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Effect of preoperative visiting operation room on emergence agitation in preschool children under sevoflurane anesthesia

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ABSTRACT

Background: Emergence agitation (EA) is a common complication in children during recovery from sevoflurane anesthesia with an high incidence. The main objective of this study was to compare the effects of preoperative visiting operation room (PVOR) to administration of propofol at the end of anesthesia on EA in preschool children under sevoflurane anesthesia.

Methods: Sixty-nine preschool children aged from 3 to 6 years scheduled for tonsillectomy under sevoflurane anesthesia were randomly allocated to one of the three groups to receive either PVOR (Group PV), routine preoperative visit (Group RV) or routine preoperative visit plus propofol (Group RP), 23 patients were included in each group. General anesthesia was induced and maintained with sevoflurane. Parental separation status score, mask acceptance score, Aono's four point score and pediatric anesthesia emergence delirium (PAED) score and incidence of EA were recorded. PAED score > 10 were regarded as EA. Recovery profile and adverse events were also recorded.

Result: Parental separation status score and mask acceptance score in group PV was significantly lower than that in group RV and group RP ($P < 0.05$); Aono's four point score, PAED score and incidence of EA in group PV and group RP was significantly lower than that in group RV ($P < 0.05$); Time to extubation and time to interaction in group PV and group RV was significantly shorter than that in group RP ($P < 0.05$); POV and rescue by fentanyl in group PV and group RP was significantly lower than that in group RV($P < 0.05$).

Conclusion: PVOR can effectively reduce the incidence of EA as well as administration of propofol without additional medical expenses and other adverse effects.

1. Introduction

Sevoflurane has been a preferred anesthetic agent for induction and maintenance of pediatric anesthesia because of its rapid induction and recovery characteristics, lack of pungency and agreeable odor, and acceptable cardiovascular profile [1]. Emergence agitation (EA) is a common complication in children during recovery from sevoflurane anesthesia, with an high incidence ranging from 18% to 90% depending on different anesthetic technique and scoring scale [2,3]. EA is simply excessive motor activity and a nonspecific symptom resulting from any type of internal discomfort including pain and anxiety [4]. Although the exact causes and potential mechanisms of EA in children have not been determined, several risk factors are considered to be involved, such as age, mental state, pain, anesthesia methods and surgical procedure [5]. A higher incidence of EA occurred in children with a mental state of preoperative anxiety [6], which indicated that EA were closely related to preoperative anxiety, such as unfamiliarity to the operation room environment and fearing of induction of anesthesia. Many pharmacological preventions can reduce the incidence of EA, which includes administration of opioids, midazolam, ketamine, alpha-2 agonist sedatives, propofol and NSAIDs during perioperative period [5]. Propofol is first choice when it comes to pharmacological prevention and treatment of EA [7], but the administration of propofol would lengthen the time to awakening [8,9] and increases additional cost of propofol when patients inducted and maintained with sevoflurane alone. Are there any non-pharmacological interventions which can reduce the incidence of EA as well as pharmacological prevention? The main objective of this randomized, controlled trial was to compare the effects of preoperative visiting operation room (PVOR) to administration of propofol at the end of anesthesia on EA in preschool children under sevoflurane anesthesia. We hypothesized that PVOR was not inferior to propofol to reduce the incidence of EA in preschool children under sevoflurane anesthesia.

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2. Materials and methods

2.1. Patients enrollment

This study was approved by the Ethics Committee of Taizhou Municipal Hospital (Taizhou, China; reference no. 2016TZMH009) and written informed consent was obtained from the parents of all participants. This study was implemented in accordance with the Declaration of Helsinki of the World Medical Association. This prospective, randomized trial was conducted from July 2016 to June 2017 at Taizhou Municipal Hospital. Sixty-nine preschool children aged from 3 to 6 years with American Society of Anesthesiologists (ASA) physical status I or II scheduled for tonsillectomy under sevoflurane anesthesia were enrolled in this study. Exclusion criteria included a history of surgery, psychological or neurological disorders, developmental delay, parental refusal, upper tract infection and recent administration of sedatives or analgesics.

2.2. Randomization group

The enrolled children of 69 patients were randomly allocated to one of the three groups to receive either PVOR (Group PV), routine preoperative visit (Group RV) or routine preoperative visit plus propofol (Group RP) by using a computer-generated randomization program. 23 patients were included in each group.

2.3. Procedure

In group PV (n = 23), the anesthetist guided preschool children and their parents visit waiting areas, operation room, recovery room, made them understand the operation process, displayed the instrument, explained the feeling during induction and recovery of anesthesia and answered all other questions about surgery; In group RV (n = 23) and group RP (n = 23), the anesthetist visited preschool children and their parents in wards. Patients in three groups had been visited one day before operation and did not receive premedication.

All children were fasted for 6 h before the surgery. After checking the information of patients in the waiting areas, the patients were separated from their parents and transported to the operation room. Electrocardiography (ECG), heart rate (HR), non-invasive blood pressure (NIBP), pulse oxygen saturation (SpO2) and bispectral index (BIS) were monitored. After pre-oxygenation, general anesthesia was induced via a facemask with oxygen-air mixture and sevoflurane with increments of 1% every two breaths up to 8%. After consciousness of patients was lost, intravenous access was established and an infusion of saline solution was administered on the basis of standard fluid administration guidelines. Tracheal intubation was performed after obtaining sufficient depth of anesthesia with the use of opioids (4 μg/kg fentanyl) and neuromuscular blocking drug (0.2 mg/kg of cisatracurium). Mechanical ventilation was maintained with 8 ml/kg tidal volume and adjusted ventilation frequency to sustain normal end-tidal carbon dioxide tension (35–45 mmHg). Anesthesia was maintained with sevoflurane in order to keep the BIS value of 45–55. Parental separation status was measured after patients arriving the operation room using a four-point scale [10] and mask acceptance was scored during the induction of anesthesia using a four-point scale [11,12] (Table 1). 1 mg/kg dose of propofol was injected at the end of operation referring to implications for practice [13] in group RP and equal volume of saline solution was given in other two groups. After finishing the surgery, sevoflurane was discontinued and 8 L/min fresh gas flow was administered in order to accelerate the sevoflurane clearance. The neuromuscular block was antagonized with neostigmine and atropine. After tracheal catheters were extubated when patients opened their eyes and could show purposeful movements, they were transferred to PACU. The time from discontinuation of sevoflurane to extubation and to interaction were recorded.

Table 1
Parental separation status scale, Mask acceptance scale and Aono's four point scale.

Parental separation scale	Mask acceptance scale	Aono's four point scale	Points
Asleep	Asleep	Calm	1
Good separation, awake, calm	awake, calm, co-operative, accepting mask	Not calm but easily calmed	2
Awake, anxious, can be easily reassured	Slight fear but can be easily reassured	Not easily calmed, moderately agitated or restless	3
Crying, cannot be reassured	Restrained	Excited or disoriented	4

In the PACU, ECG, HR, NIBP and SpO2 were monitored. 29% oxygen was inhaled with a face mask for patients by the nurses. One anesthesiologist blinded to the patients group evaluated EA every 5 min using Aono's four point scale [14] (Table 1) after arrival at the PACU until discharge from the PACU. Score 1and 2 in the scale were considered no EA and score 3 and 4 were considered EA. The highest EA scores observed during this period were recorded. Severity of agitation was assessed using pediatric anesthesia emergence delirium (PAED) scale [15] (Table 2). PAED score > 10 were regarded as presence of EA, and PAED score > 15 were regarded as severe agitation. Postoperative pain were evaluated using objective pain score (OPS) at the same time intervals [16]. Aono's four-point scale score = 4, PAED scale score > 15 or OPS score > 4 was regarded as presence of sever agitation and fentanyl1μg/kg intravenously was administered as rescue medication for patients.

The time to discharge from PACU were recorded after patients fulfilled the discharge criteria with an Aldrete score [17] ≥ 9. The incidence of adverse events such as postoperative vomiting (POV), oxygen desaturation (SpO2 below 95%) were also recorded from extubation to discharging from the PACU.

2.4. Statistical analysis

The primary outcome of this study was the incidence of postoperative EA in the PACU. Sample size calculation was based a meteanalysis [18] which showed 20% and 38.3% incidence of EA in propofol group and in placebo group. A sample size of 23 patients in each group was calculated to detect a 10% decrease in the incidence of EA with $\alpha = 0.05$ and $\beta = 0.2$.

Enumeration data presented as number (n) or percentage (%) were compared with χ^2 analysis and Fisher's exact test. Measurement data expressed as mean ± SD were analyzed using one-way analysis of variance. Multiple comparisons were performed with Fisher's Least Significant Difference (LSD) *t*-test. The statistical analysis was performed using SPSS software (version 21.0, Chicago, Illinois). Probability value < 0.05 was considered to indicate statistical significance.

Table 2
Pediatric anesthesia emergence delirium scale (PAED).

Description	Not at all	Just a little	Quite a bit	Very much	Extremely
makes eye contact	4	3	2	1	0
actions are purposeful	4	3	2	1	0
aware of surroundings	4	3	2	1	0
restless	0	1	2	3	4
inconsolable	0	1	2	3	4