The Safety of Early Administration of Oral Fluid Following General Anesthesia in Children Undergoing Tonsil Operation: A Prospective Randomized Controlled Trial

Meng-Hang Wu
Department of Liver of West China Hospital / West China School of Nursing, Sichuan University

Chang-qing Liu
West China School of Nursing / Operating Room of Anesthesia Surgery Center of West China Hospital, Sichuan University

Xiao-qi Zeng
Department of Anesthesiology of West China Hospital / West China School of Nursing, Sichuan University

An-na Jia
Department of Anesthesiology of Anesthesia Surgery Center of West China Hospital / West China School of Nursing, Sichuan University

Xiao-rong Yin (lcqing915@126.com)
Sichuan University

Keywords: Tonsil operation, recovery from the general anesthesia, oral fluid, safety, feasibility

DOI: https://doi.org/10.21203/rs.3.rs-73622/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License
Abstract

Background: The feasibility and safety of giving a small amount of water to children in the recovery period after tonsillectomy under general anesthesia to reduce the thirst and its associated restlessness reaction remain unknown.

Methods: This study was approved by our institutional ethics committee, and which adhered to CONSORT guidelines. Pediatric patients undergoing tonsil surgery who met the inclusion and exclusion criteria of our study were randomized into the experimental and control groups. In the experimental group, patients were given a small amount of water instantly after recovering from the general anesthesia, which included the recovery of cough and deglutition reflex, and attaining grade V of muscle strength. The control group was given a small amount of water 4 to 6 hours after the operation. The incidence of nausea and vomiting and the degree of thirst relief were measured and compared between the two groups.

Results: 300 patients were randomized into each group. There was no significant difference in the incidence of nausea and vomiting 20 minutes after drinking water between the two groups (P>0.05). The thirst score of children over 5 years old in the experimental group was significantly lower than that of the control group (P<0.05).

Conclusion: The early administration of a small amount of oral fluid in children undergoing tonsil surgery and recovering from the general anesthesia is not only safe but also effective in reducing postoperative thirst.

Trial registration: Current Controlled Trials ChiCTR1800020058, 12-12-2018.

Background

Tonsils and adenoids are immune-active organs located at the upper respiratory tract. When enlarged, they can cause narrowing of the upper respiratory tract and hindering the gas exchange of the respiratory system, which may adversely affect the normal physical and intellectual development of children. If left treated, abnormal facial development and occlusion of teeth may ensue, leading to otitis media, sinusitis, and other diseases[1, 2]. Hence, tonsillectomy and adenoidectomy are indicated in the presence of sleep and respiratory disorder secondary to adenotonsillar hypertrophy[3]. Given the unique anatomical features in children and the operative site which is close to the pharynx and larynx, such operations are associated with the possible risk of bleeding, aspiration, laryngospasm, and restlessness, which may further substantiate the risk of wound bleeding, increased pain and even suffocation [4].

The recovery period following the general anesthesia is a period for children to fully regain their important physiological functions, but it is also a period associated with a high risk of adverse events and even life-threatening caused by restlessness[5, 6]. Studies have shown that restlessness is not uncommon in children and adolescents during the recovery period following the general anesthesia, especially in male
children\[7\]. Thirst is common in children undergoing tonsillectomy, and it often causes severe agitation in the recovery period following the anesthesia, leading to increased oxygen consumption, arrhythmia, wound bleeding, etc. In severe cases, the patient may inadvertently pull out the infusion tube, urinary tube, and other treatment equipment, which will adversely affect the postoperative recovery\[8\]. Therefore, it is clinically necessary to give a small amount of water to children in the recovery period after tonsillectomy under general anesthesia to reduce the thirst and its associated restlessness reaction. Our study aimed to examine the feasibility and safety of early administration of oral fluid, and if such intervention would provide the thirst relief in this group of patients.

1 Methods

1.1 General information

This study was approved by our institutional ethics committee (2017 Review No. 231), with the registration number ChiCTR1800020058 (http://www.chictr.org.cn/showproj.aspx?proj=33847), the date of registration(12-12-2018), and which adhered to CONSORT guidelines. In this study, 300 children undergoing tonsil operation in the West China Hospital of Sichuan University were recruited and randomized into 2 groups by using the computer-generated random number list. In the experimental group, patients were given a small amount of water instantly after recovering from the general anesthesia whereas in the control group, patients were given a small amount of water at 4 to 6 hours after the operation.

1.2 Methods Of Oral Fluid Administration

The administration of oral fluid was introduced in stages. In the experimental group, when children regained full consciousness following the general anesthesia, they were assessed instantly on several criteria: the recovery of coughing and swallowing reflex, no nausea and vomiting, muscle strength returned to level V, had a desire for water consumption. Once these criteria were fulfilled, the protocols for oral fluid (water) administration would then be carried out. First, the child’s lips and mouth would be wet with 1–5 ml water. Then, the head of the child would be turned to one side and the child would be given water to drink by a systemically trained anesthesiologist or nurse. Depending on the condition of the child, drinking through a straw or with an empty needle involved a small amount of water to be injected into the mouth several times. The child would be observed closely for any discomfort such as choking or coughing. If there was no discomfort, the remaining water would then be injected slowly into the mouth, or the child would be encouraged to drink him/herself. In the control group, similar criteria were assessed before children were allowed to drink a small amount of water at 4 to 6 hours after surgery.

The inclusion criteria were
children aged 3–12 years old undergoing elective tonsil operation; ASA class I-III; fulfilled the criteria for oral fluid administration as outlined above. Analgesics were administered over 20 minutes.

**The exclusion criteria were**

Sick children with bleeding, dysphagia, nausea and vomiting, or needing active resuscitation in the Post-anesthesia Care Unit (PACU).

### 1.3 Observation Indicators

After drinking water, patients were observed closely for at least 20 minutes for complications including cough, aspiration, nausea and vomiting. The effect of thirst relief was then assessed on children of over 5 years old using the self-rating thirst scale, which involved the children using the 0-100 mm verbal numeric scale (0 = not thirsty − 100 = very thirsty) according to their thirst level.

### 1.4 Statistical Analysis

SPSS 23.0 was used for statistical analysis. The chi-square test was used to analyze categorical data, whereas the t-test was used for continuous data. A *P*-value of < 0.05 was considered statistically significant.

### 2 Results

#### 2.1 Patient demographics between the two groups

A total of 300 patients were recruited into our study for randomization. However, 15 of these refused to drink water, 12 were lost to follow-up and 5 data was incomplete and couldn't be verified. Therefore, a total of 268 cases were included in the analyses. Of these, 138 patients were in the experimental group and 130 were in the control group (Fig. 1), with the age ranged 3–12 years old. The amount of water consumed was less than 1 ml/ kg body weight, approximately 13.56 ± 19.82 ml in the experimental group. The demographics of patients were compared (Table 1) which showed no statistical difference (*P* > 0.05) between the experimental and control groups.
Table 1  
Comparison of demographic data between the experimental and control groups

| Items                           | Experimental group | Control group | P-Value |
|---------------------------------|--------------------|---------------|---------|
| Age (year), mean ± SD           | 5.76 ± 2.09        | 5.87 ± 1.96   | 0.663   |
| Gender(n,%)                     |                    |               | 0.807   |
| Male                            | 73(52.9)           | 65(47.1)      |         |
| Female                          | 71(54.6)           | 59(45.4)      |         |
| Weight(Kg), mean ± SD           | 22.11 ± 8.92       | 22.44 ± 7.74  | 0.751   |
| Preoperative fasting time(h), mean ± SD | 10.34 ± 2.57   | 10.43 ± 2.56  | 0.765   |
| Anesthesia time(min), mean ± SD | 68.33 ± 22.80      | 66.73 ± 21.83 | 0.558   |
| Time of operation(min), mean ± SD | 34.79 ± 14.22    | 34.97 ± 17.42 | 0.926   |
| Intraoperative infusion volume(ml), mean ± SD | 190.25 ± 120.79 | 188.58 ± 134.53 | 0.914 |
| ASA classification(n,%)         | 7(5.1)             | 5(3.8)        | 0.966   |
| †                               | 127(92.0)          | 123(94.6)     |         |
| ‡                               | 4(2.9)             | 2(1.5)        |         |

2.2 Comparison of the use of peri-operative anesthetic drugs between the two groups

The use of atracurium was significantly higher in the control group compared with the experimental group (P = 0.02). There was no other statistically significant difference between the two groups in the use of perioperative anesthesia drugs as shown in Table 2.
Table 2
Comparison of the anesthetic drugs used between two groups

| Items                                      | Experimental group (N = 138) | Control group(N = 130) | P-Value |
|--------------------------------------------|------------------------------|------------------------|---------|
|                                            | n(%)                         | n(%)                   |         |
| Fentanyl                                   | 122(88.4)                    | 113(86.9)              | 0.715   |
| Sufentanil                                 | 13(9.4)                      | 20(15.4)               | 0.192   |
| Remifentanil                               | 24(17.4)                     | 30(23.1)               | 0.287   |
| Sevoflurane                                | 137(99.3)                    | 126(96.9)              | 0.202   |
| Atracurium                                 | 111(80.4)                    | 118(90.8)              | 0.023   |
| Propofol                                   | 127(92)                      | 115(88.5)              | 0.410   |
| Dexmedetomidine                            | 80(58.0)                     | 67(51.5)               | 0.326   |
| Atropine                                   | 80(58.0)                     | 66(50.8)               | 0.270   |
| Tramadol                                   | 56(40.6)                     | 59(45.4)               | 0.460   |
| Lidocaine                                  | 9(6.5)                       | 15(11.5)               | 0.199   |
| Ondansetron hydrochloride tablets          | 120(87.0)                    | 122(93.8)              | 0.065   |
| Midazolam                                  | 120(87.0)                    | 106(81.5)              | 0.243   |
| Granisetron                                | 5(3.6)                       | 5(3.8)                 | 1.000   |
| Dexamethasone                              | 102(73.9)                    | 96(73.8)               | 1.000   |
| Neostigmine                                | 6(4.3)                       | 3(2.3)                 | 0.502   |
| Hemocoagulase Bothrops Atrox for Injection | 46(33.3)                     | 43(33.1)               | 1.000   |
| Penehyclidine                              | 2(1.4)                       | 2(1.5)                 | 1.000   |

2.3 Comparison of the incidence of nausea and vomiting between the two groups

There was no incidence of aspiration in this study. There was no significant difference in the incidence of nausea and vomiting between the two groups before and after oral fluid consumption at the PACU, or in the ward ($P > 0.05$). However, we observed incidences of nausea and vomiting occurred in the control group in the ward, but this difference did not reach statistically significant ($P = 0.054$). (Table 3)
Table 3
Comparison of incidence of nausea and vomiting between two groups

| Items                                                                 | Experimental group (N = 138) | Control group (N = 130) | P-Value |
|-----------------------------------------------------------------------|------------------------------|-------------------------|---------|
| Incidence of nausea at PACU, n(%)                                     |                              |                         |         |
| Before drinking at the PACU                                           | 0                            | 2(1.5)                  | 0.234   |
| 20 minutes after drinking at PACU                                      | 2(1.4)                       | 3(2.3)                  | 0.676   |
| Incidence of nausea at PACU, n(%)                                     |                              |                         |         |
| Before drinking at the PACU                                           | 0                            | 0                       |         |
| 20 minutes after drinking at PACU                                      | 1(0.7)                       | 1(0.8)                  | 1.000   |
| Nausea and vomiting before returning to the ward for food, n (%)      | 0                            | 1(0.8)                  | 0.485   |
| Nausea after eating in the ward, n (%)                                | 0                            | 4(3.1)                  | 0.054   |
| Vomiting after eating in the ward, n (%)                              | 0                            | 3(2.3)                  | 0.113   |
| Nausea and vomiting occurred 24 hours after surgery                   | 3(2.2)                       | 2(1.5)                  | 1       |

2.4 Comparison of thirst scores between the two groups of children over 5 years old

There were 189 children of over 5 years old in our study (Table 4). There was no significant difference (P > 0.05) in the thirst score before oral fluid was given in the PACU. However, the thirst score in the experimental group after 20 minutes of oral fluid consumption in the PACU was significantly lower compared with the control group (P = 0.001).

Table 4
Comparison of thirst scores between the two groups of children over 5 years old (n = 189)

| Items                              | Experimental group (N = 92) | Control group (N = 97) | P-Value |
|------------------------------------|----------------------------|------------------------|---------|
| The child was awake in the PACU    | 46.85 ± 40.43              | 43.20 ± 35.72          | 0.660   |
| 20 minutes after drinking at PACU  | 36.52 ± 36.30              | 54.64 ± 34.79          | 0.001   |

3 Discussion

Pediatric patients undergoing tonsil surgery are usually allowed to only start oral intake gradually at 6 hours after recovering from the general anesthesia. The types of oral intake include ice drinks, such as ice...
milk and pure ice cream without impurities which help to relieve pain and reduce the risk of bleeding. Fruit and juice are advised to avoid because these contain fruit acids, which may cause pain and affect wound healing by stimulating the wound\textsuperscript{[9]}. After tonsillectomy, children are usually advised to stay quietly in bed, speak little, and do not cough forcefully to prevent bleeding. Some scholars believe that children should drink ice fluid on the day after surgery\textsuperscript{[10]}. In our study, the mineral water under normal room temperature was given to the children in the early phase of recovery from general anesthesia in the experimental group following tonsil surgery. We did not observe any adverse events such as bleeding and there was no increase in the incidence of nausea or vomiting. Our data suggested that early administration of oral fluid after general anesthesia for tonsil surgery is safe.

The most common symptoms after tonsillectomy are wound pain and pain upon swallowing. Some children also experience nausea and vomiting. The routine use of intravenous dexamethasone in this setting has been reported to reduce the incidence of vomiting from 27–11\%\textsuperscript{[11]}. In our study, 73.8\% of the children received dexamethasone intraoperatively, and the incidence of nausea and vomiting after the administration of oral fluid following the general anesthesia was only 0.7\%. Such a low incidence of nausea and vomiting in our study may be related to the intraoperative use of dexamethasone and antiemetic drugs.

Chen xiaoping et al.\textsuperscript{[12]} reported that the time of eating after general anesthesia in non-abdominal surgery should be determined by the extend of the operation, the method of anesthesia, and the children's reaction. For the body surface or limb surgery, the body reaction is relatively mild. Patients may not eat if they are still under the influence of anesthesia causing nausea and vomiting. Hence, patients can usually eat when they have fully recovered from the anesthesia that their nausea and vomiting have subsided. In the ambulatory surgical setting, a study\textsuperscript{[13]} has demonstrated that there was no statistically significant difference in the incidence of nausea and vomiting within 24 hours after minor surgery between the drinking and the non-drinking group. Another study\textsuperscript{[14]} showed that among pediatric patients undergoing adenotonsillectomy, there was a significantly higher incidence of emesis when patients were encouraged to drink compared to patients who drank voluntarily, with the incidence of emesis escalated in both groups when the target volume of 240 ml was reached. Further studies have also reported that early oral fluid administration in adult patients undergoing non-gastrointestinal surgery was safe with patients experiencing lower thirsty and oropharyngeal discomfort scales\textsuperscript{[15]}, and early postoperative oral hydration in small quantity in children is feasible without increasing the incidence of nausea, vomiting, choking and aspiration\textsuperscript{[16]}. Our study has further emphasized that early administration of oral fluid is feasible, safe, and associated with reduced incidence of postoperative nausea and vomiting in children who has the desire to drink. Such feasibility and safety observed were most likely because of our stringent criteria in the patient assessment before allowing oral fluid and close supervision and observation of fluid intake in the early phase.

There were some limitations to this study. We did not study the optimal amount of fluids allowed after tonsil surgery. Furthermore, there was no blinding in assessing the nausea/vomiting. Moreover, the long-
term efficacy of a small amount of water for children undergoing tonsil surgery has not yet been
determined, and further studies were needed.

4 Conclusion

In conclusion, the early administration of a small amount of oral fluid in children undergoing tonsil
surgery and recovering from the general anesthesia is not only safe but also effective in reducing
postoperative thirst. It is safe and feasible to drink a little water after the recovery of cough swallowing
reflex and muscle strength.

Declarations

Ethics approval and consent to participate: Ethical approval was obtained from the Biomedical Ethics
Committee of West China Hospital of Sichuan University (2017 Review No. 231), and written informed
consent was obtained from all family members of the sick children, with the trial registration number
ChiCTR1800020058, the date of registration (12-12-2018), and which results were reported adhered to
CONSORT guidelines.

Consent to publish: All authors have read and approved the final manuscript to publish.

Availability of data and materials: The data that support the findings of this study are available on
request from the corresponding author. The data are not publicly available due to privacy or ethical
restrictions.

Competing Interest: The authors declare no conflict of interest.

Funding: Not.

Authors' Contributions: MH W and CQ L were involved in the design of this study, data collection, analysis
and interpretation of data, drafting and revising the manuscript. XQi Z and AN J provided help with the
data collection, analysis and interpretation. XR Y made substantive intellectual contributions to the
interpretation of data and draft of the manuscript. The authors had read and approved the final
manuscript.

Acknowledgments: The authors appreciate the 300 research subjects for their devotion and cooperation.

References

[1] Mao Ai-jun, Li li, Wang Xue-ling. Efficacy of adenoidectomy and (or) tonsillectomy treated snoring
disease in children [J]. CHINA MODERN MEDICINE, 2011, 18(13):158-159.
[2] Cai Yun-gan, Wen Tai-pei. Treatment of children snore by tonsillectomy combined with nasal endoscopic-assisted adenoidectomy [J]. Journal of Clinical and Experimental Medicine, 2011, 10(11): 842-843.

[3] Stuck BA, Götte K, Windfuhr JP, Genzwürker H, Schrotten H, Tenenbaum T. Tonsillectomy in Children [J]. Dtsch Arztebl Int, 2008, 105(49): 852-861. doi: 10.3238/arztebl.2008.0852.

[4] Zhong Tai-di. Management of patients in the period of anesthesia recovery [M]. Beijing: people's medical publisher, 2003: 301-331

[5] Liu Hai-jian, Weng Hao, Wang Jian-guang. Effects of dexmedetomidine on emergence agitation after tonsillectomy [J]. J Clin Anesthesiol, 2012, 28(8): 772-774.

[6] Bao Yang, Shi Dong-ping, Feng Wei-zheng. Research progress of restlessness in children with general anesthesia in the wake period [J]. J Clin Anesthesiol, 2010, 26(2): 183-184.

[7] Yang Wen-yan, Wang Chong-qian, Heng Xin-hua. Advances in the study of drug use before anesthesia in children [J]. J Clin Anesthesiol, 2011, 27(9): 931-933.

[8] Fan Hao, Tao Fan, Wan Hai-fang, Luo Hong. A prospective cohort study of the risk factors of emergence agitation in pediatric after general anesthesia [J]. Natl Med J China, 2012, 92(17): 1194-1197.

[9] Yang Feng-mei. Dietary nursing experience after tonsillectomy in children. Journal of psychologists, 2012, 214: 240

[10] Liu Zhi-hong, Liu Xi-wei, Li Yan-zhu. Nursing care after tonsillectomy. Chinese and foreign health abstract, 2012, 361-362.

[11] Bennett A M, Emery P J. A significant reduction in paediatric post-tonsillectomy vomiting through audit [J]. Ann R Coll Surg Engl, 2008, 90(3): 226-230. doi: 10.1308/003588408X261591.

[12] Chen Xiao-ping. Surgery [M]. Beijing: people's medical publisher, 2006: 57.

[13] F Jin, A Norris, F Chung, T Ganeshram. Should adult patients drink fluids before discharge from ambulatory surgery? [J]. Anesth Analg, 1998, 87(2): 306-311. doi: 10.1097/00000539-199808000-00013.

[14] Abtin Tabaei, Jerry W Lin, Vanessa Dupiton, Jacqueline E Jones. The role of oral fluid intake following adeno-tonsillectomy [J]. Int J Pediatr Otorhinolaryngol, 2006, 70(7): 1159-1164. doi: 10.1016/j.ijporl.2005.11.015.

[15] Xiao-rong Yin, Ling Ye, Liang Zhao, Li-sha Li, Jin-ping Song. Early versus delayed postoperative oral hydration after general anesthesia: a prospective randomized trial [J]. Int J Clin Exp Med, 2014, 7(10): 3491-3496.
[16] Yin Xiao-rong, Tan Ling, Liao Yan, Liu Yao, Yin Yan, Guo Li-juan. Feasibility of a small amount of water intake at early stage after general anesthesia in children [J]. Chinese Journal of Anesthesiology, 2012,32(3):282-283.