

## Effect of Propofol and Fentanyl with the Controls to Prevent Emergence Agitation in Children Receiving Sevoflurane for Adenotonsillectomy

D.S. Sudhakar<sup>1</sup>, G.M. Jagadeesh<sup>2</sup>, Shanmugam<sup>3</sup>

<sup>1</sup>Assistant Professor <sup>2</sup>Resident <sup>3</sup>Professor, Institute of Anaesthesiology, Madurai Medical College, Madurai - 625020, Tamil Nadu, India.

### Abstract

**Background:** The administration of a single dose of propofol is reported to be effective in decreasing the incidence and severity of emergence agitation in children following sevoflurane anesthesia. **Aim:** To compare the effect of propofol and fentanyl with the control group to prevent emergence agitation in children receiving sevoflurane for adenotonsillectomy. **Materials and Methods:** Sixty children of ASA I of either sex divided into three groups. Twenty children in each group. Group FF: Children given 1.5 mcg/kg fentanyl during induction, and 1.0 mcg/kg fentanyl at the end of surgery, Group FP: Children given 1.5 mcg/kg fentanyl during induction, and 1 mg/kg propofol, Group FN: Children given 1.5 mcg/kg fentanyl during induction, and 0.1 ml/kg normal saline at the end of surgery. **Results:** In our study group the age of the children, sex distribution, weight, are not statically significant. Intra operative monitoring of pulse rate, spo2 and duration of sevoflurane administration, duration of surgery are also not statistically significant. Aono's four point scale which is used to determine the presence of emergence agitation showed statistically significant reduction in group FP and group FF compare with the group FN. The PAED score used to find out the severity of the emergence agitation and the CHIPPS score are statistically not significant. The P value of Ramsay sedation score in the group FN and Group FF is 0.016. and it's statistically significant and the P value between group FN and group FP is 0.035. it's also statistically significant. **Conclusion:** Propofol and fentanyl has been useful in reducing the incidence of emergence agitation for adenotonsillectomy surgeries in children receiving sevoflurane.

**Keywords:** Adenotonsillectomy; Propofol; Fentanyl.

### Introduction

Children anaesthetized with ketamine, cyclopropane, ether and surgeries like adenotonsillectomy, thyroidectomy and circumcision are associated with excessive crying thrashing and disorientation during emergence from anaesthesia.

Today, approximately 4 million children undergo anaesthesia each year and emergence agitation has been identified as a significant problem in children recovering from anaesthesia. Its incidence between 10-80%. Emergence agitation manifests with restlessness and disorientation and may cause

dislodgement of the surgical site dressing and drains and removal of intravenous catheters injury to the child. Extra nursing care especially in the post anaesthesia care unit is needed. Medication given to treat emergence agitation may delay discharge from the post anaesthesia care unit and sometimes from the hospital [1].

The term emergence agitation" is interchangeably used with "emergence delirium and "excitement" in order to describe an irritable uncooperative, and inconsolable child upon emergence. However there are difference in definition and clinical presentation of agitation and delirium. Emergence

**Corresponding Author:** Dr. G.M. Jagadeesh, Resident, Institute of Anaesthesiology, Madurai Medical College, Madurai - 625020, Tamil Nadu, India.  
E-mail: [dssudhakar80@yahoo.co.in](mailto:dssudhakar80@yahoo.co.in)

Received on 20.04.2017, Accepted on 09.05.2017

delirium is defined as upon emerging from general anaesthesia, the children is seen thrashing around in a violent manner (include pulling at monitoring equipment, intravenous catheters, endotracheal tube, drains, foley catheter, etc) screaming, incoherent, speech, hitting, biting, or attempts to leave the operating room (fall off narrow bed) encompassing any time period from end of surgery to discharge from post anaesthesia care unit. Any one of these displayed behaviours or a combination can constitute emergence delirium. This definition is not to be confuse with the diagnostic and statistical manual of mental disorders definition of delirium. There are four aetiology mentioned by the DSM, IV, TR (2000). There are substance abuse delirium, delirium due to multiple aetiologies, delirium otherwise not specific delirium due to a general medical condition. Delirium associated with medical conditions like brain tumours, hypoxia, hypercarbia, congestive heart failure, septicaemia and a multitude of other conditions further described in the DSM, IV, TR(2000) [2].

Regardless of aetiology, the DSM, IV, TR defines delirium as a disturbance of consciousness. It includes the inability to focus and a change in cognition, including language disturbance and memory deficits it can develop rapidly and tends to fluctuate. One of the main features associated with emergence delirium is that it does not fluctuate. The emergence delirium seen following general anaesthesia begins upon emergence and ends prior to discharge from the post anaesthesia care unit. "Agitation" is simply excessive motor activity, which is more common in postoperative period in the children as well as in adults. It is a non specific symptom resulting from any type of internal discomfort including pain and anxiety is relatively treated with reassurance and the appropriate use of analgesics and benzodiazepines. When present, emergence agitation occurs within the first thirty minutes of recovery from anaesthesia is usually self-limited. But it can last up to two days. Many studies have been done to determine the aetiology of emergence agitation. These point to surgical and patient related factors, as well as anaesthesia related factors such as rapid emergence and type of anesthetic.

Sevoflurane is the best agent of induction and maintenance of anaesthesia in children. It is widely used among paediatric anaesthesiologists. The etiology of emergence agitation in sevoflurane is currently unknown. Sevoflurane may create a dissociative state. Children awaken with altered cognitive perception. The etiology of

emergence agitation in sevoflurane may be due to low blood solubility of sevoflurane.<sup>3</sup> A study done by Yasui et al, in rats exposed to sevoflurane demonstrated increases nor-epinephrine in the locus ceruleus, a neural structure responsible for generalized central nervous system arousal. Other causes like, lack of a young child's ability to adapt to sudden changes due to an unfamiliar environment after awakening, immature neurological development, and anxiety from being separated from their parents, increased pain sensation and sympathetic hyper activation.

Adenotonsillectomy is the most important independent risk factor for emergence agitation and it is a common surgery done in children. Eckenhoff et al speculated that "sense of suffocation" during emergence from anaesthesia may contribute to emergence agitation in patients undergoing head and neck surgery inadequate pain relief may be the strongest cause of emergence agitation. Therefore, as emergence agitation has become more common with the use of sevoflurane there is renewed interest in finding way to improve and prevent emergence agitation in children. Numerous medications have studied to prevent or reduce emergence agitation in children. Multiple drugs including propofol, dexmedetomidine, clonidine, and opioids like fentanyl, sufentanyl have been used effectively to prevent emergence agitation. It is very difficult to compare the studies as each uses different assessment tools, different type of surgical procedure, or even anaesthetic techniques. However, there is no doubt that a young anxious preschool child undergoing a painful surgical procedure without adequate pain control will most likely suffer from emergence delirium. As studies are ongoing, and trying to discover the underlying causes or trying to treat and prevent the occurrence of agitation. It is the role of the anaesthesiologist to recognize postoperatively. In our study the propofol and fentanyl are given to reduce the incidence and severity of emergence agitation in children undergoing adenotonsillectomy surgeries with sevoflurane general anaesthesia. Fentanyl is a phenyl piperidine of synthetic opioid agonist, that is structurally related to meperidine and an analgesic. Propofol is a short acting agent. It is also a hypnotic agent. Propofol provides rapid awakening and has an anti emetic property.

## Materials and Method

It is a prospective, randomized, double blinded case control study. It is done in 90 cases posted for Elective

tonsillectomy surgeries.

*Inclusion Criteria*

Both sexes of age 6-12 yrs, ASA grade- 1 & 2

*Exclusion Criteria*

Developmental delay, Psychological and neurologic disorder, Sleep apnoea, sedatives medication, an abnormal airway, reactive airway disease, extreme agitation and uncooperation

90 children undergoing adenotonsillectomy were randomized into three groups and all were given 1.5 mcg/kg fentanyl during induction .

Group FF: children given 1.5 mcg/kg fentanyl during induction and 1 mcg/kg fentanyl at the end of surgery

Group FP: children given 1.5 mcg/kg fentanyl during induction and 1 mg/kg propofol at the end of

surgery.

Group FN : children given 1.5 mcg/kg fentanyl during induction, and 0.1ml/kg normal saline at the end of surgery.

Patients are pre oxygenated with 100 percent Oxygen for 3 minutes. Anaesthesia was induced with 5mg/kg of intravenous thiopental sodium and 1.5mg/kg of intravenous succinylcholine. Nasotracheal intubation was performed. Anaesthesia was maintained with sevoflurane 2-2.5vol% and nitrous oxide/oxygen (50%/50%).

Rectal paracetamol 30 mg/kg was given intra operatively. Postoperative agitation was recorded, if any for the first postoperative hour. The incidence of emergence agitation was assessed with Aono’s four point scale. Aono’s four point scale 1 & 2 were considered as the absence of emergence agitation and scale and scales of 3 and 4 were considered as the presence of emergence agitation.

**Table 1:** Aono’s Four Point Scale<sup>4</sup>

Score	Behavior	Emergence Agitation
1	Calm	No
2	Not calm but could be easily calmed	-
3	Not easily calmed, moderately agitated, or restless	Yes
4	Excited or disorientated	-

**Table 2:** Children and Infants Postoperative Pain Scale

Item	Structure	Points
Crying	None	0
	Moaning	1
	Screaming	2
Facial expression	Relaxed/smiling	0
	Wry mouth	1
	Grimace (mouth and eyes)	2
Posture of the trunk	Neutral	0
	Variable	1
	Rear up	2
Posture of the Legs	Neutral, released	0
	Kicking about	1
	Tightened	2
Motor restlessness	None	0
	Moderate	1
	Restless	2

The severity of emergence agitation was assessed with paediatric anaesthesia emergence delirium (PAED) Scale at 5 min (t5), 15 min (t15) and 30 min (t30) after emergence. PAED scale > 10 indicates severe delirium.

Emergence time was defined as the time of first response to command or eye opening on command

after extubation.

Children and infants postoperative pain scale (CHIPPS): five behavioural items scale with a maximum score of 10 points. Significant pain behavior correspond to a score of 4 points or greater.

The parameters are assessed pulse rate, SP02, duration of surgery is from the time of opening mouth

to the completion of the procedure, duration of sevoflurane administration is from the start of sevoflurane administration to the discontinuation of sevoflurane, duration of extubation is from the time of discontinuation of sevoflurane to the removal of endotracheal tube. Children were discharged from the post anaesthesia care unit to a ward when the modified Aldrete score was more than 9 without agitation and vomiting.

The information collected regarding all the selected

cases were recorded in a master chart. Data analysis was done with the help of computer using epidemiological information package (EPI-2010) developed by centre for disease control, Atlanta. Using this software range, frequencies, means, standard deviations, chi square and values were calculated. Kruskal-Wallis chi-square test was used to test the significance of difference between quantitative variables and Yates's chi square test for qualitative variables. A 'p' value less than 0.05 is taken to denote significant relationship.

## Results

**Table 3:** Demographic distribution

Group	Range	Age in yrs Mean	SD
Group FF	8-11	9.95	1.32
Group FP	6-11	9.45	1.7
Group FN	6-12	9.5	1.88
<b>P Value between</b>			
FF&FP		0.4162 Not significant	
FF&FN		0.458 Not significant	
FP&FN		0.9236 Not significant	
<b>Weight distribution</b>			
Group FF	23-30	26.4	2.4
Group FP	18-27	25.5	3.6
Group FN	18-28	25.1	4.1
<b>P Value between</b>			
FF&FP		0.3548 Not Significant	
FF&FN		0.2476 Not Significant	
FP&FN		0.828 Not Significant	

In our study group the age of the children and weight, are not statically significant.

**Table 4:** Hemodynamic parameters

Group	Range	Pulse rate (beats/minutes) Mean	SD
Group FF	90-126	108.9	10.9
Group FP	92-126	111.6	11.5
Group FN	92-128	109.9	11.5
FF&FP		0.4553 not significant	
FF&FN		0.7142 not significant	
FP&FN		0.7242 not significant	
<b>SPO2%</b>			
Group FF	99-100	99.65	0.49
Group FP	99-100	99.65	0.49
Group FN	99-100	99.55	0.51
FF&FP		1.0 not significant	
FF&FN		0.5239 not significant	
FP&FN		0.5239 not significant	

Pulse rate and saturated oxygen are insignificant in comparing groups.

**Table 5:** Duration of surgery, sevoflurane administration and Extubation

Parameters	Range	Duration of surgery (minute)	
		Mean	SD
GroupFF	60-90	76.3	8.4
Group FP	60-90	81.0	8.7
Group FN	55-90	76.3	13.0
FF&FP		0.0629 Not significant	
FF&FN		0.691 Not significant	
FP&FN		0.3417 Not significant	
Duration of sevoflurane administration (mins)			
Group-FF	70-100	86.3	8.4
Group-FP	70-100	91.0	8.7
Group-FN	65-100	86.3	13.0
FF&FP		0.0629 Not significant	
FF&FN		0.691 Not significant	
FP&FN		0.3417 Not significant	
Duration of Extubation (in mins)			
Group FF	15-25	19.3	2.6
Group FP	15-25	19.6	2.9
Group FN	15-25	18.6	3.2
FF&FP		0.7748 not significant	
FF&FN		0.4619 not significant	
FP&FN		0.3071 not significant	

Duration of surgery, sevoflurane administration and Extubation are insignificant when compared in groups.

**Table 6:** Agitation and sedation scores

Aono's 4 point scale	Aono's 4 point scale of group		
	Group FF	Group FP	Group FN
Normal score	16 (80%)	15(75%)	7(35%)
Abnormal score	4(20%)	5(25%)	13(65%)
'p' value between			
Group FF&FP		0.5 not significant	
Group FF&FN		0.0105 significant	
Group FP&FN		0.0261 significant	
<b>PAED score</b>			
Normal score	16 (80%)	15(75%)	15(75%)
Abnormal score	4(20%)	5(25%)	5(25%)
'p' value between			
FF&FP		0.5 not significant	
FF&FN		0.5 not significant	
FP&FN		1.0 not significant	
<b>CHIPPS score</b>			
Normal score	2(10%)	2(10%)	6(30%)
Abnormal score	18(90%)	18(90%)	14(70%)
FF&FP		1.0 not significant	
FF&FN		0.1185 not significant	
FP&FN		0.1185 not significant	
<b>Ramsay sedation score</b>			
2	16(80%)	15(75%)	9(45%)
3	4(20%)	5(25%)	8(40%)
4	-	-	3(15%)
FF&FP		0.7085 not significant	
FF&FN		0.016 significant	
FP&FN		0.035 significant	

Aono's four point scale which is used to determine the presence of emergence agitation is statistically significant in group FP and group FF compare with the group FN. The PAED score used to find out the severity of the emergence agitation and the CHIPPS score are statistically not significant. The P value of Ramsay sedation score in the group FN and Group FF is 0.016, and it's statistically significant. And the P value between group FN and group FP is 0.035, it's also statistically significant.

## Discussion

Eckenhoff et al defined the sense of suffocation during emergence from general anaesthesia can cause emergence agitation in childrens undergoing head and neck surgeries. Sevoflurane also contributes for emergence agitation and inadequate analgesia is the strongest cause of emergence agitation.

In our study the emergence agitation definition is included with the children who are restless with inconsolably crying. By this the incidence is increased to 30% several studies shows, many scoring for assess emergence agitation. The Aono's four point scale assess the presence of emergence agitation. The paediatric anaesthesia emergence delirium score assess the severity of emergence agitation. These scale are reliable valid in evaluation of emergence agitation.

In the study, done by Abu shahwan the intravenous administration of sub hypnotic dose of propofol decrease the incidence and severity of emergence agitation in children, which is given at the end of sevoflurane general anaesthesia undergoing magnetic resonance imaging. In Aoued et al study the incidence agitation is significantly reduced in children undergoing strabismus surgery with sevoflurane general anaesthesia. In this study, propofol 1mg/kg given at the end of surgery.

In Bakhames et al study, the low dose fentanyl before surgery and propofol at the end of surgery decrease the emergence agitation in children undergoing sevoflurane general anaesthesia.

In our study the incidence of emergence agitation is reduced in children receiving propofol at the end of surgery. The propofol is a short acting sedative and hypnotic agent. It provides rapid awakening and an antiemetic property. Propofol is a relatively selective modulator of gamma amino butyric acid receptors, and increases chloride conductance, and results in increasing the excitatory threshold. It also inhibit N-methyl D-aspartate receptors and thus it increasing the excitatory threshold. By this

mechanism it reduce the incidence of emergence agitation.

Cohen et al study 1 mic/kg of fentanyl decrease the incidence of emergence agitation to 18% in sevoflurane general anaesthesia. In another study sufentanyl 0.2 mic/kg was given. There is reduced incidence of emergence agitation in sevoflurane general anaesthesia.

Fentanyl is a potent opioid receptor agonist with high analgesic effect. In hypothalamus, the hypocretin-orexin system regulates and maintained the arousal and the waking state. Hypocretin neurons are depressed by fentanyl. Fentanyl directly inhibit the hypocretin system by acting on the cell body and indirectly by reducing the excitatory synaptic tone. By this mechanism fentanyl reduce the incidence of emergence delirium. In our study, inj.fentanyl 1mic/kg given at the end of the surgery the incidence of emergence agitation is reduced in children undergoing adenotonsillectomy surgeries with sevoflurane general anaesthesia.

Our data also shows the incidence and severity of emergence agitation and pain are improved over time without sedative drugs and analgesic. The most successful approach to reduce incidence of emergence delirium is employing a balanced anaesthetic technique with a smooth and pain free recovery

## Conclusion

In this study we compared the propofol and fentanyl effect to prevent emergence agitation for adenotonsillectomy surgeries in children receiving sevoflurane. In our study group the age of the children, sex distribution, weight, are not statically significant. Intra operative monitoring of pulse rate, SpO2 and duration of sevoflurane administration, duration of surgery are also not statistically significant.

Aono's four point scale which is used to determine the presence of emergence agitation is statistically significant in group FP and group FF compare with the group FN. The PAED score used to find out the severity of the emergence agitation and the CHIPPS score are statistically not significant. The P value of Ramsay sedation score in the group FN and Group FF is 0.016 and it's statistically significant. And the P value between group FN and group FP is 0.035. It's also statistically significant.

The propofol and fentanyl were found to reduce the incidence of emergence agitation in children receiving sevoflurane for adenotonsillectomy. Hence,

the propofol and fentanyl has been useful in reducing the incidence of emergence agitation for adenotonsillectomy surgeries in children receiving sevoflurane.

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