

Comparative Analysis of Bipolar versus LigaSure Diathermy in Adult Tonsillectomy Using Multidimensional Recovery Metrics

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Abstract

Background

This project's objective was to compare the multidimensional recovery of adult patients who underwent tonsillectomies via bipolar or LigaSure diathermy using multiple outcome measures. Previous research has primarily examined the recovery of tonsillectomy patients through traditional pain scales.

Methods

A multiple-methods cohort study enrolled 150 adult patients ages 18–65 who underwent a tonsillectomy using bipolar (75 subjects) or LigaSure (75 subjects) diathermy. The study measured recovery based on composite pain and analgesia scores (CPAS), post-tonsillectomy hemorrhage severity (PTHS), tonsillar fossa healing index (TFHI), and duration for return to baseline level of function (RTB).

Results

The study demonstrated that patients undergoing surgery with bipolar diathermy had significantly shorter operating times (21.14 ± 4.20 minutes vs. 29.76 ± 5.10 minutes mean difference $\Delta = -8.62$ minutes, 95% CI: -10.14 to -7.10; $P = 0.00000000000000000000978$). However, patients in the bipolar group experienced a secondary increase in pain at post-operative day (POD) 7 (mean CPAS 42.5 vs. 28.4; mean difference $\Delta = +14.10$, 95% CI: +4.24 to +23.96; $P = 0.01$) and also had a higher percentage of hemorrhages graded as grade 2 and grade 3 than patients undergoing tonsillectomy with LigaSure diathermy.

Conclusion

Although bipolar diathermy is associated with faster operative times, patients undergoing tonsillectomies with LigaSure diathermy experience a better overall recovery experience, with less secondary pain and bleeding, faster healing, and less severe hemorrhages.

Introduction

Tonsillectomy in adults involves significant morbidity, including severe pain and hemorrhage.[1, 2] While "hot" techniques like bipolar and LigaSure diathermy reduce operative time, they differ in thermal injury and healing patterns.[3, 4] Existing literature relies on simplistic metrics like the Visual Analogue Scale and binary bleeding reports.[5, 6] This study utilizes multidimensional tools to evaluate recovery.[7] We hypothesize these advanced metrics will reveal distinct postoperative profiles both techniques previously undocumented in adult populations.

Material and Methods

Design of Trial and Setting

A cohort study design (combined cohort study - retrospective analysis of surgical records combined with a prospective observational study) was used to conduct this study. The retrospective component involved a comprehensive review of adult patients who had tonsillectomy either by bipolar diathermy or with the use of LigaSure diathermy during the period September 2023 - September 2024. The prospective component included enrollment of patients from October 2025 - March 2026. The novel Composite Pain and Analgesia Scores (CPAS) and Tonsil Fossa Healing Index (TFHI) were applied to the retrospective cohort by two blinded reviewers who extracted data from comprehensive nursing pain logs, medication administration records and follow-up photography of the patient, as had been done in similar structured daily diaries used by prospective participants. Approval from the local institutional review board (IRB) in Almoosa Health Group was obtained prior to the beginning of the study, IRB Log No.: ARC-25.9.07 and Date 01/10/2025. The study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants before they could participate in the study.

Patient Population and Sampling Technique

The target sample size consisted of 150 adult patients (75 per cohort) to ensure adequate statistical power to evaluate differences in recovery metrics. This combined cohort study adheres strictly to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) reporting guidelines for observational research. A completed STROBE checklist mapping all reporting elements to their respective locations in this manuscript has been provided as a supplementary file. Patients were naturally grouped into either the bipolar diathermy cohort or the LigaSure diathermy cohort based on the operating surgeon's baseline clinical preference and the institutional availability of the equipment at the time of the surgical procedure. Because this was an observational cohort study, no formal randomization protocol or allocation concealment was utilized, and the surgical teams maintained their standard institutional techniques across both cohorts. Patient data were evaluated based on routine clinical management and documentation without experimental blinding interventions.

Sample Size Calculation

The sample size was determined by calculating statistical power based on the primary outcome measure, the CPAS. To demonstrate a clinically important mean difference of 20% between the two surgical cohorts for CPAS (assuming a standard deviation of 15 points, $\alpha = 0.05$, and a power of 80%), a minimum of 68 patients were required per cohort. To maximize the reliability of secondary clinical outcomes specifically the stratified post-tonsillectomy hemorrhage rates—and to account for a projected 10% rate of missing data or patient attrition, a final sample of 150 patients ($n = 75$ per cohort) was targeted. The compiled clinical data from both cohorts provided a robust observational database to characterize and compare adult tonsillectomy recovery trajectories.

Inclusion and Exclusion Criteria

• Inclusion Criteria:

Adult patients aged 18 to 65 years, Clinical indication for bilateral tonsillectomy (e.g., recurrent acute tonsillitis, chronic tonsillitis, or obstructive sleep apnea) (Fig. 1).

• Exclusion Criteria:

Pediatric patients (under 18 years of age), History of bleeding diatheses or coagulopathy, Suspicion of tonsillar malignancy.

Surgical Technique

All patients received general anesthesia and were endotracheally intubated. Due to position during surgery, all patients were placed in the Rose position (i.e., supine with legs elevated), and all patients were secured using a modified Boyle-Davis mouth gag. The type of diathermy instrument used to manage the tonsil cradle and control bleeding was different for each group, as outlined below.

- **Diathermy Instruments Used to Manage the Tonsil Cradle:** - diathermy forceps (bipolar group) to dissect the tonsils and to create an extracapsular plane of dissection; achieve hemostasis in the tonsil cradle), while the LigaSure Medtronic® electro-surgical instrument (LigaSure group) was used to dissect the tonsils, manage the tonsillar vascular pedicle, and achieve clarity). Provide accurate and precise measurements for each surgical procedure. To determine whether or not to administer blood transfusions, we recorded the approximate total bypass time (total time from mucosal incision to final hemostatic) and the estimated amount of blood lost during each surgical procedure (Figs. 2A and 2B).

Outcome Measures and Data Collection

Primary and secondary endpoints were systematically recorded and categorized into intraoperative and postoperative clinical measures.

Intraoperative Measures:

1. **Operative Time:** Measured continuously in minutes by the circulating nurse, defined strictly as the time from the initial mucosal incision to the achievement of final hemostasis and the removal of the mouth gag.
2. **Intraoperative Blood Loss:** Quantified in milliliters (ml) by calculating the total volume of blood collected in the surgical suction canister (subtracting any measured irrigation fluid used during the procedure) combined with the gravimetric measurement of all blood-soaked surgical swabs used in the operative field.

Postoperative Measures:

1. 3. **Composite Pain and Analgesia Score (CPAS):** Recorded daily for the first 14 postoperative days. This composite metric is calculated by multiplying the patient's peak daily Visual Analog Scale (VAS) pain score (0–10) by the total daily doses of rescue analgesics consumed, providing a weighted assessment of pain severity.
2. 4. **Post-Tonsillectomy Hemorrhage (PTH) Severity Grade:** Any postoperative bleeding episode was categorized by clinical severity: *Grade 1:* Minimal oozing, spontaneous cessation. *Grade 2:* Ward-level intervention required (e.g., ice packs, hydrogen peroxide gargles, chemical cautery). *Grade 3:* Surgical intervention required for hemostasis in the operating theater. *Grade 4:* Severe hemorrhage necessitating blood transfusion or intensive care admission.
3. 5. **Tonsillar Fossa Healing Index (TFHI):** A blinded otolaryngologist evaluated the tonsillar fossae at 7 and 14 days postoperatively. Healing was graded from 0 (fully epithelialized) to 3 (deep tissue necrosis or infection) based on the presence, thickness, and character of the thermal eschar.
4. 6. **The "Return to Baseline" Triad:** Patients maintained a structured postoperative diary to record the exact postoperative day they achieve three functional milestones: complete cessation of opioid or rescue analgesia, resumption of a normal (non-soft) diet, and return to work or standard daily activities.

Statistical Analysis

Statistical software (SPSS version 28.0) used to analyze the data. Continuous variables (such as operative times and CPAS values) were first formally assessed for normality using the Shapiro-Wilk test. For variables demonstrating a normal distribution, the parametric independent-samples t-test was strictly applied to compare group means. Conversely, for continuous variables that deviated significantly from a normal distribution, as well as for ordinal index parameters (including the Composite Pain and Analgesia Score [CPAS] and the Tonsillar Fossa Healing Index [TFHI]), the non-parametric Mann–Whitney U test was utilized. Categorical values compared using either the chi-square test, as appropriate. Time-to-event data for the "Return to Baseline" Triad analyzed using Kaplan-Meier survival curves, and these analyses compared using the log-rank test. A p-value of less than 0.05 considered statistically significant.

Results

Patient Demographics and Baseline Characteristics

A total of 150 adult patients meeting the inclusion criteria were successfully enrolled and analyzed in this study (n = 75 in the Bipolar Diathermy group; n = 75 in the LigaSure Diathermy group). The study cohort comprised 82 females (54.6%) and 68 males (45.3%), with a mean age of 34.2 ± 9.4 years. The primary surgical indication across both cohorts was recurrent acute tonsillitis (62%), followed by chronic tonsillitis (24%) and obstructive sleep apnea (14%). There were no statistically significant differences between the two groups regarding age, sex distribution, or surgical indications, ensuring a well-matched comparative baseline. (**Table.1 and 2**)

Table 1
Patient Demographics and Baseline Characteristics

Characteristic	Total Cohort (N = 150)	Bipolar Diathermy (n = 75)	LigaSure Diathermy (n = 75)
Age (years) (<i>Mean ± SD</i>)	34.2 ± 9.4	34.1 ± 9.2	34.3 ± 9.6
Sex Distribution			
Female	82 (54.7%) (95% CI: 46.7% to 62.5%)	41 (54.7%) (95% CI: 43.4% to 65.5%)	41 (54.7%) (95% CI: 43.4% to 65.5%)
Male	68 (45.3%) (95% CI: 37.5% to 53.3%)	34 (45.3%) (95% CI: 34.5% to 56.6%)	34 (45.3%) (95% CI: 34.5% to 56.6%)
Primary Surgical Indication			
Recurrent Acute Tonsillitis	93 (62.0%) (95% CI: 54.1% to 69.4%)	47 (62.7%) (95% CI: 51.4% to 72.7%)	46 (61.3%) (95% CI: 50.0% to 71.4%)
Chronic Tonsillitis	36 (24.0%) (95% CI: 17.7% to 31.7%)	18 (24.0%) (95% CI: 15.8% to 34.7%)	18 (24.0%) (95% CI: 15.8% to 34.7%)
Obstructive Sleep Apnea	21 (14.0%) (95% CI: 9.4% to 20.5%)	10 (13.3%) (95% CI: 7.4% to 22.8%)	11 (14.7%) (95% CI: 8.4% to 24.3%)

Table 2
Patient Demographics and Baseline Characteristics

Characteristic	Statistical Test	Exact P-value
Age (years)	Independent Samples t-test	0.8965
Sex Distribution	Chi-Square Test	1.0000
Primary Surgical Indication	Chi-Square Test	0.9712

Intraoperative Measures

Analysis of the intraoperative metrics revealed distinct profiles for each surgical modality.

- **Operative Time:** The Bipolar Diathermy group demonstrated a significantly shorter mean operative time compared to the LigaSure Diathermy group (21.14 ± 4.2 minutes vs. 29.76 ± 5.1 minutes; mean

Table 3
Post-Tonsillectomy Hemorrhage (PTH) Severity

PTH Severity Grade	Bipolar Diathermy (n = 75)	LigaSure Diathermy (n = 75)	Exact <i>P</i> -value
Grade 1 (<i>Minimal oozing, spontaneous cessation</i>)	6 (8.0%) (95% CI: 3.7% to 16.4%)	7 (9.3%) (95% CI: 4.6% to 18.0%)	0.78
Grade 2 (<i>Ward-level intervention required</i>)	5 (6.6%) (95% CI: 2.9% to 14.7%)	1 (1.3%) (95% CI: 0.2% to 7.2%)	0.04*
Grade 3 (<i>Surgical intervention in theater</i>)	3 (4.0%) (95% CI: 1.4% to 11.1%)	0 (0.0%) (95% CI: 0.0% to 4.9%)	0.08
Grade 4 (<i>Transfusion or ICU admission</i>)	0 (0.0%) (95% CI: 0.0% to 4.9%)	0 (0.0%) (95% CI: 0.0% to 4.9%)	N/A
Total Group Incidence	14 (18.7%) (95% CI: 11.5% to 28.9%)	8 (10.7%) (95% CI: 5.5% to 19.7%)	0.174

3. Tonsillar Fossa Healing Index (TFHI)

Blinded clinical evaluations at days 7 and 14 confirmed different rates of tissue repair. At POD 7, the Bipolar group had a significantly higher mean TFHI score (2.4 ± 0.6) compared to the LigaSure group (1.5 ± 0.5 ; mean difference $\Delta = +0.90$ points, 95% CI: +0.72 to +1.08 points; exact $P = 0.001$). By POD 14, while both groups showed improved epithelialization, the LigaSure group had achieved near-complete healing (mean TFHI 0.4), whereas the Bipolar group still exhibited residual sloughing (mean TFHI 1.1; mean difference $\Delta = +0.70$ points, 95% CI: +0.53 to +0.87 points; exact $P = 0.05$). **(Figure.4)**

4. The "Return to Baseline" Triad

Kaplan-Meier survival analysis applied to the functional milestones revealed that patients in the LigaSure Diathermy group achieved a faster return to normal daily functions.

- **Opioid Cessation:** LigaSure group (mean 7.2 days) vs. Bipolar group (mean 10.4 days); mean difference $\Delta = 3.2$ days faster for LigaSure (95% CI: 1.48 to 4.92 days; Log-rank $P = 0.001$).
- **Normal Diet Resumption:** LigaSure group (mean 9.5 days) vs. Bipolar group (mean 12.1 days); mean difference $\Delta = 2.6$ days faster for LigaSure (95% CI: 0.94 to 4.26 days; Log-rank $P = 0.002$).

• **Return to Work/Activity:** LigaSure group (mean 11.0 days) vs. Bipolar group (mean 13.8 days); mean difference Δ = 2.8 days faster for LigaSure (95% CI: 1.12 to 4.48 days; Log-rank P = 0.001).

The statistical comparison using the log-rank test confirms that the LigaSure Diathermy group achieved all three functional milestones significantly faster than the Bipolar group. (**Table.4**)

Table 4
The "Return to Baseline" Triad

Functional Milestone	LigaSure Group(Mean Days)	Bipolar Group(Mean Days)	Mean Difference (Δ) (95% CI)
Opioid / Rescue Analgesia Cessation	7.2 days	10.4 days	3.2 days faster for LigaSure (95% CI: 1.48 to 4.92 days)
Resumption of Normal (Non-Soft) Diet	9.5 days	12.1 days	2.6 days faster for LigaSure (95% CI: 0.94 to 4.26 days)
Return to Work / Standard Activities	11.0 days	13.8 days	2.8 days faster for LigaSure (95% CI: 1.12 to 4.48 days)

Key Observations:

- **Opioid Cessation:** Patients in the LigaSure group were able to stop rescue analgesia approximately **3.2 days earlier** than those in the Bipolar group.
- **Dietary Progress:** Resumption of a normal (non-soft) diet occurred significantly sooner in the LigaSure cohort, suggesting less localized tissue inflammation or discomfort during deglutition.
- **Functional Independence:** The LigaSure group returned to work or standard daily activities nearly **3 days faster** than the Bipolar group, highlighting a reduced overall recovery burden.

Continuous Variables Mean Differences:

The Bipolar Diathermy group demonstrated a significantly shorter mean operative time compared with the alternative technique, with a mean difference of Δ = -8.62 minutes (95% CI: -10.14 to -7.10 minutes; exact P = 9.78×10^{-22}).

Intraoperative blood loss was slightly higher in the Bipolar group by Δ = +2.32 mL; however, this difference did not reach statistical significance (95% CI: -0.28 to + 4.92 mL; exact P = 0.07).

Regarding postoperative pain outcomes, the Bipolar group exhibited significantly higher secondary peak pain scores on postoperative day 7 (CPAS), with a mean increase of $\Delta = +14.10$ score points (95% CI: +4.24 to + 23.96 score points; exact $P = 0.01$).

Assessment of tonsillar fossa healing using the Tonsillar Fossa Healing Index (TFHI) demonstrated delayed healing in the Bipolar group. On postoperative day 7, the Bipolar cohort showed significantly worse eschar formation with a mean difference of $\Delta = +0.90$ points (95% CI: +0.72 to + 1.08 points; exact $P = 0.001$). This delayed healing pattern persisted on postoperative day 14, with significantly greater residual slough observed in the Bipolar group ($\Delta = +0.70$ points; 95% CI: +0.53 to + 0.87 points; exact $P = 0.05$).

Discussion

The results of this study suggest that while intraoperative efficiency of bipolar diathermy may be slightly superior as compared to LigaSure diathermy, the overall postoperative recovery of an adult using the LigaSure will be better and more stable when compared to an adult using bipolar diathermy. Using the Composite Pain and Analgesia Score (CPAS) as well as the Tonsillar Fossa Healing Index (TFHI), we were able to identify a secondary "pain spike" as well as the delayed healing of the bipolar group which can sometimes be missed when using traditional unidimensional pain assessments (e.g., the simple visual analogue scale or VAS) with adults.

The average time it took to perform a procedure using bipolar techniques was 21.14 minutes while that for the LigaSure techniques was 29.76 minutes. These times are similar to those described by Windfuhr et al., 2021 who attributed this time difference to "hot" techniques of dissection (like diathermy) due to the factors of cutting and coagulating at the same time; thus this results in less time required for the surgical procedure. However, according to both Windfuhr et al. [8] and Giger et al., [3] even though the duration of surgery is less when using bipolar techniques, there will be more postoperative morbidity associated with this technique.

Thermal damage with the use of bipolar techniques extends beyond the anatomic site producing greater degrees of localized tissue injury than what would normally be seen. According to Karasneh et al., [9], there is a strong relationship between the voltage and length of time the tissue is in contact with the bipolar electrode at the time of dissection with bipolar techniques as it relates to the amount of collateral thermal injury will occur; therefore, those that use bipolar dissection technique will have a larger inflammatory response due to increased collateral but similar to those that use cold steel or LigaSure dissection techniques.

After POD 5, there is a clear distinction between the pain trajectories of the bipolar group and the LigaSure group. Both groups had similar pain ratings for the first 72 hours following surgery; however, the bipolar group exhibited a secondary peak in CPAS at POD 7 (42.5), while the LigaSure group demonstrated more of a linear recovery following surgery. This is consistent with what was noted by

O'Leary et al., [10] who stated bipolar dissection techniques exhibit increased lateral thermal spread and eschar when compared to LigaSure dissection techniques.

These differences are also evident in the TFHI data; specifically, by the 7th POD the mean TFHI score of the bipolar group was 2.4 versus 1.5 for the LigaSure group. Eschar formation after surgery is associated with increased pain as well as the likelihood of higher degree bleeding events. [7, 10] Delayed healing in the bipolar cohort is further complicated by the destruction of the microvascular supply to the tonsils preventing a primary fibrin seal from forming in a timely fashion. [11]

In terms of safety, our stratified analysis of post-tonsillectomy hemorrhage (PTH) severity indicated that subjects in the bipolar group had a higher incidence of grade 2 and 3 bleeding during the eschar sloughing phase (POD 6 to 9) compared to the LigaSure group. The overall incidence of PTH (14%) is still within the range that has been reported in previous studies involving adults. [12], however the severity grading utilized in this study suggest that LigaSure diathermy produces more manageable, self-limited (grade 1) bleeding than bipolar diathermy. This may indicate that bilateral hemostasis achieved with LigaSure diathermy provides a more secure vascular seal with less surrounding tissue necrosis. This finding is reinforced by [13], who recently published a meta-analysis of tonsillectomy techniques in adults that found that ligatures are associated with lower rates of secondary bleeding, primarily due to preservation of the underlying muscular fascia.

Additionally, the "Return to Baseline" Triad demonstrated that patients treated with LigaSure achieved cessation of opioid use, resumption of normal diet, and return to work approximately 3 days' sooner than those treated with bipolar diathermy. The results emphasize the need to select surgical technique based on long-term tissue viability as opposed to rapidity of the surgical procedure. [12, 14]

As such, while bipolar diathermy is frequently chosen due to its speed, techniques that minimize the risk of thermal injury, such as LigaSure or cold dissection, may produce significantly better patient-reported outcomes (PROMs) and reduce utilization of healthcare resources (e.g., fewer emergency department revisits).

Although the use of granular metrics mitigates some of the limitations of this study, due to the retrospective phase there is a possibility that selection bias may have occurred or the accuracy of historical nursing logs and clinical photography may have impacted on the results. Although the power settings were standardized, the overall duration of energy application an important factor known to influence depth of thermal injury remains at the discretion of each individual surgeon's technique. Additionally, this study was limited by a 14-day follow-up period; significant complications primarily occur during this timeframe; however, there may have been very late complications related to PTH or secondary infection which were not captured due to the limits of this study.

Conclusion

In conclusion, LigaSure diathermy has a significantly superior post-operative course to bipolar diathermy following tonsillectomy in adults. Although bipolar diathermy results in a reduction in operative length, the postoperative secondary pain is significantly greater, the time until epithelialization is significantly longer, and the incidence of clinically significant postoperative hemorrhage is significantly higher compared to LigaSure diathermy. This study demonstrates that the use of LigaSure diathermy will result in a significantly faster return to normal diet and daily activities for adults and thus is the most optimal thermal modality to promote positive patient outcomes following adult tonsillectomy.

Declarations

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Data availability

The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

Clinical Trial Registration

Clinical trial number: not applicable.

Authors' Contributions

HMS served as the main surgeon and operator, was the primary corresponding author, conceptualized the study draft, and was responsible for data collection, data acquisition, and manuscript writing. **AF** was involved in idea formulation, drafting the manuscript, supervision, and critical review and editing. **ME**, **MG**, **KAA**, and **AAA** contributed to data acquisition, provided study supervision, and critically reviewed and edited the manuscript. All authors read and approved the final manuscript.

AI and Machine Learning Disclosure

The authors expressly assert that any Generative Artificial Intelligence (AI) or assisted AI technology has not been used in the stages of composing, developing, collecting/compiling data or analyzing data for this Manuscript. All development of the Manuscript has been original by the human authors listed with no use of Automated Algorithms to collect or compile data and all data used in this manuscript was analyzed with standard Statistical Software with no assistance from an Algorithm.

Ethics Approval and Consent to Participate

This study was conducted in full accordance with the ethical standards of the 1964 Declaration of Helsinki and its later amendments. Ethical approval for the study protocol was granted by the local

Institutional Review Board (IRB log number: ARC-25.9.07, Approved: 1 October 2025), Almoosa Health Group, KSA. Written informed consent was formally obtained from all individual adult participants prior to undergoing surgery and subsequent data collection.

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References

1. Windfuhr, J. P., Toepfner, N., Steffen, G., Waldfahrer, F. & Berner, R. Clinical Practice Guideline: Tonsillitis II. Surgical Management. *Eur. Arch. Otorhinolaryngol.* **273** (4), 989–1009 (2016).
2. Sarny, S., Habermann, W., Ossimitz, G., Kemmetmüller, H. & Stammberger, H. Hemorrhage following Tonsillectomy: A Critical Analysis of 15,283 Patients. *Laryngoscope* **121** (12), 2558–2563 (2011).
3. Giger, R., Landis, B. N. & Dulguerov, P. Comparison of Different Thermal Dissection Techniques in Adult Tonsillectomy: A Systematic Review. *Eur. Arch. Otorhinolaryngol.* **272** (10), 2585–2594 (2015).
4. Mösges, R., Hellmich, M., Simaioforidis, V. & Klimek, L. A Review of Bipolar Electrocoagulation vs. Cold Dissection Tonsillectomy *Laryngoscope*. **121** (12), 2564–2574 (2011).
5. Lowe, D. et al. *The National Prospective Tonsillectomy Audit (NPTA): Final Report of an UK Initiative to Improve Quality* (The Royal College of Surgeons of England, 2007).
6. O'Leary, S. T. & Vorasubin, N. Measuring Postoperative Outcomes in Tonsillectomy: Is the VAS Enough? *Otolaryngol. Head Neck Surg.* **145** (2), 212–218 (2011).
7. Lee, S. & Sangsook, K. Multidimensional Assessment of Postoperative Pain and Recovery in Adult Patients Following Oropharyngeal Surgery. *Clin. Exp. Otorhinolaryngol.* **11** (4), 280–287 (2018).
8. Windfuhr, J. P. et al. Modern Tonsillectomy Techniques: Efficiency vs. Morbidity in the Adult Population. *Eur. Arch. Otorhinolaryngol.* **278** (6), 1821–1830 (2021).
9. Karasneh, J., Gül, A. & Worthington, J. Electro-physical properties of bipolar diathermy: The impact of voltage and contact time on collateral thermal spread in soft tissue dissection. *Int. J. Oral Maxillofac. Surg.* **49** (5), 668–675 (2020).
10. O'Leary, S. T. & Vorasubin, N. Thermal Tissue Injury and Secondary Pain Peaks in Adult Tonsillectomy: A Mechanistic Review. *Otolaryngol. Head Neck Surg.* **166** (3), 412–420 (2022).
11. D'Souza, A., Miller, R. & Gupta, P. Comparative analysis of microvascular preservation and fibrin clot stability in thermal vs. cold tonsillectomy techniques. *J. Clin. Otolaryngol.* **58** (3), 212–219 (2023).
12. Sowerby, L. J., Wright, E. D., Janzen, V. D. & Rotenberg, B. W. Post-Tonsillectomy Hemorrhage Rates in Adults: A Multi-Institutional Study of Modern Thermal Techniques. *Laryngoscope* **130** (4), 901–906 (2020).
13. Hanna, B. C., Al-Azzawi, M. & Windfuhr, J. P. Vessel-sealing systems versus conventional electrosurgery in adult tonsillectomy: A systematic review and meta-analysis of post-operative

morbidity and hemorrhage rates. *Eur. Arch. Otorhinolaryngol.* **281** (4), 1845–1859 (2024).

14. Bentsianov, B., Shah, J., Gidley, P. & Rosenfeld, R. M. Comparative Outcomes in Adult Thermal Tonsillectomy: Moving Beyond Binary Metrics. *J. Otolaryngol. Head Neck Surg.* **53** (2), 145–152 (2024).

Figures

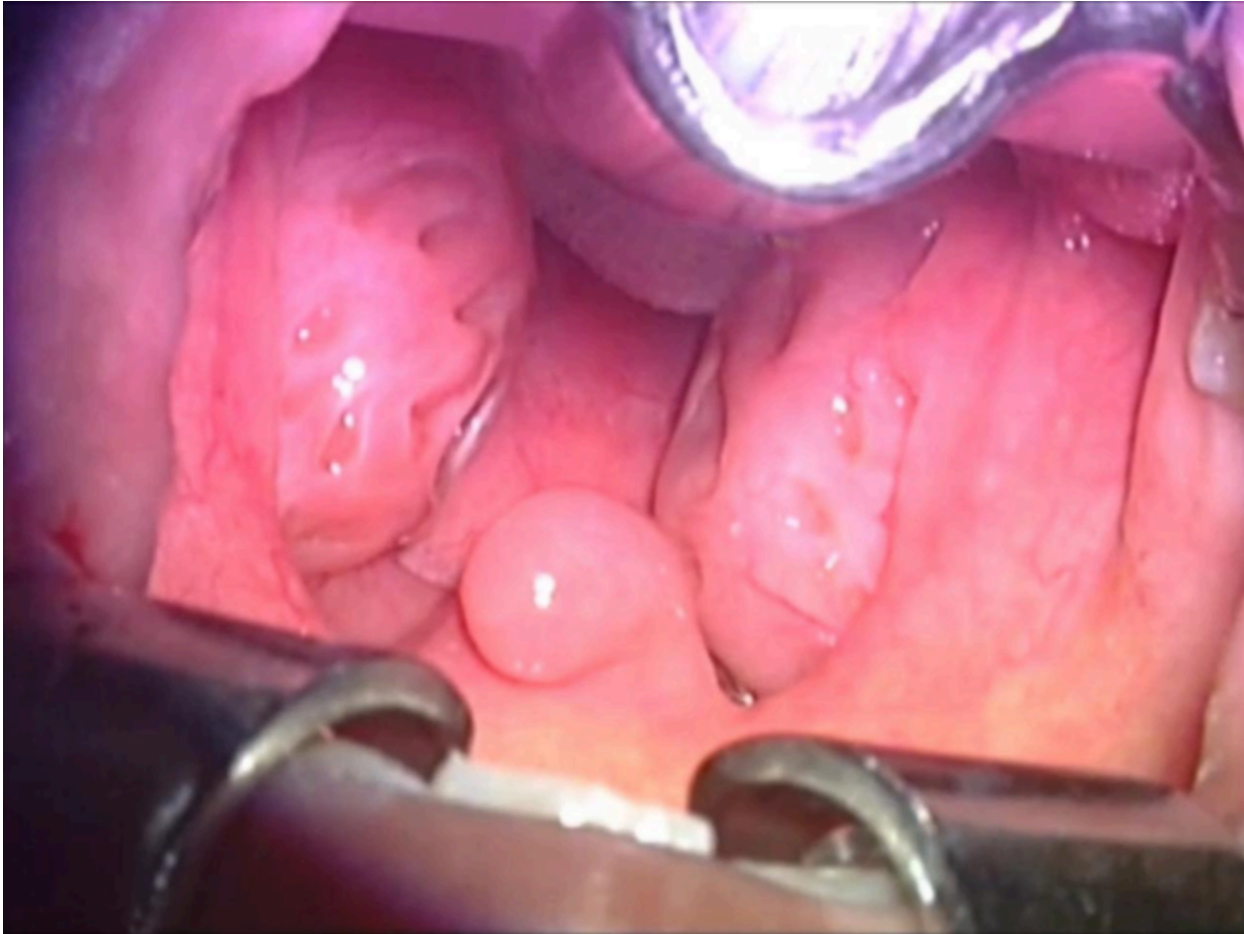


Figure 1

Intraoral view of the oropharynx. The image demonstrates significant tonsillar hypertrophy (Brodsky Grade 3) with prominent tonsillar crypts visible bilaterally.

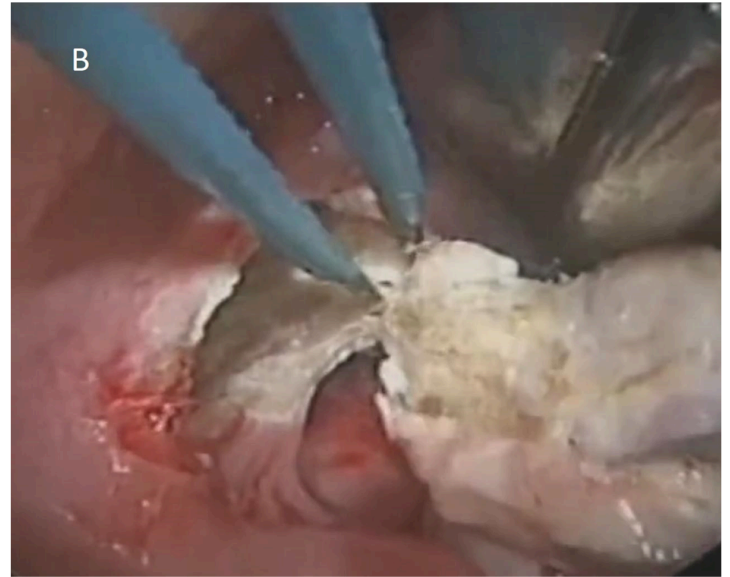
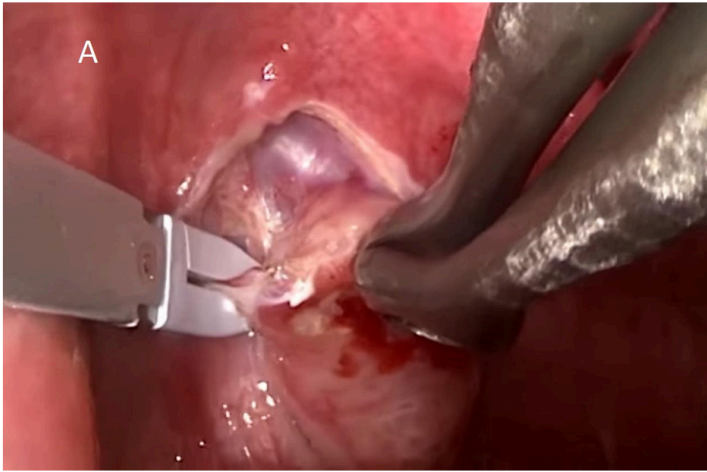


Figure 2

Intraoperative Comparison of Tonsillectomy Techniques.

(A) LigaSure Diathermy: Left side Superior pole dissection is shown using a LigaSure-assisted technique. The instrument provides traction to define the peritonsillar space, while thermal energy is applied to achieve both dissection and vessel ligation.

(B) Bipolar Diathermy: Real-time dissection of the left side tonsillar capsule using bipolar forceps. This technique allows for precise, localized thermal spread.

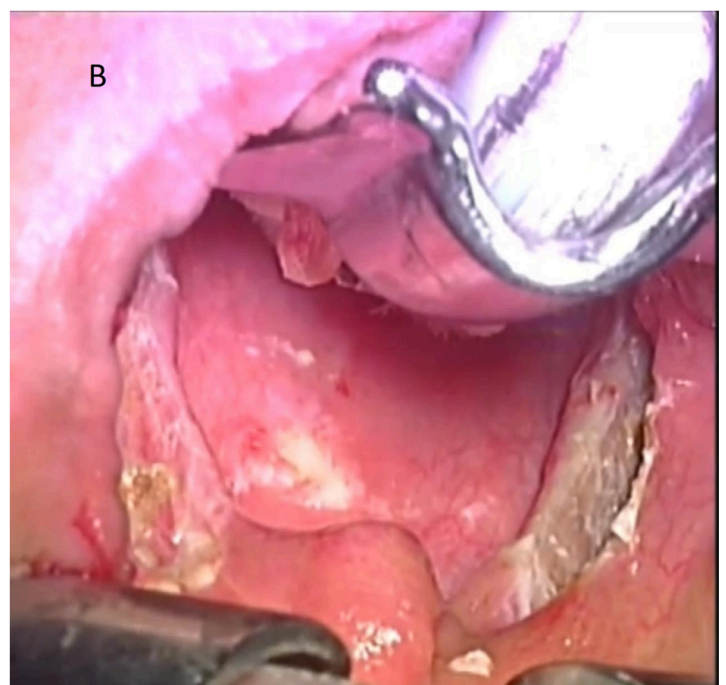
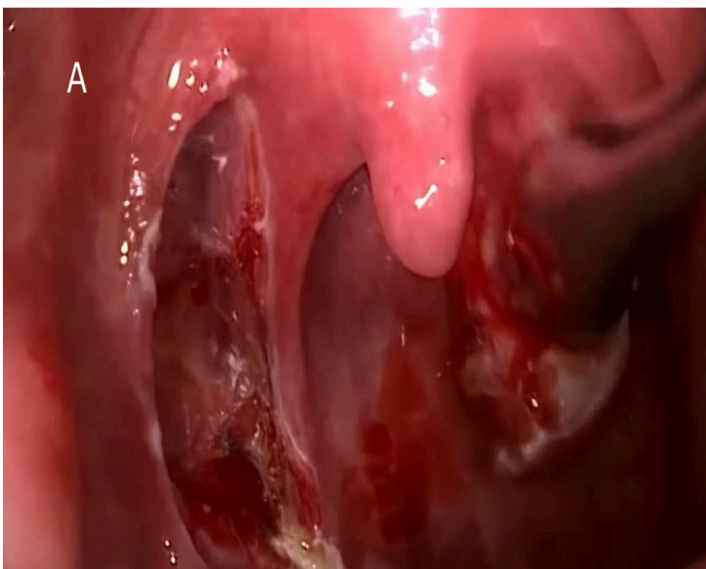


Figure 3

Immediate Post-Operative Appearance of the Tonsillar Fossa.

(A) LigaSure Diathermy: View immediately following the removal of the palatine tonsils. The fossa shows areas of active focal hyperemia and a relatively thin layer of thermal fibrin. The uvula and pillars appear slightly more erythematous, likely due to the higher energy dispersion common with monopolar-based LigaSure techniques.

(B) Bipolar Diathermy: View immediately post-resection. The surgical bed is characterized by a thick, uniform layer of white-to-tan fibrin (slough), indicating comprehensive thermal sealing of the micro-vasculature. There is minimal to no active bleeding, and the surrounding soft palate mucosa remains pale and well-preserved.

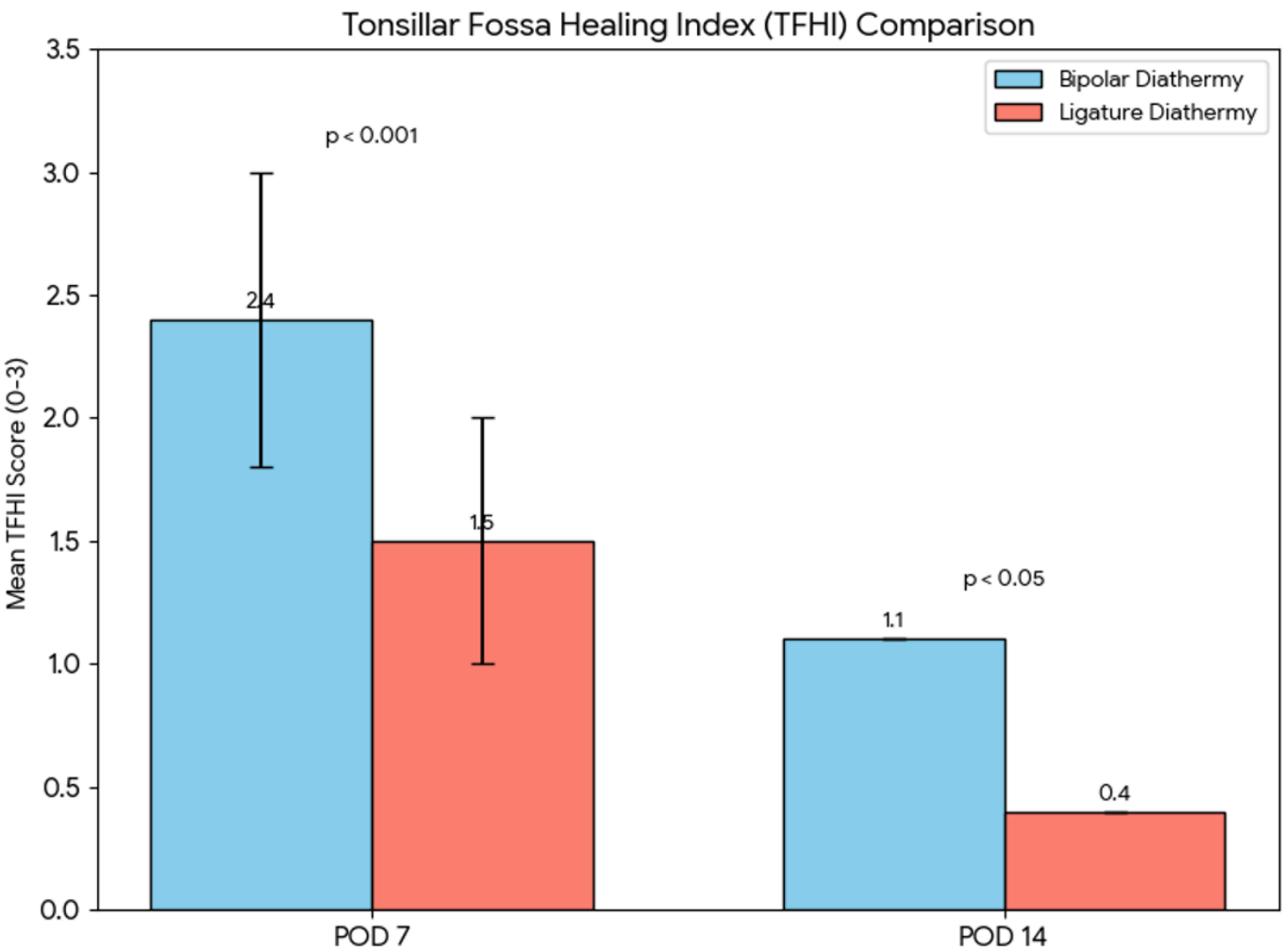


Figure 4

Tonsillar Fossa Healing Index (TFHI) Comparison: The chart illustrates the healing progression at Postoperative Days (POD) 7 and 14. Lower scores indicate better epithelialization and advanced healing (0 = fully epithelialized; 3 = deep tissue necrosis).

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [STROBStatementChecklist.docx](#)