

# Coblation tonsillectomy versus coblation tonsillectomy with ties in adults

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## Abstract

**Objective:** This study was performed to compare the intraoperative and postoperative courses of coblation tonsillectomy and coblation tonsillectomy with ties in adults.

**Methods:** All patients who underwent tonsillectomy from July 2012 to September 2016 were retrospectively reviewed. Intraoperative and postoperative bleeding, pain, and return to normal food intake were compared between patients who underwent coblation tonsillectomy and those who underwent coblation tonsillectomy with ties.

**Results:** Of 515 patients, 300 (58.3%) underwent coblation tonsillectomy and 215 (41.7%) underwent coblation tonsillectomy with ties. Twenty-five (4.9%) patients developed postoperative hemorrhage, 22 (88.0%) of whom had undergone coblation tonsillectomy and 3 (12.0%) of whom had undergone coblation tonsillectomy with ties. Patients who underwent coblation tonsillectomy reported less pain than those who underwent coblation tonsillectomy with ties. Patients who underwent coblation tonsillectomy with ties resumed a normal diet significantly later than those who underwent coblation tonsillectomy ( $10.0 \pm 3.2$  vs.  $8.2 \pm 1.9$  days, respectively).

**Conclusion:** Coblation tonsillectomy is associated with less intraoperative bleeding, a shorter surgery time, less postoperative pain, and fewer days to recovery of a normal diet than is coblation tonsillectomy with ties. However, coblation tonsillectomy with ties is associated with remarkably reduced postoperative hemorrhage.

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## Keywords

Coblation, ties, tonsillectomy, hemorrhage, pain, tonsillar hypertrophy, recurrent tonsillitis

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## Introduction

Tonsillectomy is one of the most common surgeries in the field of otolaryngology and is frequently performed to resolve recurrent tonsillitis or upper respiratory tract obstruction due to tonsillar hypertrophy.<sup>1</sup> Multiple surgical techniques and instruments have been described to minimize intraoperative hemorrhage and reduce the operation time, postoperative pain, and incidence of comorbidities in patients undergoing tonsillectomy.<sup>2,3</sup>

Coblation tonsillectomy has been shown to induce less postoperative pain, intraoperative hemorrhage, and surgical trauma and to provide quick recovery and a short hospitalization time.<sup>4</sup> Coblation is a technique that utilizes bipolar radiofrequency energy for soft tissue dissolution. Two electrodes are immersed in a medium of normal saline, which produces a plasma field of sodium ions. Many highly ionized particles are contained in the plasma field, resulting in coagulation of vessels and vaporization of tissues. In contrast to electrocautery, which works at a temperature of up to 400°C, coblation devices work at a temperature of 60°C.<sup>5</sup>

Which surgical technique has the lowest postoperative complication rate is controversial. Many studies have shown that coblation is a safe method with a lower incidence of intraoperative and postoperative bleeding in both children and adults. In these studies, however, the overall bleeding rate ranged from 2.4% to 5.6% (including primary and secondary hemorrhage).<sup>5,6</sup> The frequency of postoperative hemorrhage was lower in cold steel tonsillectomy with ties.<sup>7-9</sup> Furthermore, this technique is the

gold standard in the United Kingdom.<sup>9</sup> However, whether coblation tonsillectomy with ties has lower rates of hemorrhage and complications than coblation tonsillectomy without ties remains unknown. In our clinical practice and some other studies, coblation as a hot technique was associated with a higher risk of hemorrhage, especially secondary hemorrhage, than was cold steel tonsillectomy.<sup>8,10,11</sup> The National Prospective Tonsillectomy Audit showed a hemorrhage rate of 4.03% with coblation tonsillectomy and 1.28% with cold steel tonsillectomy without any hot technique.<sup>12</sup> Only a few studies have described coblation dissection and the use of ties in tonsillectomy. Furthermore, many studies on coblation focused on postoperative hemorrhage in children.<sup>13,14</sup> The present study was performed to compare the intraoperative and postoperative courses of coblation tonsillectomy and coblation tonsillectomy with ties in adult patients at our hospital.

## Materials and methods

### Patients

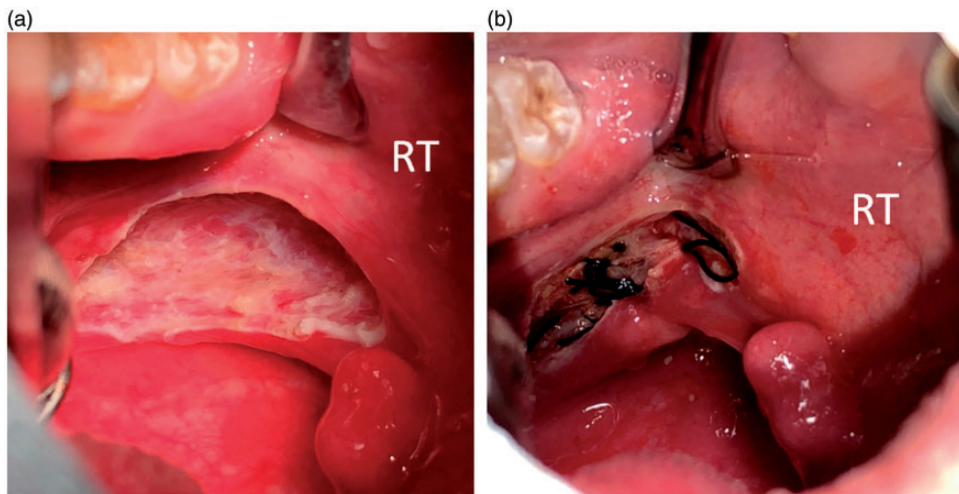
This retrospective study was approved by Shandong Provincial Hospital Ethics Institutional Committee, Shandong Province, China, on 1 September 2016. All patients provided written informed consent to participate in the study. Patients older than 18 years underwent tonsillectomy at Shandong Provincial Hospital Affiliated to Shandong University from July 2012 to September 2016. A senior author with more than 20 years of experience consecutively performed all

operations. Coblation tonsillectomy was performed in the early part of the study, and coblation tonsillectomy with ties was performed in the latter part. The inclusion criteria were tonsillar hypertrophy and recurrent tonsillitis. Recurrent tonsillitis was defined as multiple episodes of tonsillitis within the past year. Patients with acute tonsillitis within 2 weeks, peritonsillitis, or systemic diseases such as coagulopathies and cardiovascular disease were excluded. Patients with a history of unilateral tonsillectomy, tonsillar biopsy, tonsillectomy for carcinoma, or tonsillectomy for palatal malformation were also excluded. Demographic and surgical outcome data were obtained from the patients' medical charts. We collected the patients' questionnaires by mail, in person, or via WeChat 16 days after the surgery.

### *Surgical technique*

Informed consent was obtained before the intervention. Coblation tonsillectomy or coblation tonsillectomy with ties was

performed in all patients in this study. All patients underwent the surgery under general anesthesia with orotracheal intubation. For coblation tonsillectomy, coblation was used to both remove the tonsil and stop the bleeding. Intraoperative hemostasis was achieved using the coblation coagulation setting without standard bipolar cautery or electrocautery. When bleeding did not stop with coblation, other methods such as ties or bipolar cautery were used. For coblation tonsillectomy with ties, the tonsil was dissected using coblation, and hemostasis was achieved with ties using 4-0 non-absorbable sutures. Figure 1(a) and (b) shows operative photographs of the wound surface changes after coblation tonsillectomy and coblation tonsillectomy with ties, respectively. The patients were required to report their pain status for 10 consecutive days postoperatively. All patients used the same medications and avoided nonsteroidal anti-inflammatory drugs for 2 postoperative weeks. The postoperative visual analog scale scores were recorded on an 11-point Likert scale. Each



**Figure 1.** Operative photographs of wound surface. (a) Wound surface after coblation tonsillectomy. (b) Wound surface with bleeding sites tied by black suture after coblation tonsillectomy with ties. RT, right tonsil.

patient's daily pain score during swallowing was documented.

### Statistical methods

The demographic characteristics, preoperative diagnosis, duration of surgery, intraoperative blood loss, postoperative hemorrhage, and pain scores were compared between the two groups (coblation and coblation with ties). Student's *t*-test was used for continuous variables, and the  $\chi^2$  test (or Fisher's exact test when any of the expected counts were <5) was used for categorical and ordinal variables. Statistical analyses were performed using the commercially available software SPSS version 19.0 (IBM Corp., Armonk, NY, USA), and data are expressed as mean  $\pm$  standard deviation. A *P*-value of <0.05 was considered statistically significant.

## Results

### Demographic characteristics, primary diagnosis, and intraoperative events

After exclusion of 11 patients, this study enrolled 515 patients (300 in the coblation group and 215 in the coblation with ties group). The 11 excluded patients were not included in the 300 patients of the coblation group. Table 1 shows the data of all participants. Age, sex, and primary diagnosis were similar between the two groups. The mean surgery time was significantly longer in the coblation group (31.4 minutes; range, 11.0–56.3 minutes) than in the coblation with ties group (41.5 minutes; range, 15.0–66.5 minutes) (*P* = 0.021) (Table 1). The mean estimated intraoperative blood loss was significantly lower in the coblation group (16.5  $\pm$  6.1 mL; range, 0–40 mL) than

**Table 1.** Comparison of demographic characteristics, primary diagnoses, and postoperative events among all patients (N = 515).

| Variables  | Coblation       | Coblation with ties | <i>P</i> value |
|--|-----------------|---------------------|----------------|
| Age, years   |                 |                     |                |
| Patients, n  | 300             | 215                 |                |
| Mean $\pm$ SD  | 31.5 $\pm$ 7.6  | 33.1 $\pm$ 8.5      | 0.530          |
| Min, Max   | 18.2, 64.0      | 18.5, 62.3          |                |
| Sex, n   |                 |                     |                |
| Female   | 165             | 103                 | 0.377          |
| Male   | 135             | 112                 |                |
| Primary diagnosis, n                                 |                 |                     |                |
| Recurrent tonsillitis                                | 210             | 165                 | 0.553          |
| Tonsillar hypertrophy                                | 65              | 40                  | 0.521          |
| Both recurrent tonsillitis and tonsillar hypertrophy | 20              | 10                  | 0.625          |
| Surgery time, min                                    |                 |                     |                |
| Patients, n  | 300             | 215                 |                |
| Mean $\pm$ SD  | 31.4 $\pm$ 10.2 | 41.5 $\pm$ 8.7      | 0.021          |
| Min, Max   | 11.0, 56.3      | 15.0, 66.5          |                |
| Estimated blood loss, mL                             |                 |                     |                |
| Patients, n  | 300             | 215                 |                |
| Mean $\pm$ SD  | 16.5 $\pm$ 6.1  | 27.3 $\pm$ 7.8      | 0.017          |
| Min, Max   | 0, 40           | 5, 55               |                |

SD, standard deviation; Min, minimum; Max, maximum.

in the coblation with ties group ( $27.3 \pm 7.9$  mL; range, 5–55 mL) ( $P=0.017$ ) (Table 1).

### Postoperative hemorrhage

Of the 515 patients, 25 (4.9%) developed postoperative hemorrhage. Of these 25 patients, 22 (88.2%) had undergone coblation tonsillectomy and 3 (11.8%) had undergone coblation tonsillectomy with ties ( $P=0.002$ ) (Table 2). Six of the 25 patients (24.0%) developed 2 episodes of hemorrhage; 5 of these 6 patients were in the coblation group, while 1 was in the coblation with ties group. In 18 (72.0%) of the 25 patients, the hemorrhage stopped after overnight observation; however, 7 (28.0%) patients required hemostatic treatment. Among the patients who required hemostatic treatment, five (71.4%) had undergone coblation tonsillectomy and two (28.6%) had undergone coblation tonsillectomy with ties. Postoperative bleeding occurred at a mean of  $7.8 \pm 2.1$  days (range, 0–14 days) after coblation tonsillectomy and  $4.5 \pm 0.85$  days (range, 0–14 days) after coblation tonsillectomy with ties. Postoperative bleeding occurred at a mean of  $6.2 \pm 2.2$  days (range, 0–14 days) after tonsillectomy for all patients. Figure 2 shows the distribution of postoperative hemorrhage based on the postoperative day.

### Pain scores

Table 3 shows the mean pain score of each patient for 10 days postoperatively and the summary statistics for the two groups. The patients in the coblation group had lower mean pain levels. The pain scores were significantly different between the two groups ( $P=0.002$ ).

### Food intake

All patients achieved normal food intake (solid food intake) within 16 postoperative days. The Kaplan–Meier plot shows the food intake from the first day to the day of normal food intake in the two groups (Figure 3). Visual analysis implicated that coblation might be associated with fewer recovery days based on the food intake compared to coblation with ties. Overall analysis showed that coblation led to a 1.80-day reduction of this period compared to coblation with ties ( $P=0.004$ ).

## Discussion

Coblation tonsillectomy has been proven safe and effective in previous studies and is widely used for tonsillectomy in both adults and children. In addition, coblation tonsillectomy is associated with better postoperative morbidity than are other techniques based on the preoperative diet, postoperative pain, and use of

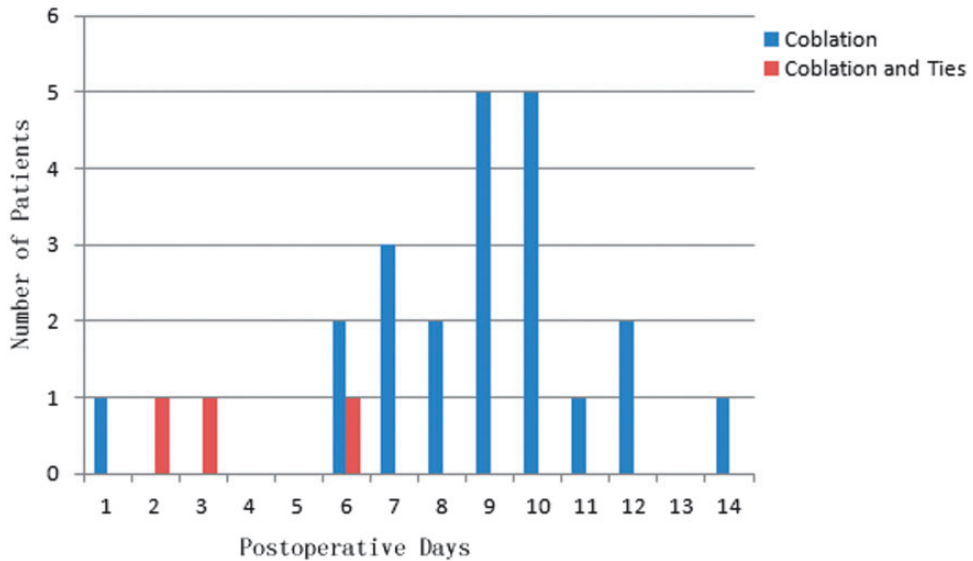
**Table 2.** Comparison of postoperative hemorrhage between the two groups.

| N = 515  | All patients         | Coblation (n = 300)  | Coblation with ties (n = 215) | P value |
|--|----------------------|----------------------|-------------------------------|---------|
| Postoperative hemorrhage                               | 25 (4.9)             | 22 (7.3)             | 3 (1.4)                       | 0.002   |
| Two episodes of bleeding                               | 6 (1.2)              | 5 (1.7)              | 1 (0.5)                       | 0.403   |
| Postoperative hemorrhage requiring surgical management | 7 (1.4)              | 5 (1.7)              | 2 (0.9)                       | 0.744   |
| Postoperative hemorrhage POD                           | $6.2 \pm 2.2$ (0–14) | $7.3 \pm 2.3$ (0–14) | $4.5 \pm 0.85$ (0–14)         | 0.336   |

Data are presented as n (%) or mean  $\pm$  standard deviation (range).

P values were calculated for comparison between coblation and coblation with ties groups.

POD, postoperative day.



**Figure 2.** Distribution of postoperative hemorrhage by postoperative day.

**Table 3.** Comparison of pain scores between the two groups.

| Method              | n   | Mean | Median | SD   | Minimum | Maximum | P value |
|---------------------|-----|------|--------|------|---------|---------|---------|
| Coblation           | 300 | 3.55 | 3.05   | 1.06 | 2.15    | 6.35    | 0.002   |
| Coblation with ties | 215 | 4.36 | 4.15   | 1.51 | 2.56    | 7.58    |         |

SD, standard deviation.

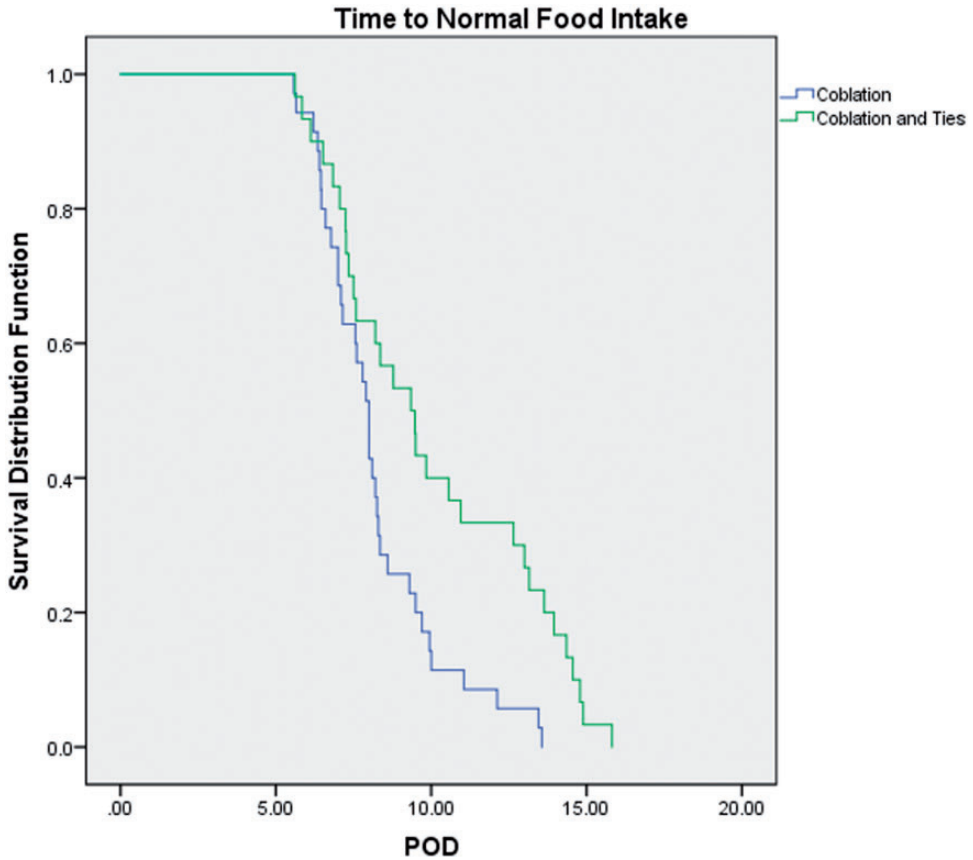
postoperative analgesia. However, few data are available comparing coblation tonsillectomy to coblation tonsillectomy with ties based on the surgical time, bleeding, diet, and pain. This study compared coblation tonsillectomy to coblation tonsillectomy with ties based on the aforementioned variables in adults.

Our study showed less intraoperative bleeding and a shorter surgery time in the coblation group. The mean blood loss was 16.5 mL, similar to the data published by Elbadawey et al.<sup>15</sup> The intraoperative blood loss in the coblation with ties group was remarkably higher than that in the coblation group. A Cochrane review by Pinder et al.<sup>16</sup> showed that postoperative hemorrhage was unaffected by the surgical

method. The present study, however, showed a completely different situation.

The mean surgery time for the coblation technique was 31.4 minutes (range, 11.0–56.3 minutes), which is longer than that in recently published literature (about 14 minutes).<sup>17</sup> Compared with the surgery time of 41.5 minutes for coblation tonsillectomy with ties, this result is statistically significant ( $P=0.021$ ). In these studies, the use of coblation led to a short operative time, perhaps because the coblation device could cut and stop bleeding simultaneously. Some time was required to suture the bleeding site in the coblation with ties group, leading to a longer surgical time than in the coblation group.

In the present study, the postoperative hemorrhage rate was 7.3% in coblation



**Figure 3.** Survival analysis of time to normal activity. POD, postoperative day.

tonsillectomy, which was about five times higher than that in coblation tonsillectomy with ties (1.4%). The difference was statistically significant ( $P=0.002$ ). In previous studies on coblation tonsillectomy, Kim et al.<sup>18</sup> reported an overall bleeding rate of 2.9% in 1082 patients, Söderman et al.<sup>8</sup> reported an overall bleeding rate of 13.8% in 1424 adult and pediatric patients, and He et al.<sup>20</sup> reported an overall postoperative bleeding rate of 1.9% in 2045 children. In the present study, the rate of postoperative bleeding was 4.9% (25/515). Most patients with postoperative hemorrhage (88.0%; 22/25) were in the coblation group; only three were in the coblation with ties group. Moreover, among the patients with repeated

hemorrhage, five were in the coblation group and only one was in the coblation with ties group. In most patients (72.0%; 18/25), bleeding resolved by compressing the hemorrhagic site, while a few patients (28.0%; 7/25) required sutures or electrocautery. Bleeding in the coblation group occurred for a mean of 7.3 postoperative days, which is comparable with the results reported by Elbadawey et al.<sup>15</sup> However, bleeding occurred for only 4.8 days in the coblation with ties group. These results were not statistically significant because of the smaller sample size. Coblation tonsillectomy was a significantly greater contributor to postoperative hemorrhage than was coblation tonsillectomy with ties.

**Table 4.** Comparison of time until normal food intake between the two groups.

| N = 515                                    | All patients     | Coblation<br>(n = 300) | Coblation with<br>ties (n = 215) | P value |
|--|------------------|------------------------|----------------------------------|---------|
| PODs until return to<br>normal food intake | 9.1 ± 3.2 (5–16) | 8.2 ± 1.9 (5–14)       | 10.0 ± 3.2 (6–16)                | 0.004   |

Data are presented as mean ± standard deviation (range).

P value was calculated for comparison between coblation and coblation with ties groups.

PODs, postoperative days.

Local pain after the operation is a major drawback of tonsillectomy. However, Wiltshire et al.<sup>20</sup> showed a remarkable improvement in postoperative pain and return to normal food intake with coblation. Some other studies have since shown varying results. Hong et al.<sup>21</sup> reported no significant difference in pain scores among 40 patients who underwent either electrocautery or coblation. However, Elbadawey et al.<sup>15</sup> found that the average pain values for each of the first 10 postoperative days were lower with coblation tonsillectomy than with cold dissection tonsillectomy. Our study showed a significant difference in the pain scores between the two groups ( $P=0.002$ ). Because ties cause further tissue destruction, this result may have been due to the lower levels of tissue damage in coblation without ties.

Our study also evaluated the return to a normal diet postoperatively (Table 4). The amount of time taken to resume a “normal” diet was shorter after coblation, suggesting that coblation tonsillectomy might be more advantageous than coblation tonsillectomy with ties. Sutures caused more tissue damage and took more time to recover. Therefore, a rapid return to a normal diet following coblation was a benefit that resulted from minimal tissue damage.

## Conclusion

Both methods have different advantages and disadvantages. Coblation tonsillectomy is associated with significantly lower

intraoperative bleeding, a shorter surgery time, less postoperative pain, and fewer days until a return to a normal diet than is coblation tonsillectomy with ties. However, coblation tonsillectomy with ties was associated with remarkably reduced postoperative hemorrhage.

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## Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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