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Comparison of Emergence and Recovery in Different Age Pediatric Patients Undergoing Ambulatory Surgical Procedures

Günübirlik Cerrahi Uygulanan Pediatrik Hastalarda Uyanma ve Derlenmenin Yaş Gruplarına Göre Karşılaştırılması

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ABSTRACT

Objectives: In this study, we aimed to investigate the effects of children's age on awakening and recovery in ambulatory pediatric surgery cases.

Methods: The data of patients who underwent ambulatory surgical procedures were reviewed retrospectively, and the files of ASA I patients who used sevoflurane as an induction and maintenance agent and were placed in a laryngeal mask for airway maintenance were reviewed. Patients who used neuromuscular blockers during anesthesia were not included in the study. The patients were divided into two groups according to their age, as Group K (age of 36 months and below) (n=34) and Group B (age of over 36 months) (n=28). Hemodynamic data of the patients, laryngeal mask removal times at the end of surgery, and extubation times were evaluated. The Aono's 4-Point Scale, which evaluates the agitation of the patients in the recovery unit, and the Steward Recovery Score, which evaluates the recovery quality, were examined.

Results: There was no difference according to age in terms of laryngeal mask removal times and eye opening times. Aono's 4-Point Scale and Steward Recovery Scale were found to be higher in children aged 36 months and below in recovery unit.

Conclusion: While the laryngeal mask removal times and extubation times were similar in all age groups we examined in our study, recovery was faster in younger patients and emergence agitation was observed more frequently.

Keywords: Ambulatory surgical procedures; emergence agitation; recovery.

ÖZET

Amaç: Çalışmada, günübirlik çocuk cerrahisi olgularında çocukların yaşının uyanma ve derlenme üzerine etkilerinin araştırılması amaçlandı.

Yöntem: Retrospektif olarak günübirlik çocuk cerrahisi yapılan hastaların dosyaları taranarak, indüksiyon ve idame ajanı olarak sevofluran kullanılan ve hava yolu idamesinde larengeal maske yerleştirilen "American Society of Anesthesiologist I (ASA I)" hastaların dosyaları incelendi. Anestezi sırasında nöromusküler bloker kullanılan hastalar çalışmaya dahil edilmedi. Hastalar yaşlarına göre 36 ay ve altı, 36 ay üstü olarak iki gruba ayrıldı. Hastaların hemodinamik verileri, cerrahi bitiminde larengeal maske çıkarılma zamanları ve ekstübasyon zamanları ile derlenme ünitesinde Aono's Four Point Scale ile hastaların ajitasyonu ve Steward Recovery Score ile derlenme kalitesi incelendi.

Bulgular: Larengeal maske çıkarılma zamanları ve göz açma zamanları açısından yaşa göre fark bulunmadı. Derlenmede Aono's Four Point Scale ve Steward Recovery Scale yaşı 36 ay ve altı olan çocuklarda daha yüksek bulundu.

Sonuç: Çalışmada incelenen tüm yaş gruplarında uyanma değerlendirildiğinde larengeal maske çıkarılma zamanları ve ekstübasyon zamanları benzerken, küçük yaş hastalarda derlenme daha hızlı oldu ve uyanma ajitasyonu daha fazla görüldü.

Anahtar sözcükler: Derlenme; günübirlik cerrahi; uyanma ajitasyonu.

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Ambulatory surgery is the surgery in which patients come to the hospital on the day of surgery and are observed for a short time after the surgery and discharged on the same day. The advantages of day surgery are that surgery cancellations are low, the waiting time is shortened, and the risk of nosocomial infection is reduced. They provide better comfort to patients, shorten hospital stay, and are economically advantageous. For this reason, it is preferred by both the patient and the institution providing the service.[1] Short hospital stay and early mobilization reduce the risk of hospital-acquired infection and thromboembolism.[2] Due to these advantages, the number of day surgeries has increased.[3]

Although general and regional techniques are used as a method of anesthesia, general anesthesia is used more.[4] In surgeries where complete muscle relaxation is not desired, a laryngeal mask can be placed without the use of neuromuscular blockers.[5] Vascular access is opened after induction with an inhalation agent in patients who are taken to the operating room without opening the vascular access. Then, the patient's airway safety is maintained by placing a laryngeal mask.[6,7]

Children have fewer comorbidities compared to adults, and most of the operations in children are minor surgery, and ambulatory surgery is more preferred in the pediatric age group.[8] In this study, we aimed to investigate the effects of children's age on awakening and recovery in pediatric ambulatory surgery cases.

Methods

The ethics committee approval of the study was obtained from the Medeniyet University Goztepe Research Hospital Ethics Committee (2019/0516). Patients who underwent day surgery for circumcision and inguinal hernia in the pediatric operating room between February 1, 2011, and August 1, 2011, were retrospectively reviewed. The data of ASA I group patients who did not have vascular access when they came to the operating room, who used sevoflurane for anesthesia induction and maintenance, and whose airway was controlled by a laryngeal mask, were recorded. The data of the patients were evaluated by dividing them into two groups as Group K (36 months and below) (n=34) and Group B (over 36 months) (n=28). Patients who came to the operating room by vascular access, had advanced systemic disease, and were applied a method other than laryngeal mask for airway maintenance were not included in the study.

When the children with suitable pre-operative fasting periods came to the operating room, necessary preparations were made for the monitoring of heart rate (HR) and peripheral oxygen saturation (SpO_2), and the patients were monitored.

Anesthesia was induced using sevoflurane in 6 L/min fresh gas flow (50% O_2/N_2O) using a face mask suitable for the age and face of the patient. When the level of anesthesia was at a sufficient depth, a vascular access was opened from an appropriate extremity and 1 mcg/kg fentanyl i.v. (Talinat, VEM Drug, Istanbul, Turkey) was applied for preemptive analgesia. Then, a laryngeal mask suitable for the patient was placed and ventilation was started at the tidal volume and frequency appropriate for his weight and age. During the operation, the fresh gas flow was reduced to 4 L/min and the sevoflurane (Sevorane, Abbvie, Istanbul, Turkey) vaporizer was adjusted so that the agent concentration was 1 MAC. Five minute interval HR and SpO_2 values of the patients were recorded before and after induction, after placing the laryngeal mask, and throughout the surgery. When the skin incision is closed, paracetamol 15 mg/kg i.v. (Perfalgan, Bristol Myers Squibb, New York, USA) was applied for post-operative analgesia.

At the end of the surgery, the sevoflurane vaporizer was turned off and the fresh gas flow was adjusted to 100% O2 6 L/min. The laryngeal mask was removed when the patient had a tidal volume of more than 8 ml/kg and a respiratory frequency appropriate for his age. Laryngeal mask removal time and eye opening time were recorded. Laryngeal mask removal time; the time elapsed from laryngeal mask removal after the vaporizer was turned off was considered. Eye opening time; the time from when the child opened his eyes after the vaporizer was turned off. After patients transferred to the recovery room, HR, SpO_2, Aono's 4-Point Scale[9] (Table 1) for post-operative agitation, and Steward Recovery Score[10] (Table 2) for recovery sufficiency were recorded to determine the recovery level. Patients with Steward Recovery Score ecovery Score y fre

Adverse events in the operating room (such as ventilation problems, laryngospasm, bronchospasm, and bradycardia) and adverse events in the recovery (such as respiratory arrest, pain, nausea, and vomiting) were analyzed and recorded from files.

Table 1. Aono's 4-point scale

Clinical score	Patient characteristic
1	Calm (conversation)
2	Not calmed but could be easily calmed
3	Not easily calmed, moderately agitated, or restless
4	Combative, excited, disoriented

Table 2. Steward Recovery Score

Consciousness	
Awake	2
Responding to stimuli	1
Not responding	0
Airway	
Coughing on command or crying	2
Maintaining good airway	1
Airway requires maintenance	0
Movement	
Moving limps purposefully	2
Not purposeful movement	1
Not moving	0

Statistical Analysis

IBM SPSS Statistics 22 (IBM SPSS, Turkey) program was used for the statistical analysis of the findings obtained in the study. The conformity of the parameters to the normal distribution was evaluated with the Shapiro–Wilk test. While evaluating the study data, in addition to descriptive statistical methods (mean, standard deviation, and frequency), Student's t-test was used for comparisons of normally distributed parameters between two groups, and Mann–Whitney U-test was used for comparisons of non-normally distributed parameters between two groups. Continuity (Yates) correction was used to compare qualitative data. Significance was evaluated at $p<0.05$ level.

Results

In the study, the data of 62 patients between May 2011 and August 2011 were analyzed retrospectively. There was no statistical difference between the groups in terms of surgery time, laryngeal mask removal time, and eye opening time ($p>0.05$) (Table 3). There was a statistical difference between the groups in operating room and recovery room HR values ($p<0.05$) (Fig. 1). However, this difference was found between the physiological ranges in the ages of both groups. There was no statistical difference between the groups in SpO_2 values at all times ($p>0.05$).

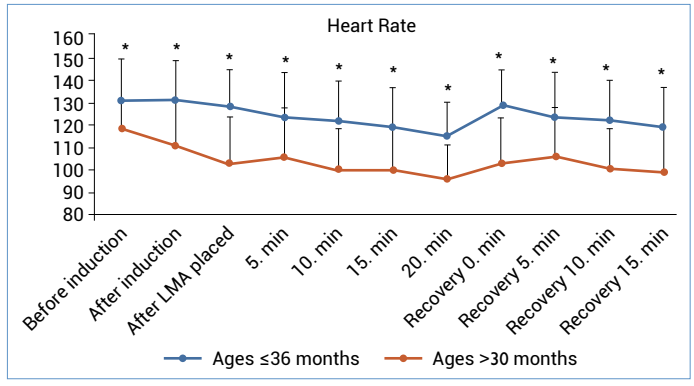

Figure 1. Heart rates of groups.

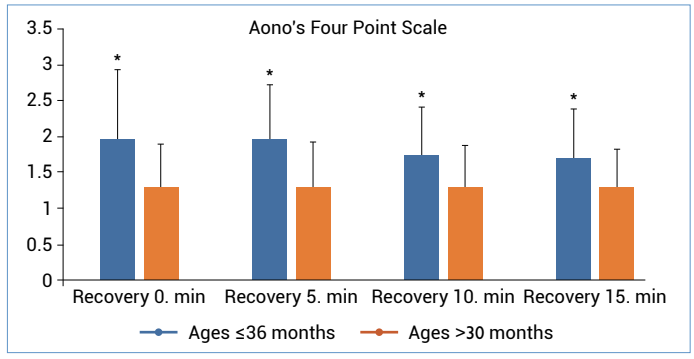

Figure 2. "Aono's 4-Point Scale" values of groups.

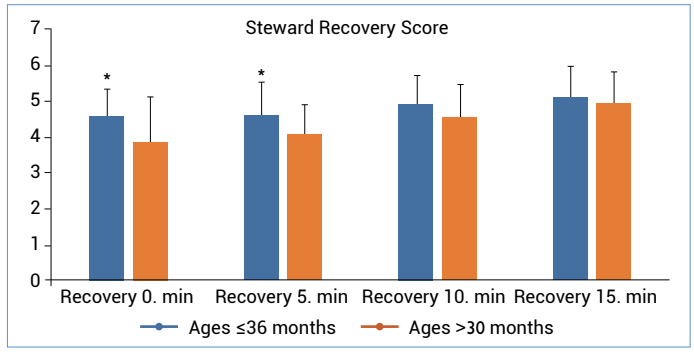

Figure 3. "Steward Recovery Score" values of groups.

Table 3. Evaluation of operation time, LMA removal time, and eye opening time according to age groups

	Age≤36 months Median±SD	Age>36 months Median±SD	p
Operation time (minute)	25.41±12.87 (20)	23.21±10.98 (22.5)	0.543
LMA removal time (minute)	4.03±1.42 (4)	4.36±1.44 (4)	0.287
Eye opening time (minute)	7.65±2.36 (8)	7.75±2.22 (8)	0.791
Sex (M/F)	31/3	22/6	0.298

Mann–Whitney U-test.

The 0 min, 5 min, 10 min, and 15 min Aono's 4-Point Scale values were found to be statistically significantly higher in young children compared to older children ($p<0.05$) (Fig. 2). Steward Recovery Score 0 and 5 min measurements were found to be statistically significantly higher in young children compared to older children ($p<0.05$) (Fig. 3).

Discussion

Ambulatory surgery has been performed safely in the pediatric patient group for a long time. Recovery from anesthesia after day surgery is divided into three periods. The first period is the period when protective reflexes and motor functions return in the recovery unit. Mid-term is the period in which the patient is prepared for discharge in a suitable place under the supervision of a nurse. The mid-term is the time it takes to mobilize and return functions such as oral fluid intake and urination. In the late period of recovery, the daily routine and habits are returned after discharge.[11] In our retrospective study, we investigated whether there was a difference in the first period of recovery between children under the age of 3 and over the age of 3 after day surgery.

It has been reported that ambulatory surgery can be performed more safely 44–46 weeks after conception in children.[12] The age range of our patients whose data we evaluated in the study was between 2 and 144 months, above the recommended age.

Since there are different developmental stages, hemodynamic measurements in children differ according to age, and HR is one of these variables.[13] In groups consisting of children of different ages, both the operating room and recovery unit HR differed and are within the physiological limit values according to their ages.

During recovery from anesthesia, the laryngeal mask can be removed in the early period under deep anesthesia or in the late period under superficial anesthesia. Both methods have their own advantages and disadvantages. In some studies, early removal has been shown to reduce airway complications.[14] However, there are potentially life-threatening risks such as breath-holding, tongue retraction, and desaturation. There are also studies showing that both methods are not superior to the other.[15] During awakening from anesthesia, the children's laryngeal masks were removed in the late period when the MAC value was 0.2 and below and adequate spontaneous breathing. The time to remove the laryngeal mask and the time to open the eyes during recovery from anesthesia were similar in both age groups.

Mental status changes with hallucination, delirium, and confusion observed during recovery and recovery following general anesthesia have been defined as agitation at awakening.[16] It has been reported that emergence agitation typically occurs within 45 min of awakening from anesthesia, and it is frequently seen in preschool children and most commonly in boys aged 2–6.[17] Although the cause of emergence agitation has not been fully explained, it has been reported that pain, pre-operative anxiety, age, surgical procedure performed, personality traits, and type of anesthesia may cause it.[18] Penile block was applied with long-acting local anesthetic bupivacaine before the procedure in all circumcised patients, and the same agent was infiltrated around the wound edges in patients who underwent inguinal hernia operation. In addition, paracetamol was given to all patients for post-operative analgesia. We think that we have taken measures to prevent pain that may be a cause of waking agitation. In our study, although emergence agitation was observed in both groups, it was found that awakening agitation was higher in the group aged 3 years and younger than the group above 3 years of age.

It has been reported that the risk of emergence agitation is higher with inhalation agents such as sevoflurane and desflurane, which are used safely in the induction and maintenance of anesthesia in pediatric patients, when compared to midazolam, remifentanil, propofol, ketamine, and barbiturates.[7,17] Sevoflurane, which provides rapid recovery, was used as an anesthetic agent in studies, and it was stated that rapid recovery from anesthesia may be a risk factor for arousal agitation.[17]

It is stated that otolaryngology surgery is an independent risk factor for emergence agitation.[19] Tonsillectomy, strabismus surgery, and neurosurgical interventions are also among the risk factors.[17] Surgical procedures such as circumcision and inguinal hernia were applied in this study. Although these interventions are not shown as a risk factor for awakening agitation in the literature, we think that the development of emergence agitation but with low score in all of our patients, especially in the younger age group, may be related to their age.

Scoring systems such as Aono's 4-Point Scale and PAED

have been developed to recognize and rate emergence agitation.[20] Although emergence agitation definition varies depending on the scoring system used, it has been reported that the incidence of post-operative agitation is 5.3–50% general post-operative patients and 12–13% in post-operative pediatric patients.[21] In our study, the "Aono's 4-Point Scale," which is an easily applicable scoring system, was used in the detection and rating of emergence agitation, and it was found to have higher values in children aged 3 years and younger. The majority of the younger age group was evaluated in Aono's 4-Point Scale as "2=not calm, but easily calmed."

Scoring systems such as "Steward Recovery Scale" and "Aldrete's Scoring System" have been developed, which determine the adequacy of recovery for the patient to be sent to the service. In this study, the "Steward Recovery Score" system was used, considering that it is more practical and fully meets the expectations. In studies using this score, instead of evaluating intermittent measurements, a study was planned by considering the time until the score reached the value of 6.[22] In some studies, the awakening and recovery process was evaluated by calculating the score at regular intervals.[23] In our study, patients whose scores were calculated intermittently were evaluated, and the Steward Recovery Score was found to be higher in children aged 3 years and younger than in children over 3 years of age who matched the same times. Our younger age group patients were compiled earlier than our older age group patients.

The limitations of our study are the retrospective nature of the study, the small number of patients, the evaluation of ASA I patients in certain surgeries such as circumcision and inguinal hernia, and the failure to evaluate the late recovery period of the patients. In different surgeries, it can be observed differently in awakening and recovery according to different ages. We think that prospectively planned studies in different surgeries with larger patient numbers may yield better results.

Conclusion

In a retrospective study in which we compared the recovery and early recovery of different age groups after anesthesia ambulatory surgical procedures; it was concluded that there was no difference in the awakenings of children aged 3 years and younger and those over 3 years old, and younger children woke up more agitated and recovered faster.

Disclosures

Ethics Committee Approval: The ethics committee approval of the study was obtained from the Medeniyet University Goztepe Research Hospital Ethics Committee (2019/0516).

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

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