

Clinical study on postoperative nausea and vomiting in pediatric patients with cleft lip and/or palate. Part 1: assessment of incidence and risk factors

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Abstract

Objectives: The purpose of this study was to evaluate the incidence of and risk factors for postoperative nausea and vomiting (PONV) after cleft-related surgery.

Methods: Forty-six pediatric patients who underwent cleft-related surgery from March to August 2016 were evaluated. The following items were examined: the presence or absence of PONV, age at the time of surgery, body weight at the time of surgery, surgery time (ST), anesthesia time (AT), and method of anesthesia. The presence or absence of PONV was considered an objective variable, and all others were considered explanatory variables.

Results: In total, 10 and 36 patients did and did not develop PONV, respectively, for a 21.7% incidence of PONV. Among boys, 2 and 23 patients did and did not develop PONV, respectively, while among girls, 8 and 13 patients did and did not develop PONV, respectively. The incidence of PONV was significantly higher among girls ($p=0.014$). Significant differences in ST ($p=0.011$) and AT ($p=0.015$) were found between patients with and without PONV. In all patients, the method of anesthesia involved the use of sevoflurane, fentanyl, and remifentanyl. Multiple logistic regression analysis showed that sex (odds ratio, 9.670; 95% confidence interval, 1.489–62.815; $p=0.018$) and ST (odds ratio, 0.955; 95% confidence interval, 0.919–0.993; $p=0.020$) were risk factors for PONV.

Conclusions: The incidence of PONV was 21.7%. All identified risk factors were inevitable, suggesting that preventive treatments using medications might need to be introduced.

Keywords: Pediatric patients, Cleft lip and/or palate, Postoperative nausea and vomiting

Introduction

Postoperative nausea and vomiting (PONV) is a postoperative complication of surgery in children who have undergone general anesthesia. PONV is rare in children aged <3 years, and its frequency in children aged ≥ 3 years is believed to be twice as high as that in adults. Thus, the risk of PONV is considered high in children, especially after particular surgical procedures such as tonsillectomy.^{1,2} However, no previous reports have examined the development of PONV following cleft-related surgery. In the present retrospective study, we evaluated the incidence of and risk factors for PONV following cleft-related surgery under general anesthesia in children.

Methods

Patients

Among pediatric patients who underwent cleft-related surgery under general anesthesia (soft or hard palatoplasty in a two-stage procedure or secondary bone grafting) from March to August 2016, we included 46 patients in the present study (18 underwent soft palatoplasty, 7 underwent hard palatoplasty, and 21

underwent secondary bone grafting). Patients who had received intraoperative dexamethasone and droperidol (medications that are also used for prevention of nausea and vomiting) and patients who received postoperative treatment in the intensive care unit while still intubated were excluded.

Methods

The following items were retrospectively examined using the patients' medical and anesthesia records:

- (1) Presence or absence of PONV
- (2) Sex
- (3) Age at the time of surgery
- (4) Body weight at the time of surgery
- (5) Surgery time (duration of surgery)
- (6) Anesthesia time (duration of anesthesia)
- (7) Method of anesthesia

Statistical analysis was carried out using the statistical software JMP-11 (SAS, Tokyo, Japan), and the PONV and non-PONV groups were compared on the basis of various survey items using the chi-square test or Mann–Whitney U test. For the evaluation of risk factors, the presence or absence of PONV was considered the objective variable, and items (2) to (6) were considered explanatory variables. Variables were selected using a stepwise method with $p=0.2$ as a basis for the addition and removal of variables, and a multiple logistic regression analysis was performed. The level of statistical significance was set at $p=0.05$.

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Table 1 Comparison of survey items between the PONV(-) and PONV(+) groups

Survey items		PONV(-) group	PONV(+) group	p value
Sex	M	23	2	
	F	13	8	0.014
Age at the time of surgery, mos		65.5 (20.0–114.3)	101.5 (52.5–139.3)	0.072
Body weight at the time of surgery, kg		15.8 (10.4–29.7)	23.8 (13.7–34.1)	0.187
Surgery time, min		100.0 (75.3–129.0)	71.5 (61.5–90.5)	0.011
Anesthesia time, min		160.5 (144.5–202.0)	142.5 (124.3–153.0)	0.015

All data except sex are presented as median (interquartile range).
M, male; F, female

Ethical considerations

This study was conducted with adherence to standard clinical practices following approval by the Institutional Review Board of Fujita Health University (No. HM17-100).

Results

In total, 10 and 36 patients did and did not develop PONV, respectively; the incidence of PONV was 21.7%.

The patients comprised 25 boys and 21 girls. A total of 2 and 23 boys did and did not develop PONV, respectively, while 8 and 13 girls did and did not develop PONV, respectively. The rate of PONV was significantly higher among girls (chi-square test, $p=0.014$) (Table 1).

The median (interquartile range) age at the time of surgery, body weight at the time of surgery, surgery time, and anesthesia time in patients without PONV were 65.5 months (20.0–114.3), 15.8 kg (10.4–29.7), 100.0 min (75.3–129.0), and 160.5 min (144.5–202.0), respectively. These values in patients with PONV were 101.5 months (52.5–139.3), 23.8 kg (13.7–34.1), 71.5 min (61.5–90.5), and 142.5 min (124.3–153.0), respectively (Table 1). Significant differences in the surgery time ($p=0.011$) and anesthesia time ($p=0.015$) were found between the two groups (Mann–Whitney U test).

The patients were divided into two groups according to their age at the time of surgery (≥ 3 and < 3 years), and the presence or absence of PONV was compared between the groups. In the ≥ 3 -year age group, 8 and 20 children did and did not develop PONV, respectively. In the < 3 -year age group, 2 and 16 children did and did not develop PONV, respectively. No significant difference was found between the two groups (chi-square test, $p=0.161$).

In terms of the method of anesthesia, sevoflurane was used for anesthesia induction and maintenance, fentanyl was used for anesthesia induction, and remifentanyl was used for anesthesia maintenance in all patients.

Multiple logistic regression analysis was performed to evaluate the risk factors associated with the occurrence of PONV. A stepwise procedure using other survey items against the occurrence or nonoccurrence of PONV showed that sex and surgery time were explanatory variables with odds ratios of 9.670 (95% confidence interval, 1.489–62.815; $p=0.018$) and 0.955 (95% confidence interval, 0.919–0.993; $p=0.020$), respectively. Sex (girls versus boys) and surgery time were identified as risk factors (Table 2).

Discussion

In 2014, the Society for Ambulatory Anesthesiology (SAMBA) published guidelines for the prevention and treatment of PONV

Table 2 Multiple logistic regression analysis for determination of risk factors associated with postoperative nausea and vomiting

Survey items	Odds ratio	95% confidence interval	p value
Sex	9.670	1.489–62.815	0.018
Surgery time	0.955	0.919–0.993	0.020

(SAMBA guidelines); they presented an algorithm consisting of risk assessment, basic risk reduction, prevention, and treatment and showed the importance of risk assessment and preventive treatment.³

Eberhart et al.⁴ previously reported that the risk factors for the occurrence of POV in children included an age of ≥ 3 years, surgery time of ≥ 30 min, surgery for correction of strabismus, and a personal history of PONV. They stated that in the presence of all three risk factors, the predicted incidence of POV was 50%. With respect to the reason why PONV was higher in children aged ≥ 3 years, the authors considered that younger patients often cannot describe feelings of retching or nausea and that mental factors are affected more strongly with maturation. We considered that the reason why the incidence of PONV was not significantly different between the two groups in the present study was that we only included children who underwent cleft-related surgery under general anesthesia.

We conducted literature searches in PubMed and Ichushi Web using the following search terms: “child,” “cleft palate,” “postoperative vomiting,” and “postoperative nausea and vomiting.” We found no reports on cleft-related surgery from 2000 to 2017. In addition to tonsillectomy, other surgical operations in the fields of gynecological surgery, digestive surgery, maxillofacial surgery, neurosurgery, and urological surgery are also believed to be associated with an elevated risk of PONV.^{3,5}

Because cleft-related surgery is included in the field of maxillofacial surgery and the operated region is located near the palatine tonsils, cleft-related surgery has been assumed to be high-risk. However, the incidence of PONV in the present study was 21.7%, which is lower than that reported in previous studies^{6–8}; in those studies, the incidence of PONV following tonsillectomy under general anesthesia ranged from 36.4% to 88.9%. The reason why the incidence of PONV was lower in cleft-related surgery than in tonsillectomy was thought to be related to the fact that hypopharyngeal gauze packing in cleft-related surgery prevented blood from falling to the stomach.

In terms of the method of anesthesia, the use of volatile anesthetics, nitrous oxide, and opioids is believed to increase the risk of PONV. Total intravenous anesthesia using propofol is recommended³; however, administering propofol to children may lead to propofol infusion syndrome. Therefore, propofol must be carefully administered.⁹ In children, slow induction of anesthesia

is often performed, and in the present study, sevoflurane was used for introduction and maintenance of anesthesia in all patients. Rapid induction of anesthesia is impossible in some children, and the use of volatile anesthetics may be inevitable.

In previous studies,^{1,10} sex and surgery time were reported to be risk factors for PONV in children undergoing general anesthesia.

The SAMBA guidelines show that risk factors can be reduced by selecting the prevention of PONV as the first choice of treatment.³ However, sex as a patient-related risk factor and surgery time as a surgical risk factor are difficult to avoid or reduce.

For hard palatoplasty and secondary bone grafting, which are cleft-related surgeries performed after the age of 3 years, patients with two of the risk factors for POV in children described by Eberhart et al.⁴ (namely an age of ≥ 3 years and a surgery time of ≥ 30 min) were considered the high-risk group. However, the risk was difficult to reduce in patients with both factors, suggesting that preventive treatments through administration of medications in accordance with the SAMBA guidelines will need to be introduced to suppress the occurrence of PONV.

This study has some limitations. First, the types of surgery were confined to cleft-related surgery (soft and hard palatoplasty in a two-stage procedure and secondary bone grafting). Second, the most appropriate times for surgery were decided by age; each surgery was performed from 1.5 to 2 years, at about 5 years, and from 8 to 10 years of age, respectively. Additionally, the surgery times were approximately constant, becoming longer in the order of hard palatoplasty, secondary bone grafting, and soft palatoplasty. Third, the surgery and anesthesia times and the age and body weight at the time of surgery had strong correlations; therefore, we cannot deny the possibility of confounding bias. In the multiple logistic regression analysis, sex and surgery time were thus extracted as risk factors using a stepwise method. Sex was the independent factor because it was thought that the clinical significance of the surgery time was low.

Conflict of Interests

The authors declare no conflicts of interest related to this article.

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