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Effect of anesthesia without a neuromuscular blocking agent on intraoperative bleeding in adenotonsillectomy patients

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ABSTRACT

Objective: The purpose of this study was to examine the effect of general anesthesia, applied without a neuromuscular blocking agent, on the extent of intraoperative bleeding in children undergoing adenotonsillectomy.
Materials and methods: A total of 81 adenotonsillectomy cases were examined retrospectively. The patients' ages, genders, and tonsil and adenoid sizes, as well as anesthetic technique, operation time, extent of bleeding during operation, and period of stay in the postanesthesia care unit, were reviewed. Among the patients, 38 were administered anesthesia with a neuromuscular blocker (control group) and 43 patients were given anesthesia without a neuromuscular blocker (study group).
Results: No statistically significant difference was found between groups in terms of age, gender, and tonsil and adenoid sizes ($p > 0.05$). The operation times of the study group were significantly lower than those of the control group ($p = 0.036$; $p < 0.05$). A highly statistically significant difference was found between groups in terms of extent of bleeding ($p = 0.001$; $p < 0.01$). Bleeding in the study group was significantly lower than that in the control group. No statistically significant difference was found in terms of period of stay in the post anesthesia care unit ($p > 0.05$).
Conclusion: In this study, we determined that, general anesthesia without a neuromuscular blocking agent significantly decreases operation time and intraoperative bleeding in adenotonsillectomy patients.

1. Introduction

Adenotonsillectomy is one of the most commonly performed surgical procedures on children today. Currently, the most common indication of adenotonsillectomy is adenotonsillar hypertrophy [1,2], which is a serious public health problem because of the major complications it may cause. The most common complications of adenotonsillectomy are intraoperative and postoperative bleeding. Given this situation, studies have been increasingly directed toward reducing intraoperative and postoperative bleeding in patients.

Endotracheal intubation for general anesthesia administration to adenotonsillectomy patients is traditionally performed by using neuromuscular blocking agents. However, many studies have demonstrated that endotracheal intubation can be easily and reliably applied without the use of neuromuscular blockers in appropriate cases [3–5]. Thus, anesthetic administration without neuromuscular blockers has become a routine practice. Endotracheal intubation can be ensured through deep-inhalation anesthesia, especially in children [3]. In numerous previous studies, the convenience of laryngoscopy and intubation, the position of vocal cords, coughing, jaw relaxation, and movements of extremities were assessed in intubations performed without neuromuscular blocking agents [3,6]. The purpose of the current work was to investigate the effect of general anesthesia, applied without neuromuscular blocking agents, on interoperative bleeding in children undergoing adenotonsillectomy.

2. Materials and methods

After obtaining approval from the Local Ethics Committee of Medipol University, we retrospectively examined patients who underwent adenotonsillectomy operations due to adenotonsillar hypertrophy between 1 June 2014 and 31 August 2014. The patients' ages, gender, and tonsil and adenoid sizes, as well as anesthetic technique, operation times, extent of bleeding during

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surgery, and period of stay in the post anesthesia care unit (PACU), were determined from the patients' files. Children who were operated on by the same surgeon through cold dissection were indiscriminately included in the study. Adenoid tissue was curetted. A tampon was placed to nasopharynx and extracapsular tonsillectomy was performed by using cold dissection tools. Absorbable tie was used for bleeding control. Data on the files were reviewed and recorded by an archiving officer, who was not informed about the purpose of the study and the included groups. The control group consisted of 38 cases who were administered anesthesia with a neuromuscular blocking agent, whereas the study group comprised 43 patients who were given anesthesia without a neuromuscular blocking agent. Cases who presented bleeding diathesis, were older than 12 years, had chronic metabolic diseases, were syndromic, were operated with hot techniques during surgery, underwent only tonsillectomy or only adenoidectomy were excluded from the study.

For the patients in the study group, anesthesia was induced with the inhalation of sevoflurane at a concentration of 8% in a 40–60% O_2–N_2O mixture. With a 22G cannula, IV vascular access was established on the back of a patient's hand after the patient fell asleep. Then, 1 mg/kg meperidine IV was administered, and after 2 min, intubation was performed (by the same anesthetist) using a spiral cuffed endotracheal tube with an appropriate diameter. Anesthetic maintenance consisted of 3% sevoflurane in a 40–60% O_2–N_2O mixture. After the anesthetist confirmed that the tube was in the trachea, the operation was initiated. For the control group, anesthesia was induced with sevoflurane inhalation at the same concentration and mixture as those applied in the study group. After a patient fell asleep, IV vascular access was established on the back of the patient's hand with a 22G cannula. Two minutes after the administration of 0.5 mg/kg rocuronium and 1 mg/kg meperidine IV, intubation was performed (by the same anesthetist) using a spiral cuffed endotracheal tube with an appropriate diameter. Anesthetic maintenance was ensured with sevoflurane inhalation at the same concentration and mixture as those applied in the study group. After confirmation of tube position (trachea), the operation was initiated. Intraoperative bleeding in the patients who underwent adenotonsillectomy in our hospital were evaluated by subtracting the amount of mouth rinsing serum from the blood collected from the aspiration bag and assessed on the basis of swab weights. The data collected were recorded on the patients' files. The patients in the control group were extubated after recovery of spontaneous ventilation and muscle strength at the end of the operation. By contrast, the patients in the study group were extubated right after the operation.

3. Statistical analyses

The Number Cruncher Statistical System 2007 and Power Analysis and Sample Size 2008 statistical software (Utah, USA) programs were used for statistical analyses. Descriptive statistical methods (mean, standard deviation, median, frequency, rate, minimum, maximum) were employed to assess the collected data. Additionally, a Student's *t*-test was performed to compare the two groups in terms of variables that showed normal distribution of the quantitative data, and the Mann–Whitney *U* test was used to compare the two groups in terms of variables that did not exhibit normal distribution. Pearson's chi-square test was also adopted to compare the qualitative data. In all analyses, $p < 0.05$ was taken to indicate statistical significance.

4. Results

The study was conducted on 81 patients, among whom 43 (53.1%, male) constituted the study group and 38 (46.9%, female) constituted the control group. The ages of the patients varied between 2 and 12 years, with the average age being 5.51 ± 2.08 years.

Table 1
Comparison of parameters evaluated based on groups.

	Study group ($n=43$)	Control group ($n=38$)	p
	Mean ± SD	Mean ± SD	
Age	5.49 ± 1.97	5.53 ± 2.23	0.935[a]
Operation time	36.58 ± 6.99	39.87 ± 6.87	0.036[a,*]
Bleeding amount	69.67 ± 40.56	116.68 ± 46.36	0.001[a,**]
Tonsil size; (Median)	3.02 ± 0.64 (3.0)	3.18 ± 0.65 (3.0)	0.257[b]
Adenoid size; (Median)	2.84 ± 0.65 (3.0)	3.03 ± 0.49 (3.0)	0.132[b]
Post-op time	18.93 ± 6.13	20.26 ± 6.18	0.334[a]
Modified aldrete score; (Median)	9.70 ± 0.64	9.45 ± 0.79	0.111[b]
	n (%)	*n* (%)	
Gender			
Male	23 (53.5%)	20 (52.6%)	0.939[c]
Female	20 (46.5%)	18 (47.4%)	

[a] Student's *t*-test.
[b] Mann–Whitney *U* test.
[c] Pearson chi-square test.
[*] $p < 0.05$.
[**] $p < 0.01$.

As indicated in Table 1, no statistically significant difference was found between groups in terms of age, gender, and tonsil and adenoid sizes ($p > 0.05$). Operation times (intubation–extubation time) were 36.58 ± 6.99 min and 39.87 ± 6.87 min in the study and control groups, respectively (Fig. 1 and Table 1). The difference was at a statistically significant level ($p = 0.036$; $p < 0.05$). The extent of bleeding was 69.67 ± 40.56 ml in the study group and 116.68 ± 46.36 ml in the control group, with a highly statistically significant difference ($p = 0.001$; $p < 0.01$) (Fig. 2 and Table 1). In terms of duration of stay in the post anesthesia care unit, no statistically significant difference was found between the groups ($p > 0.05$).

5. Discussion

Depolarizing or non-depolarizing neuromuscular blocking agents are used to ease endotracheal intubation after anesthetic induction in the traditional general anesthetic approach. However, the use of these agents is not exactly favorable in all cases. Risks such as anaphylaxis, awareness, myalgia, malign hyperthermia and delay in the recovery of spontaneous ventilation in cases of intubation difficulty usually arise. If difficult intubation is expected or unexpectedly encountered, the use of neuromuscular blocking agents is undesirable given the delay in recovery of muscular tonus

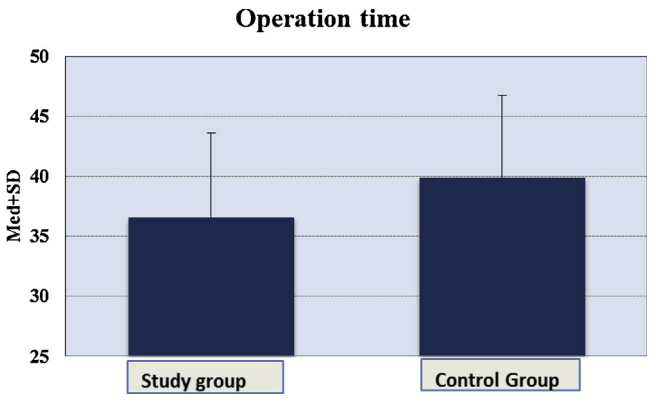

Fig. 1. Distribution of operation times based on groups.

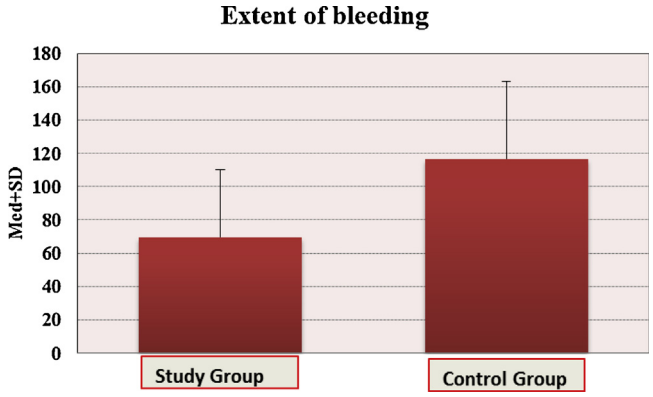

Fig. 2. Distribution of bleeding amounts based on groups.

and prolonged awakening time [6–11]. Furthermore, at shorter-than-expected operation times, medications with strong side effects (e.g., neostigmine and atropine) are used to counteract the effect of non-depolarizing neuromuscular blocking agents. In appropriate cases where surgeons forgo the use of such agents, the aforementioned medications and side effects are avoided.

Sevoflurane, which is an inhalation agent for clinical use, ensures appropriate and fast induction because it has an acceptable odor and causes low airway irritability and low blood gas solubility [12,13]. It is a reliable inhalation agent for induction also because of its stable hemodynamics, low arrhythmogenic effect, and low risk of myocardial depression [14,15]. Some anesthetists in our hospital do not use neuromuscular blocking agents for adenotonsillectomy operations, whereas others do. Those who do not use such agents ensure anesthetic induction through inhalation with 8% sevoflurane in a 40–60% O_2–N_2O mixture and provide anesthetic maintenance with 3% sevoflurane in a 40–60% O_2–N_2O mixture. Sabapathy et al. [16] reported that the administration of 60% N_2O and 8% sevoflurane in O_2 was an acceptable alternative to endotracheal intubation provided through propofol and succinylcholine. In Blair et al.'s [17] comparison of a group of patients, for whom neuromuscular blocking agents were not used, the authors found that for patients who were given intravenous agents, anesthetic induction and tracheal intubation using 8% sevoflurane in a 60% N_2O–O_2 mixture for 3 min was an acceptable alternative to the "gold standard" of succinylcholine and propofol. This evaluation was based on the fact that no significant difference in the overall assessment of intubation conditions was found among the patients.

As indicated in previously conducted studies, the non-use of neuromuscular blocking agents in short operations performed on children has become a widespread practice. In the present research, we observed that the study group (no neuromuscular blocking agent administered) exhibited less intraoperative bleeding and was operated on at shorter periods. We believe that the smaller extent of bleeding may associated with the high muscular tonus in the group for whom a neuromuscular blocking agent was not used. Hemostasis may easily proceed in vessels that are located among muscles because of high muscular tonus and the presence of smooth muscles in vessels walls. In the study group, the time at which hemostasis occurred was shorter because of the reduced extent of intraoperative bleeding, and recovery of muscle strength occurred at an earlier time. Given these conditions, extubation was accomplished also within a shorter period, thereby considerably decreasing operation time. As a result, the operating room was occupied for shorter periods and parents endured less stress as they waited for the patients.

The most important limitation in this study is that it was retrospective in nature. Nevertheless, its findings are regarded as valuable in that they demonstrate the advantages of forgoing the use of neuromuscular blocking agents in children undergoing adenotonsillectomy. Additionally, the study can serve as reference for prospective studies on this issue.

6. Conclusion

We determined that such an approach considerably decreases the extent of intraoperative bleeding and operation times for adenotonsillectomy patients. Therefore, forgoing the use of neuromuscular blocking agents during adenotonsillectomy is more advantageous in terms of avoiding associated side effects and blood loss and in terms of ensuring a shorter operation time. The results of the study require verification from prospective studies.

Conflict of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this paper.

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