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Effects of preemptive analgesia and preoperative anxiety on emergence delirium after pediatric adenotonsillectomy

Pediatrik adenotonsillektomi sonrası uyanma deliryumu üzerine preemptif analjezi ve preoperatif anksiyetenin etkileri

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ABSTRACT

Aim: Postoperative emergence delirium (PED) is characterized by restlessness, disorientation, and agitation, particularly in children during emergence from anesthesia. Its etiology includes preoperative anxiety, head-neck surgery, inhalation agents, and pain. This study evaluated the effects of preemptive analgesia and preoperative anxiety on PED after pediatric adenotonsillectomy.

Material and Methods: After ethics committee approval and written parental consent were obtained, 64 pediatric patients were enrolled. In this prospective observational study, patients were categorized according to the timing of intravenous acetaminophen administration: 30 minutes before surgical incision(Group 1) or 15 minutes before the end of surgery (Group 2). Preoperative anxiety was assessed using the modified Yale Preoperative Anxiety Scale (m-YPAS), postoperative delirium using the Pediatric Anesthesia Emergence Delirium (PAED) scale, and pain using the Wong-Baker Faces Pain Scale (WBFPS). Measurements were recorded at 0, 5, 10, 15, 30, 45, and 60 minutes postoperatively. A p value <0.05 was considered statistically significant.

Results: Groups were comparable in demographics, anesthesia time, surgical history, parental satisfaction, and complications. Preoperative anxiety was high in both groups (m-YPAS ≥30). Group 1 had shorter extubation times(p<0.001). PAED scores ≥10 persisted for 10 min in Group 1 and 15 min in Group 2. PAED and WBFPS scores decreased over time, with a positive correlation between them in both groups (p<0.05).

Conclusion: Preemptive analgesia reduced postoperative pain but did not significantly affect PED within the first 10 minutes. These findings suggest that managing both anxiety and pain may be necessary to prevent PED in pediatric patients. Further studies are warranted.

Keywords: Preemptive analgesia, preoperative anxiety, emergence delirium, pediatric adenotonsillectomy

ÖZ

Amaç: Postoperatif uyanma deliryumu (PED), özellikle çocuklarda anesteziden uyanma sırasında huzursuzluk, yönelim bozukluğu ve ajitasyon ile karakterizedir. Etiyolojisinde preoperatif anksiyete, baş-boyun cerrahisi, inhalasyon ajanları ve ağrı rol oynar. Bu çalışmada, pediatrik adenotonsillektomi sonrası PED üzerine preemptif analjezi ve preoperatif anksiyetenin etkileri araştırılmıştır.

Gereç ve Yöntemler: Etik kurul onayı ve yazılı ebeveyn onamı alındıktan sonra 64 pediatrik hasta çalışmaya dahil edildi. Bu prospektif gözlemsel çalışmada hastalar, intravenöz asetaminofen uygulama zamanına göre; cerrahi insizyondan 30 dakika önce (Grup 1) veya cerrahinin bitiminden 15 dakika önce (Grup 2) olacak şekilde sınıflandırıldı. Preoperatif anksiyete modified Yale Preoperative Anxiety Scale (m-YPAS) ile, postoperatif deliryum Pediatric Anesthesia Emergence Delirium (PAED) ölçeği ile ve ağrı Wong-Baker Faces Pain Scale (WBFPS) ile değerlendirildi. Ölçümler postoperatif 0, 5, 10, 15, 30, 45 ve 60. dakikalarda kaydedildi. p<0,05 değeri anlamlı kabul edildi.

Bulgular: Gruplar demografik özellik, anestezi süresi, cerrahi geçmiş, ebeveyn memnuniyeti ve komplikasyonlar açısından benzer bulunmuştur. Her iki grupta preoperatif anksiyete yüksekti (m-YPAS ≥30). Grup 1'in ekstübasyon süresi anlamlı olarak daha kısaydı (p<0.001). PAED skorları Grup 1'de 10 dakika, Grup 2'de 15 dakika ≥10 olarak kaldı. PAED ve WBFPS skorları zamanla azalmış ve her iki grupta pozitif korelasyon göstermiştir (p<0.05).

Sonuç: Preemptif analjezi postoperatif ağrıyı azaltmış ancak ilk 10 dakikadaki PED skorlarını anlamlı şekilde etkilememiştir. Bulgular, PED'nin önlenmesinde hem anksiyete hem de ağrı yönetiminin birlikte ele alınmasının önemini göstermektedir.

Anahtar Kelimeler: Preemptif analjezi, Preoperatif anksiyete, uyanma deliryumu, pediatrik adenotonsillektomi

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Highlights

- The preemptive group (acetaminophen 30 minutes before surgery) demonstrated significantly shorter extubation times ($p < 0.001$).
- In Group 1, Pediatric Anesthesia Emergence Delirium scores remained ≥10 for the first 10 minutes postoperatively, whereas in Group 2, elevated PAED scores persisted through 15 minutes.
- PAED and WBFPS scores were initially positively correlated and declined over time. Although preemptive analgesia reduced postoperative pain, it was insufficient alone to meaningfully decrease PED in the early awakening period. These findings support the need for multimodal strategies, combining pain control with preoperative anxiety management, to more effectively prevent PED.

INTRODUCTION

Adenotonsillectomy is one of the most frequently performed otorhinolaryngology (i.e., ear-nose-throat, ENT) surgeries in children. During the period of emergence from anesthesia following pediatric adenotonsillectomy, unwanted behaviors and conditions such as pain, postoperative emergence delirium (PED), or both may occur (1-6). It has been shown that preoperative anxiety and pain play a role in the development of PED (5-10). It has been reported that preemptive analgesia reduces the severity of PED by lowering postoperative pain. However, results obtained on this topic, the timing of preemptive analgesia, and the effects of the method are still debated (1-12). Recent studies have demonstrated that preemptive acetaminophen administration alleviates postoperative pain in children undergoing ENT procedures (1-5,8,10-12).

This study was conducted to determine the effects of preemptive analgesia and preoperative anxiety on PED following pediatric adenotonsillectomy.

MATERIAL and METHODS

Ethics Committee Approval

This prospective observational study was conducted at Zonguldak Bülent Ecevit University Hospital between October 2019 and 2020 after obtaining local ethics committee approval (protocol No: 2019/14, ClinicalTrials.gov Identifier: NCT05802082) and written parental consent. All procedures in the study complied with the principles of the Declaration of Helsinki.

Study Design and Participants

The study sample included children aged 2-10 years who were scheduled for elective adenotonsillectomy and categorized in the American Society of Anesthesiologists (ASA) I-II risk groups. Patients who had allergies to the study drugs, a risk of difficult airway (e.g., obesity), neurological or developmental disorders (e.g., epilepsy), a recent or active upper respiratory tract infection, chronic medication use (e.g., anxiolytics, opioids, steroids), adverse events observed during emergence (hypoxia, hypercarbia, hypotension, hypoglycemia, or hypo-/hyperthermia), or lack of parental consent were excluded from the study.

Children and their parents were informed about the measurement instruments to be used in the study in the anesthesia outpatient clinics and preoperative waiting rooms. To make vascular access easier in the children who were not premedicated, when they were in the ENT inpatient clinic, a lidocaine-prilocaine cream (EMLA®) was applied to the back of the appropriate hand, the hand was covered, and the children were transferred to the operating room. The children were taken to the preoperative waiting room with one of their parents 30 min before surgery, and their age, sex, weight, ASA classification, and duration of fasting were recorded. The preoperative anxiety levels of the children were evaluated using m-YPAS (13) in the preoperative waiting room with their parents present.

Intervention and Grouping

After m-YPAS assessment, intravenous access was established on the dorsum of the hand where EMLA® cream had been applied, using a 22-gauge cannula, and fluid infusion was initiated.

In this prospective observational study, patients were categorized according to the timing of intravenous acetaminophen (10 mg/kg) administration: 30 minutes before surgical incision (Group 1) and 15 minutes before the end of surgery (Group 2). No random allocation was performed; the timing of acetaminophen administration was determined according to routine clinical practice. Patients in Group 1 were transferred to the operating room following acetaminophen infusion, whereas patients in Group 2 were transferred after completion of the m-YPAS assessment. Parents accompanied their children during this process.

Anesthesia Management

After admission to the operating room, routine monitoring was established in all patients, including electrocardiography (ECG), non-invasive blood pressure (NIBP), and peripheral oxygen saturation (SpO_2). To maintain intraopera-

tive normothermia, all patients were actively warmed using a warming blanket throughout the procedure. Anesthesia was administered by an anesthesiologist who was unaware of the study protocol. The administration of midazolam during anesthesia induction and the operating room temperature were recorded.

Anesthesia induction was performed using a standardized protocol in all patients. Intravenous induction was achieved with propofol (2–3 mg/kg) and fentanyl (1–2 μg/kg). Neuromuscular blockade for endotracheal intubation was established with rocuronium (0.6 mg/kg). Anesthesia was maintained with inhaled sevoflurane (2%) in a 50% oxygen–air mixture and remifentanil infusion.

Endotracheal intubation was performed by an experienced pediatric anesthesiologist using direct laryngoscopy. Endotracheal tube size was determined according to the age-based formula (age/4 + 4), and cuffed spiral endotracheal tubes were used in all patients. No cases of difficult intubation were encountered, and no repeated intubation attempts were required.

Following completion of the adenotonsillectomy and confirmation of adequate hemostasis by the surgeon, anesthetic gases and remifentanil infusion were discontinued. The time from induction to discontinuation of anesthetic agents was recorded as the anesthesia duration. The time from discontinuation of anesthetic agents to extubation was defined as the extubation time. The time from discontinuation of anesthetic agents to achieving an Aldrete score of 9 was defined as the recovery time.

At the end of surgery, neuromuscular blockade was reversed with sugammadex. Patients were extubated after full recovery of spontaneous respiration, protective airway reflexes, and adequate consciousness.

All intraoperative and postoperative medications were recorded. For postoperative nausea and vomiting management, metoclopramide (0.15 mg/kg) was administered to all patients; if nausea or vomiting persisted, ondansetron (0.1 mg/kg) was administered. Parents were allowed to accompany their children in the postoperative recovery unit.

Data Collection Instruments

Preoperative anxiety was assessed using the m-YPAS, PED was assessed using the Pediatric Anesthesia Emergence Delirium (PAED) score, and pain was assessed using the Wong-Baker Faces Pain Scale (WBFPS).

Modified Yale Preoperative Anxiety Scale

The Yale Preoperative Anxiety Scale (YPAS), developed to assess the anxiety levels of children before they undergo surgical interventions, was revised in 1997 and updated as m-YPAS (13). m-YPAS evaluates anxiety under five domains based on 22 forms of behavior. The raw score range of m-YPAS is 5-22, while evaluations are made by converting this range into 0-100 using the formula described below. The score for the form of behavior observed to the highest extent in each of the 5 m-YPAS domains is taken as the score in that domain. Because each domain of m-YPAS has different scores (4 or 6), and the child receives the score corresponding to their behavior in each domain, the scoring is made using the correction formula "(1/4 + 1/6 + 1/4 + 1/4 + 1/4) x 100/5", and a score of 23-100 is obtained. Children with scores equal to or smaller than 29 are considered "calm", while those with scores equal to or greater than 35 are considered "anxious"(13). The Turkish version of the modified Yale Preoperative Anxiety Scale demonstrated good internal consistency (Cronbach's alpha = 0.85 and 0.86 for two independent observers) and was reported to be a valid and reliable instrument for assessing preoperative anxiety in children (14).

Wong-Baker Faces Pain Scale

In the assessment of postoperative pain, scales with facial expression options are preferred in children, elderly people, and patients with communication problems (8). WBFPS, which was developed in 1988 by Wong et al., is a pain assessment scale that can be applied fast to and understood easily by children under 18 years of age. Each number on the scale in the range of 0-10 corresponds to a different facial expression, and these expressions indicate the level of pain felt by the patient. While the number 0 corresponds to a happy face indicating no pain at all, the number 10 corresponds to a crying face indicating the most severe pain. In assessments using WBFPS, the physician explains to the patient how the scale is used and asks them to express their pain by instructing them to 'mark the level of pain they are currently feeling'(8,15). In our study, we planned to administer oral ibuprofen at a dose of 10 mg/kg to the patients with WBFPS scores of ≥4.

Pediatric Anesthesia Emergence Delirium

PAED was defined in 2004 by Sikich et al. (16) to diagnose postoperative delirium in children over the age of 2. It has 5 psychometric items. Three of these items have significant power to distinguish delirium from pain, while the last 2 items have lower levels of sensitivity. PAED scores of ≥10 are interpreted as the 'presence of emergence delirium'. PAED has been acknowledged as an ideal, reliable, and valid scale to evaluate agitation in pediatric patients, demonstrating good internal consistency (Cronbach's alpha = 0.89) and interobserver reliability (0.84) in the original study by Sikich and Lerman (16). Although PAED has been used in several studies in Türkiye (17,18), no Turkish version with reported validity and reliability has been published to date. In our study, PAED scores of ≥10 were considered to be indicative of PED. In case of delirium, 1 mg/kg propofol was planned as a rescue treatment.

Parental satisfaction

In the postoperative period, the parents of the patients were asked to rate their levels of satisfaction with the process (1=bad, 2=poor, 3=good, or 4=excellent).

Each data collection instrument (m-YPAS, WBFPS, and PAED) was filled out by the same researcher who was not informed about group allocations, did not participate in the intraoperative procedures, but was trained about the scales used in the study. The measurements were made at the postoperative 0th, 5th, 10th, 15th, 30th, 45th, and 60th mins.

Each patient, their parent, the anesthesiologist, and the surgeon were blinded to the group allocations in the study. The time from admission to the postoperative reanimation room to transfer to the inpatient clinic (reanimation time) and complications, if any (nausea, vomiting, cough, head-neck pain, and increased secretion), were recorded.

Statistical Analysis

The sample size needed to conduct the study was calculated based on a 95% confidence interval (1-α), 95% testing power (1-β), and an effect size of d=0.838, and it was determined that at least 32 patients needed to be included in each group (19). The collected data were analyzed using the IBM Statistical Package for the Social Sciences (SPSS) V23. The Shapiro-Wilk test was used to assess normality. Categorical data were compared between groups using Pearson's chi-squared or Yates-corrected chi-squared tests. Two independent groups of normally distributed data were compared using independent-samples t-tests, while non-normally distributed data were compared using the Mann-Whitney U test. Intragroup comparisons across multiple time points were performed using the Friedman test with pairwise comparisons by the Dunn test. The relationships between m-YPAS scores and PAED scores at each time point were analyzed using Pearson's correlation coefficient for normally distributed data and Spearman's rho correlation coefficient for non-normally distributed data. Similarly, the relationships between pain scores and PAED scores were analyzed using Spearman's rho correlation coefficient. Quantitative variables are presented as mean ± standard deviation or median (minimum–maximum), and categorical variables as frequency (percentage). Statistical significance was set at $p<0.05$.

RESULTS

A total of 82 patients were initially assessed for eligibility. Of these, 18 were excluded for the following reasons: age >10 years (n = 2), allergy to study drugs (n = 2), risk of difficult airway (e.g., obesity) (n = 1), neurological or developmental disorders (n = 2), recent or active upper respiratory tract infection (n = 3), chronic medication use (e.g., anxiolytics, opioids, steroids) (n = 2), adverse events observed during emergence (hypoxia, hypercarbia, hypotension, hypoglycemia, or hypo-/hyperthermia) (n = 1), and lack of parental consent (n = 5).

There was no significant difference between the groups in terms of sex, age, weight, ASA risk classes, fasting times, operating room temperature, or anesthesia, emergence, and reanimation times. The patients in both groups had high m-YPAS scores, and there was no significant difference between the groups. It was observed that 82.8% (n=53) of the patients were anxious in the preoperative stage. Group 1 had a significantly shorter extubation time ($p<0.001$; Table 1).

The groups were similar in terms of their history of previous surgeries, status of premedication for anesthesia induction, intraoperative and postoperative additional drug use, postoperative complications, and parental satisfaction ($p>0.005$; Table 2).

Table 1: Comparison of quantitative data

	Group 1 (n=32)	Group 2 (n=32)	p
Gender (Female/Male)	14/18	15/17	1.000
Age (years)	5.47 ± 2.2	5.75 ± 2.4	0.618*
Body weight (kg)	23.53 ± 10.49	25.17 ± 13.05	0.554*
ASA Risk (I/II)	24/8	30/2	0.085
Room Temperature (^{0}C)	21.93 ± 1.51	21.85 ± 1.32	0.827**
Fasting Time (hours)	9.52 ± 1.63	9.84 ± 1.57	0.485*
Anesthetic Time (minutes)	58.13 ± 23.86	55.56 ± 23.96	0.614*
Extubation Time (minutes)	6.44 ± 2.41	9.06 ± 2.68	<0.001*
Recovery Time (minutes)	7.56 ± 3.45	9.25 ± 4.25	0.136*
Recovery Stay Time (minutes)	24.31 ± 6.39	22.91 ± 3.95	0.316*
m-YPAS score	45.76 ± 16.05	53.86 ± 22.15	0.160*

*Mann Whitney U test, **Independent two-sample t test, mean ± standard deviation;
ASA: American Society of Anesthesiologists, **m-YPAS:** Modified Yale Preoperative Anxiety Scale

Table 2: Comparison of categorical data

	Group 1 n=32 (%)	Group 2 n=32 (%)	p
Surgical History			
Yes	7 (21.9)	10 (31.3)	0.571**
No	25 (78.1)	22 (68.7)	
Premedication			
Yes	7 (21.9)	12 (37.5)	0.274**
No	25 (78.1)	20 (62.5)	
Intraoperative drug use			
No	8 (25)	4 (12.5)	0.664*
Prednol	9 (28)	12 (37.5)	
Jetocaine	6 (18.8)	4 (12.5)	
Prednol+Jetocaine	6 (18.8)	9 (28.1)	
Avil+Prednol+ Jetocaine	2 (6.3)	1 (3.1)	
Avil+Prednol	1 (3.1)	1 (3.1)	
Avil	0 (0)	1 (3.1)	
Postoperative complications			
No	13 (40.6)	8 (25)	0.196*
Cough	4 (12.5)	6 (18.8)	
Sore throat	4 (12.5)	3 (9.4)	
Cough+Sore throat	4 (12.5)	2 (6.3)	
Nausea+Cough	1 (3.1)	0 (0)	
Nausea+Cough+ Sore throat	2 (6.3)	0 (0)	
Headache	1 (3.1)	0 (0)	
Cough+Increased secretion	1 (3.1)	2 (6.3)	
Sore throat+Increased secretion	1 (3.1)	2 (6.3)	
Nausea+Vomiting+ Increased secretion	1 (3.1)	0 (0)	
Increased secretion	0 (0)	4 (12.5)	
Nausea+Vomiting	0 (0)	2 (6.3)	
Nausea+Vomiting+ Cough+Sore throat	0 (0)	1 (3.1)	
Cough+Increased secretion+Sore throat	0 (0)	2 (6.3)	
Parent Satisfaction			
Poor	1 (3.1)	0 (0)	0.601*
Acceptable	4 (12.5)	2 (6.3)	
Good	21 (65.6)	24 (75)	
Very Good	6 (18.8)	6 (18.8)	
Postoperative medication use			
None	25 (78.1)	26 (81.3)	0.550*
Analgesic	5 (15.6)	6 (18.7)	
Analgesic+ Antiemetic	1 (3.1)	0 (0)	
Analgesic+Nebul	1 (3.1)	0 (0)	

*Pearson's chi-square test, **Yates-corrected chi-square test, frequency (percentage);
Group 1: patients administered 10 mg/kg acetaminophen iv 30 min before surgery
Group 2: patients administered 10 mg/kg acetaminophen iv 15 min before surgery

While there was no intergroup difference in terms of the PAED and WBFPS scores of the patients, there were significant intragroup differences (p<0.001; Table 3). The median PAED scores of Group 1 were ≥10 within the postoperative first 10 min, while those of Group 2 were ≥10 up to the 15th min, and these scores decreased over time. None of the patients developed PED severe enough to require pharmacological treatment in the postoperative reanimation room.

Although WBFPS scores decreased over time in both groups, the presence of early pain showed a positive correlation between PAED and WBFPS (p<0.05; Table 4).

DISCUSSION

According to the results of our study, pediatric patients undergoing adenotonsillectomy surgery had generally high m-YPAS scores, and preoperative anxiety was common. The presence of parents alone was inadequate in reducing this anxiety. It was observed that preemptive acetaminophen administration reduced postoperative pain but did not have a significant effect on PED development. Our results demonstrated that preoperative anxiety and pain were significant factors in the development of PED following pediatric adenotonsillectomy, and pharmacological premedication was necessary for anxiety management.

Table 3: Comparison of PAED and WBFPS scores between and within groups

	Time (min)	Group 1	Group 2	p*
PAED				
	0	14 (10 - 20)^{a}	14.5 (6 - 20)^{ab}	0.925
	5	15 (8 - 20)^{a}	15 (3 - 19)^{a}	0.498
	10	12 (1 - 18)^{b}	12.5 (3 - 17)^{b}	0.850
	15	9.5 (0 - 17)^{c}	10 (0 - 16)^{c}	0.909
	30	6.5 (0 - 14)^{d}	5.5 (0 - 13)^{d}	0.407
	45	5 (0 - 10)^{e}	3.5 (0 - 12)^{e}	0.685
	60	3 (0 - 6)^{f}	3 (0 - 10)^{f}	0.521
	p**	<0.001	<0.001	
WBFPS				
	0	0 (0 - 8)^{d}	0 (0 - 8)^{cd}	0.371
	5	2 (0 - 8)^{bc}	2 (0 - 8)^{b}	0.231
	10	2 (0 - 10)^{a}	2 (0 -10)^{ab}	0.350
	15	2 (0 - 10)^{ab}	3 (0 -10)^{a}	0.108
	30	2 (0 - 8)^{bc}	2 (0 - 8)^{b}	0.600
	45	2 (0 - 4)^{c}	2 (0 - 8)^{c}	0.851
	60	0 (0 - 2)^{d}	0 (0 - 6)^{d}	0.351
	p**	<0.001	<0.001	

*Mann Whitney U test, mean ± standard deviation, median (minimum – maximum); ** Friedman test; a-f=There is no difference between times with the same letter.

Table 4: Relationship between m-YPAS-PAED and PAED-WBFPS scores of groups

	Time (min)	mYPAS-PAED	PAED -WBFPS
		r;p	r;p
Group 1	0	-0.085*; 0.645	-0.067**; 0.715
	5	0.084*; 0.649	0.302**; 0.093
	10	0.293*; 0.104	0.351**; 0.049
	15	0.211*; 0.246	0.420**; 0.017
	30	0.191*; 0.296	0.462**; 0.008
	45	0.087**; 0.637	0.243**; 0.181
	60	0.193**; 0.289	0.187**; 0.305
Group 2	0	0.178**; 0.330	0.003**; 0.985
	5	0.198**; 0.277	0.128**; 0.487
	10	0.276**; 0.126	0.401**; 0.023
	15	0.145**; 0.428	0.364**; 0.040
	30	0.400**; 0.023	0.378**; 0.033
	45	0.327**; 0.068	0.404**; 0.022
	60	0.340**; 0.057	0.466**; 0.007

*Pearson correlation coefficient, **r: Spearman's rho correlation coefficient; **m-YPAS:** Modified Yale Preoperative Anxiety Scale, **PAED:** Post Anesthetic Emergence Delirium, **WBYAS:** Wong Baker Facial Pain Scale

It was reported that 65% of children experienced intense anxiety in preoperative waiting areas and during anesthesia induction (20). It was emphasized that this anxiety led to the administration of sedation to children at high doses in the preoperative period and the development of agitation, pain, and behavioral problems in the postoperative period (21,22). In the literature, while it has been reported that there is no clear relationship between preoperative anxiety and PED, some studies have shown positive correlations between these two variables (4,6,18,23). It was reported that the presence of parents near their children before induction not only reduced preoperative anxiety and increased the cooperation of children but also lowered their agitation levels during emergence (23). In our study, high levels of anxiety persisted in the patients who were accompanied by their parents but not administered premedication, and the duration of PED presence in these patients was not significantly affected. This result suggested that the presence of parents alone was inadequate in preventing PED, and pharmacological premedication was necessary.

Post-tonsillectomy pain management in children is difficult (12). Preemptive analgesia has been reported to delay the onset of postoperative pain and reduce its severity and duration (1-12). Acetaminophen is prevalently used as a preemptive analgesic for post-tonsillectomy pain management in children and adults (24). In our study, we also used acetaminophen as a preemptive analgesic agent.

Pain is an important factor contributing to the development of PED, and the effective treatment of pain can reduce the prevalence and severity of PED (8). It was stated that preemptive analgesic administration could lower PED and pain levels. WBFPS is one of the measurement instruments that are based on the self-reports and behavioral analyses of children, and it is frequently employed (15). In this study, in which we used WBFPS scores to assess pain, while the pain scores of Group 1 were usually lower than those of Group 2, these differences were not statistically significant. On the other hand, there was a significant positive relationship between pain and PAED scores. In our opinion, preemptive acetaminophen administration in pediatric adenotonsillectomy cases is more effective in postoperative pain management. Considering the measurements made at all time points in this study, the patients in both groups had similar PAED and WBFPS scores, and these scores decreased over time.

PED is a clinical picture that usually spontaneously resolves after general anesthesia and lasts about 5-15 min (25). PED, which can be seen in up to 80% of children who are administered sevoflurane, is associated with rapid emergence and the anxiety status of the patient related to the ambient settings (26,27). In our study, the initial PAED scores of the patients in both groups were high. The duration of the presence of PED in our study was similar to those reported in other studies in the literature, and it was observed that as postoperative monitoring times increased, PAED scores decreased. The initially high PAED scores of the patients may be attributed to their rapid emergence from anesthesia related to sevoflurane usage. The shorter PED durations in Group 1 may also be explained by the lower rate of exposure to sevoflurane in these patients.

The limitations of this study included its small sample, short monitoring times, the absence of a placebo group, and the fact that individual differences were not investigated. Moreover, although we used scales with proven validity to collect data, the measurements and evaluations may have been influenced by a set of various factors and prevented us from a clearer understanding of the relationships between concepts. The combined usage of scales that can specifically distinguish preoperative anxiety, postoperative pain, and PED can reduce the likelihood of errors.

Conclusion

Preemptive analgesia reduced postoperative pain scores in pediatric patients. However, as it did not decrease PAED scores within the first 10 minutes postoperatively, it was concluded that it had no significant effect on PED. Further comprehensive studies focusing on both anxiety and pain management are warranted for the prevention of PED in pediatric patients.

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Author Contributions

Concept: **Gamze Küçükosman, Keziban Bollucuoğlu, Bengü Gülhan Köksal,** Design: **Gamze Küçükosman, Bengü Gülhan Köksal,** Data Collection or Processing: **Dilay İlke Alp, Özcan Pişkin, Rahşan Dilek Okyay,** Analysis or Interpretation: **Gamze Küçükosman, Bengü Gülhan Köksal, Hilal Ayoğlu, Naci Murat,** Literature search: **Dilay İlke Alp, Gamze Küçükosman,** Writing: **Gamze Küçükosman, Dilay İlke Alp, Hilal Ayoğlu,** Approval: **Gamze Küçükosman, Hilal Ayoğlu.**

Conflicts of Interest

The authors declare no conflict of interest.

Financial Support

There is no financial disclosure to declare in this study.

Ethical Approval

This study was approved by the Zonguldak Bülent Ecevit University Non-Interventional Clinical Research Ethics Committee, with an approval number of protocol No: 2019/145-18/09 and an approval date of 18.09.2019. ClinicalTrials.gov Identifier: NCT05802082)

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APPENDIX 1. The mYPAS

A. Activity

1 = Looking around, curious, playing with toys, reading (or other age-appropriate behavior); moves around holding area/treatment room to get toys or go to parent;may move toward OR equipment.

2 = Not exploring or playing, may look down, may fidget with hands or suck thumb (blanket); may sit close to parent while waiting, or play has a definite manic quality.

3 = Moving from toy to parent in unfocused manner, nonactivity-derived movements; frenetic/frenzied movement or play; squirming, moving on table, may push mask away, or clinging to parent.

4 = Actively trying to get away, pushes with feet and arms, may move whole body; in waiting room, running around unfocused, not looking at toys or will not separate from parent, desperate clinging.

B. Vocalizations

1 = Reading (nonvocalizing appropriate to activity), asking questions, making comments, babbling, laughing, readily answers questions but may be generally quiet; child too young to talk in social situations or too engrossed in play to respond.

2 = Responding to adults but whispers, “baby talk,” only head nodding.

3 = Quiet, no sounds or responses to adults.

4 = Whimpering, moaning, groaning, silently crying.

5 = Crying or may be screaming “no.”

6 = Crying, screaming loudly, sustained (audible through mask).

C. Emotional expressivity

1 = Manifestly happy, smiling, or concentrating on play.

2 = Neutral, no visible expression on face.

3 = Worried (sad) to frightened, sad, worried, or tearful eyes.

4 = Distressed, crying, extremely upset, may have wide eyes.

D. State of apparent arousal

1 = Alert, looks around occasionally, notices or watches what anesthesiologist does with him/her (could be relaxed).

2 = Withdrawn, child sitting still and quiet, may be sucking on thumb or face turned into adult.

3 =Vigilant, looking quickly all around, may startle to sounds, eyes wide, body tensed.

4 = Panicked whimpering, may be crying or pushing others away, turns away.

E. Use of parents

1 = Busy playing, sitting idle, or engaged in age-appropriate behavior and does not need parent; may interact with parent if parent initiates the interaction.

2 = Reaches out to parent (approaches parent and speaks to otherwise silent parent), seeks and accepts comfort, may lean against parent.

3 = Looks at parents quietly, apparently watches actions, does not seek contact or comfort, accepts it if offered or clings to parent.

4 = Keeps parent at distance or may actively withdraw from parent, may push parent away or desperately clinging to parent and will not let parent go.