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MIDAZOLAM VERSUS NALBUPHINE ON PREVENTION OF EMERGENCE AGITATION IN PEDIATRIC PATIENTS ON SEVOFLURANE ANESTHESIA

By

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ABSTRACT

Background: Emergence agitation (EA) in children is increased after sevoflurane anesthesia. Nalbuphine and midazolam have been used for prophylactic treatment. It is characterized by mental confusion, irritability, disorientation, crying, and increased recovery time in the post anesthesia recovery room, increasing parents' concern and anxiety with respect to the clinical condition of their children. It can also lead to possible injury, damage to surgical dressings, lost intravenous catheters, and disconnected cables and monitoring instruments and source of dissatisfaction for parents, nurses, and others taking care of these children.

Objectives: The aim of the present study was to compare the effect of nalbuphine and midazolam before termination of sevoflurane-based anesthesia on the incidence and severity of EA in children as a primary outcome and post-operative pain, comparison of alertness and spontaneous behavior according to 3 step scales, adverse effects in both groups, and intraoperative hemodynamics as a secondary outcome.

Patients and Methods: This prospective double-blind randomized studyon 90 children between 4 and 8 years of age and of American Society of Anesthesiologists I undergoing adenotonsillectomy under sevoflurane-based anesthesia was enrolled in the study. Children were randomly allocated to one of the two equal groups: group (N) received nalbuphine 0.1 mg/kg and group (M) received midazolam 0.03 mg/kg. The study drugs were administered 5 min before the end of surgery. In the postanesthesia care unit, the incidence of EA was assessed with Aonos four-point scale. Severity of EA was assessed with the pediatric anesthesia emergence delirium scale upon admission (T0), after 5 min (T5), 10 min (T10), 15 min (T15), and 30 min (T30).

Results: The incidence and severity of EA were lower in group (N) as compared with group (M) at T0, T5, and T10.

Conclusion: Nalbuphine 0.1 mg/kg was more effective compared with midazolam 0.03 mg/kg in decreasing the incidence and severity of EA, when administered 5 min before the end of surgery in children undergoing adenotonsillectomy under sevoflurane anesthesia.

Key words: emergence agitation, midazolam, nalbuphine, sevoflurane.

INTRODUCTION

Postoperative agitation, also referred to as emergence delirium in international literature, is a well-documented clinical phenomenon, particularly in children It can lead to possible injury, damage to surgical dressings, lost intravenous catheters, disconnected cables and monitoring instruments, and source of dissatisfaction for parents, nurses, and others taking care of these children, and hence the children require extra nursing care and supplemental sedative and/or analgesic medications, which may delay patient discharge from hospital *(Kuratani and Oi, 2008)*, and are seven times more likely to have new-onset separation anxiety, apathy, and sleep problems *(Cravero et al., 2000)*.

It is during the first 30 min after emergence that the greatest incidence of agitation is observed, and the duration is generally limited. However, prolonged episodes of agitation lasting for up to 2 days have been described *(Vlajkovic and Sindjelic, 2007)*. Sevoflurane is an inhalational anesthetic used widely as a pediatric or outpatient anesthetic due to its excellent hemodynamic stability and low blood solubility, which allows rapid induction and emergence from general anesthesia, as well as control of the depth of anesthesia. However, when sevoflurane is used alone it is associated with a higher incidence of EA in children. With sevoflurane anesthesia, the incidence of EA varies widely between 2% and 80% depending on the scoring system and the anesthetic technique used and is more frequently observed in preschool children. The incidence of EA has led many authors to propose prophylactic treatment to reduce its incidence. These have included propofol, α2-adrenoceptor agonists, and midazolam *(Johr and Berger, 2005)*.

Nalbuphine hydrochloride is a synthetic opioid agonist antagonist. It is a potent analgesic and is essentially equivalent to morphine. It can also be used as a supplement to balanced anesthesia, for preoperative and postoperative analgesia *(Guignard, 2006)*. and may be a useful adjuvant to treat EA *(Dalens et al., 2006)* Midazolam is an agonist at γ aminobutyric acid–A receptors, and its desirable clinical effects range from anxiolytic to hypnotic depending on the percentage of receptor occupancy rather than plasma concentrations of the drug .It is also used to prevent EA after sevoflurane anesthesia *(Galinkin et al., 2009)*.

AIM OF THE WORK

This study compared prevention of emergence agitation after Sevoflurane anesthesia as a primary outcome and postoperative pain, comparison of alertness and spontaneous behavior according to 3 step scale, adverse effects in both groups and intraoperative hemodynamicsasa secondary outcome while using Midazolam versus Nalbuphine in pediatric patients undergoing adenotonsillectomy under Sevoflurane anesthesia.

METHODS

This prospective randomized double-blind study was carried out at Al-Azhar University Damietta Hospital from February 2018 to September 2018, After Al Azhar Faculty of medicine ethical committee approval. Written informed consent was taken from parents of 90

healthy children of both sex aged 4–8 years, with American Society of Anesthesiologists physical status I , scheduled to undergo tonsillectomy with or without adenoidectomy. Any child with parent refusal or preoperative agitation or physical developmental delay was excluded from the study. The patients were then randomized using a computer-generated randomization table to one of two equal groups (45 patients each): the nalbuphine group (group N(n=45) and the midazolam group group M (n=45).

Preoperatively, patients were made to fast for 6 h for solids and 2 h for clear fluids. No pre-medications were taken for the purpose of the study. Upon arriving in the operating room each patient was monitored for heart rate (HR), ECG, SPO2, noninvasive blood pressure, and ETCO2. Parents were present and collaborated during facemask induction and then left the theater when their children closed their eyes. General anesthesia was induced for all children with oxygen 100% with fresh gas flow of 6 l/min and sevoflurane with increments of 1% at each breath up to 8%. Once an appropriate depth of anesthesia was obtained, an intravenous cannula was inserted and 10 ml/kg of lactated Ringer's solution was infused over 20 min, followed by standard fluid maintenance therapy according to the patient's weight. After adequate depth of anesthesia was reached, suitable endotracheal tube was inserted and sevoflurane concentration was reduced to 3 in 100% oxygen and fresh gas flow was reduced to 2 l/min. Spontaneous breathing was allowed provided ETCO2 remained below 50 mmHg If ETCO2exceeded 50 mmHg, the patient was excluded from the study and assisted ventilation was performed. Diclofenac sodium 2 mg/kg was given intravenously slowly diluted for intraoperative analgesia. At the end of the surgery and just before discontinuation of sevoflurane and extubation the study drugs were injected intra venous as 0.1 mg/kg nalbuphine in group (N) and 0.03 mg/kg midazolam in group (M).

Sevoflurane administration was discontinued immediately after the study drug injection, the fresh gas flow was increased to 8 l/min oxygen, and the patient was extubated precisely 60 s later. After extubation, patients were taken directly to the postanesthesia care unit (PACU) in a quiet and warm environment without any stimulus.

Data to be measured:

Demographic data (age, weight, and sex), type of surgery, duration of surgery, and duration of anesthesia were evaluated. HR, mean arterial blood pressure (MAP), SPO2, and respiratory rate (RR) were monitored by Nihon Kohden monitor at baseline before induction of anesthesia, at 10, 20, and 30 min intraoperatively, and at 5, 10, 20, and 30 min postoperatively in PACU. The incidence of EA was evaluated using Aono's four-point scale *(Voepel-Lewis et al., 2003)*. The severity of EA was evaluated using the pediatric anesthesia emergence delirium (PAED) scale devised by *(Sikich and Lerman 2004)*.

Postoperative pain was assessed using the modified Children's Hospital of Eastern Ontario Pain Scale (CHEOPS) *(Mitchell. 1999)*.

Patients were discharged from the PACU when they satisfied stable vital

signs: patent airway without manipulation, oxygen saturation more than or equal to 95% on room air, restoration of a state of alertness close to that observed before the procedure had begun, and state of quietness sufficient to ensure that the child is not distressed and will not harm him/herself or the attendants.

Statistical analysis:

Statistical presentation and analysis of the present study was conducted, using the mean, standard deviation, and chi- square test by SPSS V.16.

P value $\leq$ 0.05 was considered significant.

RESULTS

As regards of the demographic data, there was no significant difference between the two groups (Table 1).

Table (1): Demographic data, type of surgery and duration of surgery, anesthesia, and emergence in both groups

Parameters \ Groups	Group (N)	Group (M)	P value
Age**(Years)**	5.6 ± 1.32	5.7 ± 1.3	>0.05
Weight **(Kg)**	18.9 ± 2.91	19.1 ± 33	>0.05
Duration of surgery **(Minutes)**	23.3 ± 3.3	23.9 ± 3.1	>0.05
Type of surgery	21 T / 24 A	22 T / 23 A	>0.05
Sex **(M/F)**	20/25	21/24	>0.05
Duration of anesthesia **(Minutes)**	37.9 ± 2.7	38.1± 2.9	>0.05
Dutaion of emergence **(Minutes)**	8.1 ± 1.9	7.7 ± 1.8	>0.05

As regards incidence of EA according to Aono's four-point scale in the two studied groups at awakening, it ranged from 1 to 4 in both groups with median values of 1 and 2 in groups (N) and (M), respectively. In group (N) five (11.1%) patients had EA, whereas in group (M) 15 (33.3%) patients had EA. There was a statistically significant decrease in the incidence of EA in group (N) in comparison with group (M) (Table 2).

Table (2): Incidence of EA according to Aono's four point scale

No.of cases	Incidence of EA	
Median	Group (N) 1	Group (M) 2
P value	0.001	

(score of 3 and 4 = presence of EA)

As regards the severity of EA according to PAED in the two studied groups, there was a statistically significant increase in the severity of EA in group (M) compared with group (N). Fifteen (33.3%) patients in group (M) had severe EA that lasted up to 10 min (PAED scale ≥15), whereas only five (11.1%) patients in group (N) had severe EA that lasted up to 5 min (PAED scale ≥15) (Table 3).

Table (3): Comparison of severity of EA according to (PAED) between the two studied groups

Groups / Postoperative	Group (N)	Group (M)	P value
After awakening	0-17 (1)	1-20 (5)*	0.0001
At 5 min	0-12 (1)	1-14 (4)*	0.0001
At 10 min	0-12 (1)	0-10 (3)*	0.001
At 20 min	0-10 (0)	0-10 (2)*	0.001
At 30 min	0-3 (0)	0-3 (1)*	0.0001

As regards postoperative pain according to modified Children's Hospital of Eastern Ontario Pain Scale (MCHEOPS) in the two studied groups, 13 (28%) patients in group (M) had postoperative pain (MCHEOPS ≥6) compared with only three (6%) in group (N) at 5 min. There was a significant decrease in MCHEOPS in the studied groups over time (Table 4).

Table (4): Postoperative pain according to (MCHEOPS)

Groups / Parameters	At 5 min		At 10 min		At 30 min	
	Group (N)	Group (M)	Group (N)	Group (M)	Group (N)	Group (M)
Median	**3**	**5***	**3**	**4***	**3**	3*
Range	**3 – 7**	**3 – 11**	**3 – 4**	**3 – 7**	**3 – 4**	3 – 4
P value	0.0001		0.001		0.003	

(MCHEOP score ≥ 6 will receive rescue analgesic)

As regards propofol and paracetamol consumption as rescue medications in the two studied groups, there was a statistically significant increase in total dose of propofol and paracetamol as rescue medications in group (M) compared with group (N). Fifteen (33.3%) patients received propofol for the treatment of EA and 13 (28.9%) patients received paracetamol for the treatment of

postoperative pain in group (M), whereas five (11.1%) patients received propofol for the treatment of EA and three (6.7%) patients received paracetamol for the treatment of postoperative pain in group (N) (Table 5).

Table (5): Propofol and paracetamol consumption as rescue medications

Groups / Parameters	Paracetamol consumption		Propofol consumption	
	Group (N)	Group (M)	Group (N)	Group (M)
Mean ± SD	170 ± 30* <0.001	210 ± 32	17 ± 2.1* <0.001	20.67 ± 3.13
No of cases (%)	3 (6.7 %)	13 (8.9 %)	5 (11.1 %)	15 (33.3 %)
P value	**<0.01**		**0.01**	

As regards alertness and spontaneous behavior according to 3 step scale. The majority of patients in group (N) were alert and awake which were more than in group (M) and 5 patients were agitated in group (N) while 15 patients were agitated in group (M) that was statistically significant (Table 6).

Table (6): Alertness and spontaneous behavior according to 3 step scale

Groups / Parameters	Alertness and Spontaneous behavior	
	Group (N)	Group (M)
Median	1	**2***
Range	1 – 3	**1 – 3**
P value	0.001	

As regard adverse effects in both groups there was no serious complications as laryngospasm and desaturation except self – limited cough in 2 patients (4.4 %) in group (N) and 1 (2.2 %) patient in group (M) and one self – limited attack of postoperative vomiting in 5 patients (11.1 %) in group (N) and 1 patient (2.2 %) in group (M) with no statistical significance (Table 7).

Table (7): Adverse effects in both groups

Groups / Complication	Groups				
	Group (N)		**Group (M)**		P value
	N	%	N	**%**	
Cough	2	4.4 %	1	2.2 %	> **0.05**
Vomiting	5	11.1 %	1	2.2 %	> **0.05**
Laryngospasm	0	0.0	0	0.0	
Desaturation	**0**	**0.0**	**0**	**0.0**	

As regards patients' basic monitoring throughout the course of anesthesia (HR, MAP, peripheral oxygen saturation, end-tidal carbon dioxide, and RR), there was a no significant difference between the two studied groups, except for HR and MAP in group (M), which showed a significant increase postoperatively at all-time intervals compared with group (N) (Table 8 and Table 9).

Table (8): Comparison of heart rate (beats/min) between the two studied groups

Parameters \ Groups		Group (N) (n=45)	Group (M) (n=45)	P value
Preoperative		93.4 ± 5.7	95.1 ± 7.3	> 0.05
Intraoperative	At induction	88.93 ± 4.3	90.9 ± 6.2	> 0.05
	At 10 min	97.2 ± 4.06	99.5 ± 6.9	> 0.05
	At 20 min	103.6 ± 4.8	102.5 ± 7.2	> 0.05
	At 30 min	106.6 ± 4.4	104.3 ± 6.9	> 0.05
Postoperative	At 5 min	96.3 ± 13.2	112.4 ± 20.8*	0.0001
	At 10 min	91.6 ± 6.9	104.3 ± 6.3*	0.0001
	At 20 min	89.8 ± 5.8	102.4 ± 4.3*	0.001
	At 30 min	87.8 ± 4.6	99.4 ± 6.7*	0.0001

Table (9): Comparison of the changes in mean arterial blood pressure (MAP) between both groups

Postoperative \ Groups	Group (N)	Group (M)	P value
At 5 min	**50.2 ± 4.32**	**54.2 ± 6.4***	0.001
At 10 min	**49.6 ± 2.43**	**52.4 ± 2.2***	0.0001
At 20 min	**49.7 ± 1.79**	**52.3 ± 1.5***	0.0001
At 30 min	49.7 ± 1.35	52.1 ± 1.8*	0.0001

Other patients' basic monitoring with no significant difference between the two studied groups (peripheral oxygen saturation, end-tidal carbon dioxide, and RR) (Table 10, Table 11 and Table 12).

Table (10): Comparison of peripheral oxygen saturation SpO_2 % between both groups (mean ± SD)

Parameters \ Groups		Group (N) (n=45)	Group (M) (n=45)	P value
Preoperative		**99.22 ± 0.77**	**99.18 ± 0.74**	> 0.05
Intraoperative	**At induction**	**99.69 ± 0.47**	**99.69 ± 0.46**	> 0.05
	At 10 min	**99.6 ± 0.48**	**99.69 ± 0.47**	> 0.05
	At 20 min	**99.7 ± 0.48**	**99.7 ± 0.46**	> 0.05
	At 30 min	**99.6 ± 0.47**	**99.6 ± 0.48**	> 0.05
Postoperative	**At 5 min**	**98.3 ± 1.16**	**98.69 ± 0.87**	> 0.05
	At 10 min	**98.1 ± 1.02**	**98.5 ± 1.01**	> 0.05
	At 20 min	**98.7 ± 0.89**	**98.6 ± 0.97**	> 0.05
	At 30 min	98.4 ± 1.01	98.4 ± 0.94	> 0.05

Table (11): Comparison of intraoperative (ETCO2) changes between both groups (mean ± SD)

Groups / Intraoperative	Group (N)	Group (M)	P value
At induction	**33.69 ± 2.3**	**34.4 ± 2.8**	> 0.05
At 10 min	**33.07 ± 1.9**	**33.76 ± 2**	> 0.05
At 20 min	**34.82 ± 1.7**	**35.33 ± 1.3**	> 0.05
At 30 min	34.6 ± 1.6	35.2 ± 1.4	> 0.05

Table (12): Comparison of postoperative (RR) (breath/min) changes between both groups

Groups / Intraoperative	Group (N)	Group (M)	P value
At induction	**33.69 ± 2.3**	**34.4 ± 2.8**	> 0.05
At 10 min	**33.07 ± 1.9**	**33.76 ± 2**	> 0.05
At 20 min	**34.82 ± 1.7**	**35.33 ± 1.3**	> 0.05
At 30 min	34.6 ± 1.6	35.2 ± 1.4	> 0.05

DISCUSSION

The incidence of EA (using Aono's four-point scale) and severity of EA (using PAED scale) were considered the primary outcomes in the present study, and we found a significant decrease in the incidence and severity of EA in the nalbuphine group (11%) in comparison with the midazolam group (33%) (which is within the usual range of EA after sevoflurane anesthesia) as indicated by the lower values of Aono's four-point scale and PAED scale and the significantly lower need for postoperative rescue medication (propofol) in the nalbuphine group. Postoperative pain has been the most confounding variable when assessing a child's behavior upon emergence because of the overlapping clinical picture with EA/emergence delirium. Inadequate pain relief may be the cause of agitation, particularly after short surgical procedures for which peak effects of analgesics may be delayed until the child is completely awake.

In agreement with our results, *(Dalens et al., 2006)* concluded that intravenous nalbuphine at the end of the procedure at a dose of 0.1 mg/kg seemed to offer the highest benefit/risk ratio when sevoflurane has been used as the sole anesthetic.

The results of the present study as regards the effect of midazolam on prevention of sevoflurane EA are in line with those of *(Ozcan et al., 2014)* who concluded that neither ketamine nor midazolam added to caudal block under sevoflurane anesthesia and further have effect on EA. Moreover, *(Breschan et al., 2007)* found that rectal midazolam given 10–15 min before surgery did not show any benefits for treating EA. Moreover, *(Abu-Shahwan and Chowdary 2007)* observed that the incidence of EA in children premedicated with midazolam for dental repair under sevoflurane anesthesia was as high as 34.2%.

In disagreement with our results, *(Cho et al., 2014)* concluded that giving 0.03 mg/kg of midazolam before the end of surgery reduces the incidence of EA in children scheduled for squint surgery. The difference with the results of the present study could be attributed to the less tissue trauma with strabismus surgery, and consequently less pain compared with adenotonsillectomy. Moreover, the mean age group in their study was 8 years, which was higher than that in our study (5 years). Moreover, *(Chen et al., 2010)* found that 0.05 mg/kg midazolam in combination with 0.5 μg/kg of fentanyl at the end of surgery was effective in reducing the incidence and severity of EA for cataract surgery, which could be attributed to the higher dose of midazolam in their study, and addition of 0.5 μg/kg of fentanyl to midazolam enhanced its effectiveness in reducing the incidence and severity of EA. Further, it can be attributed to the different nature of cataract surgery as compared with adenotonsillectomy as regards tissue trauma, which is more in adenotonsillectomy.

As regards hemodynamic parameters, our results showed that there was a significant increase in HR and MAP in the midazolam group compared with the nalbuphine group at postoperative measurements, especially at 5 and 10 min, which was associated with the increase in the incidence of EA in the midazolam group.

In agreement with our results, *(Dalens et al., 2006)* concluded that there were nonsignificant changes in vital parameters as regards HR, MAP, and SPO2 in the nalbuphine group. Moreover, *(Ozcan et al., 2014)* studied the effects of ketamine and midazolam on EA after sevoflurane anesthesia in children receiving caudal block and concluded that there were no significant changes in vital parameters except increase in HR and MAP postoperatively in the midazolam group more than the ketamine group.

As regard alertness and spontaneous behavior according to 3 step scales, our results showed that majority of patients in nalbuphine group were alert and awake compared with midazolam group.

In agreement with our results, *(Dalens et al., 2006)* concluded that significant increase in number of patients who were mostly alert and have spontaneous behavior as regard 3 step scale in nalbuphine group in comparison with ketamine and saline group administered just before discontinuing anesthesia.

As regard adverse effects in both groups, our results showed that was no serious complications as laryngospasm and desaturation except self – limited cough in 2 patients (4%) in nalbuphine group and 1 patient (2%) in midazolam group and one self – limited attack of postoperative vomiting in 5 patients (11%) in nalbuphine group and 1 patient (2%) in midazolam group with no statistical significance.

In agreement with our results, *(Cho et al., 2014)* concluded that the incidence of postoperative adverse events, including nausea, vomiting and laryngospasm did not differ among the patient groups

CONCLUSION

From the results of the present study we concluded that the use of a small dose of nalbuphine (0.1 mg/kg) in sevoflurane-

anesthetized children undergoing tonsillectomy with or without adenoidectomy was better than a small dose of midazolam (0.03 mg/kg) for the prevention of sevoflurane EA without any significant adverse effects.

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مقارنة بين الميدازولام و النالبوفين في منع ظهور الهلوسة و فرط الحركة في الأطفال أثناء الأفاقه بعد العمليات الجراحية من التخدير الكلي بمخدر السيفوفلوران

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قسم التخدير والرعاية المركزة ، كليه الطب ، جامعة الأزهر (القاهره بنين ،دمياط *،القاهره بنات)**

خلفية البحث : يعتبر الهياج المصاحب للإفاقة من التخدير ظاهرة موثقة جيدا تحدث فى الأطفال والبالغين فى فترة ما بعد الجراحة مباشرة وذلك مع انتشار التخدير باستخدام السيفوفلوران والديسفلوران عن طريق الإستنشاق. فالعديد من الدراسات التى نشرت حديثا أكدت زيادة معدلات حدوث هذه الظاهرة والتى يكون فيها المريض فى حالة هياج عصبى ويصعب السيطرة عليه. وعلى الرغم من كونها محددة الحدوث وتستغرق ٥ – ١٥ دقيقة. فقد تكون شديدة وقد تؤدى الى الأذى الجسدى للطفل وبشكل خاص فى موقع الجراحة او الدرانق أو القسطرة ، مما يؤثر على نتائج الجراحة.

ويعتبر التخدير عن طريق الاستنشاق باستخدام السيفوفلوران واسع النطاق فى تخدير الأطفال وذلك بسبب استقرار الدورة الدموية وقلة ذوبانه فى الدم مما يؤدى الى سرعة التخدير والإفاقة والتحكم فى عمق التخدير ومع ذلك يؤدى استخدام السفوفلوران وحده فى التخدير الى حدوث ظاهرة الهياج المصاحب للإفاقة بنسبة كبيرة (٣٠ – ٨٠ %) ، مما دفع الكثير من الباحثين الى استخدام بعض العقاقير لمنع حدوث هذه الظاهرة او الحد من حدوثها ،ومن هذه العقاقير عقارى النالوفين والميدازولام.

الهدف من البحث: تهدف هذه الدراسة إلى مقارنة تأثير الميدازولام و النالوفين على منع الهياج المصاحب للإفاقة من التخدير باستخدام السيفوفلوران فى جراحة استئصال اللوزتين مع أو بدون اللحمية.

المرضي و طرق البحث: أجريت هذه الدراسة فى مستشفي جامعة الازهر بدمياط على ٩٠ مريضا من عمر ٤ الى ٨ سنوات تجري لهم حراجة لاستئصال اللوزتين مع او بدون استئصال اللحمية حيث تم تخديرهم كليا باستخدام استنشاق السيفوفلوران .وقد تم متابعة العلامات الحيوية للمريض بقياس ضغط الدم ونسبة تشبع الدم بالاكسجين و رسم القلب الكهربى وقياس نسبة ثانى اكسيد الكربون فى نهاية

الزفير وتم تخديرهم كليا باستنشاق السيفوفلوران ثم تركيب كانيولا وريدية طرفية وإعطاء المحلول الوريدي المناسب وتركوا للتنفس التلقائي.

وفى نهاية اجراء الجراحة تم تقسيم المرضى عشوائيا الى مجموعتين متساويتين حسب الدواء الذى تم اعطاؤه وريديا الى :

المجموعة الأولى : تم إعطاؤهم النالوفين وريديا بجرعة ٠,١ مجم/كجم.

المجموعة الثانية : تم إعطاؤهم الميدازولام وريديا بجرعة ٠,٠٣ مجم/كجم.

ثم تم ايقاف استنشاق السيفوفلوران وإفاقة المريض وتقييم العقاقير المستخدمة فى الدراسة وتسجيل تأثيرها على معدلات التنفس ودرجة الوعى والإفاقة ونسبة حدوث الهياج المصاحب للإفاقة وكذلك المضاعفات بعد الافاقه.

النتائج: لا يوجد فرق ذو دلاله احصائيه فيما يتعلق بالبيانات الديموغرافية ، ومدة التخدير ومدة الجراحة والعلامات الحيوية قبل وأثناء الجراحة أما بعد الجراحة فكان هناك ارتفاع فى معدلات النبض وضغط الدم فى المجموعة الثانية خصوصا فى الدقيقة ٥ و ١٠.

• فيما يتعلق بمدة الإفاقة من التخدير ، لم يكن هناك فرق ذو دلاله احصائيه بين المجموعتين .

• فيما يتعلق بالهياج ما بعد التخدير ، كان هناك اختلاف كبير بين المجموعتين فى الدقيقة ٥ و ١٠ بعد العملية الجراحية بينما لم يكن هناك فرق فى الدقيقة ٣٠ حيث كان أكثر عدد للمرضى المصابين بالهياج فى مجموعة الميدزولام (١٥ حالة)، بينما عدد المرضى المصابين بالهياج فى مجموعة النالوفين (٥ حالات) فقط وانعكس ذلك على زيادة كمية استخدام عقار البروبوفول كعلاج للهياج ما بعد التخدير فى مجموعة الميدازولام .

• كما وجد أن معدلات حدوث الألم فيما بعد الجراحة فى مجموعة النالوفين كان أقل مقارنة بمجموعة الميدازولام وانعكس ذلك على ارتفاع نسبة الحالات التى احتاجت للمسكنات بعد الجراحة فى مجموعة الميدازولام .

• كذلك لم تسجل حدوث أى مضاعفات فى المجموعتين سوى حدوث كحه و قيء فى بعض حالات مجموعة النالوفين .

الاستنتاج: من هذه النتائج تم استنتاج أن استخدام جرعة صغيرة من عقار النالوفين أفضل من استخدام جرعة صغيرة من عقار الميدازولام للأطفال تحت التخدير الكلى عن طريق استنشاق السيفوفلوران حيث يؤدى الى منع حدوث الهياج المصاحب للإفاقة من التخدير باستخدام السيفوفلوران .

• يوصى باستخدام جرعة صغيرة من عقار النالوفين للأطفال تحت تخدير السيفوفلوران فى نهاية العملية لتقليل الهياج المصاحب للإفاقة من التخدير باستخدام مستنشق السيفوفلوران فى جراحة استئصال اللوزتين مع او بدون اللحمية.

• ينبغى القيام بالمزيد من الدراسات للكشف عن الألية الفعلية او الأكثر شيوعا المسببة للهياج ما بعد التخدير بمستنشق سيفوفلوران عند الأطفال فى محاولة لتجنب ذلك.

• ينبغى القيام بالمزيد من الدراسات على عدد أكبر من المرضى ونوعيات مختلفة من الجراحات لتعميم نتائج هذه الدراسة.