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Original Research Article

Effect of dexmedetomidine on emergence agitation and recovery profiles after sevoflurane anaesthesia in pediatric ENT surgeries

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ABSTRACT

AIMS & OBJECTIVES: Emergence agitation is a common problem in pediatric patients after general anesthesia induced by sevoflurane as reported by pediatric anaesthesiologists. Sevoflurane is widely used in pediatric anesthesia for its pharmacologic profile, which allows rapid inhalational induction and awakening from anesthesia. In our study we aim to identify the effect of Dexmedetomidine in reducing sevoflurane induced emergence agitation and postoperative pain scores in children.

MATERIAL AND METHODS :The study was conducted after approval from ethics committee. 60 children posted for ENT surgery were included after informed written consent from parents/guardians. Patients were randomly divided into two groups (A& B). General anesthesia was induced with sevoflurane 2- 3% and 20 minutes before the end of surgery Injection Dexmedetomidine 0.75mg/Kg diluted in 10 ml NS was given slowly over 10 minutes in group A and in group B patients received 10ml NS was given over 10 minutes. After extubation, both the groups were compared for EA and postoperative pain scores based on PAEDS score and FLACC score.

RESULTS: Significant difference was found in HR at the time of extubation which was significantly less in group A. PAEDS score and FLACC score were significantly less in group A compared to group B($p<0.05$).

CONCLUSION: Dexmedetomidine is an effective drug in reducing sevoflurane induced Emergence Agitation and postoperative pain in children.

1. INTRODUCTION

Emergence agitation is a common problem in pediatric patients characterised by a dissociated state of consciousness in which the child becomes inconsolable, irritable, uncooperative and sometimes aggressive[1][2] and has behavioural disturbances during early emergence from general anesthesia and continues through the initial recovery period[3]. Patients with EA may unconsciously remove their endotracheal tubes, urinary catheters and stomach tubes leading to incision dehiscence, bleeding, urinary retention and asphyxia.[4,5] Sevoflurane is widely used in pediatric anesthesia for its pharmacologic profile, which allows rapid inhalational induction and awakening from anesthesia.[1][4] However, the occurrence of agitation is a common phenomenon in children undergoing general anesthesia with sevoflurane. It is influenced by technique and anesthetic agents. The incidence of emergence agitation after sevoflurane anesthesia estimated at 80%.[2] Emergence agitation occurs most

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frequently in preschool children during the early stage of emergence from anesthesia. Many techniques and medication which include parental presence at emergence[4] regional block[5] premedication, propofol, μ-opioid agonist and α2 agonists have been used to reduce pediatric EA[2][6]. Dexmedetomidine, a selective α2 agonist can induce a satisfactory sedative effect by primarily acting on the α adrenergic receptors of the brainstem nucleus to inhibit norepinephrine release. Dexmedetomidine does not cause respiratory depression, but it does have cardiovascular effects, so use of the drug requires monitoring.[2] Various doses of Dexmedetomidine (0.15-2μg/kg) have been used to prevent EA in pediatric patients following sevoflurane anesthesia[2].

AIMS AND OBJECTIVE

PRIMARY OBJECTIVE: TO IDENTIFY THE EFFECT OF DEXMEDETOMIDINE ON EA IN PEDIATRIC PATIENTS UNDERGOING SEVOFLURANE ANESTHESIA.

SECONDARY OBJECTIVE: TO OBSERVE POSTOPERATIVE PAIN SCORE, RESCUE ANALGESIA REQUIREMENT AND ANY ADVERSE EFFECTS.

2. MATERIAL AND METHODS:

The present study was observational hospital based study conducted in the Department of Anesthesiology, Gandhi medical college and associated Hamidia Hospital after approval from Ethics Committee. Informed written consent was taken from their parents or guardians. 60 children were taken and randomly divided into two groups (A&B).

INCLUSION CRITERIA:

- 60 pediatric patients undergoing ENT surgeries
- Patients of age group 4-12 years
- ASA grade 1&2

EXCLUSION CRITERIA:

- Patients with cardiac disease, abnormal upper airway, reactive airway disease such as asthma.
- Patients with allergies to Dexmedetomidine
- Patients with history of upper respiratory tract infection in the preceding 4 weeks.
- Patients receiving medications known to interact with Dexmedetomidine such as Lorazepam, Diphenhydramine or Furosemide.

PREOPERATIVE PREPARATION: Intravenous accesses were secured in all children on the day before the surgery by experienced nurses. All the children must be fasted for 6 hours.

In The Operation Theatre: Upon arrival in the operating room, the children were monitored with electrocardiography (ECG), pulse oximetry (SpO_2), capnography, and noninvasive arterial blood pressure (NIBP). All the patients were premedicated with Injection Ondansetron 0.1mg/Kg, Injection Midazolam 0.5mg/kg, Injection Glycopyrrolate 0.01mg/Kg, Injection Fentanyl 1μg/Kg. General anesthesia was induced with gradual rise of sevoflurane concentration to reach a maximum of 4% Sevoflurane in 100% oxygen(4-6L/min) through a facemask. After loss of eyelash reflex, all the patients were intubated with an endotracheal tube of appropriate size after adequate depth of anesthesia was obtained with Injection Succinylcholine 1mg/Kg. Throat packing was done as required. Anesthesia will be maintained using 1-2vol. % of sevoflurane in approximately 50 % oxygen and 50 %N2O with a total inflow of 2 L/min. Oxygen saturation(SpO2), electrocardiogram, heart rate(HR), mean arterial pressure(MAP), end tidal CO2 were monitored throughout the surgery. In group A 20 minutes before the end of surgery, 0.50 μg/kg of Inj. Dexmedetomidine diluted in 10 ml

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of normal saline was slowly injected for 10 min. In group B patients were given 10 ml normal saline. Syringes of Dexmedetomidine and NS were prepared and injected by an anesthesiologist who did not participate in the assessment of EA. At the end of surgery, the sevoflurane was stopped and neuromuscular blockade reversed with IV neostigmine 0.05mg/kg and IV Glycopyrrolate 0.01mg/kg and extubation done when the patients began breathing spontaneously and could open their eyes on command. The patients were transferred to the postanesthetic care unit (PACU) when fully awake with one parent. In the PACU, the ECG, NIBP, SpO_2, and the respiratory rate monitored.

Recordings to be done at the time of extubation, on arrival at PACU (T = 0), and 15 and 30 min later (T = 15, T = 30, respectively). The postoperative pain is to be assessed via the Face, legs, activity, Cry and inconsolability(FLACC) scale[3]. Nalbuphine as a rescue analgesic at a dose of 0.1mg/Kg is given if FLACC score ≥ 5[3].

FLACC scale

Behavioral Observation Pain Rating Scale

Categories	Scoring		
	0	1	2
Face	No particular expression or smile; disinterested	Occasional grimace or frown, withdrawn	Frequent to constant frown, clenched jaw, quivering chin
Legs	No position or relaxed	Uneasy, restless, tense	Kicking, or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid, or jerking
Cry	No crying (awake or asleep)	Moans or whimpers, occasional complaint	Crying steadily, screams or sobs, frequent complaints
Consolability	Content, relaxed	Reassured by occasional touching, hugging, or talking to. Distractable	Difficult to console or comfort
Each of the five categories (F) Face; (L) Legs; (A) Activity; (C) Cry; (C) Consolability is scored from 0-2, which results in a total score between 0 and 10.			

The severity of emergence delirium evaluated using the pediatric anesthesia emergence delirium scale (PAED)[3] with scores ranging from 0 to 20. PAED scale was monitored after shifting in PACU(T=0) and at 10 min intervals until discharge from PACU. Total PAED scores are sum for the five behaviours listed. EA was confirmed with a total PAED score that was 10 or more. If child had severe EA(score ≥16) rescue analgesia was given[4].

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

PAED, pediatric anaesthesia emergence delirium.

STATISTICAL ANALYSIS

- The comparison of the variables which were quantitative and not normally distributed in nature were analysed using Mann-Whitney Test and variables which were quantitative and normally distributed in nature were analysed using Independent t test.
- The comparison of the variables which were qualitative in nature were analysed using Chi-Square test.
- The data entry was done in the Microsoft EXCEL spreadsheet and the final analysis was done with the use of Statistical Package for Social Sciences (SPSS) software, IBM manufacturer, Chicago, USA, ver 25.0.
- p value < 0.05 was considered statistically significant.

3. RESULTS

TABLE 1: Comparison of demographic characteristics and requirement of rescue analgesia between group A and B.

Demographic characteristics	Group A(n=30)	Group B(n=30)	Total	P value
Age(years)	7.9 ± 2.09	7.33 ± 2.51	7.62 ± 2.31	0.336‡
		Gender		
Female	18 (60%)	14 (46.67%)	32 (53.33%)	0.301*
Male	12 (40%)	16 (53.33%)	28 (46.67%)	
		ASA grade		
1	11 (36.67%)	10 (33.33%)	21 (35%)	0.787*
2	19 (63.33%)	20 (66.67%)	39 (65%)	
Weight(kg)	16.5(12.25-20)	15(12-22.75)	16(12-20.25)	0.928†
Rescue analgesia	25.07±3.64	23.33±4.14	24.2±3.96	0.09

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TABLE 2: Comparison of heart rate(per minute) between group A and B.

Heart rate(per minute)	Group A(n=30)	Group B(n=30)	Total	P value
At baseline	78 ± 6.28	79.83 ± 9.98	78.92 ± 8.32	0.399†
At extubation	62.33 ± 4.94	82.67 ± 8.84	72.5 ± 12.47	<.0001†
T0	76.07 ± 6.54	78.5 ± 7.44	77.28 ± 7.05	0.184†
T10	72.67 ± 5.33	75.8 ± 5.97	74.23 ± 5.83	0.036†
T20	72.53 ± 5.35	74.6 ± 5.91	73.57 ± 5.68	0.161†
T30	71.2 ± 5.35	75.3 ± 6.52	73.25 ± 6.26	0.01†

Table 3: Comparison of systolic blood pressure(mmHg) between group A and B.

Systolic blood pressure(mmHg)	Group A(n=30)	Group B(n=30)	Total	P value
At baseline	120(118-124)	120(118-122)	120(118-124)	0.663‡
At extubation	106(104.5-108)	119(116-122)	111(106-118.5)	<.0001‡
T0	117(112.5-120)	116(112-120)	116(112-120)	0.416‡
T10	117(112-120)	116(112-120)	116(112-120)	0.953‡
T20	115(112-118)	116(112-120)	116(112-118.5)	0.551‡
T30	116(112.5-118)	116(112-118)	116(112-118)	0.982‡

Table 4: Comparison of FLACC scale between group A and B.

Flacc scale	Group A(n=30)	Group B(n=30)	Total	P value
T0	4(3-5)	8(7-8)	6(4-8)	<.0001‡
T15	3(3-4)	7(6-7)	5(3-7)	<.0001‡
T30	3(2-3)	6(5-6)	4(3-6)	<.0001‡

Table 5: Comparison of PAED score between group A and B.

Paed score	Group A(n=30)	Group B(n=30)	Total	P value
T0	7(6-8.75)	12(9-14.75)	9(7-12)	<.0001‡
T10	6(5-7)	11(7-12.75)	7(6-11)	<.0001‡
T20	5(4-6)	8(6-9.75)	6(5-9)	<.0001‡
T30	4(3-5)	7(5-8)	5(3-7)	<.0001‡

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- A total of 60 patients who enrolled in our study completed the study.
- Both the groups were comparable for demographic characteristics (Table 1). Mean age in group A was 7.9± 2.09 and in group B 7.33±2.51. Gender distribution was comparable with a p value of 0.301. Similarly on comparing ASA grade and weight no significant difference was found in our study.
- On comparing for Heart rate (HR), no significant difference was found in baseline values, at T=0,10,20 and 30 minutes(p value >0.05). At extubation we found significant difference between group A&B (p value <0.0001), group A showing lower values compared to group B.
- There was significant difference in Mean Arterial Pressure (MAP) at extubation (p value<0.0001) indicating group A patients had a more constant range of MAP compared to group B, while at other point of times (baseline, T=0,10,20,30 minutes) no significant difference was found in both the groups.
- Patients in group A who received Dexmedetomidine had stable vital parameters on extubation compared to group B.
- Emergence agitation as measured by PAED score showed patients had lower score i.e reduced incidence and severity of emergence agitation at all points of time. Children comparatively had smooth emergence in group A than group B(p value <0.05).
- Postoperative pain scores as assessed by FLACC score demonstrated that patients in group A had lower pain scores than in group B at all time points(p value<0.05).
- There was no significant difference found in both the groups when compared for requirement of rescue analgesia.(Table 1)

4. DISCUSSION

- With increasing use of Sevoflurane in pediatric patients for its pharmacologic profile emergence agitation has now become very common. Emergence agitation as defined by the number of children showing disturbances in postoperative behaviour during emergence as measured with PAED score in our study.
- As observed in our study, Dexmedetomidine significantly reduced emergence agitation and postoperative pain scores.
- Requirement of analgesia was also significantly less in group A.
- **Abdelzaam et al** compared the effect of Dexmedetomidine and Ketamine for the prevention of Emergence agitation in pediatric and concluded that both Dexmedetomidine and Ketamine reduced the incidence and severity of emergence agitation when compared to saline but the effects of Dexmedetomidine were superior to Ketamine.
- **Ghada f.Amer et al,** they conducted a study to compare the effect of Dexmedetomidine versus Propofol for prevention of emergence delirium in pediatric cataract surgery and found that patients who were given Dexmedetomidine have comparatively lower incidence of emergence delirium and significantly lower postoperative pain scores compared to those who received Propofol.

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- **Rabie Soliman et al** conducted a study to evaluate the effect of Dexmedetomidine on emergence agitation in children undergoing adenotonsillectomy under sevoflurane anesthesia and concluded that Dexmedetomidine significantly reduced the incidence of agitation with sevoflurane and also shorter time to extubation, lower incidence of postoperative nausea and vomiting and shorter post anaesthesia care unit length of stay.
- As observed in a meta analysis by **Tang W** involving a final of 24 trials conducted before August 2019 there was reduced incidence of emergence agitation (odds ratio 0.16, 95%CI 0.41,1.03)shortened extubation time(standardized mean difference [SMD]0.54,95% CI 0.28,0.81), reduced duration of PACU stay(SMD 0.29, 95% CI 0.08,0.51) when compared to placebo.
- Significant bradycardia was reported in 3 of total 30 patients given Dexmedetomidine which was managed with Injection Atropine. Incidence of nausea and vomiting were also reduced in patients of group A

5. CONCLUSION

Dexmedetomidine is an effective drug for reducing incidence and severity of emergence agitation, postoperative pain. Bradycardia and hypotension are known side effects but can be managed with medications.

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