Original Article

Comparison of intratracheal and intravenous lidocaine effects on bucking, cough, and emergence time at the end of anesthesia

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ABSTRACT

Objective: To compare the effects of intratracheal and intravenous lidocaine on bucking, cough and emergence time at the end of anesthesia.

Methodology: Sixty patients were randomly allocated in to 2 groups to receive lidocaine 1.5mg/kg either intravenous or intratracheal in a double-blind study. The number of bucking and coughs for each patient was continuously monitored for thirty minutes after extubation. Heart rate, systolic, and diastolic blood pressures were measured before the injection of test solution and one minute after the tracheal extubation. The emergence time was also recorded.

Results: There was no significant difference in the number of bucking (P=0.192) before extubation and coughs during the 30-min monitoring after extubation (P=0.97) between two groups. The difference in emergence time between two groups was not significant (P=0.715).

Conclusion: The effect of intravenous or intratracheal lidocaine was similar on bucking, cough, and emergence time at the end of general anaesthesia.

KEY WORDS: Cough, Lidocaine, Emergence, Intratracheal.

Registration Number: IRCT138810223051N **Pak J Med Sci July - September 2011 Vol. 27 No. 4 793-796**

How to cite this article:

Khezri MB, Jalili S, Asefzadeh S, Kayalha H. Comparison of intratracheal and intravenous lidocaine effects on bucking, cough, and emergence time at the end of anesthesia. Pak J Med Sci 2011;27(4):793-796

INTRODUCTION

Coughing during emergence of general anaesthesia is a physiologic response to tracheal extubation which can result in potentially dangerous patient movements, hypertension, tachycardia or other arrhythmias, myocardial ischemia, surgical bleeding, bronchospasm, and an increase in intracranial and intraocular pressures.[1,2] Several techniques have been applied to alleviate these side effects, such as: deep extubation, administration of intravenous (IV) narcotics, dexmedetomidine, use of laryngeal mask, ß-adrenergic drugs, calcium channel blocking drugs, and various ways of lidocaine application which have been studied extensively.[3-10]

However, each of these techniques has its own limitations. A reliable technique for improving the endotracheal tube (ETT) tolerance while facilitating rapid and full emergence from general anaesthesia, would be desirable in many situations. Administration of intravenous lidocaine can help smooth awake extubation, at the cost of prolonging the process of awakening. Lidocaine spray or ointment would block supraglottic reflexes leading to risk of aspiration[4,9,11] and may increase sore throat after surgery.[5] The administration of 4% or 10% lidocaine through the ETT

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* Received for Publication: March 16, 2011
* Revision Received: June 23, 2011
* Revision Accepted: June 26, 2011

cuff may be dangerous in case of cuff rupture as a consequence of damage.[4,11] Moreover, the application of excessive doses of lidocaine can cause fatal toxicity.[4] Jee, et al,[11] declared that lidocaine sprayed down the endotracheal tube suppresses the airway reflexes whereas using the same dose of IV lidocaine does not.[11] Also, Bilotta et al[12] reported that in mechanically ventilated patients with severe head trauma, endotracheal lidocaine instillation effectively prevents the increase of endotracheal suctioning-induced intracranial pressure.[12] The reflex suppression of endotracheal lidocaine is probably attributed to the mucosa-anesthetizing effect or may be similar to intravenous lidocaine.[11]

Several reports have shown that the administration of lidocaine to airways leads to various plasma concentration depending on the mode of delivery and dose, and that the plasma concentration is smaller than that of IV Lidocaine.[7,13] With regard to this point, it is expected that the emergence time in intratracheal route to be less than the IV lidocaine. However, some authors have reported that the local anaesthetics instilled into the trachea are absorbed as rapidly as IV administration.[14]

The aim of the present study was to compare the effect of intratracheal and intravenous lidocaine on cough and bucking as well as the emergence time at the end of anaesthesia.

METHODOLOGY

After obtaining approval from the Local Research Ethics Committee and written informed consent, sixty patients with American society of anaesthesiologists (ASA) physical status I and II aged 18 to 60 years, scheduled for elective minor orthopaedic surgery, lower abdominal surgery or gynaecological surgery were selected for this randomized double-blind clinical trial. The study was performed at the General Surgery Department in Rajaei Hospital and the Gynaecology surgery Department in Kosar Hospital affiliated to Qazvin University of Medical Sciences, Qazvin- Iran during January 2009 to July 2009. Patients with the following criteria were excluded from the study: history of laryngeal or tracheal surgery or pathology, bronchial asthma, addiction and smoking, patients with coexisting systemic illness, increased intracranial pressure, severe cardiac disease, active upper respiratory tract infections, increased risk for preoperative aspiration of gastric contents, combined epidural-general anaesthetic techniques, and those taking cardiovascular medications such as angiotensin converting enzyme (ACE) Inhibitors.

All patients were premedicated with midazolam 0.02mg/kg and fentanyl 1.5µg/kg. Anaesthesia was induced with thiopental (4mg/kg IV), atracurium (0.3mg/kg IV). Endotracheal intubation was performed by using 8mm for males, 7 or 7.5mm for female patients, high-volume/low pressure tubes. Patients were ventilated to End Tidal Co_2 of 32-35mm Hg with isoflurane 1-1.5% in 50% nitrous oxide in oxygen. No opioid was used thirty minutes before the end of the surgery. Peripheral arterial oxygen saturation, heart rate (HR) and arterial blood pressure (BP) were monitored using an automated non-invasive BP and ECG monitoring, throughout anaesthesia. Patients were randomly divided into 2 equal groups of 30 members each before the induction of anesthesia. In the group ITL, the patients received 1.5mg/kg of intratracheal lidocaine 2% by injection through a syringe into the outer aperture of the ETT while in the IVL group; patients received the same dose of lidocaine intravenously three minutes before the end of the surgery. Randomization was undertaken by means of computer generated random number in sealed opaque envelops. After administration of test solution by the anesthetic technician who was not involved in the study (approximately 3 minutes before the end of surgery), isoflurane and nitrous oxide were discontinued. Neostigmine 0.04mg/kg and atropine 0.02mg/kg were given to reverse the neuromuscular blockade. Extubation was performed when the patients could spontaneously breathe, open their eyes on command, and perform facial grimace. Also, the observers (anesthetists) were unaware of the study treatment groups. Systolic BP (SBP) and diastolic BP (DBP) were measured three minutes before the end of the surgery (before the injection of

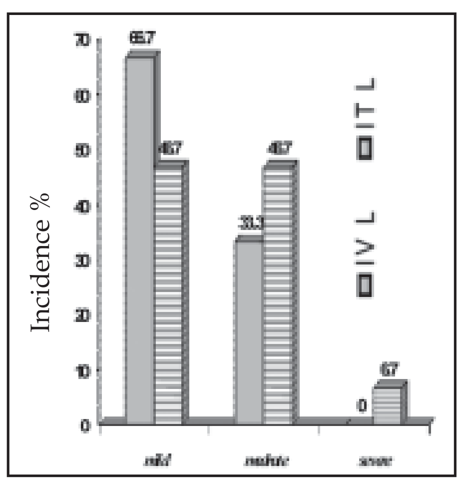

Fig-1: Comparison of bucking between two groups. IVL=Intravenous lidocaine, ITL=intratracheal lidocaine. Values are the percentage of patients.

Table-I: Patients characteristics.

Group	*IVL (n=30)*	*ITL (n=30)*	*P value*
Sex (M/F)	14/16	9/21	0.288
Age (yr)	31.1±7.3	30.8 ±9.7	0.905
Weight (kg)	60.8 ±11.6	60 ± 8.5	0.762
Height (cm)	163.5 ±6.1	163.1±6.3	0.804
Preoperative hemodynamic			
SBP (mm Hg)	122 ± 9.3	122 ± 9.3	1.000
DBP (mm Hg)	80 ± 7.3	80 ± 7.2	1.000
HR(bpm)	82 ± 10.1	80± 9.4	1.000
Length of anaesthesia (min)	105.6 ± 56.7	100.1 ±44.7	0.678

Values are numbers or mean±SD. IVL=IV lidocaine (2%, 1.5mg/kg), ITL=lidocaine (2%, 1.5 mg/kg) down the tracheal tube.

test solution) and one minute after extubation. Bucking was defined as cough reflexes or expiration reflex when the patient was intubated. Cough was defined as a strong and sudden contraction of the abdomen after extubation. Coughing and bucking were classified as mild (less than 3 times), moderate (3-5 times), and severe (more than 5 times). Occurrence of bucking, coughing, the number of coughs and bucking per patient, laryngospasm, and bronchospasm were recorded before extubation and during the thirty minutes after extubation. Also, the emergence time (the time between discontinuation of inhalation agents and the verbal and motor responses to verbal stimuli) was recorded. Statistical analysis was performed using the Student's t-test, Chi square test and Fisher's exact test. P<0.05 was considered as significant.

RESULTS

No statistical difference was found between two groups regarding the weight, height, sex distribution, age, duration of anaesthesia, preoperative SBP, DBP, or HR values (Table-I). In group ITL, bucking was observed as mild in 14(46.7%) patients, moderate 14(46.7%), and severe 2(6.7%) before extubation. Likewise, in group IVL bucking was marked as mild in 20(66.7%) patients and moderate in 10(33.3%) cases while there was no patient with sever bucking before extubation (Figure.1). There was no significant difference in occurrence of bucking before extubation between two groups (P=0.192).

Mild cough following extubation was observed in 4(3.3%) and 5(16.6%) patients of groups IVL and ITL, respectively. No case with moderate or severe cough was detected. As shown in Figure 2, there was no significant difference in incidence of cough during the thirty minutes after extubation between two groups (P=0.97).

There was no significant difference (P=0.715) in the emergence time (group ITL=11.7±4 minutes versus group IVL=11.3±3.6 minutes). As shown in Table-II, the changes in HR (P=0.956), SBP (P=0.455), and DBP (P=0.264) between two groups before the injection of test solution and one minute after tracheal extubation were insignificant. In our patients, no laryngospasm, bronchospasm, aspiration, and convulsion was observed.

Table-II: Changes in hemodynamics variables.

Groups	*IVL(n=30)*	*ITL(n=30)*	*P*
△HR1,2	11.1±20.9	20.8±12.1	0.956
△SBP1,2	14.8±9.3	16.9±11.7	0.455
△DBP1,2	7.8±7	10.3±9.9	0.264

△HR, SBP, DBP 1, 2 = The changes of heart rate (beat/min), SBP, and DBP (mmHg) before injection of the test solution and one minute after tracheal extubation. Values are mean ±SD.

DISCUSSION

According to the data of present study, the effects of intravenous and intratracheal lidocaine on coughing reflex, hemodynamic response, and the emergence time were similar in both groups. The concentration of lidocaine required to suppress the cough reflex during the emergence of anaesthesia are reported to be between 2.3 and 3µg /ml.[1] Several studies have reported that the administration of IV lidocaine two minutes before the tracheal extubation and four minutes before laryngoscopy attenuated the changes in heart rate and hypertension.[15,5] Since, it is reported that the local anaesthesia is achieved within 2-3 minutes following endotracheal lidocaine application [5,15], therefore in our study, lidocaine 1.5mg/kg was administered to both group three minutes before the end of the surgery. Jee, et al, [11] reported that when the lidocaine is sprayed down

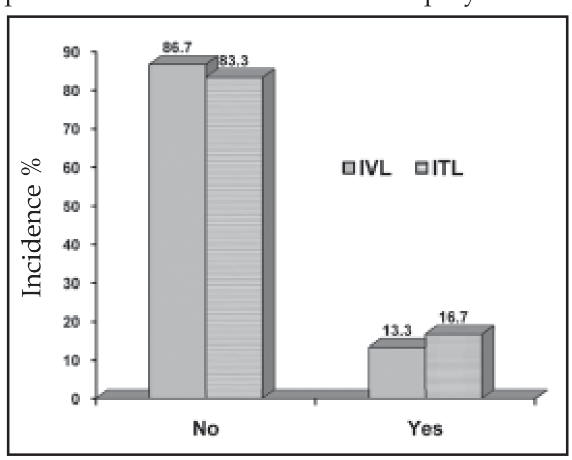

Fig-2: Comparison of cough between two groups. Values shown are percentage of patients. Yes=positive cough, NO=negative. IVL=Intravenous lidocaine, ITL=intratracheal lidocaine.

the ETT, it attenuates the airway-circulatory reflexes whereas IV administration of this drug at the same dosage does not, a finding contradictory to the result of our study in which the effect of intravenous and intratracheal lidocaine on coughing reflex and hemodynamic response found to be similar. In current study, lidocaine was used at a dose of 1.5 mg/kg in both groups. The reason for the significant difference found in Jee, et al, study, may be due to the dose of lidocaine used in IV route (1 mg/kg) which perhaps was not enough to suppress the airway reflexes. Also Gonzalez, et al,[7] reported the incidence of coughing in the ITL (64%) group was significantly less than either the IVL(96%) or control(96%) groups. It could be inferred that the difference between the results of two study may be owing to the fact that Gonzalez, et al, didn't exclude patients with history of addiction, smocking, asthma, COPD from the study. In addition, the mean age of patients selected in Gonzalez study[7] was higher (mostly about 60 years old) than the current study (mainly about 30 years old). In the present study, although all patients in both groups had bucking, the scores of bucking were mostly mild (66.7% of patients in group IVL and 46.7% in group ITL). Jee, etal,[11] also reported that the incidence of bucking was 100% in group IVL and 84% in group ITL. Our results about the incidence of bucking is almost consistent with those by Jee, et al,[11] and Gonzalez, et al,[7]. However, the difference in findings may be due to either the difference in population, methodology, or the definition of bucking. Furthermore, the results of this study are also supported by studies carried out by Bidwai, et al,[1] Nishino, et al,[16] and Geake, et al,[17] which all have indicated that the IVL in doses of 1-2mg/kg transiently suppresses coughing and other airway reflexes.

In the current study, the emergence time in the study groups was shown to be of no significant difference. But in Gonzalez study,[7] the time to extubation, was significantly longer in the IVL group than in the ITL or control groups. The reason may be due to the mean age of the patients selected in Gonzalez study which was higher (mostly around 60 years old) than that of the current study (mostly about 30 years old). It is reported that the half life of lidocaine in age group 22-26 years old is 80 minutes and in 61-71 years old 138 minutes.[18] Therefore, it seems that the effect of different plasma levels of lidocaine found for our study groups to be insensible and if the laboratory facilities to determine the plasma level of lidocaine was available, a better judgement could have been made.

We concluded that the effect of intravenous and intratracheal lidocaine on coughing reflex, hemodynamic response, and emergence time were similar in both groups. Further studies are needed to evaluate the plasma level of lidocaine in two groups. Selection of an intratracheal lidocaine dose less than IV lidocaine to evaluate the results in further studies is recommended.

ACKNOWLEDGEMENT

The authors would like to thank Mrs. Elahe Sajadi for her valuable help during this study.

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