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Original Article

Comparison of the quality of tracheal intubation in two techniques of anesthesia with Propofol/ Remifentanil and Sevoflurane / Remifentanil without using muscle relaxant in candidate children of dentistry undergoing general anesthesia

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ABSTRACT

Background and purpose of the study: Tracheal intubation without using muscle relaxants is one of the new techniques of anesthesia. In this study, the quality of tracheal intubation was evaluated in two techniques of anesthesia with propofol / remifentanil and sevoflurane / remifentanil through removing muscle relaxant. Methodology: In this single-blinded randomized clinical trial, 67 healthy children were investigated in two groups of propofol and sevoflurane. In propofol group, Lidocaine1.5 mg / kg, remifentanil 2 µg/kg and propofol 2 mg / kg were administered. In the sevoflurane group, lidocaine and remifentanil with the same dose and sevoflurane 6% were administered. The general quality of tracheal intubation was graded and recorded under the three titles of good, moderate, and poor, according to the criteria of ease of ventilation with mask, mandible mobility, vocal cords status, and the patient's body response during tracheal intubation. Results: General quality of tracheal intubation was good in 90.9% of patients who received propofol and in 94.1% of patients who received sevoflurane. Moreover, no significant difference was found between the two groups (P = 0.62). Conclusion: According to the research results, the combination of sevoflurane and remifentanil may have similar and even better effects than the combination of propofol and remifentanil in tracheal intubation in children undergoing dental work under the general anesthesia without muscle relaxant.

Keywords: Propofol, Sevoflurane, Remifentanil, Muscle relaxant

Introduction

Despite great developments in preventing and controlling tooth decay, decay is the most common chronic illness during childhood [1, 2]. One of the primary goals in children's health is to maintain the primary teeth so that permanent teeth grow normally [3]. One of the concerns of families and the community of dentists, especially dentists dealing with children, is children's fear of dental treatments [4]. Regardless of the factor of anxiety and fear, these emotions have consequences such the lack of observing oral hygiene, non-regular visits and lack of follow-up of treatment, pain, abscess, loss of primary and permanent teeth, malocclusion, impaired beauty and speech [5-7].

There are several techniques to control dental anxiety, including sedative and hypnotic drugs [8], behavioral control methods [9], combination of these two methods [10] and the use of aromatherapy methods in some cases [11]. Although the mentioned methods are helpful in many cases, they have some

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disadvantages. For example, aromatherapy and behavioral control techniques cannot be useful at high anxiety levels. The drug control method increases the success of the treatment and improves its quality, but the drugs that slow down breathing and cause failure of gag reflex has potential hazards [12].

In addition to controlling dental anxiety, all of the mentioned methods are ineffective in some cases due to the number of caries and the extent of the treatments required by child, lack of cooperation and other problems, so dentists have to use general anesthesia for the treatment of the child [13].

Nowadays, the dentistry of children undergoing general anesthesia is one of the most common dental treatments. Despite the short duration of surgery, it requires endotracheal intubation and adequate depth of anesthesia and analgesia [14, 15]. In general, anesthesia requires tracheal intubation, after the induction of anesthesia by an intravenous anesthetic, muscle relaxants are usually used to facilitate tracheal intubation [16, 17]. At present time, due to the lack of easy access to short-acting non-depolarizing muscle relaxants, such as mivacurium, succinylcholine (Esculin) is used in short-term surgeries for tracheal intubation. Esculin administration can lead to unwanted side effects such as muscle pain, increased intra-gastric and brain and eye pressure, malignant hepteremia and prolonged relaxation due to the lack of a pseudokulin esterase enzyme, so it may be prohibited in many cases [17].

In suspicious cases like the possibility of problem in tracheal intubation, muscle disorders and myopathies (myasthenia gravis) [18, 19], and known reactions to muscle relaxants such as anaphylaxis, short-term surgery procedures requiring muscle relaxation to facilitate access to surgery site and in cases where using succinylcholine is prohibited, it is rational to avoid using muscle relaxants [20, 21]. At present time, the induction of anesthesia and tracheal intubation without using muscle relaxants is one of the anesthetic techniques used in many surgeries [22, 23]. In recent years, the anesthesia induction methods without muscle relaxants have been considered and studied due to the complications of these drugs, especially in short-term surgeries [24, 25]. The most common of them is the use of short-acting opioids along with hypnotic drugs such as thiopental and propofol. Among the opioids, most of the studies have been conducted on alfentanil and remifentanil [26]. Moreover, adding lidocaine, one to three minutes before intubation, contributes to reduce the cough reflex and dysrhythmias and improves intubation conditions [27].

Previous studies have indicated that propofol alone or in combination with opioid or intravenous lidocaine is sufficient for induction and intubation in adults and requires no muscle relaxant [26]. With regard to inhalation anesthetics, although halothane has been considered for many years as a mild inhalation inducer providing good conditions for intubation, since the introduction of sevoflurane in the late 1990s, sevoflurane has been widely used instead of halothane. However, studies in this area, especially in children, are still inadequate [23]. As the comparison of inhalation anesthetics, such as sevoflurane and venous anesthetics, such as propofol, have not been carried out in the dentistry of children undergoing anesthesia, it was decided to conduct this study with the aim of introducing the most appropriate drug for induction and intubation without using muscle relaxant so that in mentioned cases and when the muscle relaxants are prohibited, the best and most appropriate method could be recommended for patient intubation. In line with this goal, remifentanil was used as a strong μ receptor agonist with unique pharmacodynamic properties and short-effects along with anesthetic drugs [24, 25].

Methodology

Having approved the subject of study by Research Deputy of Faculty of Dentistry of Khorasgan Azad University, this study was performed at Isfahan University of Medical Sciences. In this study, a total of 67 healthy children aged 3.5-6 years who were candidates for dental work undergoing anesthesia were selected by simple non-randomized sampling and were included into the study after obtaining written consent from their parents. People with grade ASA II or more, obese children, and children having probably intubation problem by anesthesiologist diagnosis were excluded from the study. The data collection method was conducted through observation, evaluation and recording in the questionnaire. Samples were randomly assigned into two groups of sevoflurane (n=34) and propofol (n=33).

In the operating room, after monitoring and establishing a peripheral artery and hydrating the patients, before and immediately after intubation and 5 minutes after intubation, the mean blood pressure and heart rate and the rate of hemoglobin saturation with oxygen (SPO2)were evaluated in them. Then, the information was recorded in the patient information form. Endotracheal intubation was performed through the nasal duct tract with the help of direct laryngoscopy and McGill pence. All patients were monitored by pulse oximetry, non-invasive automatic pressure gauge, capnography and ECG during anesthetic.

Grouping of the patients and injection of drugs were performed by the first person, in a way that in the propofol group, lidocaine 1.5 mg / kg, remifentanil 2 μg / kg in 60 seconds and propofol 2 mg / kg were administrated. In the sevoflurane group, lidocaine and remifentanil with the same dose and sevoflurane 6% were administrated [28]. All patients were ventilated with mask and 100% oxygen until they reached the 40-50 BIS and as soon as spontaneous respiration was lost. Then, laryngoscopy and intubation were performed immediately by one who did not have information on the type of drug. According to the following table (Table 1), the general quality of intubation was graded and classified under three titles of good, moderate and poor based on the criteria regarding the ease of ventilation with mask, mandibular mobility, vocal cord status, and patient body response (movement of organs and coughing) while passing the tube through the nose and tracheal.

Table 1: Total quality criteria of intubation

Variable	Score(2)	Score (1)	Score (0)

Ventilation with mask		Convenient	Difficult but implementable	Impossible
Mandible mobility		Completely loose	Slightly stiff	Completely tight
Vocal cord status		Completely open	Semi-open	Closed
Response to intubation	Body movement	Without movement	Partial movement	Severe movement
	Coughing	no	Diaphragm movement	Severe coughing (more than 10 seconds

Sscore (0-3): poo score (4-6): moderate score (7-10): good

Data were analyzed using SPSS, version 20, software. Data were analyzed using independent t-test and Mann-Whitney test. In this study, 67 children in the two groups of propofol (n=33) and sevoflurane (n=34) completed the study. Based on independent t-test and chi-square test, the two groups were similar in terms of age (p = 0.55) and gender distribution (p = 0.54), and there was no statistically significant difference between them.

Results

The mean of heart rate (p = 0.39), blood pressure (p = 0.18), and hemoglobin saturation with oxygen (p = 0.96) was examined in the three stages including before intubation, immediately after intubation and 5 minutes after the intubation. Based on independent t-test, the difference observed between two groups during the three follow-up periods was not statistically significant. In two groups, no case of impossible ventilation with the mask and no case of mandibular stiffness during the tracheal intubation were seen. The Mann-Whitney test showed that there was no significant difference between the two groups in terms of mandible mobility (p = 0.37) and the ventilation with the mask (p = 0.62) and the vocal cord status (p = 0.66). However, the ease of ventilation with the mask was higher in the Sevoflurane group (p = 0.62).

Body movement status in response to tracheal intubation was evaluated in two groups. No case of severe body movement was seen in the two groups. The Mann-Whitney test showed that body movement status was not significantly different in response to intubation between the two groups (p = 0.43). Coughing status was studied in response to intubation in two groups. No severe coughing during intubation was reported in the two groups. In 72.7% of children who received propofol, coughing was not observed in the sevoflurane group (88.2%). The Mann-Whitney test showed that coughing status in response to intubation was not significantly different between the two groups (p = 0.11).

The general quality of intubation score was found 9.2 in propofol group and 9.6 in sevoflurane group (out of 10), which was not significantly different from the independent t test (p = 0.29) (Table 2).

Table 2: Mean score of total quality of intubation in two groups

	Propofol		Sevoflurance		P-value
Score of total quality of intubation	SD	Mean	SD	Mean	0.29
	1.4	9.2	1.3	9.6	

Based on the scoring criteria, the general quality of intubation was evaluated at good level in 90.9% of patients received propofol and in 94.1% of patients received sevoflurane. Although the general quality and ease of intubation were more in the sevoflurane group, but there was no significant difference between the two groups based on the Mann-Whitney test (p =0.62). In none of the groups, the quality of tracheal intubation was obtained poor. Regarding the rest of patients, the quality of intubation was evaluated at moderate level (Table 3).

Table 3: Frequency distribution of total quality of intubation in two groups

Level of quality	Propofol		Sevoflurane		P-value
	n	%	n	%	
poor	0	0	0	0	0.62
moderate	3	9.1	2	5.9	
good	30	90.9	32	94.1	
total	33	100	34	100	

Discussion

Nowadays, dentistry of children under general anesthesia is one of the most common dental treatments. Despite the short duration of operation, it requires tracheal intubation and sufficient depth of anesthesia and analgesia [14, 15]. In general anesthesia, after anesthetic induction by an intravenous anesthetic, muscle relaxants are often used to facilitate the tracheal intubation [16, 17]. Owing to the lack of easy access to short-acting non-depolarized muscle relaxants, unwanted side effects of using them, prolonged muscle relaxation, suspected cases of difficulty in tracheal intubation, myopathies and muscular impairments, especially in short-term surgeries, the use of anesthetic induction methods without the use of muscle relaxants has been considered in recent years. The most common ones are the use of short-acting opioids along with hypnotics such as thiopental and propofol [17-19, 23]. Previous studies have shown that propofol alone or in combination with opioid or intravenous lidocaine was sufficient for induction and intubation in adults and there was no need for muscle relaxant [26].

With regard to inhalation anesthetics, although halothane has been considered for many years as a mild inhalation inducer providing good conditions for intubation, since the introduction of sevoflurane in the late 1990s, sevoflurane has been widely used instead of halothane [23]. In most cases, sevoflurane is prescribed in combination with nitrous oxide and oxygen. Evidence suggested that sevoflurane alone could provide conditions for effective intubation without the presence of thiopental and muscle relaxants, including succinylcholine. This issue is especially important in short-term surgical procedures [29]. In line with this goal, remifentanil as a strong μ receptor agonist with

unique pharmacodynamic properties and short-term effect along with propofol (short-acting hypnotic) seems to be an appropriate option [24, 25]. In a study on 76 patients aged 3 to 16 years who were in groups 1 and 2 in terms of anesthesia risk and candidate for adenotonsillectomy, Allah Yari et al., showed that the use of remifentanil 2 μg / kg followed by propofol 2.5 mg / kg, without requiring muscle relaxation in 90% of cases, provided conditions that allowed muscle relaxation to be prepared for nasothracheal intubation [17]. These results were consistent with results of the current study on tracheal intubation in the propofol / remifentanil group.

Goo et al., reported that with the administration of 2 μg/kg remifentanil followed by sevoflurane induction without requiring muscle relaxant, the tracheal intubation was possible through mouth in 89% of cases [30]. This was consistent with the results of the present study on the satisfactory tracheal intubation in the sevoflurane / remifentanil group. In comparing the effects of propofol with sevoflurane in non-muscle relaxant intubation in children who were candidates for ear, nose and throat and eye surgery, Hasani et al., found that sevoflurane could have similar and safe effects as propofol [16], which was consistent with results of the current study in both propofol and sevoflurane groups.

In a study conducted in three groups of children undergoing anesthesia with sevoflurane plus nitric oxide, propofol / succinylcholine and propofol / alfentanil, Sakai et al., showed that the acceptable conditions for intubation were obtained 97.95, 87.5 and 52.5%, respectively, in the three studied groups. In the current study, both the combination of propofol / remifentanil and sevoflurane / remifentanil had good intubation quality. They stated that sevoflurane could be used as a satisfactory method and an alternative for golden standard of succinylcholine and propofol in children and in non-emergency situations and in surgeries requiring less muscle relaxant [31]. In our study, both the combination of propofol / remifentanil and sevoflurane / remifentanil had good intubation quality.

In a study conducted by Goo et al, the rate of appropriate concentration of sevoflurane along with different concentrations of remifentanil was evaluated to provide appropriate conditions for intubation. They showed that the concentration of sevoflurane required for intubation without using muscle had decreased through increasing the rate of remifentanil [30]. In this study, the concentration of remifentanil was fixed. In a study conducted by Mencke et al, they compared intubation conditions and its complications in two groups of propofol, remifentanil and compared the sevoflurane in the propofol, remifentanil and rocuronium groups. In the tracheal intubation, the rocuronium group was better, but the complications of them were the same [32].

Based on the results of this study, by removing the muscle relaxant drug from the combination of the general anesthetic drug for children of the dentistry work, the tracheal intubation through the nose could be easily performed and the unwanted side effects of using muscle relaxants and the patient's recovery period were minimized. However, based on the statistical analysis, no significant difference was observed in the quality of tracheal intubation between the two techniques of anesthetic induction with propofol / remifentanil and sevoflurane / remifentanil. However, it seems that the general quality of intubation and ease of tracheal intubation in the combination of sevoflurane / remifentanil was higher. In addition, when propofol was prescribed, the breathing was given to the patient. Then, tracheal intubation, which was time-consuming, was performed which reduced the effect of propofol to some extent. However, as sevoflurane was given by inhalation, it could be administered continuously, that is, it could be administered before the tracheal intubation, making the effect of sevoflurane during tracheal intubation to be adequate. Thus, the use of the combination of sevoflurane / remifentanil was preferable in cases where there was no restriction in selecting any of these two methods.

Conclusion

Based on the results of this study, tracheal intubation quality in two groups of sevoflurane / remifentanil was better than propofol / remifentanil group. It is recommended that the above-mentioned compounds to be used for intubation in cases where there is contraindication in the use of muscle relaxants.

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