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Comparison of perioperative indicators, treatment efficacy, and postoperative complications between tonsillotomy and tonsillectomy for children with obstructive sleep apnea hypopnea syndrome

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SUMMARY

OBJECTIVE: This study aimed to compare the perioperative indicators, treatment efficacy, and postoperative complications between tonsillotomy and tonsillectomy for children with obstructive sleep apnea hypopnea syndrome.

METHODS: A total of 134 children with obstructive sleep apnea hypopnea syndrome were divided into tonsillotomy group (n=66) and tonsillectomy group (n=68). The tonsillotomy group received tonsillotomy treatment with a power cutter, while the tonsillectomy group received tonsillectomy treatment. The perioperative indicators, treatment efficacy, and postoperative complications were compared between the two groups.

RESULTS: There was no significant difference in operative time between the two groups ($p>0.05$), with significant difference in amount of blood loss, postoperative Visual Analogue Scale score, food intake amount, and general diet-taking starting time between the two groups ($p<0.05$). The total effective rate of treatment had no significant difference between the two groups ($p>0.05$). There was significant difference in postoperative bleeding, upper respiratory tract infection, and pharyngeal scar grade between the two groups ($p<0.05$).

CONCLUSIONS: Compared with tonsillectomy treatment for children with obstructive sleep apnea hypopnea syndrome, tonsillotomy treatment is more beneficial to optimize the perioperative indicators, relieve the postoperative pain, facilitate the postoperative recovery, and reduce the postoperative complications, which is worthy of clinical promotion.

KEYWORDS: Tonsillectomy. OSAHS. Children.

INTRODUCTION

Obstructive sleep apnea hypopnea syndrome (OSAHS) is the most common disease that affects the sleep, snoring, and mouth breathing of people. It can cause the long-term hypoxia and facial malformations, thereby severely influencing the growth and development of children. The OSAHS in children is often related to the adenoidectomy and tonsil hypertrophy due to the airway obstruction[1]. According to the 2012 Guidelines of the American Academy of Pediatrics (AAP), the incidence of OSAHS in children is about 1.2–5.7%[2]. At present, the low-temperature plasma radiofrequency tonsillectomy (TE) is mostly used for the clinical treatment of children with OSAHS, which achieves the therapeutic purpose through complete removal of tonsils and/or adenoids but causes great trauma to the body and many complications such as postoperative pain and bleeding[3,4]. However, the tonsillotomy (TT) achieves the therapeutic purpose by removing part of tonsils with cold instruments, which can not only relieves the disease of children but also retains the basic function of tonsils and reduces the occurrence of postoperative complications[5-7]. In this study, the effectiveness of TT and TE in children with OSAHS was investigated, and the perioperative indicators, treatment efficacy, and postoperative complications were observed.

METHODS

Patients

A total of 139 OSAHS children with surgical indications admitted in our hospital from January 2020 to January 2021 were randomly divided into TT group (68 cases) and TE group (71 cases), which received dynamic TT and low-temperature plasma radiofrequency TE, respectively. The follow-up was performed for 9 months, and five cases were lost to follow-up. Finally, 134 cases were included in the study. In TT group, there were 40 males and 26 females and the age was 5.57±0.82 years. There

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were 48 cases with tonsil grade II and 18 cases with tonsil grade III. In TE group, there were 43 males and 25 females and the age was 5.46±0.83 years. There were 51 cases with tonsil grade II and 17 cases with tonsil grade III. There was no significant difference in clinical baseline data between the two groups (p>0.05). This study was approved by the Ethics Committee of Zhongshan Hospital affiliated to Xiamen University. Written informed consent was obtained from the families of children.

Inclusion criteria and exclusion criteria

Inclusion criteria were as follows:

(1) OSAHS was diagnosed with combined symptoms, signs, and polysomnography indicators as recommended in the 2020 Guidelines for the Diagnosis and Treatment of Obstructive sleep apnea in Children in China[8];
(2) the preoperative examination showed no contraindications of heart, liver, or kidney function; and
(3) the course of disease was more than 6 months.

Exclusion criteria were as follows:

(1) the patients had a history of acute tonsil infection within 3 weeks before surgery;
(2) the patients had coagulation dysfunction; and
(3) the patients had anemia or leukocyte abnormalities before surgery.

Surgical methods

All children were intubated with airway tube, with pillow under shoulder and head back. Davis mouth opener was placed and fixed. The oropharynx was exposed, and the tonsils were fully exposed. In TT group, Medtronic XPS3000 power system with 0° cutting head was used for TT layer by layer from the upper pole to lower pole of tonsils. The upper fossa was exposed and opened from inside to outside. About 10% of tonsil tissues were retained. The bipolar electrocoagulation was used to stop the blood flow. In TE group, the low-temperature plasma radiofrequency ablation system with MC40 frequency knife was used for TE. The cutting energy chose step 7, with step 5 for stopping bleeding. The tonsils were slowly cut along the tongue palatal arch mucosa step by step. The gap between tonsils and surrounding tissues was exposed. The tonsils were removed from top to bottom along the gap. The tonsil fossa was examined for checking the residual tonsil tissues and bleeding.

Observation of perioperative indicators

The operation time (min) and amount of blood loss were recorded. On the perioperative days 1, 3, and 7, the pain of patients was assessed using Visual Analogue Scale (VAS), with 0 point for no pain and 10 points for extreme pain. The food (cold liquid diet or semi-liquid diet) intake amount (ml) on the postoperative days 1 and 2 was counted. In addition, the general diet-taking starting time (days) was recorded.

Evaluation of treatment efficacy

The treatment efficacy was evaluated according to the 2007 Draft Guidelines for the Diagnosis and Treatment of Children OSAHS (Urumqi)[9]. The scoring was performed using apnea–hypopnea index (AHI) and lowest blood oxygen saturation ($LSaO_2$) as follows:

(1) cured: AHI was less than five times per hour; $LSaO_2$ was more than 0.92; the clinical symptoms almost disappeared;
(2) remarkably effective: AHI decreased by >50%; the clinical symptoms were significantly mitigated;
(3) effective: AHI decreased by 25–50%; the clinical symptoms were mitigated; and
(4) ineffective: AHI decreased by <25%; the clinical symptoms were not mitigated, and even aggravated.

The total effective rate was calculated as follows: total effective rate (%) = [(number of cured cases + number of markedly effective cases + number of effective cases) / total case number] × 100.

Observation of postoperative complications

The postoperative bleeding of patients was observed. The upper respiratory tract infection of patients within postoperative 9 months was recorded. In addition, the postoperative pharyngeal scar formation was observed, and its degree was graded as follows: grade I: the palatopharyngeal arch and palatopharyngeal arch were clear, without scar formation; grade II: the palatopharyngeal arch and palatoglossus arch were fused, with a small part of fusion and visible scars; grade III: the palatopharyngeal arch and palatoglossus were mostly fused and basically disappeared; and grade IV: there was obvious scar, with protruding mucosal surface.

Statistical analysis

Statistical analysis was performed using SPSS version 20.0 software. The measurement data were expressed as mean±standard deviation and were compared by independent sample t-test. The counting data were expressed by number and rate and were compared by χ^2 test. A p-value <0.05 was considered statistically significant.

RESULTS

Comparison of perioperative indicators between the two groups

There was no significant difference in operative time between the two groups (p>0.05), with significant difference in amount of blood loss, postoperative VAS score (day 1, day 3, day 7), food intake amount (day 1, day 2), and general diet-taking starting time between the two groups (p<0.05) (Table 1).

Comparison of treatment efficacy between the two groups

At the end of treatment, there were 27 cured, 25 remarkably effective, 10 effective, and 4 ineffective cases in TT group, with 28 cured, 27 remarkably effective, 11 effective, and 2 ineffective cases in TE group. The total effective rate in TT and TE groups was 93.94 and 97.06%, respectively, with no significant difference between the two groups (p>0.05) (Table 2).

Comparison of postoperative complications between the two groups

In TT group, there were 0 cases of postoperative bleeding, 5 cases of upper respiratory tract infection, 63 cases of pharyngeal scar formation with grade I, 3 cases of pharyngeal scar formation with grade II, and 0 cases of pharyngeal scar formation with grade III. In TE group, there were 6 cases of postoperative bleeding, 14 cases of upper respiratory tract infection, 39 cases of pharyngeal scar formation with grade I, 26 cases of pharyngeal scar formation with grade II, and 3 cases of pharyngeal scar formation with grade III. There was significant difference in postoperative bleeding, upper respiratory tract infection, and pharyngeal scar grade between the two groups (p<0.05) (Table 3).

DISCUSSION

As one of the most common diseases in children, the OSAHS has attracted wide attention. This study investigated the effectiveness of TT and TE in children with OSAHS. Results showed that, compared to TE group, TT group had significant advantages in postoperative VAS score, food intake amount, and general diet-taking starting time. TE is performed at the tonsillar capsule. Elinder et al.[10]. have reported that, in TE, the thermal damage depth of tissue by plasma radiofrequency knife reaches 0.7–0.8 mm. In the process of separation, cutting, or coagulation at the capsule level, it is inevitable that part of the capsule will be damaged and the deep soft tissue

Table 1. Comparison of perioperative indicators between two groups.

Group		TT	TE	t	p
n		66	68		
Operation time (min)		16.77±2.14	16.09±2.01	1.897	0.060
Amount of blood loss (mL)		23.20±4.85	18.07±6.11	5.373	<0.001
VAS score (points)	Day 1	4.81±1.30	5.65±1.32	3.710	<0.001
	Day 3	4.92±1.12	6.27±0.93	7.600	<0.001
	Day 7	2.44±1.04	3.24±0.88	4.812	<0.001
Food intake amount (mL)	Day 1	830.31±124.07	669.13±88.17	8.689	<0.001
	Day 2	1115.92±159.66	801.50±137.12	12.241	<0.001
General diet-taking starting time (days)		6.90±0.82	12.70±1.73	24.677	<0.001

TT: tonsillotomy; TE: tonsillectomy; VAS: visual analogue scale.

Table 2. Comparison of treatment efficacy between two groups.

Group	n	Cured n (%)	Remarkably effective n (%)	Effective n (%)	Ineffective n (%)	Total effective rate (%)
TT	66	27 (40.91)	25 (37.88)	10 (15.15)	4 (6.06)	93.94
TE	68	28 (41.18)	27 (39.71)	11 (16.18)	2 (2.94)	97.06
χ^2						0.762
p						0.383

Table 3. Comparison of postoperative complications between two groups, n (%).

Group		TT	TE	χ^2	p
n		66	68		
Postoperative bleeding	Yes	0 (0.00)	6 (8.82)	6.097	0.014
	No	66 (100.00)	62 (91.18)		
Upper tract respiratory infection	Yes	5 (7.58)	14 (20.59)	4.660	0.031
	No	61 (92.42)	54 (79.41)		
Pharyngeal scar grade	I	63 (95.45)	39 (57.35)	26.748	<0.001
	II/III	3 (4.55)	29 (42.65)		

TT: tonsillotomy; TE: tonsillectomy.

and muscle tissue will be damaged. Deglutition, stimulation exposed to oropharyngeal muscles, nerve broken end, causes severe pain. TT adopts the dynamic cutter equipment for cold, which reduces the thermal damage and retains the tonsil capsule. The cutting edge is only limited at the peripheral sensory nerve. After TT, the tonsil tissue oropharyngeal secretions can be retained so that the postoperative pain is light and the time returning to normal eating is short[11,12]. However, the operation time of TT was slightly prolonged, which is considered to be related to surgical proficiency and wound size. The amount of blood loss in TT was slightly higher than TE. It is considered that the wounds of TT are on the surface of glands, resulting in more blood oozing. However, TE is mainly operated along the capsule. If the surgical skill is good, the main blood vessels will be blocked during the operation to stop bleeding and therefore the amount of blood loss is reduced.

In our study, both TT and TE showed significant efficacy in relieving the OSAHS, with no significant difference in total effective rate between the two groups. These results are consistent with previous studies[13,14]. Eviatar et al.[15] had made a long-term comparison between these two surgical procedures and confirmed that there was no significant statistical difference between TT and TE in many aspects including snoring, night suffrage, recurrent tonsillitis, hyperplasia of tonsils, or postoperative sleep monitoring indicators. Blackshaw et al.[16] showed that TT with capsule preservation was effective in the treatment of OSAHS in children.

Results of our study showed that the postoperative complications in TT group were significantly lower than TE group. The tonsil blood supply comes from five branches of the external carotid artery, but only the tonsil branch of facial artery enters the parenchyma from the lower pole of tonsil, so the bleeding during and after TE mostly comes from the lower pole of tonsil[13]. TT preserves the tonsil capsule. During the operation, only the facial artery branch entering the tonsil tissue needs to be completely hemostatic, without damaging the other branches. TE is operated under the capsule, which requires hemostasis of all branch vessels. Although the plasma system is operated at low temperature, the tissue thermal damage can still be as deep as 0.7–0.8 mm, resulting in partial collagen degeneration and forming a thin pseudomembrane covering the wound, temporarily protecting the wound from bleeding. In terms of postoperative infection, the incidence of upper respiratory tract infection in TT group was lower than that in the TE group, which may be caused by the retention of tonsil tissue and immune function of tonsil in TT group[16].

CONCLUSION

Compared with TE treatment for children with OSAHS, TT treatment is more beneficial to optimize the perioperative indicators, relieve the postoperative pain, facilitate the postoperative recovery, and reduce the postoperative complications, which is worthy of clinical promotion. This study still has some limitations. The sample size is relatively small, which may affect the persuasiveness of the results. In future studies, the sample size should be further increased for obtaining more satisfactory outcomes.

AUTHORS' CONTRIBUTIONS

HY: Conceptualization. **CJ:** Data curation, Formal Analysis. **XW:** Writing – original draft. **YH:** Writing – review & editing

REFERENCES

1. Perez C. Obstructive sleep apnea syndrome in children. Gen Dent. 2018;66(6):46-50. PMID: 30444706
2. Walton J, Ebner Y, Stewart MG, April MM. Systematic review of randomized controlled trials comparing intracapsular tonsillectomy with total tonsillectomy in a pediatric population. Arch Otolaryngol Head Neck Surg. 2012;138(3):243-9. https://doi.org/10.1001/archoto.2012.16
3. Stafford JA, Redmann AJ, Singh E, Sarber K, Ishman SL. The effect of postoperative steroid dosing on readmission rates following radiofrequency ablation tonsillectomy. Int J Pediatr Otorhinolaryngol. 2021;149:110862. https://doi.org/10.1016/j.ijporl.2021.110862
4. Rivero A, Durr M. Lingual Tonsillectomy for Pediatric Persistent Obstructive Sleep Apnea: A Systematic Review and Meta-analysis. Otolaryngol Head Neck Surg. 2017;157(6):940-7. https://doi.org/10.1177/0194599817725708
5. Shaul C, Attal PD, Schwarz Y, Muhanna N, Izgelov D, Peleg U, et al. Bipolar tonsillotomy: A novel and effective tonsillotomy technique. Int J Pediatr Otorhinolaryngol. 2016;84:1-5. https://doi.org/10.1016/j.ijporl.2016.02.012
6. Kiær EK, Bock T, Tingsgaard PK. Tonsillotomy in children with sleep-disordered breathing is safe and results in high parent satisfaction. Dan Med J. 2016;63(5):A5228. PMID: 27127014
7. Sakki AJ, Mäkinen LK, Kanerva M, Nokso-Koivisto J. Monopolar tonsillotomy versus cold dissection tonsillectomy in children: prospective study on postoperative recovery. Int J Pediatr Otorhinolaryngol. 2021;141:110513. https://doi.org/10.1016/j.ijporl.2020.110513
8. Working Group of Chinese Guideline for the Diagnosis and Treatment of Childhood OSA, Subspecialty Group of Pediatrics, Society of Otorhinolaryngology Head and Neck Surgery, Chinese Medical Association, Subspecialty Group of Respiratory Diseases, Society of Pediatrics, et al. Chinese guideline for the diagnosis and treatment of childhood obstructive sleep apnea (2020). World J Otorhinolaryngol Head Neck Surg. 2021;7(3):201-20. https://doi.org/10.1016/j.wjorl.2021.04.005
9. Editorial Board of Chinese Journal of Otorhinolaryngology Head-and Neck Surgery, Chinese Otorhinolaryngology of Chinese Medical Association. Draft of guidelines for the diagnosis and treatment of pediatric sleep apnea hypopnea syndrome (Urumqi). Zhonghua Er Bi Yan Hou Tou Jing Wai Ke Za Zhi. 2007;42(2):83-4. PMID: 17633247
10. Elinder K, Söderman AC, Stalfors J, Knutsson J. Factors influencing morbidity after paediatric tonsillectomy: a study of 18,712 patients in the National Tonsil Surgery Register in Sweden. Eur Arch Otorhinolaryngol. 2016;273(8):2249-56. https://doi.org/10.1007/s00405-016-4001-x
11. Sathe N, Chinnadurai S, McPheeters M, Francis DO. Comparative effectiveness of partial versus total tonsillectomy in children. Otolaryngol Head Neck Surg. 2017;156(3):456-63. https://doi.org/10.1177/0194599816683916
12. Odhagen E, Stalfors J, Sunnergren O. Morbidity after pediatric tonsillotomy versus tonsillectomy: A population-based cohort study. Laryngoscope. 2019;129(11):2619-26. https://doi.org/10.1002/lary.27665
13. Arambula A, Brown JR, Neff L. Anatomy and physiology of the palatine tonsils, adenoids, and lingual tonsils. World J Otorhinolaryngol Head Neck Surg. 2021;7(3):155-60. https://doi.org/10.1016/j.wjorl.2021.04.003
14. Radman M, Ferdousi A, Khorramdelazad H, Jalali P. Long-term impacts of tonsillectomy on children's immune functions. J Family Med Prim Care. 2020;9(3):1483-7. https://doi.org/10.4103/jfmpc.jfmpc_935_19
15. Eviatar E, Kessler A, Shlamkovitch N, Vaiman M, Zilber D, Gavriel H. Tonsillectomy vs. partial tonsillectomy for OSAS in children--10 years post-surgery follow-up. Int J Pediatr Otorhinolaryngol. 2009;73(5):637-40. https://doi.org/10.1016/j.ijporl.2008.12.012
16. Blackshaw H, Springford LR, Zhang LY, Wang B, Venekamp RP, Schilder AG. Tonsillectomy versus tonsillotomy for obstructive sleep-disordered breathing in children. Cochrane Database Syst Rev. 2020;4(4):CD011365. https://doi.org/10.1002/14651858.CD011365.pub2