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Original Article

Family presence in post-anesthesia care unit reduces negative postoperative behavioral changes in preschool children: a randomized controlled trial

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Abstract: Objective: To evaluate the effect of family presence during the post-anesthesia recovery period on the incidence of negative postoperative behavioral changes (NPOBCs) in preschool-aged children, and to provide evidence for the clinical implementation of family accompaniment programs. Methods: A randomized controlled trial was conducted between December 2023 and April 2024, enrolling 132 children undergoing general anesthesia. Participants were randomly divided into an experimental group (family accompaniment + standard care) or a control group (standard care alone). Data collection included vital signs (heart rate, respiratory rate, blood pressure, peripheral oxygen saturation (SpO_2)), awakening duration, and emotional state assessed using a 5-point Likert scale. Behavioral changes were evaluated at 1, 7, and 14 days post-surgery using the Post Hospitalization Behavior Questionnaire (PHBQ). Results: Compared with controls, the experimental group showed significantly lower heart rate, respiratory rate, and blood pressure ($P<0.05$). Emotional state scores were also superior in the experimental group ($P<0.001$). No significant difference was observed in SpO_2. The incidence of NPOBCs was comparable on day 1 ($P=0.054$), but significantly lower in the experimental group on days 7 and 14 ($P<0.001$). On day 1, the experimental group exhibited reduced sleep anxiety ($P=0.034$); on day 7, the incidence of overall anxiety, separation anxiety, sleep anxiety and emotional withdrawal decreased significantly ($P<0.05$); on day 14, the incidence of overall anxiety, separation anxiety, and emotional withdrawal remained significantly lower in the experimental group ($P<0.05$). Sedation was required in 3 cases in the experimental group versus 32 cases in the control group ($P<0.001$). No differences were found in analgesic use or awakening duration between the two groups ($P>0.05$). Conclusion: Family presence during post-anesthesia recovery stabilizes physiological parameters, enhances emotional well-being, and reduces mid- to late-term postoperative behavioral changes in preschool children, supporting clinical implementation of family accompaniment programs.

Keywords: Post-anesthesia care unit, family presence, preschool children, postoperative behavioral changes

Introduction

Children, due to their unique physical and psychological development, exhibit stronger stress responses to surgery and anesthesia than adults [1]. Perioperative stress may lead to negative postoperative behavioral changes (NPOBCs) in children, manifesting as sleep and eating disturbances, nightmares, anxiety, enuresis, and unexplained tantrums [2, 3]. Studies have shown that over 60% of children undergoing general anesthesia experience NPOBCs [2, 3]. These changes can impair emotional and cognitive development and complicate future medical visits, with preschool children being particularly susceptible [1, 4, 5]. Although most symptoms gradually resolve, some children experience prolonged distress.

Pharmacological interventions, such as dexmedetomidine and midazolam, have been proposed to relieve NPOBCs [6, 7]. However, these drugs may cause adverse effects, including respiratory depression and delayed emergence. Non-pharmacological methods therefore warrant consideration. Family presence during

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anesthetic induction has been shown to decrease NPOBCs [8, 9]. However, evidence on the role of family presence in the post-anesthesia care unit (PACU) is limited. Diniaco et al. [9] observed fewer negative behaviors when parents were present in the recovery room, but the study lacked randomization and adequate control for confounders. Lardner et al. [8] found that parent presence in PACU reduced the incidence of NPOBCs two weeks after surgery, though the primary outcome was crying rather than NPOBCs. Moreover, other studies have indicated that family accompaniment during post-anesthesia recovery period can promote physiological and psychological stabilization, alleviate anxiety, and reduce agitation and pain [10-15]. Thus, a well-designed randomized controlled trial is necessary to evaluate the effect of family presence in PACU on NPOBCs. The aim of this study is to determine whether family presence in PACU could reduce the incidence of NPOBCs in preschool children undergoing elective surgery.

Materials and methods

Ethics statement

This study was approved by the Ethics Committee of Children's Hospital of Fudan University (Approval No. 2023048). Written informed consent was obtained from the parents of all participating children. The trial was registered in the Chinese Clinical Trial Registry (ChiCTR2500107534). All procedures were conducted in accordance with the Declaration of Helsinki.

Inclusion criteria: (1) Age between 2 to 6 years; (2) American Society of Anesthesiologists (ASA) physical status classification I or II; (3) Scheduled for low-to-moderate complexity surgery (e.g., tonsillectomy, hernia repair, fracture reduction, circumcision); (4) Elective surgery with planned admission to the post-anesthesia care unit (PACU); (5) Family members consented to accompany the child and complied with the perioperative medical standards.

Exclusion criteria: (1) Children with neurological disorders or communication barriers; (2) Accompanying family member had communication barriers; (3) The accompanying family member had a contagious disease; (4) Severe intraoperative or postoperative complications occurred.

Methods

Study protocol

Participants were identified the day before surgery. Written informed consent was obtained from the parent of each child. No preoperative interventions were applied. Demographics data were collected.

On the day of surgery, all patients received a standardized anesthesia protocol. No premedication was given. An intravenous line was established in the inpatient ward. General anesthesia was induced with intravenous propofol of 3 mg/kg, fentanyl of 1 μg/kg, and rocuronium of 0.6 mg/kg. All children were intubated with an endotracheal tube of an appropriate size. Anesthesia was maintained with sevoflurane at 1.0-1.5 minimum alveolar concentration (MAC). Peripheral nerve block or caudal block with ropivacaine (0.25%) was performed as needed, not exceeding 1 ml/kg.

After surgery, all the children were extubated and transferred to the PACU. Heart rate, blood pressure, respiratory rate, pulse oxygen saturation (SpO_2) and emotional state score were recorded upon admission and every 15 minutes until discharge. Hydromorphone (2 mcg/kg) was administered if the pain score exceeded 4. The duration of PACU stay and analgesic requirements were recorded.

Follow-up assessments were made on postoperative day 1, 7 and 14. A dedicated nurse, blinded to the group assignment, performed standardized telephone interviews using the Post-Hospital Behavior Questionnaire (PHBQ) to evaluate behavioral changes.

Research tools

General information questionnaire: Designed by the research team, this questionnaire collected baseline information, including the child's demographics, diagnosis, surgical method, anesthesia method, surgery duration, intraoperative analgesic use, PACU medication, awakening duration, and vital signs during recovery (heart rate, respiratory rate, blood pressure, and oxygen saturation). For children

in the experimental group, details of the accompanying family members were also recorded.

Emotional state: Designed by Jennifer et al. in 2002, this scale assesses a series of behaviors of children during the post-anesthesia awakening period. It consists of five levels: deep sleep (1 point), awake and calm (2 points), irritable and crying (3 points), inconsolable crying (4 points), and disorientation with severe restlessness (5 points). Lardner et al. used this scale to assess children's emotional state during PACU recovery, demonstrating high reliability [8, 16].

Post Hospitalization Behavior Questionnaire (PHBQ): Designed by Vernon et al. in 1966, this questionnaire is a standardized tool widely used to assess postoperative behavioral changes in children, with high test-retest reliability [17, 18]. It evaluates six behavioral dimensions: overall anxiety, separation anxiety, sleep anxiety, diet disturbances, aggression, and emotional withdrawal, totaling 27 items. Parents or guardians rate the child's postoperative behavioral changes on a 5-point scale: 0 (no change), -1 (mild decrease), -2 (significant decrease), 1 (mild increase), and 2 (significant increase). A total score greater than 0 indicates the occurrence of postoperative behavioral changes.

Intervention methods

In this study, all children were extubated after regaining consciousness from general anesthesia. During recovery, The control group was cared for exclusively by medical staff, while the experimental group received combined family accompaniment and routine medical care. Family members selected for accompaniment were those with whom the child had a close and trusted relationship.

The day before surgery, families were introduced to the operating and recovery room environment, along with an explanation of the accompaniment process and precautions. On the day of surgery, once the child was admitted to the PACU with a secured airway and stable vital signs, family members were assisted in wearing sterile attire (gowns, caps, shoe covers) before entering the recovery room.

Accompanying family members sat beside the child's bed, providing verbal comfort and encouragement. If necessary, the child can be held horizontally, with the nurse assisting to avoid wound or drainage tube compression. Gentle physical contact, such as touching the forehead or holding hands, was encouraged. Music, animations, toys, or stickers preferred by the child were allowed to facilitate interactions. Throughout the process, nurses continuously monitored the child's condition and guided the family's involvement.

Statistical analysis methods

The primary outcome was the incidence of postoperative behavioral changes. Continuous data with normal distribution were expressed as mean ± standard deviation (SD) and analyzed using independent-sample t-tests or repeated-measures ANOVA, followed by Bonferroni correction. Non-normally distributed continuous data were analyzed using non-parametric tests. Categorical data were described as number (%) and analyzed using chi-square tests. All statistical tests were two-sided, and a *P*-value <0.05 was considered statistically significant. Statistical analysis was performed using SPSS 25.0.

Results

Comparison of baseline information between the two groups

A total of 132 children who met the inclusion criteria and underwent general anesthesia between December 2023 to April 2024 were randomly assigned to the experimental or control group. Two cases were lost to follow-up in the experimental group, leaving 64 participants, while 66 participants completed the study in the control group.

In this study, family members in the experimental group entered the recovery room within 10 minutes after the child's admission. Baseline characteristics, including gender, age, weight, disease category, surgery duration, intraoperative opioid dosage, use of regional block analgesia, and vital signs at PACU admission showed no significant differences between the two groups (P>0.05; **Tables 1**, **2**).

Comparison of vital signs and emotional states during the recovery period between the two groups

Due to varying awakening times, 9% of vital signs and emotional state data at 60 minutes

Table 1. Comparison of general information between the two groups

	Experimental Group (n=64)	Control Group (n=66)	t/χ^2	P
Male/Female (n)	40/24	36/30	0.847	0.358
Age (years, x±s)	3.73±1.15	3.64±0.98	0.485	0.628
Weight (kg, x±s)	16.58±3.06	16.81±2.73	0.448	0.655
Disease Category (n) Oto./Ort./G.S./Uro.	16/18/14/16	24/14/15/13	2.415	0.491
Surgery Duration (min, x±s)	52.50±19.64	44.70±24.43	1.752	0.082
Intraoperative opioid dose (mcg, x±s)	238.75±116.56	216.29±130.41	1.036	0.302
Regional Block Technique (n)	24	16	2.681	0.102

Oto.: Otolaryngology; Ort.: Orthopedics; G.S.: General Surgery; Uro.: Urology.

Table 2. Comparison of vital signs between the two groups (0 min)

	Experimental Group	Control Group	t	P
Heart rate (x±s)	117.13±16.08	117.23±13.73	0.038	0.969
Respiratory rate (x±s)	23.69±1.11	23.38±1.32	1.458	0.147
Systolic BP (x±s)	98.44±7.41	99.18±5.77	0.634	0.527
Diastolic BP (x±s)	55.56±7.47	56.61±5.69	0.900	0.370
SpO_2 (x±s)	99.03±1.48	99.33±1.95	0.984	0.327
Emotional state (x±s)	1.72±1.11	2.12±1.38	1.830	0.070

BP: Blood Pressure; SpO_2: Peripheral Oxygen Saturation.

were missing and imputed using sequence mean values. Overall, children in the experimental group had significantly lower heart rates, respiratory rate, and blood pressure compared to those in the control group (all P<0.05). Bonferroni post hoc test showed that the heart rate and systolic blood pressure at 30 minutes and the diastolic blood pressure at 15 and 45 minutes in the experimental group were significantly lower than those in the control group (all P<0.0125). Emotional state scores in the experimental group were superior to that in the control group (P<0.001). There was no significant difference in SpO_2 between the two groups at any time point (P=0.790, **Table 3**).

Comparison of the postoperative incidence of behavioral change between the two groups

Intergroup comparison

On postoperative day 1, there was no significant difference in the incidence of postoperative behavioral changes between the two groups (P=0.054). By postoperative days 7 and 14, the incidence of postoperative behavioral changes in the experimental group was significantly lower than in the control group (P<0.001 for both; **Table 4**).

Dimensional comparison

On postoperative day 1, the incidence of sleep anxiety in the experimental group was significantly lower than in the control group (P=0.034). On postoperative day 7, the incidences of overall anxiety, separation anxiety, sleep anxiety, and emotional withdrawal were significantly reduced in the experimental group compared with the control group (P<0.05). On postoperative day 14, the incidence of overall anxiety, separation anxiety, and emotional withdrawal remained significantly lower in the experimental group (P<0.05, **Table 5**).

Comparison of other related indicators between the two groups

During the recovery period, sedation was required in only 3 cases in the experimental group, significantly lower than 32 cases in the control group (P<0.001). There was no significant difference in analgesic medication use or awakening duration between the two groups (P=0.666 and 0.292; **Table 6**).

Discussion

This study demonstrates that family presence in the PACU significantly reduces the incidence of NPOBCs in preschool children during the critical two-week postoperative period. The children accompanied by family members presented a lower incidence of behavioral changes compared to the controls on postoperative day

Table 3. Comparison of vital signs and emotional state during recovery period between the two groups ($\bar{x}\pm s$)

	Group	15 min	30 min	45 min	60 min	Intervention Main Effect	
						F	P
Heart Rate	Experimental Group	114.41±16.46	112.91±15.96*	114.78±11.76	110.54±14.94	4.949	0.036
	Control Group	119.18±10.64	119.55±10.93	115.82±9.43	114.94±10.25		
Respiratory rate	Experimental Group	23.47±0.91	23.25±1.07	23.12±1.09	23.07±0.97	15.383	<0.001
	Control Group	23.85±0.97	23.70±1.01	23.64±0.92	23.72±0.74		
Systolic BP	Experimental Group	96.72±8.51	98.42±10.07*	96.97±8.10	97.08±7.50	11.380	0.001
	Control Group	98.79±5.38	106.09±8.05	99.58±4.81	99.17±4.79		
Diastolic BP	Experimental Group	54.53±5.56*	55.86±8.82	54.09±7.53*	56.14±6.19	5.762	0.018
	Control Group	57.51±4.73	57.64±5.02	57.18±4.91	56.85±3.98		
SpO_2	Experimental Group	99.09±1.46	99.19±1.11	99.50±0.94	99.62±0.85	0.071	0.790
	Control Group	99.45±1.55	99.21±1.58	99.39±1.36	99.52±1.01		
Emotional state	Experimental Group	2.00±1.04	1.91±0.77	2.06±0.50	2.11±0.28	71.651	<0.001
	Control Group	2.52±1.47	3.03±1.20	2.82±0.94	2.91±0.55		

SpO_2: Peripheral Oxygen Saturation; BP: Blood Pressure. *P<0.0125, compared with the control group (Bonferroni correction).

Table 4. Comparison of postoperative incidence of behavioral changes between the two groups (n, %)

	Experimental Group (n=64)	Control Group (n=66)	χ^2	P
Postoperative Day 1	27 (42.19)	39 (59.09)	3.714	0.054
Postoperative Day 7	24 (37.50)	46 (69.70)	13.553	<0.001
Postoperative Day 14	16 (25.00)	44 (66.67)	22.698	<0.001

7 and 14. Previous studies have reported that the incidence of NPOBCs ranges from 24% to 60.5% [8, 19, 20]. In our study, the incidence of NPOBCs in the control group remained high (66.67%) at postoperative day 14. The discrepancies among studies may be attributed to variations in the definition of NPOBCs, assessment time points, age distribution, cultural or institutional practices. Younger age has been identified as a risk factor of NPOBCs. Our study included only enrolled children aged under 6 years, who are particularly susceptible to behavioral changes, whereas other studies enrolled a broader age range [8, 19], which may account for a lower incidence of NPOBCs. Although postoperative behavioral changes tend to diminish over time, they may persist for an extended period. In our study, the incidence decreased gradually within 2 weeks postoperatively in the family presence group, whereas no clear downward trend was observed in the control group. This difference may be partly because of the relatively short time of observation period.

Our results confirm that family presence in the PACU has a positive effect on NPOBCs, consistent with other studies [8, 9]. As a non-pharmacological strategy, family accompaniment in the PACU provided comfort and reduce distress through physical touch, verbal reassurance, and emotional warmth, thereby reducing the incidence of NPOBCs. Whether this effect persist beyond the early postoperative period, however, requires further investigation. Parental involvement in PACU care plays a critical role in supporting children's recovery. Nonetheless, potential concerns must also be considered, including patient privacy, infection control, and the possibility of increased workload for medical staff.

Family accompaniment during the post-anesthesia recovery period exerts a soothing effect on the emotional state of preschool children and facilitates a smoother transition through recovery. The post-anesthesia recovery period represents a particularly vulnerable stage following general anesthesia, and the PACU is a crucial setting for postoperative recovery and early complication identification [21]. Due to surgical trauma, opioid exposure, and separation from parents, children frequently exhibit irritability, inconsolable crying, and non-cooperation, which may hinder recovery [10]. Most

Table 5. Comparison of six dimensions of postoperative behavioral changes between groups (n, %)

		Experimental Group (n=64)	Control Group (n=66)	χ^2	P
Overall Anxiety	Day 1	22 (34.38)	19 (28.79)	0.470	0.493
	Day 7	16 (25.00)	35 (53.03)	10.708	0.001
	Day 14	4 (6.25)	18 (27.27)	8.773	0.003
Separation Anxiety	Day 1	28 (43.75)	40 (60.61)	3.701	0.054
	Day 7	18 (28.13)	44 (66.67)	19.348	<0.001
	Day 14	14 (21.88)	39 (59.09)	18.636	<0.001
Sleep Anxiety	Day 1	11 (17.19)	22 (33.33)	4.472	0.034
	Day 7	15 (23.44)	28 (42.42)	5.292	0.021
	Day 14	10 (15.63)	18 (27.27)	2.609	0.106
Diet Disorder	Day 1	17 (26.56)	16 (24.24)	0.092	0.761
	Day 7	11 (17.19)	21 (31.82)	3.748	0.053
	Day 14	2 (3.13)	6 (9.09)	1.103	0.294
Aggression	Day 1	19 (29.69)	30 (45.45)	3.439	0.064
	Day 7	16 (25.00)	23 (34.85)	1.501	0.221
	Day 14	8 (12.50)	17 (25.76)	3.677	0.055
Emotional Withdrawal	Day 1	14 (21.88)	20 (30.30)	1.195	0.274
	Day 7	14 (21.88)	34 (51.52)	12.257	<0.001
	Day 14	6 (9.38)	15 (22.73)	4.277	0.039

Table 6. Comparison of sedation, analgesic medication use, and awakening duration during recovery period

	Experimental Group	Control Group	t/χ^2	P
Sedation Instances (n)	3	32	29.492	<0.001
Analgesic Medication Dose (mcg, x±s)	2.30±10.85	1.55±8.81	0.432	0.666
Awakening Duration (min, x±s)	58.75±3.33	60.00±8.94	1.060	0.292

studies in China focus on agitation scores as the primary outcome measure [22, 23]; however, agitation is often self-limiting. In contrast, this study employed emotional state scores as the main recovery-period evaluation indicator. Our results showed that average emotional state scores in the family accompaniment group were significantly lower than those in the control group from 15 to 60 minutes after PACU admission. Notably, the markedly reduced need for sedation (3 vs. 32 instances) underscores the calming effect of family accompaniment and suggests a potential reduction in risks associated with sedative use, such as respiratory depression. Interestingly, our results differ from those of Lardner's study [8], possibly due to differences in study design (e.g., outpatient vs. inpatient settings, minute-by-minute vs. 15-minute assessments).

There are also some limitations to our study. First, postoperative behavior changes were only assessed within 2 weeks postoperatively. The potential long-term effects of family presence on behavior outcomes warrant further investigation. Second, our study focused exclusively on children younger than 6 years, who are most vulnerable and most likely to benefit. Whether similar effects extend to older patients remains to be determined. Third, parental factors such as anxiety and educational background, both reported to be associated with negative behavior changes [24], were not assessed. Moreover, the postoperative behavioral outcomes were mainly collected based on parental reports, which may introduce subjective bias [25]. Future studies should incorporate parental demographic and psychosocial characteristics (e.g., education level, age, gender) to better understand their influence. Finally, although randomization was performed in our study, intergroup differences cannot be completely excluded.

Conclusion

Parental presence with children is a primary focus of family-centered care [26]. This study demonstrates that family presence in the PACU is a safe and effective strategy to support recovery in preschool children. These findings highlight the value of standardized family accompaniment protocols in pediatric perioperative care and underscore the importance of non-pharmacological interventions in improving patient outcomes. In future clinical practice, family presence in the PACU should be considered as routine to optimize behavioral recovery in children undergoing surgery.

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Disclosure of conflict of interest

The authors report no actual or potential conflicts of interest.

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