

The Effect of a Parental Visitation Program on Emergence Delirium Among Postoperative Children in the PACU

WooYoung In, MPH, RN, Young Man Kim, MSN, RN, Hee Soon Kim, PhD, RN, FAAN, SeoHee Hong, MSN, RN, YuRi Suh, MSN, RN, Yerin Cha, BSN, RN, Naeun Kim, BSN, RN, JongWon Kim, BSN, RN, HyunJi Kang, BSN, RN, HyoEun Kwon, BSN, RN, YangSoo Kim, MPH, RN, Wyunkon Park, MD

Purpose: *The purpose of this study was to examine the effects of parental presence on the incidence of emergence delirium (ED) of children in the postanesthesia care unit (PACU).*

Design: *A quasi-experimental pretest and post-test study with nonequivalent and nonsynchronized control groups.*

Methods: *About 93 children aged 3 to 6 years undergoing general anesthesia for tonsillectomy were divided into two groups: parental presence and absence. ED was recorded using the Pediatric Anesthesia Emergence Delirium Scale at 0, 10, 20, and 30 minutes after PACU admission.*

Findings: *ED score at each time point in the experimental group was lower than the control group, but not statistically significant. ED score in the experimental group significantly decreased over time ($F = 6.98$; $P = .010$).*

Conclusions: *Parental visitation programs could be effective on the degree of ED in children in the PACU setting. This result may contribute to the establishment of PACU visitation program policy in South Korea.*

Keywords: *emergence delirium, parental visitation program, perioperative nursing, PACU.*

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WooYoung In, MPH, RN, Postanesthesia Care Unit, Nursing Team for Perioperative Care, Severance Hospital, Seoul, Republic of Korea; Young Man Kim, MSN, RN, Department of Nursing, Graduate School, Yonsei University, Seoul, Republic of Korea; Hee Soon Kim, PhD, RN, FAAN, Mo-Im Kim Nursing Research Institute, College of Nursing, Yonsei University, Seoul, Republic of Korea; SeoHee Hong, MSN, RN, Postanesthesia Care Unit, Nursing Team for Perioperative Care, Severance Hospital, Seoul, Republic of Korea; YuRi Suh, MSN, RN, Postanesthesia Care Unit, Nursing Team for Perioperative Care, Severance Hospital, Seoul, Republic of Korea; Yerin Cha, BSN, RN, Postanesthesia Care Unit, Nursing Team for Perioperative Care, Severance Hospital, Seoul, Republic of Korea; Naeun Kim, BSN, RN, Postanesthesia Care Unit, Nursing Team for Perioperative Care, Severance Hospital, Seoul, Republic of Korea; JongWon Kim, BSN, RN, Department of Nursing, Severance Cardiovascular Hospital, Seoul, Republic

of Korea; HyunJi Kang, BSN, RN, Postanesthesia Care Unit, Nursing Team for Perioperative Care, Severance Hospital, Seoul, Republic of Korea; HyoEun Kwon, BSN, RN, Postanesthesia Care Unit, Nursing Team for Perioperative Care, Severance Hospital, Seoul, Republic of Korea; YangSoo Kim, MPH, RN, Perioperative Care Team, Severance Hospital, Seoul, Republic of Korea; and Wyunkon Park, MD, Department of Anesthesiology and Pain Medicine, Yonsei University College of Medicine, Seoul, Republic of Korea.

Conflict of interest: None to report.

Address correspondence to Young Man Kim, 50-1 Yonsei-ro, Seodaemun-gu, Seoul 03722, Republic of Korea; e-mail address: 0100002@yuhs.ac or kym010000@gmail.com.

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EMERGENCE DELIRIUM (ED) that occurs in the recovery room after general anesthesia threatens patient safety and is an important issue. ED appears in all ages after general anesthesia; the elderly are especially susceptible, even after intravenous sedation. The incidence of ED is 12% to 31% and occurs three to eight times more frequently in children than adults.¹⁻³

ED has been described as a dissociated state of consciousness in which a child is inconsolable, irritable, uncompromising or uncooperative, typically thrashing, crying, moaning and incoherent.⁴ Children experiencing ED are restless, at risk for safety accidents including falls that may cause self-injury, their dressings or surgical sites may be disrupted, and indwelling devices may become dislodged.^{2,5} ED usually occurs within the first 10 minutes after awakening and lasts for 15 to 30 minutes. It is mostly decreased after 30 minutes, requiring extra attention and nursing care.⁶

Factors affecting pediatric delirium after general anesthesia include rapid awakening from anesthesia, postoperative pain, poor adaptability, young age, use of sevoflurane, large blood loss during surgery, no previous surgery, use of analgesics, preoperative anxiety, and family separation anxiety.^{2,7-9} In particular, drugs used to induce general anesthesia increase the incidence of delirium, so nonpharmacologic preventive interventions are required.

Nonpharmacologic interventions to prevent delirium and decrease anxiety have been suggested and include providing information, postoperative acupressure, and providing a familiar environment with family present.^{1,6,10} In the United States, children younger than 12 years in the postanesthesia care unit (PACU) have the emotional support of parents at their request.¹¹ However, in Korea, family visitation is restricted because of hospital infection prevention regulations. Also, visitation is inconsistently permitted by health care staff and limited by regulations in most countries.

Despite many health care restrictions on visits to the PACU,¹² family visitation has consistently been associated with reduced family anxiety and improved patient and parent satisfaction.¹³⁻¹⁵ However, previous studies have shown inconsistent results with respect to parental visitation interventions

on ED in children.^{3,6} These studies also lack information on experimental treatments related to anesthesia, which is known to be the primary cause of ED.^{3,6} Therefore, this study is to identify the effect of a parental visitation program on the degree of ED, after controlling the anesthesia protocol.

Purpose and Hypotheses

The purpose of this study was to evaluate the effectiveness of a PACU parental visitation program on the degree of ED after undergoing general anesthesia.

Hypothesis 1

The degree of ED in the experimental group will be less than that in the control group at 10, 20, and 30 minutes after admission to the PACU.

Hypothesis 2

In the experimental group, the degree of ED will be less than in the control group by time.

Methods

Study Design

A quasi-experimental study with a nonequivalent and nonsynchronized control group, and pretest and post-test design, was conducted from August 2015 to February 2016. Experimental group data were collected after completion of control group data collection to prevent contamination of the experimental treatment and in consideration of ethical issues (Figure 1).

Setting and Participants

This study was conducted in a 21-bed PACU at Severance hospital in South Korea, which is a tertiary hospital and has 2,100 beds. The average number of surgeries per day is more than 150, and patients from 40 operating rooms are admitted to the PACU for recovery. The ratio of PACU nurses to patients is 1:2 to 1:3.

The inclusion criteria for the study were as follows: (1) 3- to 6-year-old children, (2) who had undergone tonsillectomy by general anesthesia,

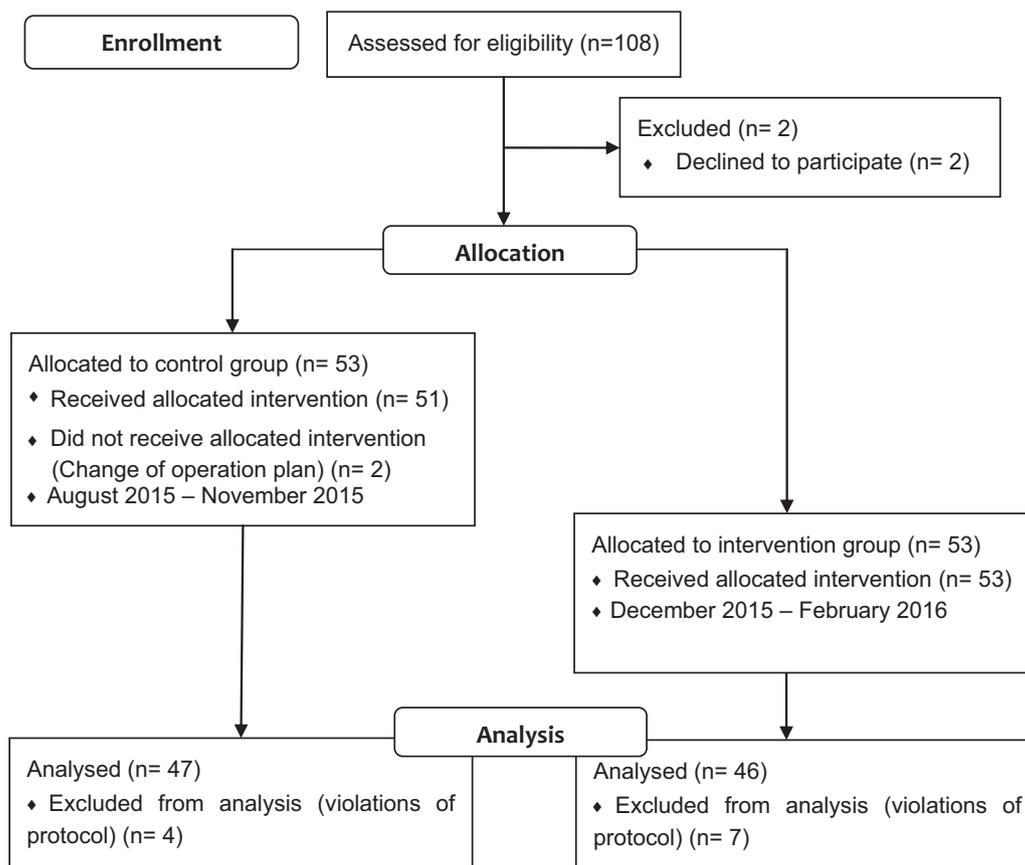


Figure 1. Flow diagram of this study.

(3) patients with elective surgery, (4) American Society of Anesthesiologists Physical Status I or II, and (5) the presence of one parent in the PACU. Children with mental retardation, neurologic comorbidities, or parents who could not read or understand the informed consent were excluded.

The sample size for this study was calculated using the G*Power 3.1.6 program (University of Düsseldorf). In a previous study,⁶ the effect size was set at 0.5 for comparing two groups. However, because this study was more homogeneous than previous studies as subject age was narrower, all children had the same surgery and were treated with the same protocol during anesthesia. In this two-tailed study, the effect size was set at 0.6, significance level was set at .05, and power was set at 0.8. The sample size recommended was 45 in each group. Fifty-four subjects were recruited for the experimental group and 54 subjects for

the control group for a total of 108 subjects, considering an expected dropout rate of 20%. Two subjects withdrew consent, 2 withdrawals were due to a change in operation plan, and 11 subjects who violated the anesthesia protocol were also excluded. The final analysis included 46 in the experimental group and 47 in the control group (Figure 1).

Measures

DEGREE OF DELIRIUM. The degree of delirium was measured using the Pediatric Anesthesia Emergence Delirium Scale developed by Sikich and Lerman.¹⁶ The Pediatric Anesthesia Emergence Delirium Scale is a five-item, five-point scale (0 to 4) developed to evaluate the degree of delirium immediately after surgery in children aged 18 months to 6 years. Total score is 20 points, with a higher score indicating that delirium was severe. Observation items consisted of five

behaviors: the child makes eye contact with the medical staff, the child's actions are purposeful, the child is aware of his and/or her surroundings, the child is restless, and the child is inconsolable. The Cronbach's α for the original tool was 0.84, and the Cronbach's α for the present study was 0.83.

PREOPERATIVE ANXIETY. The degree of anxiety before anesthesia induction was assessed using the Pediatric Anesthesia Behavior score developed by Beringer et al.¹⁷ This three-point scale was developed to evaluate the behavior of 2 to 12 years old. If the patient was quiet and controllable and complied with anesthesia induction, he or she was scored with one point (happy). If crying or avoiding, but complying with induction of anesthesia, he or she was scored with two points (sad). If the child resisted in a loud voice or resisted anesthesia induction such that physical control by the medical staff or parents was required, he or she was scored with three points (mad).

GENERAL AND SURGERY-RELATED CHARACTERISTICS OF PATIENTS AND PARENTS.

General participant characteristics included gender, age, height, and weight. Surgery-related characteristics included American Society of Anesthesiologists Physical Status classification, history of general anesthesia, total anesthesia time, total operation time, the use of opioids, and nonopioid analgesics in the PACU. Data were obtained from the electronic medical record (EMR). General parent characteristics included: age, primary caregiver, education level, and occupation.

Interventions

INTERVENTION PROTOCOL. The parent visitation program provided to the experimental group consisted of preoperative structured education and parent visitation. The researcher visited the ward and provided the education program from 5 to 9 p.m. on the day before surgery in the relevant location: single room or the ward consultation room. The teaching method and time were provided for 10 minutes using an iPad tablet (Apple Inc. Cupertino, CA) slide lecture in the consultation room of the ward. The detailed education contents were

as follows: (1) information on the environment (parent's waiting room, anesthesia preparation room, operating room and PACU, and visual information), (2) infection prevention education (dressing for visitation, including disposable visitor gowns, masks, caps, and hand hygiene), (3) information on pediatric delirium (definition and incidence), and (4) allowable actions in the PACU (when the child is asleep and awake).

The parent visitation program provided the main parent with guidance for staying with the patient while asleep and when he or she awakens; the patient can feel the parent's presence through name calling or physical touch in the PACU after the operation. Parent caregiver allowable actions in the PACU included physical touches such as calling a name, holding hands, and stroking or hugging. If the child showed delirium symptoms, the parent informed the nurse in charge, and the nurse offered medical treatment quickly per each patient's specific condition.

The control group received usual care in the PACU for 30 minutes without a parent according to the existing guidelines of Severance Hospital. After 30 minutes of admission in the PACU, when data collection for the control group was completed, parents could be with their child in the PACU. We provided education for the control group parents using the pamphlet from the experimental group.

The parent caregiver in both the experimental and control groups was required to wear a disposable visitor gown, a mask, operating room slippers, and perform thorough handwashing for infection control when entering PACU. The experimental treatment was also performed in a separate space in the PACU to provide an independent experimental environment that did not compromise the privacy of other parents.

To test the validity of the structured education program, content validity evaluation was done by five experts, including one PACU manager with a master's degree, one PACU manager with a doctoral degree, and three nurses with more than 10 years of experience in PACU, with a content validity index = 1.0. The researchers rehearsed on the day before the operation to provide the explanations to parents and provide

consistent education and explanations. Two researchers independently observed and measured patient behavior with the nurse in charge in the waiting room for anesthesia and the PACU.

ANESTHESIA AND ANALGESIC MEDICATION PROTOCOL. Anesthesia methods and analgesics used for general anesthesia were standardized and performed in cooperation with an anesthesiologist. For anesthesia induction, glycopyrrolate 0.004 mg/kg, propofol 2 mg/kg, atracurium 0.5 mg/kg, fentanyl 1.5 mcg/kg, and desflurane were administered. Within 30 minutes of operation termination, ondansetron 0.1 mg/kg, propacetamol 20 mg/kg, neostigmine 0.02 mg/kg, and glycopyrrolate 0.004 mg/kg for reversal were administered.

Data Collection

The study was approved by the institutional review board of Severance Hospital (institutional review board no. 4-2015-0517). The data collected included a patient questionnaire, observation of patient behavior, and medical records from the EMR. Data collection was done in the anesthesia waiting room and PACU on the day of surgery.

To minimize researcher bias, pre-education and training were conducted. For data collection, every day at 4:00 p.m., the researchers confirmed study participants with the EMR on the day before the operation and visited the otolaryngology ward to explain information about the parental visitation program to the parent caregiver. After explaining about the study, researchers obtained voluntary written consent from the parents.

General characteristics of the parents were collected by questionnaires in the operation waiting room after patient admission to the operating room; anxiety reactions were observed in the waiting room before anesthesia induction. Patient delirium levels were measured at 0, 10, 20, and 30 minutes after admission to the PACU.

Data Analysis

Data analysis was performed using SPSS (version 23.0, IBM Corp, Armonk, NY). The specific analysis methods were as follows:

1. Independent *t* tests, χ^2 test, and Fisher exact test were used to test for homogeneity.

2. Analysis of covariance was used to test the difference between two groups because gender was the covariate.
3. The difference in delirium between groups by time was analyzed using repeated-measures analysis of variance and generalized estimating equations (GEE).
4. Because there was a correlation between the measurement points, additional GEE analysis was performed. About 10, 20, and 30 minutes after admission in the PACU (baseline), correlation gradually decreased. Autoregressive correlation was used to evaluate change in child delirium by time point.¹⁸

Results

Homogeneity Testing

Demographic and clinical characteristics of patients were similar between experimental and control groups except on gender. There was a significant difference in gender ratio ($P = .045$) between two groups. The general characteristics of parents were homogenous. In addition, delirium scores at PACU admission were no different ($P = .271$) between the experimental (10.2 ± 3.6) and control groups (11.0 ± 3.9) (Table 1).

Hypotheses Testing

The delirium score for the experimental group was 6.28 and the control group was 6.32. The delirium score of the experimental group was slightly lower, but there was no statistically significant difference ($P = .558$). Twenty minutes after admission, the delirium scores were 3.7 in the experimental group and 4.7 in the control group. After 30 minutes, the scores were 2.7 in the experimental group and 3.4 in the control group. The delirium scores for the experimental group were lower than the delirium scores in the control group at every point; however, there was no statistically significant difference (Table 2). Hypothesis 1 was not supported.

Delirium scores were significantly different by time ($P = .001$) and gender ($P = .017$). The difference between the two groups ($P = .091$) and the interaction between group and time (linear) ($P = .876$) were not significant. However,

Table 1. Characteristics and Homogeneity of Experimental and Control Groups (*n* = 93)

Characteristics	Categories	Experimental Group (<i>n</i> = 46), <i>n</i> (%)	Control Group (<i>n</i> = 47), <i>n</i> (%)	χ^2 or <i>t</i>	<i>P</i>
		M ± SD			
Gender	Male	31 (67)	22 (47)	4.02	.045*
	Female	15 (33)	25 (53)		
Age (y)		4.9 ± 0.9	5.0 ± 1.0	-0.44	.665
Height (cm)		112.4 ± 7.3	113.7 ± 9.1	-0.80	.427
Body weight (kg)		20.8 ± 3.4	22.0 ± 5.4	-1.34	.185
ASA	1	37 (80)	36 (77)	0.20	.652
	2	9 (20)	11 (23)		
PAB	1	25 (54)	35 (74)	4.79	.091
	2	12 (26)	5 (11)		
	3	9 (20)	7 (15)		
Experience of anesthesia	Yes	2 (4)	1 (2)		.617 [†]
	No	44 (96)	46 (98)		
Duration of surgery (min)		45.0 ± 17.1	39.8 ± 18.2	1.42	.159
Duration of anesthesia (min)		66.9 ± 16.2	62.4 ± 16.1	1.35	.182
PAEDS [‡] on admission		10.2 ± 3.6	11.0 ± 3.9	-1.11	.271
Parents	Mother	42 (91)	43 (91)	0.01	.631
	Father	4 (9)	4 (9)		
Age of parent (y)		36.7 ± 3.3	37.5 ± 4.4	-1.07	.287
Primary caregiver	Mother	40 (87)	42 (89)	0.15	.928
	Father	1 (2)	1 (2)		
	Other	5 (11)	4 (9)		
Education level	High school	5 (11)	9 (19)	1.25	.264
	University	41 (89)	38 (81)		
Occupation	Yes	25 (54)	19 (40)	1.81	.179
	No	21 (46)	28 (60)		

M, mean; SD, standard deviation; ASA, American Society of Anesthesiologists; PAB, Pediatric Anesthesia Behavior score; PAEDS, Pediatric Anesthesia Emergence Delirium Scale.

**P* < .05.

[†]Fisher exact test.

[‡]PAEDS on admission means that the homogeneity of variance for the dependent variable at baseline was tested.

the mean delirium score by time increment was not linear, but quadratic or cubic curve. The cubic curve showed that there was a significant difference by time increment (*P* = .010) as presented in [Figure 2A](#) and [Table 3](#).

As a result of GEE analysis, the effects of treatment ($\beta = -1.00$; *P* = .048), gender ($\beta = 1.35$; *P* = .009), and time ($\beta = -2.51$; *P* < .001) were statistically significant ([Table 4](#)). In addition, the results of GEE in gender subgroup analysis showed

Table 2. PAEDS Differences Between the Experimental and Control Groups After Parent Visitation Program (*n* = 93)

Characteristics	Categories (min)	Experimental Group (<i>n</i> = 46)	Control Group (<i>n</i> = 47)	<i>F</i>	<i>P</i>
		M ± SD			
PAEDS	10	6.3 ± 3.4	6.3 ± 3.3	0.35	.558
	20	3.7 ± 2.4	4.7 ± 3.1		
	30	2.7 ± 2.3	3.4 ± 2.7		

PAEDS, Pediatric Anesthesia Emergence Delirium Scale; M, mean; SD, standard deviation.

Analyses using analysis of covariance models were adjusted for gender and baseline PAEDS score.

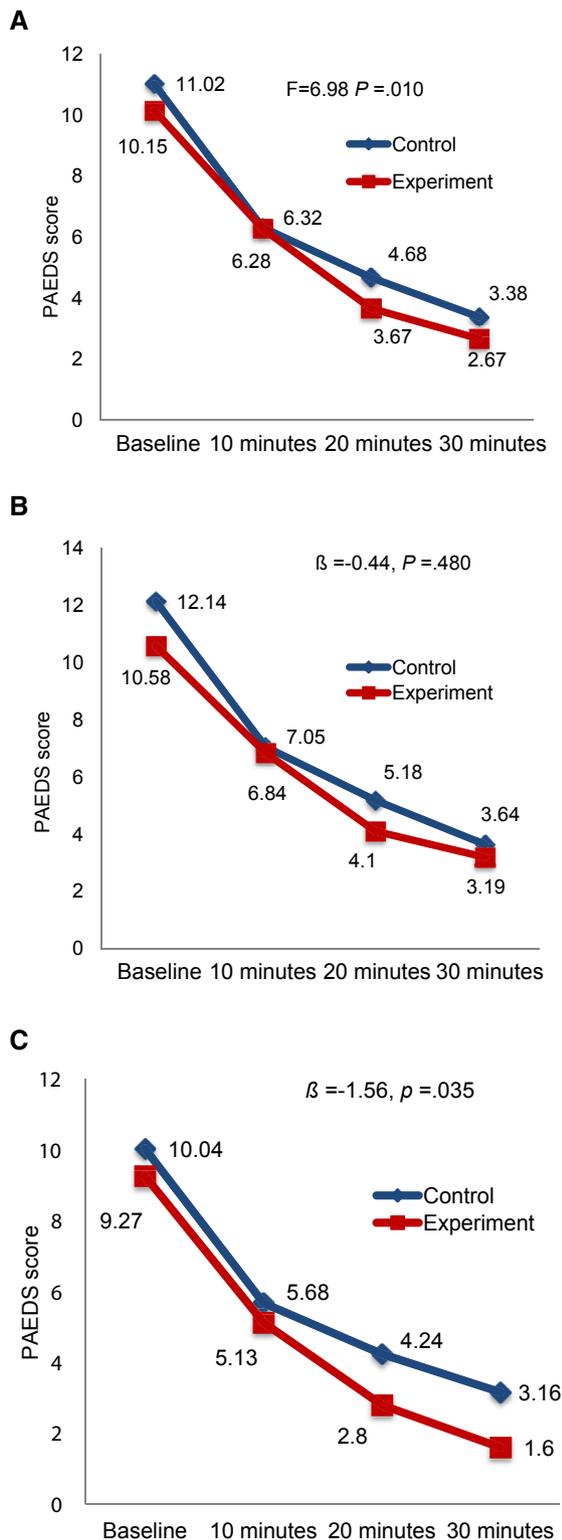


Figure 2. Mean plots of PAEDS scores in experimental versus control groups. (A) PAEDS score by treatment and time. (B) PAEDS scores of male partic-

that the delirium scores for both boys and girls in both groups decreased significantly over time. The treatment effect for the boys was not significant ($\beta = -0.44; P = .480$), but it was statistically significant for girls ($\beta = -1.56; P = .035$) (Figure 2).

In conclusion, the hypothesis that delirium score would be decreased over time in the experimental group was partially supported.

Discussion

This is the first study to evaluate the effect of parental visitation on reduction of ED in children after controlling for the general anesthesia protocol. There was no statistically significant difference in the degree of delirium after 10, 20, and 30 minutes between the experimental and control groups. However, the degree of delirium was significantly decreased in the experimental group as time passed. Especially, there was a statistically significant difference in the case of girls, but not boys in the experimental group as time passed.

There were two studies that provided similar parental visitation. In the study by Burke et al,³ there was no significant differences in the ED incidence and duration of ED in pediatric patients between the two groups, although the duration of ED in the experimental group was lower than the control group. The results were similar to the results of this study, where ED scores were lower in the experimental group than in the control group. On the other hand, the study by Yoo et al⁶ reported that ED for the experimental group was significantly lower than the control group at 10 and 30 minutes. These results suggested that parental visitation could be effective on ED. Moreover, the change of ED score over time was effective in this study and consistent with the previous study.⁶

In a previous study on differences between degree of preoperative separation anxiety and delirium in

ipants by treatment and time. (C) PAEDS scores of female participants by treatment and time. Estimated marginal means were used for mean plots. PAEDS, Pediatric Anesthesia Emergence Delirium Scale. This figure is available in color online at www.jopan.org.

Table 3. PAEDS Test After Parental Visiting Program Using Repeated-Measures ANOVA ($n = 93$)

Variables	<i>F</i>	<i>P</i>
PAEDS Treatment	2.93	.091
Gender	5.88	.017*
Time	258.52	<.001*
Treatment × time (linear)	0.02	.876
Treatment × time (cubic)	6.98	.010*

PAEDS, Pediatric Anesthesia Emergence Delirium Scale; ANOVA, analysis of variance.

* $P < .05$.

children supported by a parental visitation program after general anesthesia, Hudek¹ found that the prevalence of delirium in children with high preoperative separation anxiety was significantly greater than in those with low preoperative separation anxiety. This study result was meaningful in that preoperative anxiety was measured, and it was homogeneous between groups. Furthermore, it is meaningful to test the effect of parental visitation under a general anesthesia protocol.

Acute delirium occurs in 12% to 31% of children after general anesthesia and lasts for 15 to 30 minutes.¹⁻³ According to American Society of PeriAnesthesia Nurses guidelines,¹⁹ one PACU nurse should be assigned to each pediatric patient younger than 8 years. More may be needed in pediatric patients with delirium to ensure patient safety and the safety of nursing personnel.

Beesley et al²⁰ reported that family caregiver visitation in intensive care units reduced psychosocial stresses in parents and families. But, there are

Table 4. The Effect of Intervention Using a Generalized Estimating Equation Model ($n = 93$)

Variables	β	SE	<i>P</i>
Treatment	-1.00	0.51	.048
Gender	1.35	0.52	.009
Time	-2.51	0.12	<.001

SE, standard error.

still no guidelines for parental visitation in the PACU, and visitations have been allowed according to nurses' personal judgment. Parents can be prepared through education to visit in the PACU via a positive nursing intervention designed to reduce pediatric patient delirium and to provide psychological support and relieve parents of anxiety about their child during their PACU stay.

Limitations

There are several limitations in this study. First, we could not assign the participants randomly. As a result of the homogeneity test, the gender was not allocated evenly between the two groups and affected study results as a confounding variable. Second, although the effect size of the previous study was considered in the estimation of sample size, the difference between two groups was too small to identify the effects of program. Third, we did not measure pain, which could affect the presentation of ED. Finally, the type of anesthesia could be a potential bias. Current practices recommended that reinforced laryngeal mask airway for tonsillectomy has more advantages than endotracheal tube, except securing the airway.^{21,22} Therefore, future studies could improve internal validity by randomization or matching by exogenous variables such as gender. Also, the sample size of the study should be increased for identifying the effectiveness of the program. In other words, further research will be needed in various surgeries in children of various ages to confirm and generalize the effectiveness of the program.

Conclusions

The purpose of this study was to examine the effect of parental visitation on degree of ED in children undergoing tonsillectomy with general anesthesia. Degree of delirium was measured at 0, 10, 20, and 30 minutes after admission to the PACU. The program was not effective at each measurement point. However, as time passed, the degree of delirium rapidly decreased in the experimental group compared with the control group. These results showed that the parental visitation program was partially effective for relieving ED in children. This suggests the applicability of the parental visitation in PACU.

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