

Comparing topical administration of lidocaine alone and in combination with alfentanil in children undergoing bronchoscopy

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ABSTRACT

Introduction: Airway surgery and endoscopy in pediatric patients are always associated with challenges in anesthesia management. Deep anesthesia is required for preventing patient bucking during the procedure but patient breath should be maintained; in this regard, a combination of general and topical anesthesia can be beneficial. There is also evidence of the peripheral effects of opioids. The main objective of this study is to compare using lidocaine topically alone and combined with alfentanil opioids with respect to the central effects of opioids. **Methods:** In this study, 40 ASA class I and II children, aged 1–6 years, who were candidates for flexible diagnostic bronchoscopy were divided into two groups through block randomization using the random number table after obtaining parents' consent in complete health conditions. In this clinical trial, for collecting the data a special data collection form was used at the bedside of patients undergoing bronchoscopy at Pediatric Medical Center in 2017. Data including demographic information (age, weight, gender), duration of anesthesia, blood pressure before and after drug administration, duration of bronchoscopy, and recovery time were recorded in a form. **Findings:** In terms of demographic variables, there were not any significant differences between the two studied groups, indicating that the groups were matched and randomized appropriately. Although there were not any significant differences between the two groups of using lidocaine alone and in combination with alfentanil in other variables, in the recovery time a significant difference was observed between the two groups, with a mean of 13.05 min in the lidocaine group and 18.75 min in the lidocaine combined with alfentanil group. **Conclusion:** Topical administration of opioid with lidocaine through bronchoscopy had no impact on blood pressure, heart rate, anesthesia duration, and the frequency of perioperative complications.

Keywords: Alfentanil, bronchoscopy, children, lidocaine, topical administration

Introduction

Airway surgery and endoscopy in children are always associated with challenges in anesthesia management. Deep anesthesia is required to prevent patient bucking. The combination of general and topical anesthesia can be beneficial.^[1] Empirical evidence suggests the central and peripheral analgesic impact of opiates.

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The purpose of patients' management during bronchoscopy is to ensure sufficient depth of anesthesia, prevent strain and cough during anesthesia, hemodynamic stability, rapid recovery, and return of airway reflexes.^[2] The choice between spontaneous and controlled ventilation is often based on personal preference and does not appear to affect the outcome of the procedure. Complications are related to the actual obstruction and to the retrieval of the impacted object. The localized inflammation and irritation can lead to bronchitis, tracheitis, atelectasis, and pneumonia.^[3]

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Peri (1978) compared different topical anesthetics such as lidocaine, tetracaine, and cocaine alone and combined with other drugs in 28 patients undergoing bronchoscopy and found that lidocaine has fewer side effects than other drugs and is extensively used combined with an anesthetic.^[1] Colt *et al.* (1990) studied 56 patients undergoing bronchoscopy and concluded that using intravenous anesthetics and spontaneous ventilation is the best technique for bronchoscopy, in which propofol is preferred over fentanyl or ketamine.^[4] In their study, Idit Matot *et al.* (2000) during bronchoscopy and laryngoscopy compared the effect of using placebo and clonidine as premedication on the hemodynamic responses in 36 patients and found that heart rate and increased blood pressure were lower among patients who received clonidine in comparison with patients who received placebo, and concluded that clonidine is preferred over placebo as the premedication.^[5] Patric Farrel *et al.* (2004) examined 70 children undergoing rigid bronchoscopy and concluded that inhaled anesthetics are preferred over intravenous anesthetics because of a lower aspiration risk.^[6] Francesca Pionzoni *et al.* (2007) compared inhaled anesthetics combined with lidocaine and intravenous anesthetics in 46 children with foreign body aspiration, found no difference between inhalation and intravenous anesthesia, and concluded that anesthesia had no impact on the incidence of preoperative complications.^[2] In this regard, this study aimed to compare the clinical effects of topical administration of lidocaine alone and combined with alfentanil on children undergoing bronchoscopy at Pediatric Medical Center in 2017.

Materials and Methods

Within this study, 40 children of ASA class I and II who ranged from 1 to 6 years and were candidates for flexible diagnostic bronchoscopy were divided into two groups through block randomization using the random number table after obtaining the consent of parents in complete health conditions. To ensure blinding and randomization and to prevent bias, the patients were clustered in separate blocks according to random numbers. The researcher and the anesthesia staff were unaware of randomization and only the supervisor knew about it. The ethical approval was obtained on 2018/5/5, IR.TUMS.CHMC.REC.1397.013.

In both groups, after installation of standard monitoring equipment, anesthesia was induced in the operating room with sevoflurane 8% and oxygen 100%; then as premedications, 0.05 mg/kg atropine was administered to inhibit the bradycardia induced by vagus nerve stimulation and 0.1 mg/kg dexamethasone and 5 mg/kg hydrocortisone for preventing mucus swelling and inflammation. To induce a sufficient depth of anesthesia, 4 mg/kg lidocaine 1% and 10 µg/kg alfentanil were topically administered through the bronchoscope. In this clinical trial, for collecting the data a special data collection form was used at the bedside of patients who were candidates for bronchoscopy in the Pediatric Medical Center in 2017. Data including demographic data (age, weight, gender), duration of anesthesia, blood pressure before and after drug administration, duration of bronchoscopy, and recovery time were recorded in a form.

The exclusion criteria of the study were any congenital genetic disease, history of any previous sensitivity to the study drugs, any abnormalities in the airway anatomy, any type of laryngeal and throat infection, any type of behavioral disorder, taking any type of hypnotics and medications with depressant effect on respiration 72 h before entering the operating room, and unwillingness of the parents.

The data were analyzed using SPSS 25.0 through descriptive (mean and standard deviation) and analytical analysis (Chi-square to compare the qualitative results and *t*-test, ANOVA, and Pearson correlation coefficient to compare the quantitative results). The level of significance was below 0.05.

Results

To achieve the research objectives, data were collected and analyzed using descriptive and inferential statistical methods. This study was performed on 40 patients undergoing bronchoscopy at Pediatric Medical Center in 2017.

In the lidocaine group alone and the lidocaine with alfentanil group the mean age was 1.58 and 2.59 years, respectively. The mean weight was 10.49 kg in the lidocaine group and 12.11 kg in the lidocaine with alfentanil group; and hence, not any significant differences were observed between the two studied groups ($P = 0.4$). The results showed that 15 patients (75%) in the lidocaine group ($n = 20$) and 13 patients (65%) in the lidocaine with alfentanil group ($n = 20$) were male; and 5 patients (25%) in the lidocaine group ($n = 20$) and 7 patients (35%) in the lidocaine with alfentanil group ($n = 20$) were female. No significant differences were observed regarding gender between the two studied groups ($P = 0.4$).

Before drug administration, the mean systolic blood pressure was 95.80 in the lidocaine group and 103.25 in the lidocaine with alfentanil group ($P = 0.1$), and the mean diastolic blood pressure was 62.35 in the lidocaine group and 69 in the lidocaine with alfentanil group ($P = 0.2$). No significant differences were observed in this regard between the two studied groups [Table 1].

After topical administration, the mean systolic blood pressure was 86.50 ± 10.27 in the lidocaine group and 95 ± 11.12 in the lidocaine with alfentanil group ($P = 0.1$), and the mean diastolic blood pressure was 55.50 in the lidocaine group and 60.75 in the lidocaine with alfentanil group ($P = 0.3$). No significant differences were observed in this regard between the two studied groups; however, blood pressure slightly decreased after administration [Table 2].

The mean and standard deviation of the bronchoscopy duration, recovery time, and anesthesia duration are shown in Table 3. The mean duration of bronchoscopy was 7.90 in the lidocaine group and 7.9 in the lidocaine with alfentanil group. Anyway, this variable did not show any significant difference between the two studied groups ($P = 0.7$). The mean duration of anesthesia was 10.40 min in the lidocaine group and 16.15 min in the lidocaine with alfentanil group. No significant correlation existed between

Table 1: Mean blood pressure before drug administration

Group (mean±standard deviation)	Mean systolic blood pressure (P=0.1)	Mean diastolic blood pressure (P=0.2)
Lidocaine	95.80±8.588	62.35±6.659
Lidocaine with alfentanil	103.25±9.962	69±6.300
Both groups	99.53±9.925	65.08±6.803

Table 2: Blood pressure, SpO₂, and heart rate after drug administration

Group (mean±standard deviation)	Heart rate (P=0.03)	Mean systolic blood pressure (P=0.1)	Mean diastolic blood pressure (P=0.3)	SpO ₂
Lidocaine	135.30±16.639	86.50±10.273	55.50±6.669	96.05±2.305
Lidocaine with alfentanil	129.05±21.996	95±11.121	60.75±8.472	96.80±2.215
Both groups	132.18±19.509	90.75±11.410	59.12±7.981	96.43±2.263

Table 3: Recovery time, duration of anesthesia, and duration of bronchoscopy

Group (mean±standard deviation)	Bronchoscopy duration (P=0.7)	Anesthesia duration (P=0.3)	Recovery time (P=0.03)
Lidocaine	7.90±4.689	10.40±6.840	13.05±6.329
Lidocaine with alfentanil	7.50±2.328	16.15±9.433	18.75±9.760
Both groups	7.50±3.66	13.28±8.638	15.90±8.617

Table 4: Results of postoperative complications

Variable		Group		Total	P
		Lidocaine	Lidocaine with alfentanil		
No complication	Number	17	17	34	P=0.3
	Percent	85	85	85	
SpO ₂ decline	Number	1	0	1	P=0.07
	Percent	5	0	2.5	
Coughing	Number	2	3	5	P=0.07
	Percent	10	15	12.5	
Total	Number	20	20	40	
	Percent	100	100	100	

the two groups by this variable ($P = 0.3$). However, there was a significant relationship between the two groups in recovery time; so that patients in the lidocaine with alfentanil group stayed longer in the recovery room ($P = 0.03$).

Regarding the postoperative complications [Table 4], of 20 patients in the lidocaine group, 17 (85%) had no complications, 1 (5%) had SpO₂ decline, and 2 (10%) had cough, and of 20 patients in the lidocaine with alfentanil group, 17 (85%) had no complications, 3 (15%) had cough, and none of the patients had SpO₂ decline. There was not any significant association between the two studied groups in regard to these two variables ($P = 0.5$).

Discussion

The two studied group did not show any significant difference in terms of demographic variables of age, gender, and weight; therefore, it seems that the groups were appropriately matched, there were no confounding factors in the study, and randomization of the two groups was acceptable. During the anesthesia period there were not any significant differences between the two studied groups; anyway, in the group of lidocaine

with alfentanil, the duration of anesthesia was a slightly longer, but this difference was not significant and administration of alfentanil did not increase the duration of anesthesia.

Regarding the hemodynamic variables, before the procedure there were not any significant differences between the two studied groups in heart rate and systolic and diastolic blood pressure. After the administration of alfentanil and lidocaine, the heart rate and blood pressure were measured again that showed a slight increase in heart rate and decrease in blood pressure in both groups. Although it was normal according to the type of anesthesia and not any significant differences was observed between the two groups, in both groups after the intervention heart rate increased and blood pressure decreased. It seems that the administration of alfentanil does not result in further cardiovascular stability. Although there was not any significant differences between the two studied groups, in terms of hemoglobin oxygen saturation, hypoxia was considered SpO₂ to be less than 92%. Administration of lidocaine with alfentanil does not seem to increase the frequency of SpO₂ decline.

Although a significant difference was observed in the recovery time between the two groups, the duration of anesthesia and the duration of bronchoscopy had no significant difference between the two groups which is not clinically important. Administration of opioids seems to increase the recovery time of patients statistically, rather than clinically. Not any significant differences were observed between the two studied groups in postoperative complications such as cough, laryngospasm, and bronchospasm, and it seems that administration of lidocaine alone and lidocaine with alfentanil does not increase the frequency of perioperative complications.

Mostafa *et al.* (2013) studied 45 children undergoing bronchoscopy; the sample size in this study was close to our research ($n = 40$), but they concluded that alfentanil can induce perioperative

hemodynamic change and coughing reflex.^[7] In this study, in both case and control groups, not any significant differences were observed in the frequency of these complications, but the recovery time was longer in the alfentanil group in both studies. Xavier *et al.* (2008) studied 60 children undergoing bronchoscopy and showed that the use of propofol with lidocaine is better and has lower side effects than lidocaine with alfentanil.^[8] However, in our study, the use of lidocaine with alfentanil did not increase the incidence of complications and only prolonged the recovery time. Crawford *et al.* conducted a study in comparison of the effects of propofol and midazolam in 40 patients undergoing fiberoptic bronchoscopy and concluded that the recovery time was lower when propofol was used^[9]; whereas in this study with the same sample size, the use of alfentanil resulted in longer recovery time. In their study, Leopold compared the effect of nebulized lidocaine alone and lidocaine with halothane on 22 children undergoing bronchoscopy and concluded that lidocaine with halothane had a better effect; however, in this study, topical administration of lidocaine alone or lidocaine with alfentanil had no difference in efficacy and side effects.

Conclusion

Topical administration of opioid with lidocaine has no impact on blood pressure, heart rate, anesthesia duration, and the frequency of perioperative complications, and topical administration of opioid with lidocaine has no more advantage. It is recommended to repeat this study with a larger sample size and with other stress-suppressive medications.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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