

BENEFITS OF KETAMINE AND DEXMEDETOMIDINE IN PEDIATRIC POPULATION FOR EMERGENCE DELIRIUM: A CASE SERIES

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Abstract: Emergence delirium (ED) is common occurrence in children in the immediate post-operative period receiving sevoflurane-based general anaesthesia. It manifests as crying, excitation, agitation, delirium and behavioural disturbances during early emergence from anaesthesia. Several clinical studies suggest different pharmacological methods for either treatment or prophylaxis from ED after anaesthesia with variable success rate. However, the method of choice remains controversial. Ketamine is a non-competitive N-methyl-d-aspartate receptor antagonist with good sedation, analgesia and amnesia properties. Dexmedetomidine is a selective α_2 -adrenoceptor agonist with sedative, analgesic and anxiolytic properties. Both ketamine and dexmedetomidine has shown to benefit emergence delirium. 14 children undergoing lower abdominal surgery were included in the case series. Anaesthesia was induced with injection propofol 2mg/kg body weight IV and maintained with sevoflurane. Children between 1-7 years of age received injection 0.5mg/kg ketamine IV and injection 0.5mcg/kg dexmedetomidine IV as intermittent doses throughout the procedure. Post-operative ED was assessed with Pediatric Anaesthesia Emergence Delirium (PAED) Scale. ED was defined as PAED \geq 10. The severity of ED was reduced with low dose ketamine and dexmedetomidine and post-operative recovery was good. Low dose ketamine and dexmedetomidine reduces severity of ED in children undergoing lower abdominal surgeries with sevoflurane-based anaesthesia. Provides smooth extubation and good post-operative recovery.

Keywords: sevoflurane, ketamine, dexmedetomidine, children

1. Introduction

Emergence delirium also referred to as emergence agitation(EA) is a well documented phenomenon occurring in children in the immediate post-operative period. When Eckenhoff *et al* first described Emergence agitation in 1961.¹ Emergence agitation manifest as crying, excitation, agitation, delirium and behavioural disturbances during early emergence from

general anesthesia.² This must be prevented by providing smooth emergence to pediatric patients. High incidence of emergence agitation has given way to researchers to come up with numerous studies to prevent emergence agitation.

Parental presence at emergence, pharmacologic interventions or rarely physical restraints, are the methods used to prevent emergence agitation. Various studies proved that medications such as fentanyl, ketamine and propofol, dexmedetomidine, clonidine and midazolam have been used with differing efficacies of individual agents.

Dexmedetomidine is highly specific α_2 receptor agonist than clonidine and has sedative and analgesic properties without significant respiratory depression at clinical dosages. Ketamine is a dissociative sedative that provides analgesia and amnesia. However the efficacy of individual drugs in preventing EA remains the subject of debate. In this case series we are seeing the efficacy of ketamine and dexmedetomidine in prevention of emergence agitation in children under sevoflurane based anaesthesia.

2. Case series

This case series was conducted to compare the effectiveness of ketamine and dexmedetomidine in reducing the incidence and severity of emergence delirium associated with sevoflurane based general anesthesia in pediatric population.

14 cases scheduled for elective surgery were taken up (Table 1). Written and informed consent of the patients attenders was taken. Patients between 1-7 years were included in the study and those with difficult airway were excluded from the study.

Children were premedicated in preoperative area with injection Midazolam 0.05mg/kg body weight, injection ondansetron 0.1mg/kg B. wt. Once children were sedated, they were shifted to OT. Standard ASA monitors were connected. Preoxygenated with 100% O₂. Induced with injection Propofol 2mg/kg B. wt. Supraglottic airway device (I-GEL) of appropriate size was inserted and fixed after confirming bilateral chest rise and was maintained on sevoflurane 2%, air, oxygen and ventilated by J-R circuit. Caudal analgesia was given according to the patient demographics. A low dose Inj ketamine 0.5mg/kg IV and Inj dexmedetomidine 0.5mcg/kg IV was given intermittently throughout the procedure.

Once the surgical procedure was done inhalation agent was cut off, proper suctioning was done and once spontaneous regular breathing was seen, I-GEL was removed and child was shifted to postoperative area. On recovery ED was assessed with Pediatric Anesthesia Emergence Delirium (PAED) Scale (Table 2). ED was defined as PAED ≥ 10 .

Sl. No	Age/sex	Procedure	PAED score
1	3y 5months/ male	Circumcision	4
2	3y/male	Left pyeloplasty	3
3	2y 8months/male	Cyst excision	5
4	5y/male	Hypospadiasis repair	5
5	2y/female	Colostomy closure	4
6	18months/male	Hypospadiasis repair	6
7	4y/male	Urethroplasty	4

8	1y 7months/male	Right herniotomy	4
9	7y/male	Right orchidopexy	3
10	1y/male	Left herniotomy	6
11	2y/male	Debridment+ dressing	4
12	6y/male	Urethroplasty	5
13	2y/male	Left herniotomy	3

Table 1: Patient demographics and PAED score

Behavior	Not at all	Just a little	Quite a bit	Very much	Extremely
The child makes eye contact with the caregiver	4	3	2	1	0
The child's actions are purposeful	4	3	2	1	0
The child is aware of his/her surroundings	4	3	2	1	0
The child is restless	0	1	2	3	4
The child is inconsolable	0	1	2	3	4

Table 2: Pediatric Anesthesia Emergence Delirium scale

3. Discussion

Emergence delirium is defined as a disturbance in a child's awareness or attention to his/her environment with disorientation and perceptual alterations including hypersensitivity to stimuli and hyperactive motor behaviour in the immediate post anesthesia period.³ Usually these symptoms occur within 30 min of termination of anaesthesia and last for 15 to 30 min. However, ED can be persistent and has been reported to continue for up to 2 days.³

The incidence of ED is two to three times more common in children than in adults. There are multiple risk factor such as patient factors(preexisting behaviour, anxiety) surgical factors (ENT, abdominal surgeries, orthopedic and urology surgeries) and anesthesia factors (volatile agents, emergence duration and post-operative pain).

Several prospective clinical trail studies suggested different pharmacological methods for either treatment or prophylaxis from EA after anesthesia and surgery with variable success such as analgesics, opioids, benzodiazepines, and clonidine.⁴

Ketamine acts as a non-competitive NMDA receptor antagonist in the central nervous system. Due to its rapid onset and short duration without affecting respiratory function, ketamine is frequently used for procedural sedation and analgesia in children.⁵

The alpha 2 agonist dexmedetomidine is a new sedative, analgesic, and anxiolytic agent. Its intraoperative administration reduces anesthetic requirements, speeds postoperative recovery, and blunts the sympathetic nervous system response to surgical stimulation.⁶

Paul Swamidhas Sudhakar Russell *et al* (2022) ⁷ conducted a diagnostic meta-analysis to evaluate the efficacy of Pediatric Anesthesia Emergence Delirium Scale(PAEDS) and

concluded that PAEDS is an accurate diagnostic measure for the diagnosis of emergence delirium among children and adolescents.

Alexander N Manning et al (2020) ⁸ conducted a study among 2,142 study participants ranging in age from 1 to 15 years to evaluate the efficacy of dexmedetomidine to prevent incidence of emergence delirium in post operative period following general anesthesia. They concluded that administering an intravenous bolus dose of 0.5 µg/kg of body weight in the intraoperative phase demonstrated a significant reduction in the incidence of emergence delirium with minimal side effects.

Xu Zhang *et al* (2021) ⁹ a meta-analysis of randomized controlled trials to effect of different administration and dosage of dexmedetomidine in the reduction of emergence agitation in children. They concluded a high quality efficacy of dexmedetomidine in preventing emergence agitation in children when perineural routes administered dexmedetomidine, as premedication, as continuous dosage, and at a high dose.

Our study showed that low dose ketamine and dexmedetomidine was beneficial in providing smooth emergence to pediatric patients. Our cases showed PAED score < 10.

4. Conclusion

Low dose ketamine and dexmedetomidine reduces severity of ED in children with good post-operative recovery and analgesia.

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5. Reference

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