Bipolar diathermy-assisted coblation really affects post-tonsillectomy haemorrhage rate and white membrane in paediatric tonsillectomy

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Abstract. Bipolar diathermy-assisted coblation really affects post-tonsillectomy haemorrhage rate and white membrane in paediatric tonsillectomy. Objective: this study aimed to evaluate the effect of bipolar diathermy-assisted coblation on post-tonsillectomy haemorrhage (PTH) rate, operation time, the volume of blood loss during surgery, the time needed to return to a regular diet and the relationship between the thickness of the white membrane of tonsillar fossa and the degree of postoperative pain in paediatric tonsillectomy.

Methods: a total of 1684 patients subjected to tonsillectomy (TE) were enrolled in this study from June 2013 to December 2015. They were randomly divided into a coblation tonsillectomy (control) group and a bipolar diathermy-assisted coblation tonsillectomy (intervention) group. The surgeon reported data concerning the techniques, primary and second PTH, surgery time, the volume of blood loss during surgery, the time needed to return to a regular diet, the thickness of the white membrane of tonsillar fossa and the degree of postoperative pain.

Results: complete data concerning the technique employed for tonsillectomy as applied in all patients: early and late PTH, surgery time, volume of blood loss during surgery, time needed to resume a regular diet, the thickness of the white membrane of the homeostasis area of tonsillar fossa in the intervention group was thinner than that of the control group. The intraoperative blood loss in the control group and intervention group was 3.3 ± 1.6 mL and 2.1 ± 2.9 mL, respectively. Surgery times in the control and intervention group was 17.4 ± 5.1 min and 16.3 ± 4.8 min, respectively. The period required for resuming a regular diet in the control and intervention group was 5.4 ± 5.1 min and 5.1 ± 5.2 days, respectively.

Conclusion: bipolar diathermy-assisted coblation can reduce post-tonsillectomy haemorrhage (PTH) rate, operation time, the volume of blood loss during surgery and the white membrane thickness of tonsillar fossa. The thickness of the white membrane of tonsil fossa is positively correlated with postoperative pain degree. The time needed to resume a regular diet showed no significant differences between the two groups.
General anaesthesia was applied for all patients during surgery; a surgeon allocated the patients into each of the groups based on a randomly generated number sequence.

The operation was performed in the standard manner using the ArthroCare 2 assisted Evac-70 coblator wand and bipolar diathermy instruments (output power 25 w). The coblation device was manufactured by ArthroCare Company, Sunnyvale, CA, USA. All procedures were performed by the first author of this paper to lower any probable skill-related bias. Our surgeon had performed more than 100 coblation tonsillectomies prior to the present trial to eliminate learning curve-related disturbance. Tonsillectomy was performed under general anaesthesia. The tonsil and the capsule were dissected from the surrounding tissue by coblation. Coblation should keep a slight distance between the tissue and toward the tonsil, dissecting from the top of the tonsil to the inferior pole. Furthermore, haemostasis was achieved by coblation in the control group. Bipolar electrocautery was performed in the intervention group. Haemostasis was achieved by coblation will take more time than bipolar electrocautery does. Prior to and following surgery, soaked cottons were recorded and weighed. The amount of blood loss for each patient was calculated (1 gm = 1 mL) and surgery time was measured from the first incision to complete haemostasis. following surgery, patients were taken to the ward where they were monitored by a recovery nurse and ENT staff every day, and discharged three days following surgery (for the purposes of the investigation, the hospitalization of patients was set to be three days). During hospitalization, an identical antibiotic was used among the two groups. The patients were allowed to return home and were contacted by phone. Re-examination was conducted five days following discharge from hospital. The data obtained were entered into a database and were analysed using SPSS software (SPSS, Windows, version 16). Chi-squared tests were used to compare the outcomes of the two groups.

Results

Demographic data

The data of all enrolled patients are presented in Table 1. There was no significant difference in the
Cobolation tonsillectomy

mean age and sex of the participants in the control and intervention groups \((p > 0.05)\).

The following information was collected: surgery time; volume of blood loss during surgery; post-operative primary and secondary haemorrhage; readmission due to the need for treatment of rebleeding; the relationship between the white membrane thickness of tonsil fossa and postoperative pain degree, and the time needed to resume regular diet were evaluated.

Intraoperative blood loss and surgical time

Intraoperative blood loss in the control and intervention group was 3.3 ± 1.6 mL and 2.1 ± 2.9 mL, respectively \((p < 0.05)\).

Surgery time in the control and intervention group was 17.4 ± 5.1 min and 16.3 ± 4.8 min, respectively \((p < 0.05)\).

Time needed to return to a regular diet

The times necessary for returning to a regular diet in the control group and intervention group was 5.4 ± 3.4 days and 5.1 ± 6.2 days, respectively \((p > 0.05)\)

The white membrane thickness of tonsil fossa

A significant difference was found in the thickness of the white membrane of tonsil fossa on the third postoperative day \((p < 0.05)\) between the control group and intervention group (an average visual analogue score of 5.35: 3.62). The white membrane thickness of the haemostasis area of tonsillar fossa in the intervention group was substantially thinner than that in the control group, as observed by the naked eye.

Postoperative pain

Pain degree was determined by the 5-point Likert scale within three days post-surgery and was found to be different in the control and intervention group (average 3.64 : 2.12). However, we established the presence of a positive correlation between the white membrane thickness of tonsil fossa and the postoperative pain degree in the control and the intervention group.

Postoperative bleeding

Primary haemorrhage was defined as bleeding occurring within 24 hours after surgery and secondary haemorrhage as bleeding after 24 hours post-surgery. In the control group, the percentages of primary and secondary PTH were 2.6% and 5.8%, whereas they were 0.35% and 1.8% in the intervention group. As can be seen in Table 3, the primary PTH rate of the control group was 7.43 times higher than that of the intervention group and the secondary PTH rate of the control group was 3.22 times higher than that of the intervention group \((p < 0.05)\).

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### Table 1

<table>
<thead>
<tr>
<th>Patient profiles</th>
<th>Control group ((n = 842))</th>
<th>Intervention group ((n = 842))</th>
<th>(p)-value *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>7.0 ± 2.32</td>
<td>6.9 ± 3.09</td>
<td>(p &gt; 0.05)</td>
</tr>
<tr>
<td>Male</td>
<td>415 (49%)</td>
<td>427 (51%)</td>
<td>(p &gt; 0.05)</td>
</tr>
<tr>
<td>Female</td>
<td>412 (49%)</td>
<td>430 (51%)</td>
<td>(p &gt; 0.05)</td>
</tr>
</tbody>
</table>

### Table 2

<table>
<thead>
<tr>
<th>Visual analogue score for assessment of the white membrane thickness of tonsillar fossa.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0 (none)</td>
<td>Slightly swollen uvula</td>
<td>Slightly white membrane with a clean white colour</td>
</tr>
<tr>
<td>1-3 (mild)</td>
<td>Mildly swollen uvula and congestion</td>
<td>Mild thick white membrane and the colour is white</td>
</tr>
<tr>
<td>4-6 (moderate)</td>
<td>Swollen uvula with aggravation and a dark-red colour</td>
<td>Uneven thick white membrane with a slight yellow colour</td>
</tr>
<tr>
<td>7-10 (severe)</td>
<td>Seriously swollen uvula with an dark purple colour</td>
<td>Uneven thicker dirty membrane with a deep yellow and dark colour</td>
</tr>
</tbody>
</table>
Discussion

Tonsillectomy (TE) is one of the most common operations performed in otolaryngology worldwide. However, post-operative haemorrhage is considered the most fearsome complication, which can be extremely serious and even fatal. Despite the introduction of new techniques, PTH remains a major problem. In this study, we compared two techniques of TE, i.e., coblation and bipolar diathermy-assisted coblation TE. Coblation is a newly introduced technique of surgery that passes a bipolar radiofrequency current through a conductive medium such as saline or body fluids and produces a plasma field, the ions of which can break molecular bonds and disintegrate tissue at low temperature. The application of this new technique has received remarkable research attention due to effecting less bleeding and its achieved visibility within the surgical field. The employment of coblation TE can result in lower blood loss and tissue damage, which may minimize the postoperative recovery period and facilitate an earlier return to normal activity. However, we found a haemorrhage rate of 8.4% in the control group. Primary and secondary PTH was reported at a rate of 2.6% and 5.8% in the control group, respectively. In contrast, primary PTH occurred in only 0.35% and secondary in 1.8% of patients in the intervention group. Therefore, the rate of primary PTH in the control group was 7.43 times higher than that in the intervention group, whereas the secondary PTH rate of the control group was 3.22 times higher than that in the intervention group. To stop bleeding by bipolar diathermy in the intervention group, we found that the intraoperative blood loss and operation time were shorter in the intervention group than that in control. However, the time needed to resume a regular diet was almost the same in both groups. The thickness of the white membrane of tonsil fossa in the intervention group was significantly thinner than that in control group (p < 0.05). Thus, we speculate that an association may exist between the thickness of the white membrane of the haemostasis area of tonsillar fossa and post-tonsillectomy haemorrhage. Furthermore, an obvious positive relationship was established between the thickness of the white membrane of tonsillar fossa and the postoperative pain degree. It is well known that the white membrane of tonsillar fossa is composed of degenerated collagen, inflammatory cell infiltration and fibrillar connective tissue. Though part of the recovery processing following TE, the colour and thickness of the white membrane is nonetheless an index of recovery. The thinner and whiter its colour, the better for the recovering wound. During surgery, we noticed that it was easier to stop large-vessel bleeding by bipolar diathermy-assisted coblation than by coblation technique only. Our results revealed similar outcomes from the comparison between coblation and electrosurgical TE. In a study with 64 patients, Noon et al. discovered a significantly higher haemorrhage rate in the coblation group compared to that of the diathermy group (22.2% versus 3.4%). Sharma et al. conducted a study in which bipolar diathermy versus dissection and snare methods were compared and found that the procedure of electro-dissection TE was quicker and associated with lower intraoperative blood loss, less initial postoperative pain, reduced postoperative morbidity and earlier discharge from hospital. Nevertheless, no information is available on the white membrane thickness of tonsillar fossa in this context, a processing part of pharyngeal mucosa healing. The thickness of the white membrane in the haemostasis area of tonsillar fossa in the intervention group was thinner than in the control group when observed with the naked eye. Moreover, the colour of the white membrane in the control group was darker than that in the intervention group. Removal of the tonsils and achievement of good haemostasis was at times more difficult in the control group. A statistically significant difference was found in postoperative haemorrhage rate between the two groups. The
incidence of post-operative haemorrhage was favourably matched with the published rates of 0%-20% for other series,\(^7\) which confirmed our findings. We found postoperative haemorrhage, including both primary and secondary haemorrhage, to generally be more frequent in the control group. The white membrane thickness of the haemostasis area of tonsillar fossa, post-operative blood loss, surgical time and the volume of blood loss during surgery in the intervention group were significantly less than those in the control group. In addition, the white membrane thickness of tonsillar fossa was positively correlated with postoperative pain degree. Therefore, we consider bipolar diathermy-assisted coblation TE to be a method that is more effective for application in paediatric TE than coblation TE. To further explore the relationship between PTH and the white membrane of tonsillar fossa, in future studies, we will obtain exact data pertaining to the white membrane thickness of tonsillar fossa from experiments with laboratory animals.

**Conclusion**

Our study revealed bipolar-assisted coblation TE to be superior to coblation TE. This technique is safer and more effective than coblation TE and may be a suitable alternative method for paediatric TE.

**References**

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