

Agitation and Negative Changes of Behaviour in Children Following Same-Day Surgeries Under Sevofluran Anesthesia Monitoring of 4 Weeks

Çocuklarda Sevofluran Anestezisi Altında Gerçekleştirilen Günübirlük Minör Cerrahi Sonrası Görülen Ajitasyon ve Olumsuz Davranış Değişiklikleri 4 Haftalık İzlem

Arzu Mercan

Yeditepe University School of Medicine, Department of Anesthesiology and Reanimation

Hatice Ture

Yeditepe University School of Medicine, Department of Anesthesiology and Reanimation

Levent Elemen

Yeditepe University School of Medicine, Department of Pediatric Surgery

Murat Sayin

Yeditepe University School of Medicine, Department of Anesthesiology and Reanimation

Yasemin Orakci

Yeditepe University School of Medicine, Department of Nurse Education

Selami Sozubir

Yeditepe University School of Medicine, Department of Pediatric Surgery

Bora Aykac

Yeditepe University School of Medicine, Department of Anesthesiology and Reanimation

Corresponding Author

Arzu Mercan

*Yeditepe University School of Medicine, Department of Anesthesiology and Reanimation
Kozyatagi / Istanbul / Turkey*

E-mail: arzumercan66@hotmail.com

ABSTRACT

Objectives: The present study has been planned for the purpose of defining at what ages and which behaviors the negative changes of behavior of the children having a minor surgery under sevofluran anesthesia have the most density and what the condition of the behaviors are at the end of monitoring of 4 weeks.

Methods: Following the Ethics Committee approval and parental consents, children of 2 to 10 years old planned to be operated due to inguinal area pathologies have been included in the study. All the patients were pre-medicated with 0,5 mg/kg oral midazolam 30 minutes before the planned operation. The anesthesia induction and maintenance have been performed using sevoflurane and all the patients have received caudal block for post-operative pain control. Families monitored their children with respect to post-operative 1 hour agitation, then they have been called at the end of the 1st, 2nd and 4th weeks and they have been given questionnaires about which they had previously notified.

Results: Agitation has been observed in a total of 44 patients (51 %). Number of patients with a mild agitation was considerably high compared with number of patients with other levels of agitation ($p<0.05$). About 63 % (30 patients) among those with agitation were treated with diagnosis of mild agitation, about 25 % (11 patients) has been treated with diagnosis of moderate agitation and

about 7 % (3 patients) has been has been treated with diagnosis of severe agitation (Figure 1). Negative changes of behavior have been observed in 24 patients (28 %) at the end of the 1st week, in 11 patients (13 %) at the end of the 2nd week and in only 5 patients (6 %) at the end of the 4th week. It has been observed that post-operative negative behavior changes arose generally in sleep-related behaviors, that the most affected age group was 4 to 8 years old and while negative behavior changes have been observed in about 27,5 % of the children at the end of the 1st week, the ratio was 13 % at the end of the 2nd week and decreased to 6 % at the end of the 4th week.

Conclusions: Agitation following same-day minor surgery under sevoflurane anesthesia in children is observed in the age group of 4 to 8 years old more frequently. Also, post-operative negative changes of behavior are observed in the age group of 4 to 8 years old. Most frequently in the form of anxiety of separation from parents and changes in sleep behaviors, all of which completely resolved at the end of the 4th week.

Key words: Sevofluran, Agitation, Changes of behavior, Children

ÖZET

Amaç: Bu çalışma sevofluran anestezisi altında gününbirlik minör cerrahi geçirmiş çocuklarda görülen olumsuz davranış değişikliklerinin ne tür davranışlarda ve hangi yaş grubunda yoğunlaştığı ile 4 haftalık izlem sonunda davranışların ne durumda olduğunu tanımlamak amacı ile planlandı.

Yöntem: Etik kurul onayı ve yazılı ebeveyn izinleri alındıktan sonra inguinal bölge patolojileri nedeni ile opere edilmesi planlanan, 2-10 yaş arası çocuklar

çalışmaya dahil edildi. Planlanan operasyondan yaklaşık yarım saat önce 0,5 mg/kg oral midazolam ile premedike edilen hastalarda anestezi indüksiyonu ve idamesi sevofluran ile yapıldı ve tüm hastalara postoperatif ağrı kontrolü amacı ile kaudal blok uygulandı. Postoperatif 1 saat ajitasyon açısından izlenen çocukların aileleri postoperatif 1, 2 ve 4. haftanın sonunda telefon ile aranarak önceden bilgilendirilmiş oldukları anketler yapıldı.

Bulgular: Toplam 44 (%51) hastada ajitasyon gözlemlendi. Hafif ajitasyon gösteren hasta sayısı ajitasyonun diğer derecelerine göre anlamlı olarak daha yüksek idi ($p<0.05$). Ajitasyon gözlenen hastaların % 68 (30 hasta) kadar hafif, %25 (11 hasta) kadar orta derecede ve %7 (3 hasta) kadar da şiddetli ajitasyon olarak değerlendirilerek tedavi edildiler (Şekil 1). Olumsuz davranış değişiklikleri 1. hafta sonunda toplam 24 hastada (%28), 2. haftada 11 hastada (%13) ve 4. hafta sonunda ise yalnızca 5 (%6) hastada tespit edilmiştir. Postoperatif olumsuz davranış değişikliklerinin genellikle uyku ile ilgili davranışlarda ortaya çıktığı, en çok etkilenen yaş grubunun 4-8 yaş grubu olduğu ve 1 hafta sonra olumsuz davranış değişikliklerine çocukların %27,5 kadarında rastlanırken bu oranın 2 hafta sonunda %13 kadar olduğu ve 4 hafta sonunda da %6'ya kadar düştüğü gözlemlendi.

Sonuç: Çocuklarda sevofluran anestezisi altında gerçekleştirilmiş gününbirlik minör cerrahiye takiben oluşan ajitasyona 4-8 yaş grubunda daha sık rastlanmaktadır. Ayrıca postoperatif olumsuz davranış değişiklikleri en sık 4-8 yaş grubunda, ebeveynlerden ayrılık korkusu ve uyku davranışlarında değişiklikler şeklinde ortaya çıkmakta olup, 4 hafta sonunda neredeyse tamamen ortadan kalkmaktadır.

Anahtar Kelimeler: Sevofluran, Ajitasyon, Davranış Değişiklikleri, Çocuklar

INTRODUCTION

In approximately 60 % of all children having any types of surgical operation under general anesthesia, negative behavior changes such as sleep disorders and anxiety of separation are observed in the post-operative period (1, 2). It is claimed that the character and stress of the cases in the postoperative period of the children contribute to these behavioral changes (3). It is also claimed that the background factors of the changes of

study. Patients with known allergies to any of the study drugs, patients. Sevofluran, being an inhalation agent widely used in pediatric anesthesia, is considered to be one of the reasons of post-operative agitation (4, 5, 6). However, the contribution of sevoflurane on postoperative behavioral changes is not clear, furthermore the type of these changes has not also been determined. (7,8). The present study has been planned to evaluate the behavioral changes observed in children undergoing minor

Table 1: Questionnaire adopted from the post-hospitalization behavior query (9)

Query			
After operation of your son/daughter, have you observed any change of behavior that arose or that was present and become more severe and lasted longer than 1 week?			
	Yes	No	No Idea
If your answer is "Yes", which one of the following have you observed?			
Biting nails	Yes	No	No idea
Regression of toilet use	Yes	No	No idea
Eating habits	Yes	No	No idea
Anxiety of separation from parents	Yes	No	No idea
Aggression towards brothers/sisters	Yes	No	No idea
Uninterestedness	Yes	No	No idea
Crying during sleep	Yes	No	No idea
Night anxieties	Yes	No	No idea
Pissing in bed	Yes	No	No idea
Sleeping in parents' bed	Yes	No	No idea

behavior include age, habits of the child and the stress on the parents (1).

POPULATION AND METHODOLOGY

Following the Ethics Committee approval and parental consents 87 ASA I children between 2 to 10 years old undergoing same-day minor surgery under general anesthesia have been included in the

surgery with sevoflurane anesthesia within the postoperative 4 week period and the affected age group.

With previous anesthesia or hospitalization experience, patients in whom caudal block was contraindicated or failed, who could not be discharged from the hospital on the same day and patients with psychological

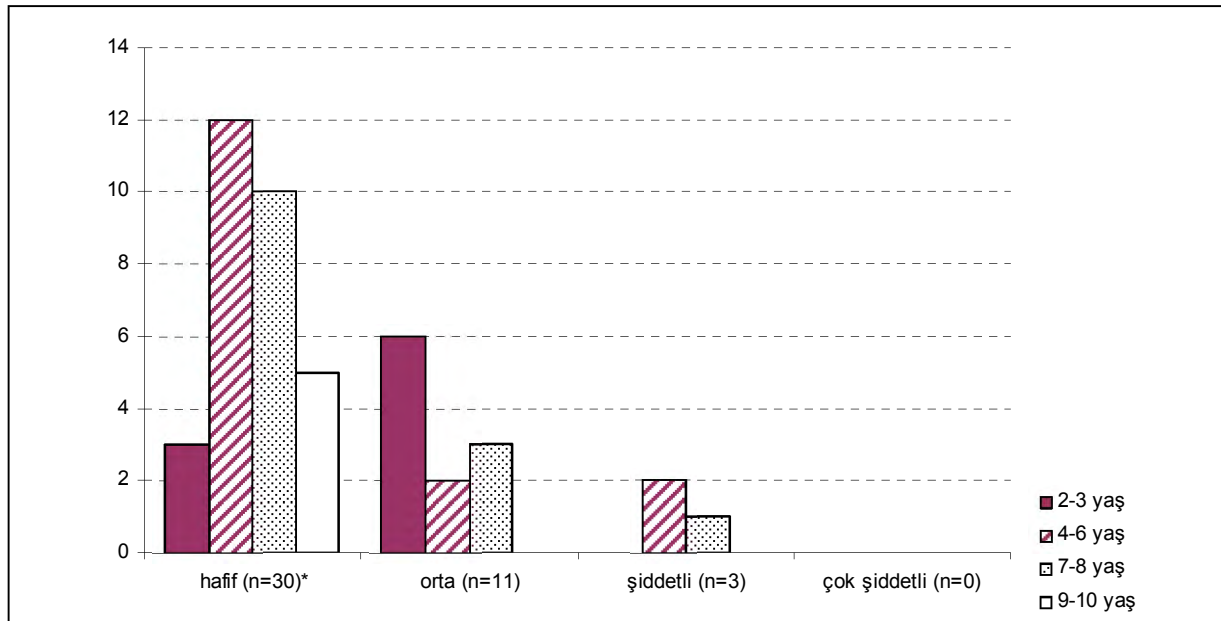


Figure 1: Distribution of the post-operative agitation severity among the age groups. * $p < 0,05$.

None: agitation score 1, **mild:** agitation score 2-3, **moderate:** agitation score 4-5, **severe:** agitation score 6-8, **too severe:** agitation score 9-10.

or psychiatric problems have been excluded from the study. The patients were pre-medicated with 0,5 mg/kg oral midazolam 30 minutes before anesthesia induction. During induction of anesthesia, 50 % O₂-NO₂ mixture and increasing doses of sevofluran have been applied. Once in each 3 to 5 breaths, the sevofluran concentration has been increased incrementally at a level of 1 % to reach a maximum concentration of 7 %.

Meanwhile, intravenous cannulation has been performed as soon as possible and Ringer Lactate was infused at a rate of 10 ml/kg for the first 20 minutes, then maintained so as to replace the surgical losses. The heart rate, blood pressure, oxygen saturation (SpO₂), end-tidal carbon-dioxide pressure (ETCO₂), inspiratory and end-tidal anesthetic gas concentrations and body temperature have been continuously monitored intra-operatively. A laryngeal mask was introduced following anesthesia induction in all the children. End-tidal sevofluran at

a concentration of 1,5 % was given during the operation.

Following the induction, the patients were put into left lateral position and 1 ml/kg or a maximum of 20 ml %0,25 bupivakain (Marcaine %0.5®, AstraZENECA) has been injected using caudal needle (Epican Paed® Braun) suitable for the patient age.

Agitation score was evaluated using a scale of 10 points (1: none, 2-3: mild, 4-5: moderate, 6-8: severe, 9-10: too severe) in the postoperative period after being observed at intervals of 10 minutes for 1 hour. The highest score observed in the postoperative period was accepted to be the agitation score and recorded accordingly.

Fentanyl 1 mcg/kg has been given intravenously to the patients with an agitation score of 6 or higher for longer than 5 minutes. The parents have been informed about the questionnaire and its timing to be applied postoperatively and

the children have been discharged from the hospital on the same day. At the end of the 1st, 2nd and 4th post-operative weeks, a questionnaire modified from the post-hospitalization behavior survey (Table I) has been given to the family on the phone (9).

All the data were expressed as mean \pm SD. The data obtained have been evaluated with chi-square tests or Fischer's exact test where appropriate, using the SPSS 13.0 ® statistics software and a p value $< 0,05$ was considered as significant.

FINDINGS

16 female and 71 male, a total of 87 patients between 2 to 10 years-old have been included in the study. The average operation time was 24 minutes, and the average weight was 23,5 kg. Average time for hospital discharge was 112 minutes (Table II). 55 patients had circumcision, 27 patients had inguinal hernia and 5 patients had undescended testicle operation (Table III).

Agitation has been observed in a total of 44 patients (51 %) in the postoperative period. Number of patients with a mild agitation was considerably high compared to patients with other levels of agitation ($p < 0.05$). About 63 % (30 patients) of the children having agitation were treated with the diagnosis of a mild level of agitation, about 25 % (11 patients) treated with diagnosis of moderate agitation and about 7 % (3 patients) treated with diagnosis of severe agitation (Figure 1). When the children was grouped according to age, it has been observed that there were 21 patients in the 2-3 years old group, 22 patients in the 7-8 years old group and 20 patients in the 9-10 years old group. Agitation has been

observed in 9 patients in 2-3 years old group, 16 patients in the 4-6 years old group and 5 patients in the 9-10 years old group.

Negative behavioral changes were observed in 24 patients (28 %) at the end of the 1st week, in 11 patients (13 %) at the end of the 2nd week and in only 5 patients (6 %) at the end of the 4th week. The negative behavioral changes observed at the end of the 1st week were as follows: parental separation anxiety (12 patients), crying during sleep (8 patients), night anxiety (2 patients), urinary incontinence (1 patient) and sleeping with the parents (1 patient). At the end of the 2nd week, number of patients still having separation anxiety was 7, crying during sleep was 2, night anxieties was 1 and sleeping in parents' bed was 1. Finally, separation anxiety continues only in 5 patients at the end of the 4th week. (Figure 2)

In the questionnaire performed one week later, it has been observed that negative behavioral changes were present in 15 patients in the 4-6 years old group, and 9 patients in the 7-8 years old group. In the questionnaire performed one week later, it has been observed that number of patients with negative behavioral changes decreased to 7 in the 4-6 years old group, and 4 in the 7-8 years old group.

At the end of the 4th week, negative behavioral changes were observed in 4 patients in the 4-6 years old group and 1 patient in the 7-8 years old group (Figure 3).

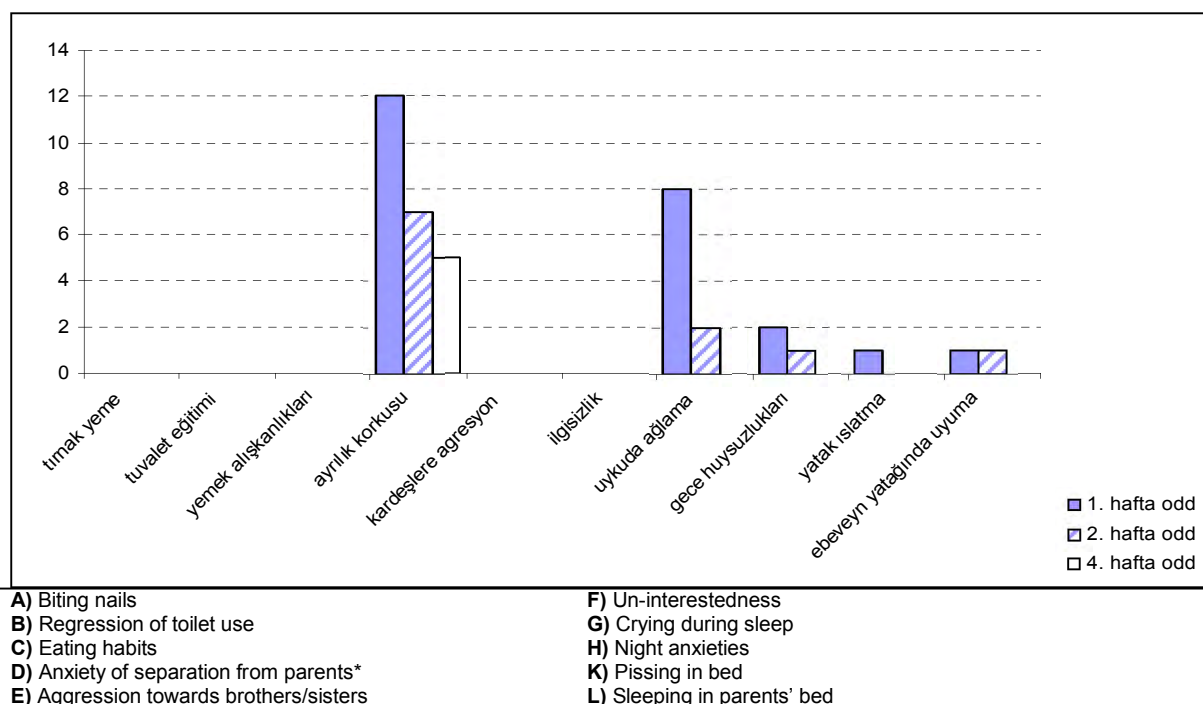


Figure 2: Change of post-operative changes of behavior (pcb) in time. * $p < 0,05$.

Table 2: Demography, operation and dismissal times of the groups (ortalama+SD).

	(n=87)
Age (yrs)	5.5±1.5
Sex (Male/Female)	71/16
Weight (kilogram)	23,4±2,1
Operation time (minutes)	23,8±6,5
Discharge time (minutes)	112±36

Table 3: Distribution of types of operations among the groups.

Type of surgery	(n=87)
Circumcision	55 (%63)
Inguinal herni operation	27 (%31)
Undescended testicle operation	5 (%6)

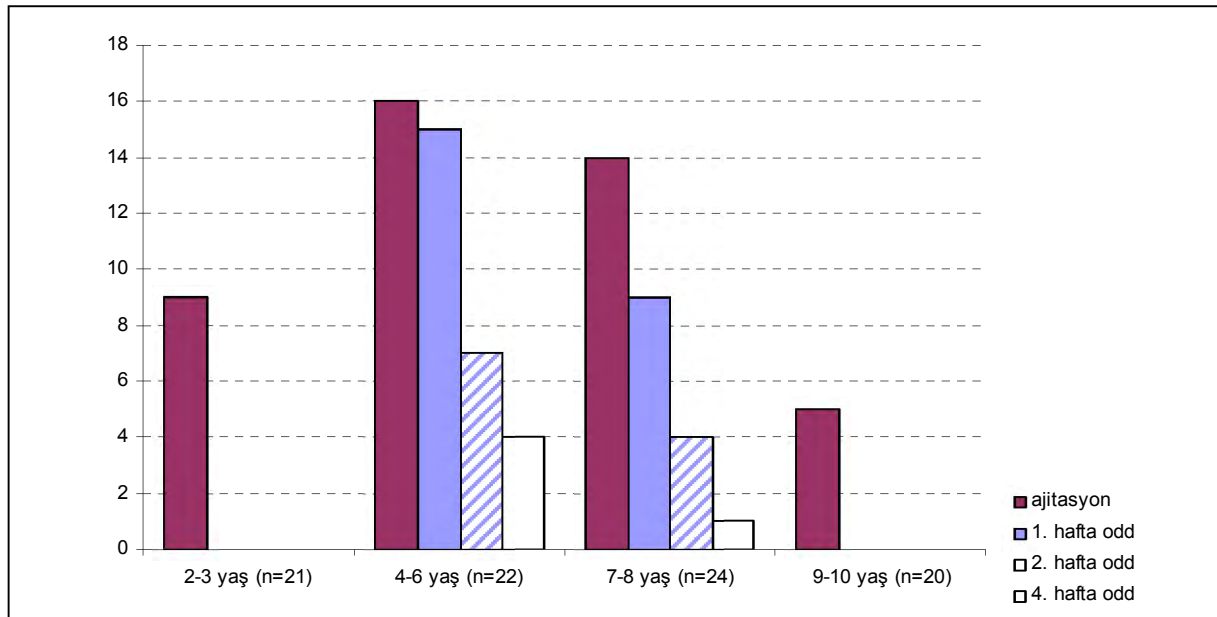


Figure 3: Distribution of the post-operative agitation and negative behavioral changes (nbc) among the age groups and variation of the negative behavioral changes based on ages.

DISCUSSION

Negative behavioral changes following surgical operation and hospitalization have long been discussed in the literature and it has been claimed that such changes of behavior may be encountered at a rate of 22-92% (2,3,6,8,9,11-14). Sevofluran is also among the anesthetic medications frequently accused of causing post-operative agitation (5, 6, 9, 10). In the present study, it has been observed that post-operative agitation most frequently arose at a mild level in 68% of the children and post-operative negative behavioral changes arose generally as sleep-related behavioral changes, and the most affected age group was 4 to 8 years old. Negative behavioral changes have been observed in about 27,5 % of the children at the end of the 1st week, the incidence was 13 % at the end of the 2nd week and decreased to 6 % at the end of the 4th week.

It has been observed in the present study that post-operative agitation most frequently arose at a mild level. Another conclusion of the present study was that

severity of agitation decreased in older children compared to the younger children. Meyer et. al. also scored agitation similarly in their study in which they compared the effects of isofluran with sevofluran on post-operative agitation and concluded that mild and moderate agitation were observed more frequently than the severe agitation (10).

It has been reported that post-operative negative behavioral changes may be observed at a frequency of 40-60% (2, 3) and generally ends within 2 weeks (15). In the present study, incidence of negative behavioral changes at the end of the 1st week (28 %) is lower in comparison with the aforementioned studies. It is highly probable that this arises from timing of the first questionnaire. The first questionnaire of the present study is performed at the end of the 1st week, whereas the other study is related with the period immediately after the operation (2). In the present study the incidence of the negative behavioral changes has been shown to decrease

significantly 2 weeks after the operation and decrease to 6 % at the end of the 4th week. In the study of Kontinemi et al. similar results with that of the present study has been reported. In their study Kontinemi et al. concluded that negative behavioral changes decreased to 9% at the end of the 4th week (2). However, as the study of Kontinemi et al. was designed in a multi-center fashion and the anesthesia method was not standardized, a reasonable comparison is not possible (2). Even though the literature includes studies on frequency and reasons of behavioral changes according to the age groups, they do not include data regarding the structure of behavioral changes (1-3, 6, 8, 9, 15).

Therefore, the present study aimed to evaluate the structure of the behavioral changes and its distribution according to the age groups. It has been observed that the most frequently observed behavioral changes was in the form of parental separation anxiety and sleep disturbances. Even though no measurement regarding level of the pre-medication could be performed, it gives the impression that the children might be affected by a surgical operation, even though they do not react while entering the operation room. Studies focused on the structure of the behavioral changes with a standard anesthesia method as in the present study, with larger workgroups aimed at a complete change of behavior profile are of great significance for prevention of such negative changes of behavior. Even though the effect of sevofluran on post-operative agitation is now known, there is no clear information as to its effect on post-operative negative changes of behavior. Well designed studies on the effects of anesthetic methods on post-operative behavioral changes with high number of children is required to better understand this behavioral changes.

It is known that post-operative agitation is a problem of the pre-school children (16, 17). Both agitation and the behavioral

changes were at highest levels in 4-8 years old patients. This might remind us that postoperative agitation triggers negative behavior in children. Therefore, it shall be more contributive to study on anesthetic methods which triggers the post-operative agitation, therefore affects the post-operative behavioral changes less.

To conclude, agitation following same-day minor surgery under sevoflurane anesthesia in children was observed most frequently in the 4 to 8 years old age group. Post-operative negative behavioral changes were also observed in the same age group most frequently in the form of parental separation anxiety and behavioral changes of sleep which was decreased at the end of the 2nd week and almost completely resolved at the end of the 4th week.

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