Comparison of intratracheal and intravenous lidocaine's effect 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 ASA I—II patients were randomly allocated 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 30 min after extubation. Heart rate and systolic and diastolic blood pressures were measured before the injection of solution test and one minute after tracheal extubation. The emergence time was also recorded.

**Results:** There was no significant differences in the numbers of bucking ($P=0.192$) before extubation and coughs during thirty minutes after extubation ($P=0.97$) between the two groups. The differences 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 anesthesia.

**Key words:** cough, lidocaine, emergence, intratracheal
Introduction:

Coughing during emergence from general anesthesia 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 increasing the 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, the use of a laryngeal mask, \(\beta\)-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 limitations. A reliable technique for improving endotracheal tube (ETT) tolerance while facilitating rapid and full emergence from general anesthesia would be desirable in many situations. Administration of intravenous lidocaine can help smooth out awake extubation, at the cost of prolonging for the process of awakening. Lidocaine spray or ointment would block supraglottic reflexes leading to the risk of aspiration \(^4,9,11\) and may increase sore throat after surgery. \(^5\) The administration of 4% or 10% lidocaine through the ETT cuff may be dangerous and may happen cuff rupture as a consequence of damage. \(^4,11\) However, excessive doses 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 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 attributable to the mucosa-anesthetizing effect or may be similar to intravenous lidocaine. \(^11\) Several reports show that lidocaine administration to the airways leads to variable
plasma concentrations depending on the mode of delivery and dose, and the plasma concentrations are smaller than those of IV Lidocaine. With regard to this, it has been expected that the emergence time in intratracheal route is less than the IV lidocaine. Although some authors have suggested that local anesthetics instilled into the trachea are absorbed as rapidly as after IV administration.

The aim of this study was to comparison of intratracheal and intravenous lidocaine's effect on cough and bucking and emergence time at the end of anesthesia.
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 from 18 to 60 years, scheduled for elective minor orthopedic surgery, lower abdominal surgery or gynecologic surgery were selected for this randomized double blind clinical trial. The study was performed in general surgical department of Rajaee hospital and gynecologic surgical department of Kosar hospital affiliated to 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 and combined epidural-general anesthetic 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. Anesthesia was induced with thiopental (4 mg/kg IV), Atracurium (0.3 mg/kg IV). Endotracheal intubation was performed by using 8 mm for males, 7 or 7.5 mm for female patients, high-volume/low pressure tubes. Patients were ventilated to End Tidal CO2 (ETCO2) of 32-35 mm Hg with isoflurane 1 % -1.5% in 50% nitrous oxide in oxygen. No opioids were used thirty minutes before the end of the surgery. Peripheral arterial oxygen saturation, heart rate (HR) and arterial blood pressure (BP) using an automated noninvasive BP and ECG monitoring, were monitored throughout anesthesia. The patients were randomly divided into 2 Groups (n=30 patients for each group) three minutes before the end of the surgery. In the group ITL, patients received 1.5 mg/kg of intratracheal lidocaine 2% by injection from a syringe into the outer aperture of the ETT and in the
IVL Group, patients received the same dose of lidocaine 2% IV. Randomization was undertaken by means of computer generated random number in sealed opaque envelops. After administration of test solution (approximately 3 minutes before the end of surgery) isoflurane and nitrous oxide were discontinued. Neostigmine 0.04mg/kg and 0.02 mg/kg of atropine were given to reverse neuromuscular blockade. Extubation was performed when the patients could breathe spontaneously and open their eyes on command perform facial grimace. The observers were unaware of the study treatment groups. Systolic BP (SBP) and diastolic BP (DBP) were measured at the three minutes before the end of the surgery (before the injection of solution test) and one minute after extubation. We defined bucking as cough reflexes or expiration reflex when patient had 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, cough, the number of coughs and bucking per patient, laryngospasm, and bronchospasm were continuously monitored and recorded before extubation and during the thirty minutes after extubation. Also the emergence time (between the discontinuation of inhalation agents and verbal and motor responses to verbal stimuli) was recorded. Statistical analysis was performed by using the Student’s t-test, Chi square test and Fisher’s exact test. P <0.05 was considered significant.
Results:

No statistical differences were found among the two groups with respect to weight, height, sex distribution, age, duration of anesthesia, or with respect to preoperative SBP, DBP, or HR values (Table 1). In the group ITL bucking was observed in 14(46.7)% of patients mild, 14(46.7)% patients moderate and 2(6.7)% patients had severe bucking before extubation, and in group IVL bucking was observed in 20(66.7)% patients mild, 10(33.3)% patients moderate and none of them had severe bucking before extubation (figure1). There was no significant difference between the two groups in the bucking before extubation (P=0.192). [Insert figure1]

In the group IVL, 4(13.3)% patients had mild cough after extubation and in the group ITL 5(16.6)% patients had cough after extubation, none of them had moderate or severe cough. As shown figure2, there was no significant difference between the two groups in the cough during the thirty minutes after extubation (P=0.97). [Insert figure2]

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 Table2, the changes of HR (P=0.956), SBP (P=0.455), DBP (P=0.264) before injection of solution test and one minute after tracheal intubation between two groups were not significant. In our patients, laryngospasm, bronchospasm, aspiration and convulsion were not been observed.
Discussion:

We found that the effect of Intravenous and intratracheal lidocaine on the coughing reflex, hemodynamic response and emergence time was similar in both groups. Concentrations of lidocaine required to suppress the cough reflex during emergence of anesthesia are reported to be between 2.3 and 3 µg/ml. Several studies reported that administration of IV lidocaine two minutes before tracheal extubation and four minutes before laryngoscopy attenuated changes in heart rate and hypertension. However, local anesthesia is achieved within 2-3 minutes of endotracheal lidocaine application. Therefore we administrated lidocaine 1.5mg/kg in both group three minute before the end of the surgery. Jee etal. was reported that lidocaine sprayed down the ETT attenuates the airway-circulatory reflexes whereas IV at the same dosage does not, but in our study, the effect of Intravenous and intratracheal lidocaine on the coughing reflex, hemodynamic response was similar. In current study, we used 1.5 mg/kg lidocaine in both groups. The reason for significant difference in Jee study, may be the dose of lidocaine in IV route (1 mg/kg) was not enough for suppression of airway reflexes. Gonzalez etal. reported the amount of coughing in the ITL group was significantly less than either the IVL or control groups. IVL did not diminish significantly the amount of coughing compared with control. It could be inferred that the difference between the results may be owing to he didn't exclude patients with history of addiction, smocking, asthma, COPD from his study. In addition, the mean age group that selected in Gonzalez study was older (often about 60 years old) than current study (often about 30 years old). In contrast some studies( Bidwai et al. , Nishino etal. and Gefke et al. indicate that IVL in doses of 1.0-2.0 mg/kg transiently suppresses coughing and other airway reflexes, which was consistent with our finding.
In this study, the emergence time was not significantly different between two groups. But in Gonzalez study, the time to extubation, was significantly longer in the IVL group than in the ITL or control groups. The reason may be the mean age of patients that selected in Gonzalez study which were older (often about 60 years old) than current study (often about 30 years old). It is reported that, the half life of lidocaine in group age 22-26 years old is 80 minutes and for 61-71 years old is 138 minutes. Therefore the effect of different plasma level of lidocaine in both groups in our study was not sensible. If there were laboratory facilities for determining plasma level of lidocaine, could be better judged. We concluded that the effect of Intravenous and intratracheal lidocaine on the coughing reflex, hemodynamic response and emergence time was similar in both groups. Further studies are needed to evaluate plasma level of lidocaine in two groups. We propose to select intratracheal lidocaine dose less than IV lidocaine to evaluate results in further study.
Acknowledgement

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References:


### Table 1. Patients characteristics

<table>
<thead>
<tr>
<th>Group</th>
<th>IVL (n = 30)</th>
<th>ITL (n = 30)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (M/F)</td>
<td>14/16</td>
<td>9/21</td>
<td>0.288</td>
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<tr>
<td>Age (yr)</td>
<td>31.1 ± 7.3</td>
<td>30.8 ± 9.7</td>
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</tr>
<tr>
<td>Weight (kg)</td>
<td>60.8 ± 11.6</td>
<td>60 ± 8.5</td>
<td>0.762</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>163.5 ± 6.1</td>
<td>163.1 ± 6.3</td>
<td>0.804</td>
</tr>
</tbody>
</table>

**Preoperative hemodynamic**

<table>
<thead>
<tr>
<th></th>
<th>IVL</th>
<th>ITL</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBP (mm Hg)</td>
<td>122 ± 9.3</td>
<td>122 ± 9.3</td>
<td>1.000</td>
</tr>
<tr>
<td>DBP (mm Hg)</td>
<td>80 ± 7.3</td>
<td>80 ± 7.2</td>
<td>1.000</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>82 ± 10.1</td>
<td>80 ± 9.4</td>
<td>1.000</td>
</tr>
<tr>
<td>Length of anesthesia (min)</td>
<td>105.6 ± 56.7</td>
<td>100.1 ± 44.7</td>
<td>0.678</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th></th>
<th>IVL (n=30)</th>
<th>ITL (n=30)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>△HR1,2</td>
<td>20.9±11.1</td>
<td>20.8±12.1</td>
<td>0.956</td>
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<tr>
<td>△SBP1,2</td>
<td>14.8±9.3</td>
<td>16.9±11.7</td>
<td>0.455</td>
</tr>
<tr>
<td>△DBP1,2</td>
<td>7.8±7</td>
<td>10.3±9.9</td>
<td>0.264</td>
</tr>
</tbody>
</table>

△ HR,SBP,DPB1,2 = The changes of heart rate (beat/min), SBP and DBP (mmHg) before injection of the solution test and one minute after tracheal intubation. Values are mean ±SD.
Figure 1. Comparison of bucking between two groups

IVL = Intravenous lidocaine, ITL = Intratracheal lidocaine. Values are percent of patients. There are no significant differences among the two groups.
Figure 2. Comparison of cough between two groups

Values are percent of patients. Yes = positive cough, NO = negative. IVL = Intravenous lidocaine, ITL = Intratracheal lidocaine. There are no significant differences among the two groups.