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RESEARCH / ARAŞTIRMA

Comparison of Total Intravenous Anesthesia with Inhaler Anesthesia in Children Intubated with Remifentanil without Muscle Relaxant

Remifentanil ile Kas Gevşeticisiz Entübasyon Uygulanan Çocuklarda Total İntravenöz Anestezi ile İnhaler Anestezisinin Karşılaştırılması

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Abstract

Objective: The effects of remifentanil and muscle relaxant-free intubation as well as total intravenous anesthesia and inhaled anesthesia for tonsillectomy and/or adenoidectomy in children were compared.

Materials and Methods: The study was conducted on 80 patients who were to undergo tonsillectomy and/or adenoidectomy between December 2014 and June 2015. Patients were randomized and divided into two groups. In the total intravenous anaesthesia group, 2.5 mg/kg propofol and 2 mcg/kg remifentanil were administered as induction within 90 seconds. In this group, 3 mg/kg/h propofol and 0.5 mcg/kg/min remifentanil were used for maintenance of anesthesia. In the sevoflurane group, 8% sevoflurane and 2 mcg/kg remifentanil were administered as induction within 90 seconds. In this group, 2.5% sevoflurane, 50% nitrogen protoxide and 50% oxygen were used at 6 l/min for maintenance of anesthesia.

Results: Peak heart rate and systolic arterial pressure were significantly higher in Group I. Diastolic arterial pressure was significantly higher in Group T at 1 and 2 minutes after intubation and in Group 2 at 10 minutes postoperatively. Mean arterial pressure was higher in Group T at 2 minutes after intubation. In addition, Wong-Baker pain scale and agitation score were significantly higher in Group I. Spontaneous respiration and extubation time were significantly shorter in Group I. There was no difference between the groups in terms of side effects.

Conclusion: Group total intravenous anaesthesia was thought to be a better choice in children because it had less impact on postoperative pain, agitation and recovery.

Keywords: Pediatric, intravenous anesthesia, sevoflurane, recovery, intubation. parents.

Öz

Amaç: Çocuklarda tonsillektomi ve/veya adenoidektomi için remifentanil ile kas gevşeticisiz entübasyonun yanı sıra total intravenöz anestezi ile inhaler anestezinin etkileri karşılaştırılmıştır.

Gereç ve Yöntem: Aralık 2014-Haziran 2015 tarihleri arasında tonsillektomi ve/veya adenoidektomi operasyonu geçirecek 80 hasta üzerinde gerçekleştirilmiştir. Hastalar randomize edilerek iki gruba ayrılmıştır. Total intravenöz aneztezi grubuna, 2,5 mg/kg propofol ve 2 mcg/kg remifentanil 90 saniye içinde indüksiyon olarak uygulanmıştır. Bu grupta, anestezi idamesi için 3 mg/kg/saat propofol ve 0,5 mcg/kg/dk remifentanil kullanılmıştır. Sevofluran grubuna ise %8 sevofluran ve 2 mcg/kg remifentanil 90 saniye içinde indüksiyon olarak uygulanmıştır. Bu grupta, anestezi idamesi için %2,5 sevofluran, %50 azot protoksit ve %50 oksijen 6lt/dk'dan kullanılmıştır.

Bulgular: Kalp tepe atımı ve sistolik arter basıncı Grup 2'de anlamlı olarak yüksek bulunmuştur. Diyastolik arter basıncı ise Grup T'de entübasyon sonrası 1 ve 2. dakikalarda, postoperatif 10. dakikada ise Grup I'de yüksek bulunmuştur. Ortalama arter basıncı ise entübasyon sonrası 2. dakikada Grup T'de yüksek görülmüştür. Ayrıca, Wong-Baker ağrı skalası ve ajitasyon skoru Grup I'de anlamlı olarak yüksek bulunmuştur. Spontan solunuma başlama ve extübasyon zamanı ise Grup I'de anlamlı olarak kısaydı. Yan etki açısından ise gruplar arasında fark görülmemiştir.

Sonuç: Grup Total intravenöz aneztezi'nın çocuklarda daha iyi bir tercih olacağı düşünülmüştür çünkü bu yöntem postoperatif ağrı, ajitasyon ve derlenme açısından daha az etkiye sahip olmuştur.

Anahtar Kelimeler: Çocuk, intravenöz anestezi, sevofluran, derlenme, entübasyon.

1. Introduction

Tonsillectomy and adenoidectomy are frequently performed surgical procedures during childhood. These operations are frequently performed today due to their short duration, relatively easy and low complication rate, easy postoperative follow-up, and many beneficial effects, such as respiratory relief and appetite changes in the very early period (1). Inhalation anaesthetics are generally used to induce and maintain anaesthesia in pediatric patients. Inhalation anaesthetic agents are preferred because of the difficulties in establishing preoperative vascular access and because inhalation anaesthetics can be more easily controlled by tapering or discontinuation when given in high doses.

Sevoflurane is an agent that can be used for induction in pediatric anaesthesia because of its ease of titration during anaesthesia due to its low blood-gas partition coefficient (0.69) and speed during the waking period. Because of these positive effects, Sevoflurane has become an ideal agent for induction (2-4). However, the introduction of new intravenous anaesthetics and analgesics, the well-known pharmacokinetic and pharmacodynamic effects of these agents, and the development of topical local anaesthetics that allow painless intravenous cannulation have made total intravenous anaesthesia (TIVA) applications more frequently used in pediatric anaesthesia.

In clinical anaesthesia, remifentanil's rapid onset of action and short duration due to rapid degradation by esterases have enabled this agent to take its place as a potent narcotic analgesic in clinical anaesthesia (5). Studies have shown that using remifentanil in adult anaesthesia results in soft induction and regular maintenance and that awakening is comfortable and quick, even at high doses. Although there is not as much information about the use of remifentanil in children as in adults, it is reported that remifentanil has a pharmacokinetic profile similar to adults in children aged 2-12 years (6-8).

This study aimed to compare total intravenous anaesthesia with inhalation anaesthesia regarding intubation quality, perioperative hemodynamic parameters, awakening from anaesthesia, pain, agitation and recovery characteristics and side effects in children undergoing intubation without muscle relaxants with remifentanil in short-term procedures.

2. Materials and Methods

After the approval of the Faculty Ethics Committee of the Mustafa Kemal University Faculty of Medicine, 80 volunteer patients between the ages of 3-12 years to undergo Adenoidectomy and Tonsillectomy at Mustafa Kemal University Hospital were included in the study. Patients and their relatives were informed that the anaesthetic agents used during the study were drugs used during routine general anaesthesia and that there was no new anaesthetic agent. Patients were evaluated at least one day before the study in a preoperative interview, and an informed consent form was obtained from the patient's parents. Patients with a history of difficult intubation, sedative drug use, central nervous system or other system diseases, or allergies to the drugs to be used were excluded from the study.

Oral midazolam 0.5 mg/kg 30 min before the operation was given to patients with appropriate fasting periods. EMLA cream was applied to the area where vascular access was planned 60 min before the operation. After premedication, heart rate (HR), systolic arterial pressure (SBP), diastolic arterial pressure (DBP), mean arterial pressure (MAP), and peripheral oxygen saturation (SPO2) were monitored as standard. Baseline blood pressure, saturation and peak heart rate were recorded before the procedure. The patients were randomly divided into two groups.

In group T, 2.5 mg/kg propofol and two mcg/kg remifentanil was administered as induction within 90 seconds. Maintenance of anaesthesia was continued with propofol 3 mg/kg/hour and remifentanil 0.5 mcg/kg/min. In group I, 8% sevoflurane and two mcg/kg remifentanil were administered as induction within 90 seconds, and 2.5% sevoflurane, 50% nitrogen protoxide and 50% oxygen were used at six l/min for the maintenance of anaesthesia. At the end of the operation, 15 mg/kg paracetamol was administered as standard for postoperative analgesia in both groups. Endotracheal intubation was performed 60 seconds after remifentanil induction in both groups. Endotracheal intubation was performed by the same anesthesiologist for each patient, and the same anesthesiologist evaluated the quality of intubation of the patients based on endotracheal intubation scores. The doses of the agents in the study were determined according to the equivalent doses used in previous studies. The endotracheal intubation score was recorded. Systolic, diastolic and mean arterial pressure (MVPA), heart rate (HR), and peripheral oxygen saturation (SpO2 measurements were recorded before induction and at 1, 2, 3, 4, 5, 10, and 15 minutes after intubation. At 0, 10, and 20 minutes postoperatively, both groups were evaluated with the Modified Aldrete Recovery Score, Agitation Score, and Wong-Baker Pain Scale. In addition, the duration of the operation, extubation time (time from anaesthetic agent to extubation), eye-opening time (time from withdrawal of anaesthetic agent to spontaneous eye opening), and time in the recovery room were recorded in both groups. Laryngospasm, bronchospasm, nausea, vomiting, desaturation and other adverse effects were recorded from the time of administration of anaesthesia until leaving the recovery room.

Table 1. Comparison of Demographic Data of the Group

Group		TIVA	SEVOFLURANE	*p*
Gender	**Male n (%)**	20 (50)	26 (35)	0.280
	Female n (%)	20 (50)	14 (65)	
ASA	**1 n (%)**	28 (70)	31 (77.5)	0.610
	2 n (%)	12 (30)	9 (22.5)	
Age (Mean ± SD)		5.8 ± 2.4	6.9 ± 2.8	0.100
Weight (Mean ± SD)		23 ± 7.7	25.6 ± 9.1	0.200
Intubation Score (Mean ± SD)		3.7 ± 0.4	3.7 ± 0.4	0.600

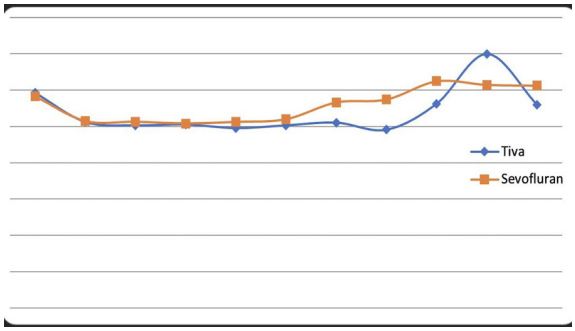

Figure 1. Heart Rate Measurement

2.1. Statistical Analysis

The statistical analysis of this study was performed with the SPSS 18.0 package program. All numerical data were given as mean ± SD. Categorical variables (Gender, ASA score, and Intubation Score) between the two groups were evaluated by Chi-square test. Parametric values between the two groups were evaluated with the Kolmogrow-Smirnow test. The data (age, systolic blood pressure, diastolic blood pressure, saturation values, peak heart rate, agitation score, Aldrete recovery score, wong-baker pain score, time to start spontaneous breathing, time to intubation, time to first eye-opening, time to orientation and obeying commands) were analyzed. T-test was used to analyze the results. Values with $p<0.05$ were considered significant.

2.2. Ethical Aspect of the Research

The principles of Helsinki declaration were taken into account in the study. The study was approved by the Faculty Ethics Committee of Mustafa Kemal University Faculty of Medicine (approval number:16/12/2014-232) of a university and written institutional permission from the institution where the study was conducted was obtained to conduct the study.

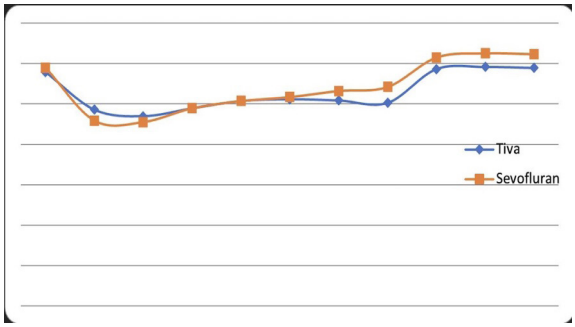

Figure 2. Systolic Arterial Pressure of the Groups (mm/Hg)

3. Results

The study included 80 patients, 40 patients from each group. The number of male patients was 46 (56.8%), and the number of female patients was 34 (43.2%). In our study, 59 patients were ASA 1, and 21 were ASA 2. When the patients were evaluated regarding age, weight, intubation score, gender and ASA score, no statistically significant difference was observed between the two groups (Table 1).

Peak heart rate was higher in the Sevoflurane group at 10 and 15 minutes perioperatively. At 1 and 20 minutes postoperatively, CTA was also significantly higher in the Sevoflurane group. The two groups had no significant difference in other measurements (Figure 1).

Systolic arterial pressure was significantly higher in the Sevoflurane group at 15 minutes perioperatively and 10 and 20 minutes postoperatively. There was no significant difference between the two groups in other measurements (Figure 2).

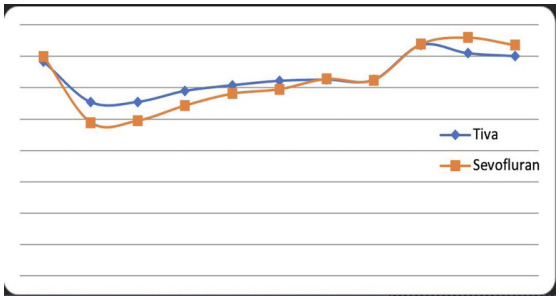

Figure 3. Diastolic Arterial Pressure of the Groups (mm/Hg)

Diastolic arterial pressure was higher in the TIVA group at 1 and 2 minutes after intubation ($p<0.010$; $p<0.030$), while diastolic arterial pressure was significantly higher in the Sevoflurane group at 10 minutes postoperatively ($p<0.050$). No significant difference was observed between the two groups in other measurements (Figure 3).

Mean Arterial pressure was significantly higher in the TIVA group at 2 minutes after intubation ($p<0.030$). Mean Arterial pressure was higher in the Sevoflurane group at 20 minutes postoperatively ($p<0.030$). The two groups had no significant difference in other measurements (Figure 4).

At 1, 10 and 20 minutes postoperatively, the Wong-Baker Pain Score was significantly higher in the Sevoflurane group ($p<0.010$, $p<0.001$, $p<0.001$, respectively) (Table 2).

The agitation score did not show a significant difference between the groups at 1 minute in the postoperative period. It was significantly higher in the Sevoflurane group at 10 and 20 minutes postoperatively ($p<0.006$; $p<0.010$) (Table 3).

Aldrete Recovery Scoring was significantly higher in the TIVA group at 1 minute ($p<0.002$) (Table 4).

The time to start spontaneous breathing after surgery and the time to intubation were significantly earlier in the Sevoflurane group ($p<0.001$). Although the time of first eye-opening, orientation and cooperation was earlier in the Sevoflurane group, it was not statistically significant (Table 5). Postoperative side effects were nausea and vomiting in 7 patients in the TIVA group and 13 in the Sevoflurane group. There was no significant difference in the incidence of side effects between the two groups ($p<0.100$).

Table 2. Evaluation of Wong-Baker Pain Scale Measurements According to Group

	TIVA	SEVOFLURANE	
	Mean ± Standard Deviation	Mean ± Standard Deviation	*p*
Wong-Baker Pain scored 1. minute	5.8 ± 2.4	7.1 ± 2.5	**0.010**
Wong-Baker Pain scoring 10. minute	5.3 ± 2.1	7.2 ± 2.9	**0.001**
Wong-Baker Pain scoring 20. minute	4.4 ± 1.3	5.9 ± 2.2	**0.001**

4.Discussion

Tonsillectomy and adenoidectomy are frequently performed surgical procedures during childhood. Therefore, with the preferred anaesthetic agents, an easy and calm induction should be possible, tracheal intubation should be performed appropriately and comfortably, the depth of anaesthesia needed for surgery should be achieved rapidly, and awakening and recovery should be rapid and uneventful.

In pediatric otolaryngology operations, it is necessary to gain upper airway control early so that the duration of surgery is short and bloody secretions can be removed rapidly at the end of surgery. Therefore, rapid awakening is desirable. Regardless of the anaesthetic method chosen, adequate suppression of surgical stress, hemodynamic stability, rapid recovery and no undesirable postoperative side effects are required (9).

Table 3. Evaluations of Agitation Scoring Measurements According to Group

	TIVA	SEVOFLURANE	
	Mean± Standard Deviation	Mean± Standard Deviation	*p*
Agitation scoring 1st minute	2.8±0.8	3.0±1.1	0.400
Agitation scoring 10 minute	3.1±0.4	3.5±0.6	**0.006**
Agitation scoring 20 minutes	3.0±0.0	3.2±0.5	**0.010**

Using muscle relaxants during endotracheal intubation may cause histamine release, myalgia, prolonged neuromuscular block and cardiovascular changes. Using muscle relaxant antagonists may cause undesirable side effects such as heart rate and blood pressure changes, arrhythmias, and increased postoperative nausea and vomiting (10, 11). Endotracheal intubation without using muscle relaxants in pediatric anaesthesia is increasingly practiced by anesthesiologists (12). Some anesthesiologists recommend using neuromuscular agents to avoid intraoperative side effects such as cough, airway obstruction or laryngospasm (13). A different study concluded that endotracheal intubation could be performed safely and effectively in pediatric patients without using neuromuscular agents (14).

This study aimed to compare total intravenous anaesthesia (TIVA) with inhalation anaesthesia regarding intubation quality, perioperative hemodynamic parameters, pain, agitation and recovery characteristics and side effects in children undergoing short-term interventions intubated with remifentanil without muscle relaxant.

Table 4. Evaluation of Aldrete Recovery Scoring Measurements According to Group

	TIVA	SEVOFLURANE	
	Mean ± Standard Deviation	Mean± Standard Deviation	*p*
Aldrete recovered scoring in 1st minute	9.3 ± 0.9	8.5 ± 1.1	**0.002**
Aldrete recovered scoring 10 minute	9.9 ± 0.2	9.8 ± 0.5	0.100
Aldrete recovery scoring 20 minute	10 ± 0.0	10 ± 0.0	-

Çağıran et al. (15) achieved 90% successful intubation with one mcg/kg remifentanil (27/30) and 96.7% successful intubation with two mcg/kg remifentanil (29/30) after 8% sevoflurane induction without using muscle relaxant. Joo et al. (16)reported that remifentanil two mcg/kg dose added to 8% sevoflurane had better intubation quality and less cough reflex than one mcg/kg dose. In our study, we successfully performed tracheal intubation in all patients with two mcg/kg remifentanil after 8% sevoflurane induction.

Naziri et al. (17) performed intubation without muscle relaxant by applying 3 mg/kg propofol and two mcg/kg remifentanil in 30 patients aged 3-12. Excellent intubation conditions were achieved in 86.7% of these patients. Batra et al. (18) successfully intubated all patients with two mcg/kg remifentanil or three mcg/kg remifentanil induction after 3 mg/kg propofol in children undergoing adenotonsillectomy operation. Stevens et al. (19) reported excellent intubation conditions with 1, 2, 3, and 4 mcg/kg/min remifentanil after 2 mg/kg propofol for intubation without muscle relaxant by 30%, 50%, 80%, and 80% respectively. In our study, 2.5 mg/kg propofol followed by two mcg/kg remifentanil was administered. Tracheal intubation was successfully achieved in all patients in parallel with and in support of the above studies.

No patient developed hypotension or bradycardia in the study by Naziri et al. (17). No side effects were reported in the study of Çağıran et al. (15). In our study, no side effects such as muscle rigidity, hypotension, bradycardia, hypoxia were observed in both groups.

Table 5. Recovery Data of the Groups

	TIVA	SEVOFLURANE	
	Mean± Standard Deviation	Mean± Standard Deviation	*p*
Time to onset of spontaneous breathing	6.2 ±2.3	3.1 ± 1.8	**0.001**
Extubation time	7.5 ± 2.3	4.2 ± 1.9	**0.001**
Time to open the first eye	9.3 ± 2.6	8.3 ± 2.6	0.100
Orientation time	11.1 ± 3.2	10.2 ± 3.1	0.200
Time to obey commands	13.9 ± 14.4	10.5± 3.0	0.100
Duration of anaesthesia	31.0 ± 7.6	30.1 ± 9.3	0.600
Operation duration	22.3 ± 7.0	23.7 ± 9.0	0.400

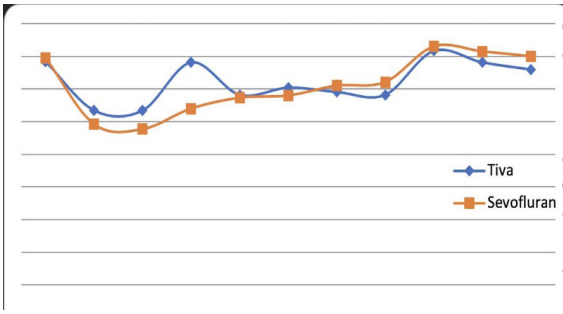

Figure 4. Mean Arterial Pressure of the Groups (mm/Hg)

In a similar study, Solak et al. (20) showed that PHR was more stable in the TIVA group. In contrast, there was a statistically significant increase in PHR after surgical incision in the inhalation group. Özgültekin et al. (21) found similar peak heart rates between sevoflurane and TIVA groups. In our study, peak heart rate (PHR) decreased after induction in both groups. While PHR did not change significantly in the TIVA group, it was significantly higher in the sevoflurane group at 10 and 15 minutes intraoperatively and at 1 and 20 minutes postoperatively compared to the TIVA group. This perioperative finding suggests that this may be due to the sympathetic stimulation effect of nitrogen protoxide. The change in postoperative peak heart rate in the sevoflurane group suggests an increase due to the agitation of the children.

Solak et al. (20) reported that diastolic arterial pressure (DAP) was lower in the inhalation group compared to the TIVA group in the postoperative period. Özgültekin et al. (21) reported in their study in children that after TIVA, desflurane and Sevoflurane anaesthesia in daytime anaesthesia, a slight decrease in mean arterial pressure (MAP) was observed in all groups after induction. However, it returned to baseline after intubation and remained stable throughout the case. In our study, systolic arterial pressure (SAP) was lower in the TIVA group at 15 minutes perioperatively and at 10 and 20 minutes postoperatively. This decrease in systolic arterial pressure is due to the lowering effect of propofol on peripheral vascular resistance (22). In two studies, Schaer reported an 8% and 15% decrease in SAP at the end of induction with propofol (23). In our study, the TIVA group had higher diastolic arterial pressure at 1 and 2 minutes perioperatively and the sevoflurane group at 10 minutes postoperatively. The fact that diastolic arterial pressure was higher in the intraoperative TIVA group was thought to be related to the demographic characteristics of the patients randomly divided into groups. In our study, mean arterial pressure was higher in the TIVA group at 2 minutes perioperative and 20 minutes postoperative. This may be due to the adverse effects of nitrogen protoxide and Sevoflurane on the myocardium and depressing peripheral vascular tone, especially at increased concentrations (24). We think that increases in mean arterial pressure are associated with early recovery. In our study, decreases in SAP and DAP did not require treatment as in similar studies.

Solak et al. (20) found no significant difference between the groups regarding SPO2 (pulse oximetry) values. Our study found no significant difference between the groups regarding SPO2 values.

Muscle rigidity due to opioid analgesics during the induction of anaesthesia is a common and undesirable event. The incidence of muscle rigidity varies between 0 and 100% in opioid anaesthetic use. The dose and rate of administration of opioids is the most critical factors in increasing the incidence. High doses and rapid and concomitant use of nitrous protoxide increase rigidity (25). The use of small doses of diazepam and midazolam in induction and intravenous anaesthetic agents such as thiopental and propofol reduces the risk of rigidity (25, 26). No muscle rigidity was observed in any patient in our study. This may be due to the slow administration of remifentanil.

Paracetamol, which is effective and safe for postoperative analgesia in pediatric patients, is the most preferred agent. It can be used for analgesia at 10-15 mg/kg, a maximum of 60 mg/kg/day (27). In our study, 15 mg/kg paracetamol was administered to both groups for postoperative analgesia at the end of the operation. In a similar study, Solak et al. (20) found that pain and agitation scores at 30 minutes postoperatively were higher in the inhalation group than in the TIVA group. Studies have shown that rapid awakening from anaesthesia increases the incidence of agitation in the pediatric age group. Children who wake up after anaesthesia find themselves in an unfamiliar environment when they open their eyes may cause fear and anxiety, and inadequate analgesia due to the end of the duration of action of short-acting agents during the waking period may also be the cause of postoperative agitation. In the study of Grundman et al., (7) the rate of agitation in propofol-remifentanil anaesthesia was 44%. Özgültekin et al. (21) compared Sevoflurane, desflurane and TIVA in daily anaesthesia and found that the agitation rate was 35% in the TIVA group, 70% in group S and 80% in group D. In a similar study, Na et al. (28) reported that the incidence of postoperative agitation was lower in the group with maintenance anaesthesia with remifentanil infusion than in the group with maintenance anaesthesia with Sevoflurane. In our study, the Wong-Baker Pain Scale was higher in the sevoflurane group at 10 and 20 minutes postop. At the same time, in our study, the post-op agitation scale was significantly higher in the sevoflurane group at 1, 10, and 20 minutes.

Sevoflurane provides rapid induction and recovery due to its low blood-gas partition coefficients. In the pediatric age group, rapid awakening from anaesthesia and inadequate analgesia are known to increase the incidence of postoperative agitation. In our study, the fact that both pain and agitation scales were high with Sevoflurane was likely since Sevoflurane provides rapid induction and recovery and inadequate analgesia.

In the study by Solak et al., (20) when the recovery data of both groups were compared, it was found to be shorter in the inhalation group compared to the TIVA

group. This is due to Sevoflurane's low blood-gas solubility coefficient and its rapid induction and awakening properties. Wandel et al.(29) used Sevoflurane as an inhaler agent and compared it with the TIVA group. As a result of the study, they found that spontaneous breathing, extubation time and cognitive functions returned faster in the sevoflurane group. In our study, the recovery score was higher in the TIVA group at 1 minute postoperatively. No significant difference was found at other time intervals. Cukurova et al. (30) reported that TIVA provided earlier recovery than Sevoflurane and desflurane in short-term interventions. When the literature is reviewed, it is seen that propofol is superior in recovery in daily, short-term interventions. However, after lengthy procedures, the terminal elimination half-life of propofol increases and recovery from propofol is prolonged. It has also been shown that the recovery time from propofol is significantly prolonged in anaesthesia lasting more than two and a half hours(29).

In our study, the recovery score was higher in TIVA at 1 minute postoperatively. There were no statistically significant differences observed between the two groups at other time intervals. The higher recovery score in our study's TIVA group suggests the shorter duration of adenoidectomy and tonsillectomy cases.

Grundman et al. (7) The spontaneous breathing time of the TIVA group was 11 ± 3.7 (7).In the study by Özgültekin et al. (21) the extubation time of the patients was found to be 5.2 ± 2.76 min in the sevoflurane group and 5.50 ± 2.33 min in the TIVA group. In the same study, spontaneous breathing and the first eye-opening time were realized earlier with the sevoflurane group. Our study revealed that spontaneous breathing and extubation times were significantly shorter in the sevoflurane group. Additionally, although the first eye-opening time, orientation time, and time to comply with commands were also earlier in the sevoflurane group, the differences were not statistically significant.

5. Conclusion and Recommendations

In conclusion, tracheal intubation without a muscle relaxant was successfully achieved with remifentanil in both groups.

6. Contribution to the Field

TIVA may be a better alternative to Sevoflurane among inhalation agents regarding postoperative pain, agitation and recovery.

Competing interests

The authors report no conflicts of interest.

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Author Contribution

Idea/Concept: RG, SH; **Design:** RG, SH; **Control/ Supervision:** RG, SH; **Sources and Funding:** RG, SH; **Materials:** GL, DT, SG; **Data Collection and/or Processing:** RG, SH; **Analysis and/or Interpretation:** RG, SH; **Literature Review:** RG, SH; **Writing the Article:** RG, SH; **Critical Review:** RG, SH.

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