Original Article

The prevalence of emergence delirium and its associated factors among children at a postoperative unit: A retrospective cohort at a Middle Eastern hospital

ABSTRACT

Background: Emergence delirium (ED) has been reported among children at a postoperative setting, which delays their recovery and exposes them to traumas. The aim of this study was to determine the prevalence of ED and its associated factors among children who underwent surgeries at a major tertiary healthcare facility in Saudi Arabia.

Materials and Methods: Between March and August 2018, a retrospective cohort study was conducted based on a review of 413 medical charts of children (<14 years) who underwent an elective/nonemergency surgery and then were admitted to a Post Anesthesia Care Unit. Patient and surgery-related characteristics were analyzed as potential factors associated with ED. The anxiety level was assessed preoperatively using the Modified Yale Preoperative Anxiety Scale (four domains), while the ED was detected after surgery using the Watcha scale (child is agitated and thrashing around).

Results: The leading surgery category was ear, nose, and throat surgeries [184 (44.6%)] and dental surgeries [109 (26.4%)]. Almost one-third received only general anesthesia (31.2%), while 271 (68.8%) received an additional regional block/skin infiltrate. The anxiety domains preop showed that the percentage mean score ± standard deviation of expression of emotions was 37.1 ± 21.6, apparent arousal 33.7 ± 20.4, activeness 30.1 ± 13.5, and vocalization 26.9 ± 20.3. The prevalence of ED among children who underwent surgeries during the 6-month period was 23 (6.6%). Almost 18.8% of those who received opioid analgesics (fentanyl alone) developed ED, while 12% of those who received both opioid and nonopioid analgesics (fentanyl/paracetamol) developed ED. ED was significantly associated with longer recovery duration 69.5 + 27.1 min, $P = 0.007$. Binary logistics regression analysis showed that participants who did not receive Precedex were adj. odds ratio = 10.3 (2.4–48.9) times more likely to develop ED, compared with those who received it, adj. $P = 0.003$. Lower preoperative scores of expression of emotions and higher scores of apparent arousal were significantly associated with ED, adj. $P = 0.035$ and adj. $P = 0.023$, respectively.

Conclusion: ED appears to be inevitable in postoperative settings. It is crucial to address any preoperative anxiety assessment as it is associated with ED. Anxiety remains a modifiable factor that can be managed, as well as to the administration of Precedex and adjunct analgesic treatments.

Key words: Anesthesia; anxiety; delirium; Precedex; surgery; Watcha; Yale

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Background

Emergence delirium (ED) has been observed in postoperative settings. It has been described as "a mental disturbance during the recovery from general anesthesia."[1] ED and agitation are two terms that have been interchangeably described in literature because they are not easily distinguished in clinical practice, yet differences do exist. ED is a complex psychiatric syndrome that includes perceptual disturbances, hallucinations, and psychomotor agitations.[1] Agitation is a state of mild restlessness and mental distress that unlike ED does not always suggest a significant change in behavior.[1] ED accounts for 19% of the pediatrics population who undergo surgeries.[2,3]

Risk factors associated with postoperative ED are either related to surgery and/or patient-related characteristics. For instance, anesthesia inhalers, such as desflurane and sevoflurane, have been associated with postoperative ED. A study conducted at the Mott Children's Hospital in Michigan concluded that the usage of sevoflurane and isoflurane for induction and maintenance among pediatrics increased the rates of ED by two-fold when compared with those who received another anesthetic regimen.[1] On the other hand, one study noted that otorhinolaryngologic and ophthalmologic surgical procedures resulted in an increase in the incidence of postoperative ED.[4] Another study reported that 61% of surgical procedures such as herniorrhaphies developed ED during recovery.[2] The administration of ketorolac prior surgery decreased postoperative ED three- to four-folds.[5] Moreover, younger children are at a higher risk of developing ED after surgery compared with older children with no gender predilection.[2,5] In fact, the younger the child, the higher the risk to develop ED.[6] Other patient-related factors such as preoperative anxiety also make the child more susceptible to develop ED.[2] However, a clear association between preoperative anxiety and ED has not been investigated sufficiently.[5]

The variations in the rates of ED have been observed in literature, due to the differences in study designs, types of surgery, and anesthetics used. This necessitates the need for more studies to identify the prevalence of ED and determine its risk factors. Although ED is self-limited (usually lasts between 5 and 15 min), it can result in numerous complications, such as postsurgical bleeding and pain at the surgery site.[4] In worst-case scenarios, the acute change in the children's cognition and attention could drive them to rip off their monitors, pull out their intravenous accesses, and even attempt to remove wound dressings or casts. Children with ED tend to have longer periods of recovery, prolonged length of stay, and subsequently elevated hospital costs.[7] Due to these complications, ED needs to be screened and the risk factors ought to be identified preoperatively to prevent it.[7] Thus, the aim of this study was to determine the prevalence of ED and its risk factors among children who underwent surgeries at a major tertiary healthcare facility in Saudi Arabia.

Materials and Methods

This was a retrospective cohort study, based on a review of medical charts that was conducted at the Post Anesthesia Care Unit of King Abdullah Specialist Children Hospital, Riyadh, Saudi Arabia. This hospital is Joint Commission International–accredited and affiliated with the Saudi Ministry of National Guard Health Affairs. The unit is well-staffed with qualified physicians, nurses, and consultants, and it has a bed capacity of 10 beds (8 regular and 2 isolation for the infectious cases). The pediatric anesthesia unit receives both elective and emergency admissions.

Ethical approval of this study was obtained from the Institutional Review Board (RC 18/063/R) at King Abdullah International Medical Research Center. No patient informed consents were obtained, as it was based on a review of the medical records. A group of three well-trained post-anesthesia care unit (PACU) nurses was assigned to screen the electronic medical records between March and August 2018 to retrieve the data of interest. Two study investigators validated the collected data. Eligible study subjects were children less than 14 years old and admitted to the postanesthesia unit after undergoing an elective nonemergency surgery. Only those with a normal healthy or a mild systemic disease as per the classification of the American Society of Anesthesiologists (levels I and II) were selected.[8]

The collected data comprised the patient's characteristics such as age, sex, and body mass index. Surgery-related characteristics were the type and duration of procedure, the duration of anesthesia, the medications given pre/intraoperatively [Table 1], and recovery duration. The Modified Yale Preoperative Anxiety Scale (short version) was collected at the preholding area to assess the child's level of anxiety. It consisted of four domains that assessed the levels of Activity (scale 1–4), Vocalizations (scale 1–6), Emotional expressivity (scale 1–4), and State of apparent arousal (scale 1–4).[9] The fifth domain (use of parents) was not used due to the absence of parents in preoperative units. Higher rating corresponded to more severe forms of anxiety. The Watcha scale was used to detect ED. It is considered as a simple tool for practitioners and has a

Table 1: List of medications administered in this study

Drug	Class	Indications	Side effects
Preoperative: midazolam	Benzodiazepines	Anxiety - preoperative sedation	Agitation Cardiac arrest Respiratory arrest Drowsiness Headache Delirium
Induction/maintenance drug: sevoflurane	Inhaled anesthetic Volatile liquid	General anesthesia	Agitation Hypotension Drowsiness Dizziness Delirium
Induction/maintenance drug: propofol	Sedative - hypnotic	General anesthesia	Injection site pain Involuntary movement Nausea and vomiting
Intraoperative analgesia: fentanyl	Opioids	Postoperative pain	Anxiety Vomiting
Intraoperative analgesia: paracetamol	Analgesic	Fever pain (mild to moderate)	Pruritus Constipation nausea/vomiting
Intraoperative analgesia: ketorolac	NSAIDs	Pain, short-term regional anesthesia	Edema Hypertension Vomiting
Intraoperative analgesia: morphine	Opioids	Pain (moderate to severe)	Pruritus Constipation
Intraoperative analgesia: tramadol	Opioids	Pain (moderate to severe)	Flushing Pruritus constipation
Intraoperative analgesia: lidocaine	Anesthetic, local amino amide	Local anesthetics Regional or peripheral blocks	Edema Erythema Headache
Intraoperative analgesia: ketamine	Anesthetic adjunct	Administration of analgesia - sedation	Hypertension Tachycardia Emergence from anesthesia
Intraoperative analgesia adjuvant: Precedex	Alpha-2-adrenergic agonist Sedative	Postoperative pain	Hypertension Nausea Vomiting Anemia

NSAIDs: Nonsteroidal anti-inflammatory drugs

high sensitivity/specificity. The Watcha scale consists of four assessment levels that are level 1 (child is calm), level 2 (crying, but can be consoled), level 3 (crying, but cannot be consoled), or level 4 (agitated and thrashing around). ED was confirmed at levels 3 and 4.[10]

Data entry and analyses were performed using the SPSS statistical software (Version 25; SPSS Inc., NY, USA). The categorical variables were presented in frequencies and percentages, whereas the continuous variables were presented in mean ± standard deviation (SD). The incidence of ED was calculated by dividing the number of documented cases of ED over the total number of pediatric cases who underwent surgeries within the study period. The scores obtained from the four anxiety domains were converted into percentage mean scores ± SD. Bivariate analyses were conducted using Pearson's Chi-square, Fisher's exact test, and Student's *t*-test as applicable. Hedges' *g* was presented as a measure of this effect. A binary logistic regression model was constructed and the adjusted odds ratio (OR) [95% confidence interval] was presented. *P* value was statistically significant at <0.05.

Results

Participant's characteristics

A total of 413 study participants underwent surgical procedures, among whom 219 (53.0%) were males and 194 (47.0%) were females. Their mean of age was 5.5 ± 2.1 years, with 240 (58.1%) between 4 and 6 years old. Almost 20% were overweight to obese. Other participant characteristics are enlisted in Table 2. The leading surgery category was classified as ear, nose, and throat (ENT) [184 (44.6%)], dental [109 (26.4%)], genitourinary [40 (9.7%)], and others [Table 3]. The anxiety scales preop showed that the mean ± SD of expression of emotions was 37.1 ± 21.6, apparent arousal

Table 2: Child and preoperation characteristics

	n (%)
Child characteristics	
Gender	
Female	194 (47.0%)
Male	219 (53.0%)
Age category	
Toddler (1-3 years)	55 (13.3%)
Preschooler (4-6 years)	240 (58.1%)
School (>6 years)	118 (28.6%)
Mean±SD	5.5±2.1
BMI categories	
Underweight (<5th)	136 (32.9%)
Normal weight (5-85th)	197 (47.6%)
Overweight/obese (>85th)	80 (19.5%)
Surgery characteristics	
Surgical grade	
One	333 (80.6%)
Two	80 (19.4%)
Anxiety scales	
Activeness (mean±SD)	30.1±13.5
Vocalization (mean±SD)	26.9±20.3
Expression of emptions (mean±SD)	37.1±21.6
Apparent arousal (mean±SD)	33.7±20.4
Intraoperative medications*	
Midazolam	11 (2.7%)
Sevoflurane	413 (100%)
Propofol	260 (63.0%)
Fentanyl	362 (92.1%)
Morphine	22 (5.6%)
Tramal	15 (3.8%)
Paracetamol	357 (90.8%)
NSAID	29 (7.5%)
Precedex	186 (47.3%)
Anesthesia*	
General	123 (31.2%)
Local	271 (68.8%)
Regional blocks	31 (11.4%)
Skin infiltrate	240 (88.6%)
Duration (mean±SD)	63.0±43.5 (min)
Outcome characteristics	
Recovery duration (min)	
Mean±SD	53.9±27.9
Emerging delirium	
No	390 (93.4%)
Yes	23 (6.6%)
Duration (mean±SD)	21.5±15.3 (min)

SD: Standard deviation; BMI: Body mass index; NSAID: Nonsteroidal anti-inflammatory drug. *Non-mutually exclusive

Table 3: List of surgery types

	n (%)	Incidence of ED
Surgery type		
ENT	184 (44.6%)	15 (8.2%)
Dental	109 (26.4%)	4 (3.7%)
Plastics	6 (1.5%)	0 (0%)
Genitourinary	40 (9.7%)	3 (7.5%)
Ortho/muscles/joints	24 (5.8%)	1 (4.2%)
Hernias	17 (4.1%)	1 (5.9%)
Ophthalmic surgeries	21 (5.1%)	0 (0%)
Excisions/removal of cysts/drainage	12 (2.8%)	0 (0%

ED: Emergence delirium

33.7 ± 20.4, activeness 30.1 ± 13.5, and vocalization 26.9 ± 20.3.

Intraoperative medications varied among participants. With regard to opioid analgesics, 362 (92.1%) received fentanyl, 22 (5.6%) received morphine sulfate, and 15 (3.8%) received Tramal. Nonopioid analgesics, such as paracetamol, were given to 357 (90.8%) and 29 (7.5%) received nonsteroidal anti-inflammatory drug (NSAID). Precedex was administered to 186 (47.3%) participants. Almost one-third received only general anesthesia (31.2%), while 271 (68.8%) received an additional regional block/skin infiltrate. The mean of anesthesia duration was 63.0 ± 43.5 min, while that of recovery duration was 53.9 ± 27.9 min.

ED and its associated factors

The incidence of ED among pediatrics who underwent surgeries during the 6-month period was 23 (6.6%). Bivariate analyses showed that participants who received intraop Precedex had the least incidence of ED (1.1%), compared with those who did not (10.1%), $P < 0.001$ [Table 4]. Almost 18.8% of those who received fentanyl alone developed ED, while 12% of those who received fentanyl/paracetamol developed ED. ED was observed in 10% of participants who received paracetamol alone, and 11.2% in those who received paracetamol/NSAID/fentanyl. Other adjunct intraoperative analgesics are presented in Figure 1. ED was significantly associated with longer recovery duration 69.5 ± 27.1 min, $P = 0.007$. Participants with higher preoperative arousal scores (43.4 ± 28.7) showed higher incidence of ED, $P = 0.021$ [Table 5].

Binary logistics regression analysis showed that participants who did not receive Precedex were adj. OR = 10.3 (2.4–48.9) times more likely to develop ED, compared with those who did, adj. $P = 0.003$. Lower preoperative scores of expression of emotions and higher preoperative scores of apparent arousal were significantly associated with ED, adj. $P = 0.035$ and adj. $P = 0.023$, respectively [Table 6].

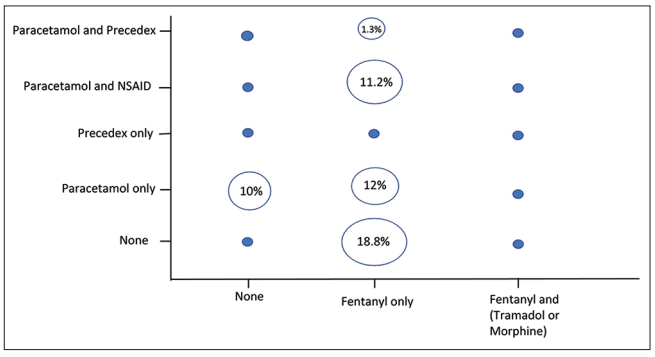

Figure 1: Incidence of ED among subgroups receiving various opioids and nonopioid analgesia

Table 4: Incidence of ED across various sample characteristics

	ED 23 (6.6%)
Gender	
Female	8 (4.3%)
Male	15 (7.0%)
	χ^2=1.350, *P*=0.245
Age category	
Preschooler (<6 years)	20 (6.9%)
School (≥6 years)	3 (2.6%)
	χ^2=2.816, *P*=0.093
BMI categories	
Underweight/normal weight	18 (5.5%)
Overweight/obese	5 (6.5%)
	χ^2=0.105, *P*=0.746
Surgery category	
Type 1	18 (5.6%)
Type 2	5 (6.4%)
	χ^2=0.085, *P*=0.770
Type of anesthesia	
Local anesthesia	17 (6.2%)
General only	6 (4.9%)
	χ^2=0.274, *P*=0.601
Intraop Precedex	
No	21 (10.1%)
Yes	2 (1.1%)
	χ^2=14.531, *P*<0.001*
Intraop paracetamol/NSAID	
No	4 (11.1%)
Yes	19 (5.3%)
	F-exact, *P*=0.149
Intraop fentanyl	
No	2 (6.7%)
Yes	21 (5.8%)
	F-exact, *P*=0.846
Intraop Tramal/morphine	
No	23 (6.6%)
Yes	0 (0.0%)
	F-exact, *P*=0.228

ED: Emergence delirium; BMI: Body mass index; NSAID: Nonsteroidal anti-inflammatory drug. χ^2: Pearson's Chi-square; F: Fisher exact, *P*: p-value. *Statistically significant at <0.05

Table 5: Incidence and duration of ED and its relationship with sample characteristics

	Emerging delirium	
	No	Yes
Anesthesia duration (mean±SD)	63.1±42.8	54.2±47.8
	t=0.963, *P*=0.336; *g*=0.14	
Recovery duration (mean±SD)	53.1±23.9	69.5±27.1
	t = -2.717, *P*=0.007*; *g*=0.50	
Preop activeness (mean±SD)	29.7±13.1	32.1±17.9
	t = -0.803, *P*=0.422; *g*=0.15	
Preop vocalization (mean±SD)	26.0±19.1	34.4±28.9
	t = -1.887, *P*=0.060; *g*=0.38	
Preop expression of emptions (mean±SD)	36.4±20.5	39.3±28.0
	t = -0.617, *P*=0.537; *g*=0.14	
Preop apparent arousal (mean±SD)	32.7±19.1	43.4±28.7
	t = -2.319, *P*=0.021*; *g*=0.33	

ED: Emergence delirium; SD: Standard deviation, *t*: Student's *t*-test; *g*: Hedges' *g*. *Statistically significant at <0.05

Discussion

ED in postoperative settings remains a clinical challenge in a sense; it is unpredictable and may progress into undesirable complications. To the child's parents, ED or any subsequent injury is accounted as a hospital liability. Therefore, health practitioners should be extra vigilant about the risk factors of ED, so that they are either eliminated or controlled in a timely manner. In literature, the incidence of postoperative ED among the pediatric population ranged between 10% and 80%.[11,12] In our study, the 6-month period incidence of ED was 6.6%, which was lower than what has been reported in a number of studies, even regarding specific types of surgeries such as ENT (8.2%). One study reported that the incidence of ED among patients undergoing a cataract surgery was 35%.[11] Another study conducted in Saudi Arabia reported a 46% incidence of ED among pediatric patients who underwent adenotonsillectomy.[13] The highest incidence of ED occurred among ENT surgical cases, followed by genitourinary cases. This study differed from the majority of previously published studies that were mainly focused on specific types of surgeries. In this study, the incidence of ED was reported in a unit that witnessed multiple types of surgeries. Investigating the incidence of ED among only one type of surgery might have overlooked its occurrence in other types of surgeries. Accordingly, findings presented in this study are more representative and draw a broader picture of ED that might occur in postoperative settings that provide care for a diverse spectrum of surgeries.

The wide usage of inhaled anesthetics, such as sevoflurane and desflurane, is confirmed to be a trigger of ED among pediatrics.[12] In fact, one study reported a 60% incidence of ED among pediatric patients who underwent sevoflurane induction without premedications.[14] Induction with sevoflurane was a homogeneous variable in this study, as its administration is not optional. Intraoperative medications in adjunct with sevoflurane remain the single most important modifiable variable to lower the rates of ED. Reports on the usage of fentanyl to reduce ED varied. One meta-analysis concluded that administering fentanyl alone significantly reduced ED.[15] Another study found that fentanyl can reduce the need for midazolam and could further decrease the incidence of EDs.[16] In this study, almost 19% of those who received fentanyl alone developed ED, yet when compared with patients who received fentanyl in adjunct with paracetamol, the incidence of ED dropped to 12%. Furthermore, when combining fentanyl with paracetamol and NSAID, the incidence of ED decreased furthermore to 11.2%. This suggests that the combination of fentanyl with other analgesics can greatly reduce the prevalence of ED. It was a challenge to compare this observation with literature due to

Table 6: Binary logistic regression analysis of factors associated with ED

	Adjusted odds ratio (95% CI)	Adjusted *P*
Gender		
Male vs. Female	1.2 (0.4-3.3)	0.778
Age		
Younger vs. older	4.9 (0.9-24.5)	0.054
BMI categories		
Overweight vs. normal	2.0 (0.5-8.2)	0.338
Surgical grade		
1 vs. 2	1.3 (0.3-5.8)	0.700
Anesthesia type		
Local vs. general	1.1 (0.3-3.4)	0.918
Intraop Precedex		
No vs. yes	10.3 (2.2-48.9)	0.003*
Intraop opioids		
No vs. yes	-	0.998
Intraop paracetamol		
No vs. yes	1.6 (0.4-6.9)	0.539
Preop activeness (score)	1.0 (0.9-1.1)	0.553
Preop vocalization (score)	1.0 (0.9-1.1)	0.238
Preop expression of emotions (score)	0.8 (0.7-0.9)	0.035*
Preop apparent arousal (score)	1.2 (1.1-1.3)	0.023*

CI: Confidence interval; BMI: Body mass index. *Statistically significant at <0.05

the absence of similar studies. In this study, the variations in the adjunct administration of opioid and nonopioid analgesics as well as Precedex have played a distinguishable role in lowering ED. This necessitates future interventional studies where these combinations are tested in a more controlled and randomized research methodologies.

Precedex in this study has yielded significant positive outcomes by lowering the incidence of ED. Precedex (dexmedetomidine) is a relatively new drug used for its sedative, analgesic, and anxiolytic characteristics.[17] It lowers the sympathetic response to painful stimuli; thus, it has the capability of reducing the total required anesthetic used during the surgery or procedure.[17] Though dexmedetomidine has some unwanted side effects such as hypotension, prolonged extubation time, bradycardia, and prolonged sedation,[18] they are dose-dependent and rarely exhibit a major concern to pediatric population. It is worth mentioning that it is not labeled for the pediatric population, except for the younger age groups undergoing various surgeries.[18] However, it has been beneficial in reducing postoperative ED.[18] One hypothesis stated that dexmedetomidine decreases postoperative ED because it reduces the sevoflurane requirements during the surgery.[19] Furthermore, dexmedetomidine also has been reported to lower the incidence of ED when used intravenously in patients undergoing cardiac surgery, lower abdominal and genital surgery, and ophthalmologic and orthopedic surgeries.[11,18-21] In one clinical trial conducted among patients age 1–6 years, a significant decrease in ED was noted when dexmedetomidine was administered to patients undergoing cataract surgeries.[11] A contradictory report claimed that there is no difference or to the least a slight decrease in the incidence of postoperative ED after administration of dexmedetomidine.[17] On the same hand, a study compared the adjunct use of dexmedetomidine and midazolam which both decreased the incidence of ED from 40% to 4.4%.[22] In this study, the incidence of ED had decreased from 10% to 1% when dexmedetomidine was administered which signifies the preventive effect of dexmedetomidine from ED in patients undergoing various surgeries.

Developing negative behaviors postoperatively increases three to five times among pediatric patients who had anxiety preoperatively, and more than 50% of them occur on the first day after surgery.[23] These include crying, nightmares, and separation anxiety.[23] In this study, two of the anxiety domains were found to be significantly associated with ED, both of which can be controlled prior surgery to lower the chance of ED. Children who were more aroused or suffered from diminished expression of emotions prior surgery showed higher prevalence of ED. One study noted that patients with preoperative mild anxiety were less likely to develop ED when compared with patients with moderate to severe anxiety.[2] Furthermore, a Belgium study found a significant association between anxiety at induction and ED.[24] The authors believed that because anxiety is a complex psychological condition, practitioners and researchers ought to examine and investigate it at its four individual domains. This analytical approach was seldom discussed in literature.

Investigating each domain of the anxiety scale aids in better understanding and guides practitioners to more specific interventions. For instance, managing the arousal status of children prior surgery such as providing preoperative educational material (board game, a video, or a booklet) has been proven effective in controlling arousal prior surgery.[25] One study observed that even the usage of films not relevant to the surgery aided in distracting the children prior surgery and reduced their fears.[26] Interpreting the expression of emotions among young children can be a challenge and is commonly witnessed in nonverbal behaviors.[27] Early recognition of disturbed emotional expression requires a therapeutic relationship between the practitioner and the child.[27] A previous experience (prior surgery) or the surgical outfit of practitioners can also aggravate this fear. Accordingly, healthcare practitioners in collaboration with parents are advised to acquaint the child with the setting, promise them with gifts, and encourage them by boosting up their morals.

A number of limitations were encountered in this study. Due to the retrospective nature of the study design, some confounders were not assessed which might have been associated with ED, such as sleep, psychosocial status, and prior experience with surgeries. Larger sample size would have allowed for stratifying by the type of surgery, so an extension in the data collection time might have revealed more incidents and allowed a matched pair group analysis. Quantifying anxiety preoperatively is difficult,[6] and healthcare practitioners in preoperative units might have under- or overscored on the assessment of anxiety scale, though frequent training is provided on this matter at this setting. On the other hand, ED might have been confused with agitation by some practitioners in the postanesthesia unit. Therefore, the true prevalence of ED is often underreported.

Conclusion and Recommendations

ED appears to be inevitable in postoperative settings, yet some patient and surgery-related characteristics could be addressed as potential predictors. Although some factors such as age, gender, body mass index, and surgical grade were not statistically associated with ED, they remain unmodifiable factors that can only serve as predictors. It is crucial to address any preoperative anxiety as it is associated with ED. Preoperative anxiety is a modifiable factor that could be managed, as well as the administration of Precedex and adjunct analgesic treatments.

Healthcare practitioners during the surgery are advised to refer to the updated evidence-based guidelines in administering anesthesia and analgesia to lessen the incidence of ED. Commonly reported risk predictors ought to be considered as warning signs among high-risk children, so frequent education and dissemination on this issue is important. The child's safety remains a paramount objective, so healthcare practitioners are advised to ensure the invasive catheters are well-secured, bed side rails are safely padded, and continuous monitoring during the recovery stage is maintained. Due to the diversity of surgery types at operative settings, healthcare practitioners need to be aware on the leading risky operations to develop ED, such as ENT. Therefore, a colored surgery codes might be more appealing to notify and alert practitioners in postanesthesia settings. Finally, a coalition of efforts between researchers and clinicians is crucial to refine the current practice based on the findings generated by randomized clinical trials and systematic review/meta-analyses studies.

Declarations

Ethics approval and consent to participate

Ethical approval to conduct this study was obtained from the Institutional Review Board Committee at King Abdullah International Medical Research Center, the Saudi Ministry of National Guard Health Affairs, Saudi Arabia.

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Conflicts of interest

There are no conflicts of interest.

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