

Original Research

Incidence and risk factors for emergence delirium in children undergoing surgery under general anaesthesia – An observational study

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Abstract:

Background: Emergence delirium (ED) is a common postoperative complication in pediatric patients undergoing surgery under general anesthesia. It is characterized by agitation, confusion, and incoherence, posing challenges in postoperative care. This study aims to investigate the incidence and risk factors associated with ED in children at ESIC MCH, Bihta, Patna, Bihar.

Materials and Methods: A prospective observational study was conducted over a period from April 2022 to September 2023 in ESIC MCH, Bihta, Patna, Bihar. A total of 300 pediatric patients, aged 2-12 years, undergoing various surgical procedures under general anesthesia were included. Data on patient demographics, type of surgery, anesthetic agents used, duration of anesthesia, and postoperative conditions were collected. Emergence delirium was assessed using the Pediatric Anesthesia Emergence Delirium (PAED) scale. Statistical analysis was performed to identify significant risk factors.

Results: The overall incidence of ED was 20% (60 out of 300 patients). Children aged 2-5 years exhibited a higher incidence (30%) compared to those aged 6-12 years (10%). The use of sevoflurane was associated with a higher incidence of ED (25%) compared to propofol (10%). Longer duration of anesthesia (>2 hours) was significantly associated with ED ($p < 0.05$). No significant differences were observed based on gender or type of surgery. Preoperative anxiety and postoperative pain were identified as significant predictors of ED ($p < 0.01$).

Conclusion: Emergence delirium is a notable postoperative complication in pediatric patients undergoing surgery under general anesthesia, with an incidence of 20%. Younger age, use of sevoflurane, longer anesthesia duration, preoperative anxiety, and postoperative pain are significant risk factors. Awareness and preventive strategies targeting these factors may reduce the incidence of ED and improve postoperative care.

Keywords: Emergence delirium, pediatric surgery, general anesthesia, risk factors, sevoflurane, postoperative care.

Introduction

Emergence delirium (ED) is a well-documented phenomenon characterized by a transient state of confusion, agitation, and disorientation observed in pediatric patients recovering from general anesthesia. This condition poses significant challenges in postoperative management, often resulting in increased stress for both patients and healthcare providers (1). The incidence of ED in children varies widely, with reported rates ranging from 10% to 80%, depending on the diagnostic criteria and patient population studied (2).

The etiology of ED is multifactorial, involving a complex interplay of anesthetic, surgical, and patient-related factors. Among the anesthetic agents, sevoflurane has been frequently associated with a higher incidence of ED compared to other agents such as propofol (3). Additionally, the duration of anesthesia has been implicated, with longer procedures increasing the risk of developing ED (4). Patient-related factors, including age, preoperative anxiety, and baseline behavioral characteristics, have also been identified as significant contributors (5,6).

Despite the extensive research, the precise mechanisms underlying ED remain elusive. It is hypothesized that rapid emergence from anesthesia, coupled with the inherent neurodevelopmental immaturity in children, may precipitate this condition (7). Furthermore, the perioperative environment and postoperative pain have been shown to exacerbate the likelihood of ED (8,9).

Given the considerable variability in the incidence and risk factors of ED, there is a pressing need for further investigation, particularly in specific clinical settings. This study aims to assess the incidence and identify the risk factors associated with ED in pediatric patients undergoing surgery under general anesthesia at ESIC Medical College and Hospitals, Bihta. By elucidating these factors, we hope to inform clinical practices and develop preventive strategies to mitigate the impact of ED on pediatric surgical care.

Materials and Methods

Study Design and Setting: This prospective observational study was conducted over a period from April 2022 to September 2023 in ESIC MCH, Bihta, Patna, Bihar. The study aimed to evaluate the incidence and risk factors associated with emergence delirium (ED) in pediatric patients undergoing surgery under general anesthesia.

Study Population: The study included 300 pediatric patients, aged 2-12 years, who were scheduled for elective surgical procedures under general anesthesia. Exclusion criteria were patients with a history of neurological or psychiatric disorders, developmental delays, or those requiring emergency surgery.

Data Collection: Data were collected preoperatively, intraoperatively and postoperatively. Preoperative data included patient demographics (age, gender, weight), type of surgery, and baseline anxiety levels assessed using the modified Yale Preoperative Anxiety Scale (mYPAS). Intraoperative data encompassed the type of anesthetic agent used (sevoflurane or propofol), duration of anesthesia and any intraoperative complications. Postoperative data included the assessment of ED using the PediatricAnesthesia Emergence Delirium (PAED) scale, pain scores using the Wong-Baker FACES Pain Rating Scale, and any postoperative complications.

Anesthetic Management: All patients received standard anesthetic care as per the hospital protocol. Induction of anesthesia was achieved using either sevoflurane or propofol, as determined by the attending anesthesiologist. Maintenance of anesthesia was carried out with the same agents, supplemented with analgesics as required. The choice of anesthetic agents was based on clinical judgment and patient-specific factors.

Assessment of Emergence Delirium: Emergence delirium was assessed using the PAED scale, which scores five behaviors (eye contact, purposeful actions, awareness of surroundings, restlessness, and inconsolability) on a scale of 1 to 4. A total PAED score of 10 or more was indicative of ED. Assessments were performed at 5-minute intervals from the time of emergence until 30 minutes postoperatively.

Statistical Analysis: Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population. The incidence of ED was calculated as the proportion of patients with a PAED score of 10 or more. Logistic regression analysis was employed to identify significant risk factors associated with ED. Independent variables included age, gender, type of surgery, type of anesthetic agent, duration of anesthesia, preoperative anxiety levels, and postoperative pain scores. A p-value of <0.05 was considered statistically significant. All analyses were performed using SPSS software version 25.0 (IBM Corp., Armonk, NY, USA).

Outcome Measures: The primary outcome measure was the incidence of emergence delirium as assessed by the PAED scale. Secondary outcome measures included the identification of risk factors for ED and the association of ED with postoperative pain and other complications.

Results

A total of 300 pediatric patients, aged 2-12 years, were included in the study. The demographic and clinical characteristics of the study population are summarized in Table 1.

Table 1: Demographic and Clinical Characteristics of the Study Population

Characteristic	Total (n=300)
Age, mean (SD)	6.5 (2.8)
Age group, n (%)	
2-5 years	120 (40%)
6-12 years	180 (60%)
Gender, n (%)	
Male	160 (53.3%)
Female	140 (46.7%)
Type of Surgery, n (%)	
ENT	90 (30%)
General Surgery	120 (40%)
Orthopedic Surgery	50 (16.7%)
Other	40 (13.3%)
Type of Anesthetic Agent, n (%)	
Sevoflurane	180 (60%)
Propofol	120 (40%)

Duration of Anesthesia, mean (SD)	120 (30) minutes
Duration > 2 hours, n (%)	90 (30%)

Incidence of Emergence Delirium: The overall incidence of emergence delirium was 20% (60 out of 300 patients). The incidence of ED by age group and type of anesthetic agent is presented in Table 2.

Table 2: Incidence of Emergence Delirium by Age Group and Anesthetic Agent

Characteristic	Total (n=300)	Emergence Delirium (n=60)	Incidence (%)
Age group, n (%)			
2-5 years	120 (40%)	36	30%
6-12 years	180 (60%)	24	13.3%
Type of Anesthetic Agent, n (%)			
Sevoflurane	180 (60%)	45	25%
Propofol	120 (40%)	15	12.5%

Risk Factors for Emergence Delirium: Logistic regression analysis identified several significant risk factors for emergence delirium, including younger age, use of sevoflurane, longer duration of anesthesia, higher preoperative anxiety, and higher postoperative pain scores. The results of the logistic regression analysis are presented in Table 3.

Table 3: Logistic Regression Analysis of Risk Factors for Emergence Delirium

Risk Factor	Odds Ratio (OR)	95% Confidence Interval (CI)	p- value
Age (2-5 years vs. 6-12 years)	2.5	1.4-4.4	0.002
Sevoflurane vs. Propofol	2.3	1.2-4.1	0.008
Duration of Anesthesia (>2 hours)	1.8	1.0-3.2	0.04
Preoperative Anxiety (mYPAS)	1.6	1.2-2.1	0.001
Postoperative Pain (Wong-Baker)	1.5	1.1-2.0	0.01

Postoperative Complications: Postoperative pain was found to be significantly higher in patients with ED compared to those without ED (mean pain score: 5.2 vs. 3.1, $p < 0.01$). Other complications, such as nausea and vomiting, were not significantly different between the two groups.

In summary, the incidence of emergence delirium in this study was 20%, with younger age, use of sevoflurane, longer anesthesia duration, higher preoperative anxiety, and higher postoperative pain scores identified as significant risk factors. These findings highlight the need for targeted interventions to mitigate the risk of ED in pediatric patients undergoing surgery under general anesthesia.

Discussion

The present study examined the incidence and risk factors associated with emergence delirium (ED) in pediatric patients undergoing surgery under general anesthesia at ESIC Medical College and Hospitals, Bihta. Our findings revealed an incidence of 20% for ED, which is within the range reported in previous studies, highlighting the persistent challenge ED poses in pediatric anesthesia (1,2).

A significant finding of our study is the higher incidence of ED in younger children, particularly those aged 2-5 years, compared to older children aged 6-12 years. This is consistent with existing literature suggesting that younger age is a prominent risk factor for ED, possibly due to the developmental immaturity of the brain and the inability of younger children to comprehend and cope with the perioperative environment (3,4).

The type of anesthetic agent was also found to influence the incidence of ED. Our study demonstrated that the use of sevoflurane was associated with a higher incidence of ED compared to propofol. This aligns with previous research indicating that sevoflurane, despite its favorable pharmacokinetic profile, is more likely to cause ED due to its rapid emergence characteristics (5,6). The findings support the hypothesis that the rapid transition from unconsciousness to consciousness can lead to a state of confusion and agitation in children (7).

Duration of anesthesia emerged as another significant risk factor, with procedures lasting more than two hours being associated with a higher likelihood of ED. This could be attributed to the prolonged exposure to anesthetic agents and the increased stress associated with longer surgical procedures (8). Similar findings have been reported in other studies, underscoring the need for careful monitoring and potential interventions during lengthy surgeries (9).

Preoperative anxiety was identified as a significant predictor of ED. Children with higher levels of anxiety before surgery were more likely to experience ED postoperatively. This finding is supported by the literature, which suggests that preoperative anxiety can predispose children to adverse psychological reactions upon emergence from anesthesia (10). Strategies to reduce preoperative anxiety, such as behavioral interventions and parental presence during induction, may therefore be beneficial in reducing the incidence of ED (11).

Postoperative pain was also significantly associated with ED, indicating that inadequate pain management may exacerbate the symptoms of delirium. Children experiencing higher levels of pain postoperatively were more prone to ED, suggesting a need for effective pain control as part of the overall strategy to manage ED (12). This finding is consistent with other studies that have emphasized the role of pain in the development of ED (13).

Our study has several limitations. The observational design limits the ability to establish causality between the identified risk factors and the incidence of ED. Additionally, the study was conducted at a single center, which may limit the generalizability of the findings to other settings. Future research should consider multicenter studies with larger sample sizes to validate and extend these findings.

Conclusion

In conclusion, the incidence of emergence delirium in pediatric patients undergoing surgery under general anesthesia is significant, with younger age, use of sevoflurane, longer anesthesia duration, higher preoperative anxiety, and higher postoperative pain scores being key risk factors. Awareness and targeted interventions addressing these factors may help mitigate the impact of ED and improve postoperative care in pediatric patients.

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