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ORIGINAL RESEARCH

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Adverse events of coblation or microdebrider in pediatric adenoidectomy: A retrospective analysis in 468 patients

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Abstract

Objective: Childhood obstructive sleep apnea hypopnea syndrome (OSAHS) is a common clinical disease that can cause serious complications if not treated in time. Adenoidectomy with or without tonsillectomy is the most important first line surgical treatment of obstructive sleep apnea in children. The aim of this study was to compare the differences between these two surgical procedures for adenoidectomy in terms of operation time, intraoperative blood loss, proportion of patients experiencing postoperative delayed hemorrhage, and incidence of adverse events.

Study Design: Retrospective analysis.

Methods: We performed a retrospective systematic analysis of patient data using the in-house electronic patient records and considered a 2-year period from 2016 to 2017. In total, 468 patients who underwent adenoidectomy under nasal endoscopy with coblation or microdebrider were identified.

Results: The coblation adenoidectomy technique was associated with significantly reduced blood loss and operation time. However, incidence of fever, neck pain, and halitosis were significantly lower in the microdebrider adenoidectomy group ($p < .01$). The difference in the postoperative primary and secondary hemorrhage between the two groups was not statistically significant ($p > .05$).

Conclusion: Coblation adenoidectomy had a significantly higher incidence of adverse events such as halitosis, neck pain, and fever. Therefore, otorhinolaryngologists should consider the differences in adverse events when selecting use of coblation adenoidectomy for pediatric patients.

Level of Evidence: IV

KEYWORDS
adenoidectomy, coblation, microdebrider, postoperative adverse events

1 | INTRODUCTION

Obstructive sleep apnea hypopnea syndrome (OSAHS) is a common disease in children, which often manifests as mouth breathing, snoring, repeated wakefulness in sleep, enuresis, and hyperhidrosis. OSAHS in children, which moreover, long-term blockage may affect their cardiovascular system, physical development, maxillofacial development, neurological cognitive function development, and hearing

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loss.[1–3] The main causes of OSAHS in children are adenoid hypertrophy, tonsil hypertrophy, and obesity. Adenoidectomy with or without tonsillectomy is the most important first line surgical treatment of obstructive sleep apnea in children. Over the years, several techniques have been developed for adenoidectomy including conventional cold curettage, microwave thermocoagulation, microdebrider, and coblation.[4,5] At present, there are two main surgical approaches for the treatment of adenoid hypertrophy in Shengjing Hospital of China Medical University, namely coblation and microdebrider since traditional electrocautery and cold adenoidectomy are outdated and obsolete in our hospital. A total of 468 patients who underwent adenoidectomy under nasal endoscopy in the Department of Otolaryngology, Shengjing Hospital from 2016 to 2017 were identified. When compared with microdebrider, coblation causes less intraoperative blood loss, with no or minimal bleeding on the wound surface, which is recognized as an outstanding advantage.[6] At present, there is a lack of detailed clinical research on the adverse events of the two surgical procedures, such as postoperative fever, neck pain, halitosis, postoperative primary/secondary hemorrhage, throat pain, and abnormal vocalization.[7,8] The aim of this study was to compare the differences between these two surgical procedures for adenoidectomy in terms of operation time, intraoperative blood loss, proportion of patients experiencing postoperative delayed hemorrhage, and incidence of adverse events.

2 | MATERIALS AND METHODS

2.1 | Clinical data

A total of 468 patients who underwent adenoidectomy under nasal endoscopy by the same surgical team in the Department of Otolaryngology, Shengjing Hospital from 2016 to 2017 were selected, including 242 males and 226 females. All parents gave informed consent before inclusion in the study, which was approved by the Ethics Committee of Shengjing Hospital of China Medical University. All included patients underwent adenoidectomy alone, without tonsillectomy or myringotomy(with or without grommet insertion), in order to rule out the effect of other surgical procedures on postoperative symptoms. The clinical symptoms included nasal obstruction leading to sleep apnea, mouth breathing, and snoring. All the enrolled patients were examined by using flexible fiberoptic nasopharyngoscopy, which has replaced mirror nasopharyngeal exam, reduced patient discomfort, and has become a routine examination in our hospital. Size of the adenoid, as well as its relationship to the choanae and eustachian tube were recorded. According to Parikh's adenoid grading scale, all included cases were classified as Grade III or IV. Patients were scheduled for surgery after complete systemic examination and evaluation of fitness for general anesthesia. Patients with congenital anomalies, submucosal cleft palate, past surgical history, allergy findings, and bleeding diathesis were excluded from the study. Patients were discharged from the hospital 2 to 3 days after surgery and the patients were followed up at 7, 14, 21, and 6 months postoperatively. At a follow-up of 6 months after surgery, the combination of questionnaire and electronic nasopharyngoscopy was used. The questionnaire mainly included the answers of the children and their parents, the improvement of snoring, nasal congestion, open-mouth breathing, and other symptoms. Flexible fiberoptic nasopharyngoscopy was performed to determine whether there was residual adenoid tissue and whether there was the injury and adhesion of the eustachian tube. The effective standard of clinical treatment is that the symptoms of sleep snoring, nasal congestion, and open-mouth breathing disappear or improve, while the ineffective standard is that the symptoms do not improve.

2.2 | Surgical procedure

2.2.1 | Microdebrider group

The patients were placed in the supine position. After successful induction of general anesthesia, a mouth prop was placed, and a thin catheter lubricated with erythromycin ointment or paraffin oil was introduced through the nasal cavity. After the soft palate was lifted, the nasopharyngeal cavity was exposed. Under the guidance of a 30-degree rigid endoscope for visualization, the adenoid tissue was excised using a Medtronic nasal operation electric cutting system (Medtronic Minneapolis, Minnesota; Figure 1A,B). During the operation, sufficient hemostasis was achieved by cotton piece compression and electric coagulation with the intensity of 25.

2.2.2 | Coblation group

A Chengdu Mechan low-temperature plasma radiofrequency ablation system (Chengdu Mechan Electronic Technology Co., Chengdu, Sichuan, China) was used. The procedures, performed before coblation, were the same as those in microdebrider group. Coblator surgical procedures used a 30-degree rigid endoscope for visualization. The ablation gear was set at 7 and the coagulation gear was set at 3 during the procedure. Adenoid tissue was ablated gradually in all the patients (Figure 1C,D).

2.3 | Observed variables

Operation time was defined as the time between the formal start and end of the operation. Intraoperative blood loss included the volume of blood in the aspirator and the number of cotton pieces used for soaking up blood during the operation, wherein a blood volume of 1 ml was counted for each cotton piece.

2.4 | Statistical method

The experiment data were calculated and processed by SPSS 17.0 software (IBM Corp., Armonk, New York). Parameters were expressed

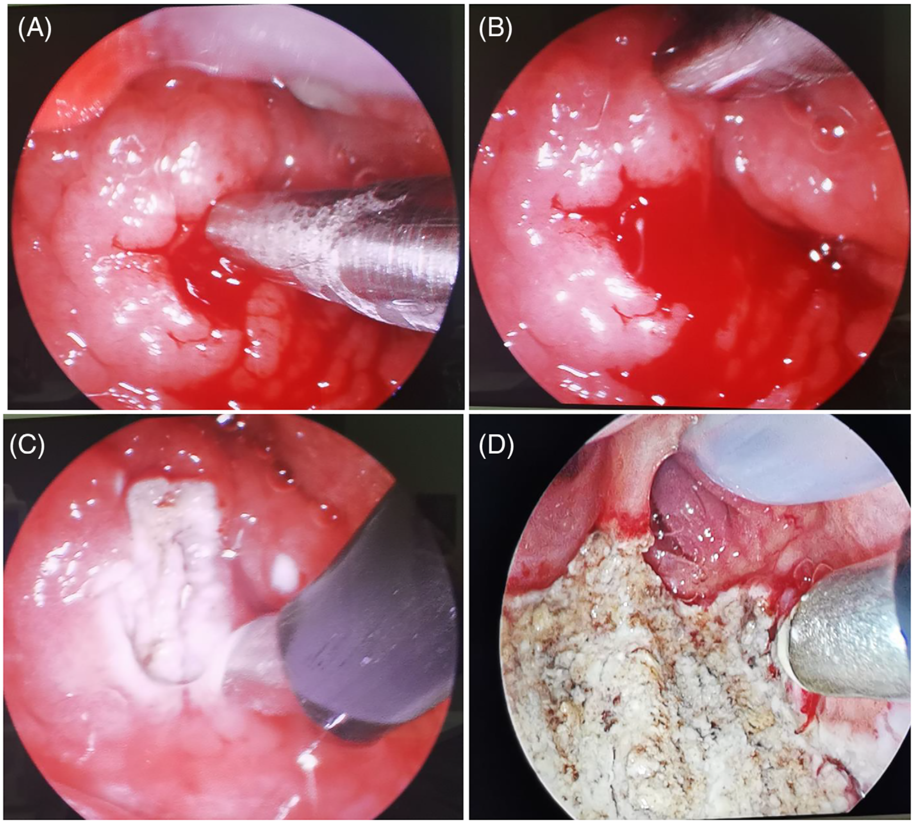

FIGURE 1 The two main surgical methods for adenoidectomy: microdebrider and coblation (A) Visual field at the beginning of microdebrider group; (B) Visual field during the operation of microdebrider group; (C) Visual field at the beginning of coblation group; (D) Visual field during the operation of coblation group.

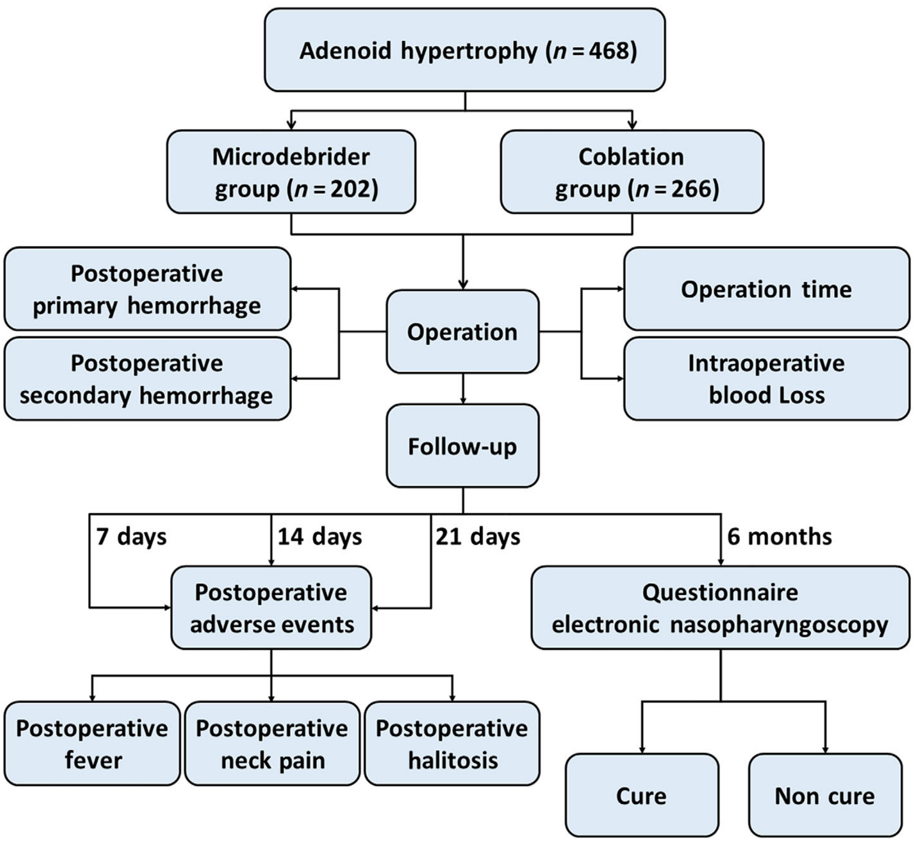

FIGURE 2 Flow diagram of general study design and timing of follow-up.

as mean ± standard deviation (x̄ ± S) or as frequencies with percentages. An independent samples *t*-test was used to compare the means of the continuous variables between the two groups, and the chi-square test was used to compare the enumerated data and rates. A $p < .05$ was considered to indicate statistically significant difference. The operation time, intraoperative blood loss, postoperative primary/secondary hemorrhage, postoperative fever, neck pain, halitosis, and other adverse events were statistically analyzed. All postoperative adverse events, including the onset and disappearance of fever, neck pain, and halitosis, were recorded in the medical records, the follow-up records, and the questionnaire. Flow diagram of general study design and timing of follow-up is presented in Figure 2.

3 | RESULTS

3.1 | Comparison of prognosis between coblation and microdebrider

A total of 468 patients who underwent adenoidectomy under nasal endoscopy with coblation or microdebrider were identified. Microdebrider was performed in 202 patients, including 107 males and 95 females, aged 3–6 years, with an average age of 4.3 ± 1.5 years. Coblation was performed in 266 patients, including 135 males and 131 females, aged 3–6 years, with an average age of 4.5 ± 1.7 years. All 468 patients had an uneventful operation. Clinical features and the cure rate of studied symptoms are summarized in Table 1. There was no statistically significant difference in the basic patient characteristics such as age, sex, and adenoid size between the two groups ($p > .05$). Patients reported an improvement in the symptoms of nasal congestion, snoring, and mouth breathing after both the surgical procedures. Postoperative hemorrhage of the adenoid tissue was characterized as primary (within 24 h after surgery) and secondary (>24 h after surgery) hemorrhage. In the microdebrider group, postoperative hemorrhage occurred in two cases; one case had primary hemorrhage, while the other case had secondary hemorrhage on the third day after the operation. Similarly, postoperative hemorrhage occurred in two cases in the coblation group as well, with one case having primary and the other having secondary hemorrhage on the sixth day after surgery. All of these cases were treated with electrocoagulation under general anesthesia to ensure definite hemostasis, and there was no recurrence of hemorrhage.

3.2 | Comparison of operation time and intraoperative blood loss between coblation and microdebrider

The operation time, intraoperative blood loss, and number of patients experiencing postoperative primary/secondary hemorrhage are shown in Table 2. The intraoperative blood loss and operation time in the coblation group were significantly less than those in the microdebrider

TABLE 1 Demographic and disease characteristics of the patients

	Microdebrider group ($n = 202$)	Coblation group ($n = 266$)	t/χ^2	*p*-value
Age (years)	4.3 ± 1.5	4.5 ± 1.7	1.33	.1857
Gender				
Male	107 (53.0%)	135 (50.8%)	0.2263	.6343
Female	95 (47.0%)	131 (49.2%)		
Effectiveness				
Cure	198 (98.0%)	260 (97.7%)	0.419	.8378
Noncure	4 (2.0%)	6 (2.3%)		
Complications				
Residual adenoid tissue	3	4	–	1
Injury or adhesion of eustachian tube	2	3	–	1
Velopharyngeal insufficiency	0	0	–	1

TABLE 2 Comparison of operation time, intraoperative blood loss, and postoperative hemorrhage between coblation and microdebrider

Group	Operation time (x̄ ± s, min)	Intraoperative blood loss (x̄ ± s, ml)	Proportion of postoperative primary hemorrhage (%)	Proportion of postoperative secondary hemorrhage(%)
Microdebrider group ($n = 202$)	25.27 ± 8.75	10.26 ± 3.23	0.49% (1/202)	0.49% (1/202)
Coblation group ($n = 266$)	13.56 ± 5.34	3.23 ± 4.24	0.38% (1/266)	0.38% (1/266)
t/Fisher's exact test	17.88	19.63	0.4917	0.4917
p-value	<.001*	<.001*	1	1

Note: *Statistically significant.

TABLE 3 Comparison of postoperative adverse events between coblation and microdebrider

Group	Proportion of postoperative fever (%)	Proportion of postoperative neck pain (%)	Proportion of postoperative halitosis (%)
Microdebrider group ($n = 202$)	7.4% (15/202)	1% (2/202)	33.2% (67/202)
Coblation group ($n = 266$)	21.2% (56/266)	16.9% (45/266)	100% (266/266)
χ^2	188.38	32.24	249.84
p-value	<.001	<.001	<.001

Note: *Statistically significant.

group ($p < .05$). There was no significant difference in the number of patients experiencing postoperative primary and secondary hemorrhage between the two groups ($p > .05$).

3.3 | Comparison of adverse events between coblation and microdebrider

Comparison of adverse events after coblation and microdebrider is shown in Table 3. There was a significant difference in the proportion of patients who developed postoperative fever, neck pain, and halitosis between the two groups (all $p < .001$). There was no statistically significant difference in the proportion of patients who developed delayed hemorrhage between the two groups ($p > .05$).

4 | DISCUSSION

At present, adenoidectomy for children in Shengjing Hospital of China Medical University is mainly performed by coblation or microdebrider since traditional electrocautery and cold adenoidectomy are outdated and obsolete in our hospital. Considering the influence of surgical skills and proficiency on the conclusion, a total of three experienced professors participated in the operation, excluding the influence of interns on the results of the study. All patients were questioned in a similar manner at regular follow-up after surgery and on a 6-month postsurgery questionnaire. In addition, it is important to note that the cost difference between the two types of surgical methods is not significant and is clinically acceptable.

With the skillful application of nasal endoscopy in our hospital, nasal endoscopy has replaced the traditional visualization. Adenoidectomy can be performed under a clear visual field by both microdebrider and coblation under nasal endoscopy. As a result, surgeon is able to accurately identify the relationship between the adenoid tissue and the surrounding adjacent structures such as the tubal torus, so as to determine the precise extent of the operation.[9] The problem with microdebrider is the high risk of bleeding, which hinders the operation. Compression or electrocoagulation hemostasis is required to control the bleeding, which increases the operation time. Moreover, for the adenoid tissue around the torus and the edge of the choanae, complete excision with the microdebrider is difficult.[10] The residual adenoid tissue may proliferate again after the operation, leading to recurrence.[11,12] This procedure may also damage the posterior edge of the nasal septum and mucous membrane of the choanae, resulting in adhesion formation and even increasing the probability of choanal atresia.[13,14] The results of this study showed that in coblation under nasal endoscopy, the anatomical relations could be identified clearly, the operation time was short, and the blood loss was low which was consistent with the findings of other studies from China that showed that there was no or minimal bleeding at the coblation incision site, the postoperative recovery was quick, and the recurrence rate was low.[6]

We compared the incidence of postoperative adverse events such as halitosis, neck pain, and fever between the two approaches of adenoidectomy, and found that this incidence was significantly higher after coblation than after microdebrider. At present, the clinical concept of fever refers to a body temperature higher than 37.3°C or 1°C higher than the basal body temperature. In the coblation group, 21.1% of the children had fever after the operation, which was significantly higher than 7.4% in the microdebrider group. Most children in coblation group began to have fever on the first day after the operation, and this was more common in younger children. We speculate that the reason for this could have been the reabsorption of the inflammatory mediators from coblation site into the blood, resulting in an increase in body temperature. A few patients developed postoperative fever owing to complicated upper and lower respiratory tract infections occurring as a result of impaired immunity after the operation.[15,16]

Although most specialists in otorhinolaryngology and pediatrics find halitosis to be a common problem in children with adenoid hypertrophy, there are no objective data on this topic in the literature.[17,18] As for the postoperative halitosis, it has been reported in the literature that halitosis occurs over a 7-day period in patients undergoing electrocautery adenoidectomy and will resolve postoperatively with simple analgesia and without antibiotics.[19] Interestingly, we found that all the patients who underwent coblation had significant halitosis, and this proportion was far greater than the proportion of 33.2% in the microdebrider group. Halitosis began on the 1st postoperative day; started worsening at the 4th to 5th day and began to disappear at the 10th postoperative day, and the degree of odor was more intense. We speculated that it might be related to the decomposition of necrotic tissues and proteins at the site of coblation due to bacterial growth.

In the coblation group, 16.9% of the patients felt severe neck pain, especially pain in the supine position. In severe cases, the patient was unable to rotate the neck or the head was skewed to one side, which was similar to the phenomenon of torticollis. Confusingly, neck pain after adenoid coblation has not been reported in the literature. We analyzed the causes: the adenoid tissue passes through the prevertebral fascia and clings to the muscles anterior to the cervical spine, so inflammation and thermal radiation injury after coblation will pass through the prevertebral fascia and reach the muscles to cause spasm, thus resulting in pain and dyskinesia. The postoperative neck pain usually lasts for <2 weeks. At present, there are two surgical procedures for coblation, namely layer-by-layer coblation and block resection. Layer-by-layer coblation refers to thinning and ablation with a plasma knife up to the prevertebral fascia, while block resection constitutes cutting between the prevertebral fascia and the adenoid tissue, and resecting a large block of the adenoid gland. In the process of block resection, it is possible that in order to remove a large portion of the adenoid tissue, deep resection is performed and thus, prevertebral fascial injury occurs. Therefore, paying attention to the depth of the resection during the operation, and avoiding cutting too deep, thus preventing the damage to the prevertebral fascia and exposure of the muscle, are the key operation points for coblation and microdebrider.

By comparing the adverse events of these two surgical procedures, we can conclude that the anatomical layers could be clearly visualized under nasal endoscopy. Coblation also caused lesser blood loss and was associated with a shorter operation time, while there was no significant difference in the incidence of postoperative primary or secondary hemorrhage between the two procedures.[20–22] Although the difference in blood loss is statistically significant, it is not clinically significant. Moreover, there is no doubt that plasma adenoid ablation is indeed a step forward in the direction of reducing bleeding, and it is worth considering how to reduce intraoperative bleeding to a greater extent in the future, or even achieve no bleeding. The longer time spent by the microdebrider technique is due to the longer time spent on the hemostasis portion, not the longer removal time. In particular, the efficiency of cauterization of the surface for hemostasis is the rate limiting step. With experience, the hemostasis time using cautery can be significantly reduced as surgeons do more. However, adverse events such as halitosis, neck pain, and fever were more likely to occur after coblation. To summarize, the abovementioned two surgical procedures have their own advantages and disadvantages when employed in clinical practice, and human factors also play a role in determining the outcome of the operation. Therefore, otorhinolaryngologists should keep the differences in adverse events when selecting use of coblation adenoidectomy for pediatric patients.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in the study.

DATA AVAILABILITY STATEMENT

The datasets used and analyzed in this study are available from Weiliang Bai, the corresponding author, on reasonable request.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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