blood lost during the procedure.

Table 2. Intraoperative Blood Loss Comparison Between Dissection and LigaSure Methods (n = 30 each)

Variable	Dissection (n=30)	LigaSure (n=30)	p-value	Test used	Significance
Median blood loss(ml)	60.0	6.5	0.000	Mann-Whitney U test	Significant
Standard deviation	50.5	23.4	-	-	-
Minimum blood loss(ml)	8	2	-	-	-
Maximum blood loss	206	131	-	-	-
Shapiro-Wilk normality p	0.009	0.000	<0.05	Shapiro-Wilk test	Not normally distributed
Mean(ml)	69.8 (±50.5)	13.4 (±23.4)	0.001	Independent t-test	Significant
IQR (ml)	78.5	8.75			

DISCUSSION

Our findings provide compelling evidence in support of the LigaSure technique. Specifically, we observed that the LigaSure method significantly reduced intraoperative blood loss, with a median of 6.5 mL in the LigaSure group, compared to a higher 60.0 mL in the conventional dissection group (p = 0.00). This stark difference highlights the superior hemostatic control achieved by LigaSure, which aligns well with the findings of several international studies that have consistently reported its advantages in terms of reduced intraoperative bleeding (18,19). A meta-

analysis by Kang et al examined multiple studies comparing LigaSure to dissection and found that LigaSure not only reduced intraoperative blood loss but also shortened the operative time (18). These findings are in line with our study, which demonstrates that the ability of LigaSure to minimize bleeding may contribute to more efficient and safer surgical procedures. By reducing the time spent in the operating room, LigaSure also offers the potential for lower risks of infection and quicker patient turnover. In addition to blood loss, the study by Lachanas VA et al. reported that patients who underwent LigaSure tonsillectomy had lower postoperative hemorrhage rates and experienced a quicker recovery period compared to those who underwent traditional dissection (19). This aspect of the LigaSure technique—its impact on postoperative recovery—is particularly important, as it may contribute to shorter hospital stays, fewer complications, and faster return to normal activities, which can be crucial for both patients and healthcare systems, especially in a resource-constrained setting like ours. Moreover, Saleem et al. found comparable results, showing that LigaSure was associated with a significant reduction in blood loss compared to conventional dissection (17). Their study also corroborated our findings, with the LigaSure group demonstrating significantly lower blood loss. This further emphasizes the potential of LigaSure to reduce not only intraoperative blood loss but also the need for additional interventions such as blood transfusions, which can carry their risks and costs. The implications of reducing blood loss are critical, particularly in preventing complications like postoperative bleeding, which can lead to longer recovery times, increased hospital stays and added healthcare costs. A study by Pang et al looked at coblation tonsillectomy with and without a microscope and deemed the microscope group to perform better in terms of blood loss and post-operative pain (20). Using a microscope to enhance visualization for both cold steel and harmonic scalpel tonsillectomy, Samdani et al. still found that the harmonic scalpel technique resulted in significantly less intraoperative blood loss (14). The surgical microscope enhances visualization by providing magnification and illumination of the surgical field, allowing for more precise dissection and identification of blood vessels, contributing to less intraoperative blood loss. The addition of microscope use with newer techniques like LigaSure could yield even better results regarding blood loss with LigaSure's precise and reliable vessel sealing. Further research can be carried out by comparison of LigaSure tonsillectomy with and without a microscope.

Little research is available comparing the relationship of intraoperative blood loss in tonsillectomy with gender, age, and indications for tonsillectomy. A study by Zhen et al suggests no difference between genders, which is in concordance with our study (21). The same study suggests increased blood loss in adults, whereas our study does not find any increased blood loss with increasing age. No significant difference was observed in our study regarding the indication for surgery, while Zhen et al suggested an increase in intraoperative blood loss in patients with recurrent tonsillitis. The lack of significant differences in our study by gender, age, or surgical indication suggests that the benefits of LigaSure are broadly applicable across patient subgroups. The data demonstrate that the choice of surgical method is the primary determinant of intraoperative blood loss in tonsillectomy. LigaSure offers a substantial reduction in blood loss compared to dissection. This universality enhances the clinical utility of the technique, making it a valuable tool for surgeons regardless of patient demographics or the underlying reason for surgery.

Overall, our study, along with the evidence from these international studies, strongly supports the use of LigaSure as a more effective and safer alternative to dissection techniques in tonsillectomy. The reduction in blood loss, coupled with the potential benefits in terms of recovery time and fewer postoperative complications, suggests that LigaSure may be a highly valuable addition to clinical practice, particularly in Pakistan, where the benefits of reduced complications and faster recovery could greatly improve patient outcomes and reduce healthcare costs. While our study provides strong evidence regarding the superiority of LigaSure in reducing intraoperative blood loss, it is limited by being a single-center trial. Future multi-center studies would help establish the generalizability of these

results across different hospital settings in Pakistan. Moreover, our study focused on blood loss as the primary outcome, and further research should explore other important postoperative outcomes, such as recovery time, pain levels, and complications, to fully assess the advantages of LigaSure.

CONCLUSION

This study provides compelling evidence supporting the use of LigaSure in tonsillectomy for reducing intraoperative blood loss. The consistency of benefit across patient subgroups and the magnitude of blood loss reduction suggest that wider adoption of this technique could significantly improve surgical outcomes. Given the paucity of local data, our study contributes valuable insight into the potential benefits of LigaSure for tonsillectomy in Pakistan.

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