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Original Article

The Surgical Evolution: A Comparative Review of Conventional and Coblation Techniques for Tonsillectomy

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ABSTRACT

Background: Tonsillectomy is one of the most commonly performed surgical procedures in pediatric otorhinolaryngology. While cold steel dissection tonsillectomy has long been regarded as the gold standard, newer techniques such as coblation tonsillectomy have been introduced with the aim of reducing intraoperative blood loss and postoperative morbidity. However, evidence comparing these techniques remains variable.

Aim and Objectives: The aim of this study was to compare cold steel dissection tonsillectomy and coblation-assisted tonsillectomy in pediatric patients. The objectives were to compare intraoperative parameters, specifically operative time and blood loss, between the two techniques, and to evaluate and compare postoperative outcomes, including pain, morbidity, and the time required to resume a normal diet and routine daily activities..

Materials and Methods: This prospective, randomized comparative study was conducted at Government Tirupur Medical College Hospital, Tiruppur, India, between August 2025 and December 2025. A total of 56 pediatric patients undergoing tonsillectomy were randomized into two groups: Group A underwent cold steel dissection tonsillectomy (n=27) and Group B underwent coblation-assisted tonsillectomy (n=29). Intraoperative parameters assessed included operative time and blood loss. Postoperative outcomes evaluated were pain intensity using validated pediatric pain scales, time to resume a normal diet and routine physical activities, and the incidence of postoperative hemorrhage. Statistical analysis was performed using appropriate comparative tests, with $p<0.05$ considered statistically significant.

Results: Coblation tonsillectomy demonstrated significantly shorter operative time (18.62 ± 2.34 minutes) compared to cold steel dissection (29.22 ± 1.78 minutes; $p<0.001$). Intraoperative blood loss was significantly lower in the coblation group (21.24 ± 3.64 ml) than in the cold steel group (85.93 ± 8.99 ml; $p<0.001$). Postoperative recovery was faster in the coblation group, with earlier resumption of a normal diet (1.62 ± 0.04 vs 2.96 ± 0.59 days; $p<0.01$) and routine physical activity (2.62 ± 0.49 vs 3.78 ± 0.75 days; $p<0.01$). Postoperative pain scores were significantly lower in the coblation group during the early postoperative period. No cases of primary hemorrhage were observed in either group; one case of minor secondary hemorrhage occurred in the coblation group.

Conclusion: Coblation-assisted tonsillectomy is a safe and effective alternative to cold steel dissection tonsillectomy in pediatric patients, offering significant advantages in terms of reduced operative time, minimal blood loss, decreased postoperative pain, and faster recovery. While cold steel dissection remains a reliable technique, coblation may provide superior short-term clinical outcomes in the pediatric population.

Keywords*: Tonsillectomy; Coblation; Cold steel dissection; Pediatric otolaryngology; Postoperative pain; Blood loss.*

INTRODUCTION

Tonsillectomy remains one of the most frequently performed surgical procedures in modern medicine, with hundreds of thousands of cases conducted annually in both pediatric and adult populations [1]. There has been ongoing debate regarding the optimal tonsillectomy technique in order to achieve better operative outcomes with fewer complications. For many years, cold steel dissection tonsillectomy has persisted as the gold standard technique for tonsil removal [2].

Among the various surgical techniques, improvement in intraoperative efficiency and reduction of postoperative morbidity are the most important parameters when evaluating the best method for tonsillectomy. Cold steel dissection tonsillectomy leaves the tonsillar bed as an open wound that heals by secondary intention, resulting in postoperative pain and bleeding as the two major complications [3].

Coblation tonsillectomy was first introduced in 2001 as a more effective and safer alternative technique. This method generates a plasma field at the surface of the probe, enabling tissue ablation at relatively low temperatures (40–70 °C). The plasma field consists of highly ionized particles that disrupt molecular bonds within the tissue, allowing precise dissection while significantly reducing heat dissipation to adjacent tissues. This is in contrast to diathermy-based techniques, which may generate temperatures exceeding 500 °C. In addition, the radiofrequency generator can be used for coagulation to achieve effective hemostasis [4].

A considerable number of studies have been published either supporting the efficacy of coblation tonsillectomy or questioning its benefits due to unsatisfactory outcomes [5,6]. Hence, the present study was designed to compare cold steel dissection tonsillectomy and coblation tonsillectomy with respect to intraoperative time, postoperative pain and morbidities, and the time required to resume a normal diet and daily activities.

Aim and Objectives:

The aim of this study was to compare cold steel dissection tonsillectomy and coblation-assisted tonsillectomy in pediatric patients. The objectives were to compare intraoperative parameters, specifically operative time and blood loss, between the two techniques, and to evaluate and compare postoperative outcomes, including pain, morbidity, and the time required to resume a normal diet and routine daily activities.

Materials and Methods:

This prospective, randomized comparative study was conducted at the Government Tirupur Medical College Hospital, a tertiary care center in Tiruppur, India, following approval from the Institutional Ethics Committee. The study population comprised 56 pediatric patients (26 females and 30 males) scheduled for tonsillectomy between August 2025 and December 2025. The sample size was determined using a power analysis for the comparison of two independent means. To achieve a statistical power ($1-\beta$) of 80% with a significance level (α) of 0.05 and a medium-to-large effect size (Cohen's $d=0.75$), a minimum of 28 patients per group was required [7,8]. Participants were randomly assigned to either Group A (conventional cold steel dissection; n=27) or Group B (coblation-assisted tonsillectomy; n=29). Prior to intervention, written informed consent was obtained from parents or legal guardians, and verbal assent was secured from the children.

Inclusion criteria were limited to patients under 18 years of age presenting with clear indications for surgery, specifically recurrent tonsillitis (defined as five to six episodes annually for two consecutive years) or significant tonsillar hypertrophy resulting in symptomatic snoring and obstructive sleep apnea. To minimize confounding variables, patients with known hematological irregularities, clotting disorders, congenital anomalies, or active acute infections at the time of surgery were excluded [9]. Preoperatively, all patients underwent a comprehensive otorhinolaryngology examination and were cleared for general anesthesia through a standardized pre-anesthetic check-up.

Intraoperative data were captured via a multi-parameter survey, focusing on total surgical duration and estimated blood loss. Following the procedure, patients were monitored for a duration of three months. Longitudinal postoperative data were collected to track pain intensity using validated pediatric pain scales, the timeline for the resumption of a normal diet and physical activity, and the incidence of primary or secondary hemorrhagic complications. This framework ensured a robust analytical dataset for comparing the clinical outcomes of conventional versus coblation techniques.

Surgical Procedures

Cold Steel Dissection Tonsillectomy

All procedures were performed under general anesthesia with endotracheal intubation. The patient was placed in the Rose position, and a Boyle-Davis mouth gag with an appropriate tongue blade was secured using a Draffin's bipod stand. The palatine tonsil was retracted medially using Dennis Browne tonsil-holding forceps. An initial mucosal incision was made just medial to the anterior pillar using Metzenbaum scissors. Following identification of the peritonsillar capsule, dissection was carried out using a Gwynne-Evans dissector until the lower pole was reached. The specimen was then removed using an Eve's tonsil snare [10]. Hemostasis was initially achieved by packing the tonsillar fossa with sterile gauze for 10 minutes. Upon removal of the pack, the fossa was inspected using a Mollison's anterior pillar retractor. Residual bleeding points were managed through ligation or selective bipolar diathermy. The same protocol was applied to the contralateral side.

Coblation-Assisted Tonsillectomy

For the coblation cohort, an EVAC 70 Xtra wand (ArthroCare Corp., Austin, TX, USA) was utilized, integrated with a continuous saline irrigation system. The device was operated in "ablate" mode for tissue dissection and "coagulate" mode for hemostasis. An incision was made in the anterior pillar at the upper pole to identify the capsular plane. Dissection proceeded from the superior to the inferior pole using a gentle sweeping motion, maintaining a minimal distance between the wand tip and the tissue to facilitate the formation of a localized plasma field [11]. This low-temperature molecular dissociation allowed for precise separation of the tonsil from the superior constrictor muscle while maintaining concurrent hemostasis throughout the dissection.

Postoperative Protocol and Follow-up

Postoperative management was standardized across both groups to ensure comparative validity. Intravenous paracetamol was administered to facilitate early oral intake and reduce the risk of secondary infection. Patients were initiated on a cold liquid and ice cream diet six hours post-surgery (Day 0), transitioning to a semi-liquid diet on Day 1. Clinical follow-up was scheduled for Days 1, 3, 5, 7, and 14 post-surgery. Pain intensity was quantified using the Visual Analogue Scale (VAS) for older children and the Parents' Postoperative Pain Measure (PPPM) survey for younger children, with results normalized to a 10-point scale [12,13]. During each follow-up visit, clinicians recorded the time required to return to a normal diet and the resumption of routine physical activities.

Results:

The data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 27.0. For current study 56 patients' parameters were evaluated, 29 patients of them were treated using coblation tonsillectomy, whereas conventional cold dissection tonsillectomy was used to treat the other 27 patients and the results were arranged as follow: The major surgical methods are as shown in Table. 1

Table 1: Surgical Methods- Total number of children undergone

SURGICAL METHODS		Female	Male	Total
SURGICAL METHOD	Coblation Methos	14	15	29
	Dissection	12	15	27
Total		26	30	56

Mean age among 56 children was 10.46 years as evaluated. The mean age of patients was 11.6 years with a mean of 2.2–40 years. The data showed that 30 (53.6%) were males out of 56 and 26 (46.4%) were females.

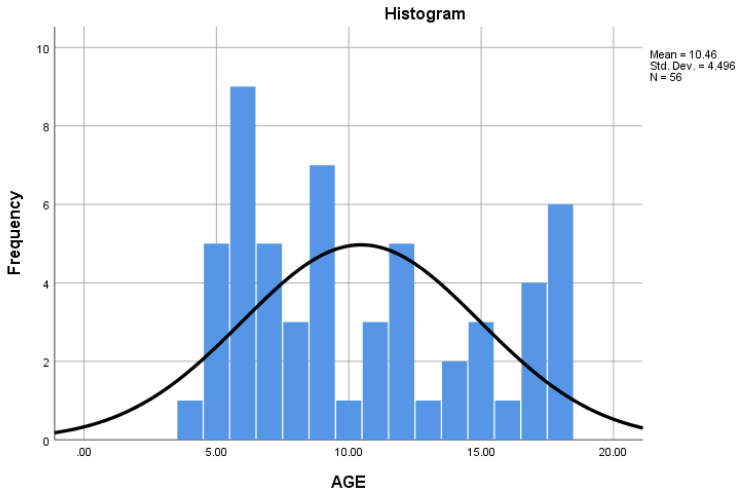

Figure1: Histogram- Age Distribution

Table2: Sex of the children

Sex	Total number	Percent
Female	26	46.4
Male	30	53.6
Total	56	100.0

The results of the comparative analysis between the cold steel and coblation techniques revealed significant advantages for the coblation cohort across all measured parameters. Regarding intraoperative efficiency, the coblation method required a

significantly shorter operative time of 18.62±2.34 minutes compared to 29.22±1.78 minutes for the cold steel group ($p<0.001$). This was accompanied by a substantial reduction in intraoperative blood loss, which averaged 21.24±3.64 ml in the coblation group versus 85.93±8.99 ml in the cold steel group ($p<0.001$), highlighting the effective hemostatic control provided by the plasma-mediated technology.

Postoperative recovery milestones also demonstrated the superiority of the coblation technique. Patients in the coblation group returned to a normal diet significantly faster, requiring only 1.62±0.04 days compared to 2.96±0.59 days for the cold steel group ($p<0.01$). Furthermore, the duration to resume routine physical activities was significantly shorter for coblation patients (2.62±0.49 days) than for those in the cold steel cohort (3.78±0.75 days; $p<0.01$). These findings suggest that the reduced thermal damage and precise dissection of coblation contribute to an accelerated healing process and a faster return to baseline function in the pediatric population.

Table:3 Major Parameters

Category	Parameter	Cold Steel (n=27)	Coblation (n=29)	P-value
Intraoperative	Operative time (minutes)	29.22 ± 1.78	18.62 ± 2.34	< 0.001
Intraoperative	Blood loss (ml)	85.93 ± 8.99	21.24 ± 3.64	< 0.001
Postoperative Recovery	Time to normal diet (days)	2.96 ± 0.59	1.62 ± 0.04	< 0.01
Postoperative Recovery	Return to routine activity (days)	3.78 ± 0.75	2.62 ± 0.49	< 0.01
Pain (VAS)	Day 1	4.63 ± 0.49	2.52 ± 0.57	< 0.001
Pain (VAS)	Day 3	3.37 ± 0.49	1.55 ± 0.51	< 0.001
Pain (VAS)	Day 5	2.56 ± 0.51	1.00 ± 0.00	< 0.001
Pain (VAS)	Day 7	0.19 ± 0.40	0.03 ± 0.19	0.071
Pain (VAS)	Day 14	0.00 ± 0.00	0.00 ± 0.00	N/A
Complications	Primary hemorrhage	0	0	-
Complications	Secondary hemorrhage	0	1	> 0.05

The longitudinal assessment of postoperative pain revealed a favorable profile for the coblation cohort. Pain intensity, quantified via the Visual Analogue Scale (VAS) and the Parents' Postoperative Pain Measure (PPPM), was recorded on days 1, 3, 5, 7, and 14. While initial pain levels on day 1 were comparable, statistical analysis using the Student's t-test demonstrated that pain scores on days 3 and 7 were significantly lower in the coblation group compared to the cold steel dissection group ($p<0.01$). This reduction in mid-term postoperative pain likely contributed to the earlier resumption of a normal diet observed in the coblation cohort.

The safety profile was robust for both surgical techniques, with no significant difference in the incidence of adverse events. Regarding hemorrhagic complications, there were no reported cases of primary hemorrhage (defined as bleeding occurring within <24 hours postoperatively) in either the coblation or the cold steel dissection cohorts. In the assessment of delayed complications, a single instance (3.4%) of secondary hemorrhage occurred in the coblation group on postoperative day 5. This event was classified as minor and was managed successfully with conservative measures; no surgical re-intervention or blood transfusion was required. No other major adverse events, such as dehydration requiring readmission or postoperative infection, were recorded during the 14-day follow-up period, indicating that both methods are safe for use in the pediatric population.

Discussion:

The evolution of tonsillectomy techniques has focused on the "dual challenge" of reducing intraoperative risks and minimizing postoperative morbidity. Our study indicates that Coblation-assisted tonsillectomy significantly outperforms the traditional Cold Steel Dissection method across several key clinical parameters.

Intraoperative Efficiency and Safety

The most immediate benefit observed in the coblation group was the reduction in operative time and blood loss. By utilizing a localized plasma field to dissociate tissue at low temperatures (40–70 ∘C), the surgeon can achieve simultaneous ablation and hemostasis. These results are corroborated by Facharzt et al. [14], who noted that the efficiency of the EVAC wand reduces the "stop-and-start" nature of traditional dissection where bleeding points must be addressed separately. Furthermore, our finding of zero primary hemorrhages aligns with the large-scale analysis by Shapiro and Bhattacharyya [17], which confirmed that coblation is as safe as cold steel in the immediate 24-hour postoperative window.

Postoperative Recovery and Pain Management

Pain management remains a significant hurdle in pediatric tonsillectomy. Our data showed lower VAS scores for the coblation cohort, particularly in the first five days. This is likely due to the limited thermal spread to the underlying superior constrictor muscle, a concept explored by Polites et al. [15]. They concluded that the "cool" technology of coblation reduces deep-tissue injury, which in turn leads to a faster resumption of a normal diet and physical activity.

Businco and Tirelli [16] also emphasize that radiofrequency-based plasma dissection preserves the integrity of the tonsillar pillars. This anatomical preservation explains why our coblation patients returned to a normal diet nearly 1.3 days earlier than the cold steel group. While secondary hemorrhage occurred in one case (3.4%) within our coblation group, this rate is consistent with the audit cycle findings of Javed et al. [18], suggesting that the safety profile remains high when proper surgical technique is applied.

Conclusion:

As highlighted by Verma et al. [19], the current trend in modern otorhinolaryngology is shifting toward techniques that prioritize patient "quality of life." Our study concludes that while cold steel dissection remains a reliable and cost-effective method, Coblation-assisted tonsillectomy is superior for pediatric patients due to significantly reduced surgical time, minimal blood loss, and an accelerated recovery timeline with less postoperative pain.

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