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Remifentanil vs. Lidocaine on Response to Tracheal Tube during Emergence of General Anesthesia

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ABSTRACT

Introduction: Response to tracheal tube during emergence of general anesthesia is a main concern. We aimed to compare the effect of Remifentanil and Lidocaine on response to tracheal tube during emergence of general anesthesia.
Materials and Methods: In this randomized clinical trial, we enrolled 80 consecutive patients with American Society of Anesthesiology (ASA) physical status I–II, who underwent general anesthesia for general surgery in Amir-Al-Momenin Hospital on Zabol University of medical sciences from May 2011 to September 2011. Patients received either i.v. lidocaine 1.5 mg /kg (Group L) or 0.5mic/kg/min of Remifentanil (Group R) for emergence from anesthesia.
Results: The frequency of cough during emergence from general anesthesia was significantly higher in Group L than in Group R (70.7% vs. 40.3%, P=0.014). Also the grade of cough during the emergence was significantly higher in Group L than in Group R (P=0.013).The difference between two groups regarding sedation level, visual analogue scale (VAS), and pethidine consumption were not significant (P=0.08).
Conclusion: we specified Remifentanil reduces cough during the emergence from general anesthesia more effective than Lidocaine in patients undergoing general surgery. In addition, Remifentanil and i.v. lidocaine revealed comparable impact regarding VAS scoring, sedation level and pethidine consumption.

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Introduction

Emergence from anesthesia and tracheal extubation may increase arterial pressure, heart rate, plasma concentration of catecholamine, intracranial pressure, and development of myocardial ischemia in susceptible individuals (1). Divers class of drugs such as IV opioids, vasodilators, beta blockers, local anesthetics, and extubation under deep anesthesia may decrease these responses (2, 3). Before emergence, the IV opioids administration may be suitable for preventing cough, hemodynamic response and agitation, but may cause delayed emergence (2-4). To rapid return of protective reflexes and avoid residual hypertension, respiratory depression or sedation at extubation, the action of agents should be short (4). Previous studies indicated that the pharmacokinetics effect properties of Remifentanil result in a rapid onset and offset of action. Moreover it has been signified to attenuate cardiovascular responses to tracheal intubation. These studies showed Remifentanil has a short context-sensitive half-time. Therefore, a rapid shift from the deep anesthesia required during surgery to lighter sedative levels during emergence may be more predictable with Remifentanil(5-7). On the other hand several studies have showed I.V. administration of lidocaine suppress emergence cough without risk for serious complications,

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while other studies showed intratracheal administration of lidocaine attenuates the cardiovascular responses to endotracheal intubation (8-11).

We primarily investigated the effect of Remifentanil and lidocaine on response to tracheal tube during emergence of general anesthesia. As a secondary outcome, we aimed to compare the effects of these two treatments protocol on hemodynamic response and recovery profiles.

Materials and Methods

In this randomized clinical trial, we enrolled 80 consecutive patients with American Society of Anesthesiology (ASA) physical status I–II, who underwent general anesthesia for general surgery on Amir-Al-Momenin Hospital on Zabol University of medical sciences from May 2011 to September 2011. The study was approved by the ethical committee of Zabol University of Medical Sciences. After the explanation of the study protocol, written informed consents were obtained from all patients.

Exclusion criteria included: a potential for difficult airway, increased risk of perioperative aspiration, history of chronic respiratory disease such as chronic obstructive pulmonary disease or asthma, recent respiratory tract infection, chronic coughing, current smoking.

Patients were randomly assigned to one of the two treatment groups according to a computer-generated random numbers .Patients received either i.v. lidocaine 1.5 mg/kg (Group L) or 0.5 µg/kg/min of Remifentanil (Group R) for emergence from anesthesia.

All patients were premedicated with I.V. Midazolam 0.02 mg/kg 15 min before induction and 3µg/kg of i.v Fentanyl 5 min before induction. Non-invasive arterial pressure, heart rate (HR), end-tidal carbon dioxide (ETCO2), and nasopharyngeal temperature were monitored at 5 min intervals.

Anesthesia was induced using i.v. Sodium Thiopental 5 mg/kg and after the patient was unable to respond to verbal response, i.v. Atracurium 0.5 mg/kg was administered 3 min before induction. Tracheal intubation was performed in all patients using a 7.5 mm (internal diameter) reinforced tracheal tube and cuff pressure was maintained at 20–25 mmHg with a hand pressure gauge throughout the procedure.

Anesthesia was maintained with Isoflurane and Remifentanil, mechanical ventilation was maintained with a tidal volume of 8 ml/kg, and ventilator frequency was adjusted to maintain ETCO2 at 4.6–5.3 kPa and temperature was maintained at 36–37.8C.

Two practitioners were involved during the emergence phase. The first anesthetist knew which group the patient was in, but the second anesthetist did not. When a surgeon started to suture the subcutaneous tissue, the first anesthetist shielded the pump from the second anesthetist and stopped the Remifentanil in patients assigned to Group L, but maintained Remifentanil in patients assigned to Group R.

At the same time, the second anesthetist adjusted Isoflurane to 0.8 minimum alveolar concentrations (MAC) (1.4–1.6%, adjusted to age) in all patients. The second anesthetist performed all tasks related to emergence from general anesthesia, as well as the monitoring and recording needed for this study except for control of the Remifentanil pump and i.v. Lidocaine or i.v. saline administration.

After completion of skin suture, atropine 0.02 mg/kg with neostigmine 0.04 mg/kg was given to antagonize the residual neuromuscular block. Reversal was confirmed when train-of-four response greater than 90%. After the end of surgery and return from the fully extended position to the neutral position, the first anesthetist administered 0.15 ml /kg of i.v. Remifentanil to the patients of group R and 1.5 mg/kg of i.v. Lidocaine to the patients of group L. At the same time, the second anesthetist turned Isoflurane off.

The patients were asked by continual verbal requests to open their eyes. When the patients opened their eyes, they were encouraged to breathe deeply. When spontaneous respiration, adequate tidal volume, and ventilator frequency were confirmed, the patient was extubated and oxygen was immediately supplemented via a facemask for 5 min. After confirming of stable respiratory and circulatory conditions, patients were transported to the recovery theater.

The time periods from the end of surgery (Isoflurane discontinuation) to eye opening and to extubation were recorded. During emergence, which was defined as the time interval from the end of surgery to 5 min after extubation, the level of cough was assessed and recorded by the following cough grading system: Grade 0, no cough; Grade 1, single cough with mild severity; Grade 2, cough persistence less than 5 seconds with moderate severity; Grade 3, severe persistent cough for more than 5 seconds (bucking) (12). Cough was defined as a sudden contraction of the abdomen. The mean arterial pressure (MAP) and HR were also recorded at the following time points: T0, before induction of anesthesia (baseline); T1, the end of surgery; T2, immediately before extubation; T3, 5 minutes after extubation and T4 in post-anesthetic care unit (PACU). In addition, the level of sedation and the ventilatory frequency were estimated and recorded at the T3 point by the following sedation grading system (SGS): Grade 0, deeply

sedated and unresponsive; Grade 1, sedated but responsive to light glabellar tap or loud voice; Grade 2, sedated but responsive to normal voice; Grade 3, awake and responding. A third anesthetist investigated the occurrence of hypertension, postoperative pain, sedation, and nausea in the patients during their (PACU) stay. The parameters of interest were defined by the following criteria: hypertension, an increase of 30% from MAP to T0 shown by estimation at successive 5 minutes intervals; pain, more than five points on the visual analogue scale (VAS); residual sedation, less than Grade 2 on the SGS at 10 min after PACU admission; nausea, need for antiemetic treatment.

Statistical analysis

Previous report by Kim indicated an incidence of 76% of coughing after general anesthesia. Based on the assumption that 50% reduction would be clinically significant, at least 30 patients in each group would be required (α= 0.05 and β= 0.2) (13).

Data were analyzed using SPSS version 11.5 (SPSS Inc., Chicago, IL, USA). All data are expressed as mean (SD), median (range), or number (proportion, %). Normally distributed continuous variables were compared using an independent

Two-tailed Student's t-test .Categorical data were analyzed using the chi square test or Fisher's exact test where appropriate. P<0.05 was considered statistically significant.

Results

In this clinical trial we evaluated 80 patients (39 male 49%, 41female 51%) with mean age 33.86±14.5 years, forty one patients (51%) in group L and 39 patients (49%) in group R. The difference between two groups regarding sex and age was not significant (P=0.39 and P=0.55 respectively). The frequency of operation types were as follow; 44 patients (55%) appendectomy, 17 patients (21.25%) cholecystectomy, and 19 patients (23.75%) other general surgeries. Demographic manifestations and the duration of anesthesia in two groups were presented in Table 1.

The frequency of cough during emergence from general anesthesia was significantly higher in Group L than in Group R (70.7% vs. 40.3%, P=0.014). Also the grade of cough during the emergence was significantly higher in Group L than in Group R (P= 0.013) (Table 2).

The difference between two groups regarding sedation level was not significant (P=0.08) (Table 3).

The mean VAS in L group was 5.34±1.13 and in R group was 5.17±1.09 and the difference between two groups was not significant (P=0.51) (Table 4).

Table 1. Demographic data, duration of anesthesia, time to extubation and Time to eye opening in two groups

Group	L		R		P
Sex	Male 22(53.7%)	Female 19(46.3%)	Male 17(43.6%)	Female 22(56.4%)	0.39
	Mean±SD		Mean±SD		
Age	32.92±14.25		34.84±15.02		0.55
Weight	68.43±7.17		67.71±6.79		0.64
Duration(min)	78.12±12.34		82.17±13.35		0.58
Time to eye opening (min)	6.92±1.15		7.13±1.21		0.62
Time to extubation (min)	8.53±2.13		8.40±1.74		0.91

Table 2. The cough occurrence in groups L and R

Group		L		R		P
		N	%	N	%	
Cough frequency		29	70.7	16	40.3	0.014
Cough grading	Grade 0	13	31.7	22	56.4	0.013
	Grade 1	12	29.3	9	23.1	
	Grade2	10	24.4	6	15.4	
	Grade 3	6	14.6	2	5.1	

Table 3. The sedation level in groups L and R

Group		L		R		P
		N	%	N	%	
Sedation	Grade 0	10	24.4	6	15.4	0.08
	Grade 1	15	36.6	24	61.5	
	Grade 2	16	39	9	23	

Table 4. The frequency of VAS scoring in groups L and R

Group		L		R		P
VAS (Mean±SD)		5.34±1.13		5.17±1.09		
		N	%	N	%	
VAS (N %)	3	3	7.3	4	10.3	0.51
	4	6	14.6	5	12.8	
	5	12	29.3	13	33.3	
	6	14	34.1	14	35.9	
	7	6	14.6	3	7.7	

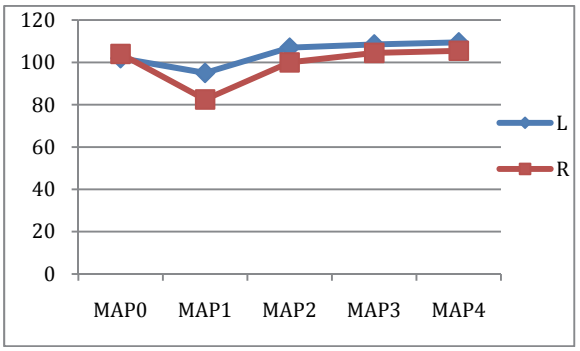

Figure 1. MAP in two groups

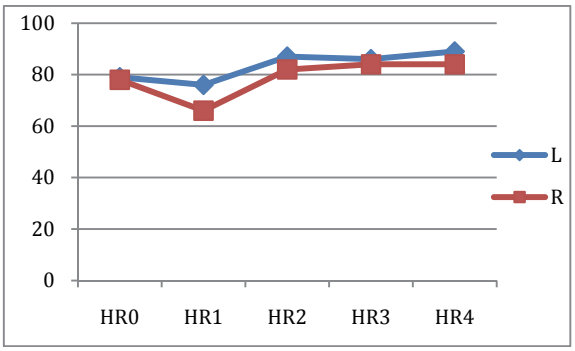

Figure 2. The mean of Heart rate in two groups

The mean pethidine consumptions were 35.73±16.18 and 32.89±19.01 in L group and R group, respectively (P=0.47).

The MAP (Figure 1) before induction did not show significant difference between L and R groups. However it showed significant difference after surgery (P=0.001), before extubation (P=0.001), 5 min after extubation (P=0.03) and in recovery room (P=0.016) (Figure 1).

The mean (HR) (Figure 2) before induction (P=0.6), before extubation (P=0.06) and 5 min after extubation (P=0.3) did not show significant difference in L and R groups, however it was significantly different after surgery (P=0.001), and in recovery room (P=0.03) (Figure 2).

Discussion

Our results indicated that the frequency of cough during emergence from general anesthesia was significantly higher in Group L than in Group R (P=0.014). Furthermore the grade of cough during the emergence was significantly higher in Group L than in Group R (P= 0.013).

Various methods and drugs have been applied to prevent hyperdynamic responses and coughing during emergence from anesthesia (3). To develop the knowledge of emergence we designed this comparative study. In this clinical trial, we evaluated 80 patients with mean age 33.86±14.5. To obtain more accurate results from the trail, two groups were properly matched and the differences between two groups regarding sex, age, and also blood pressure and heart rate before induction were not significant (P>0.05). Several studies in this field have supported our findings and indicated that Remifentanil depresses cough reflex (2, 14). Although there are no intraoperative specific data on antitussive properties of Remifentanil, it may suppress coughing by blunting the reflex responses via actions on a putative cough center in the medulla (2, 14).

Lee et al. in a study compared the effects of lidocaine and Remifentanil on response to the tracheal tube during emergence from general anesthesia and in line with our results designated Remifentanil was more effective than IV lidocaine in patients undergoing thyroid surgery (15). However, another study by Cho et al. did not support our results and signified that Remifentanil did not prevent cough during emergence from anesthesia (16).

We indicated the two treatments strategy did not differ significantly in their recovery profiles, which included level of sedation, VAS scoring and pethidine consumption after extubation. In other words Remifentanil did not show remarkable superior effect to lidocaine regarding sedation and pain control.

Basically Remifentanil is a short-acting phenylpiperidine derivative with μ opioid receptor agonist effects that may reduce pain. Cavaliere et al. supported this opinion in their study and in contrast to our findings pointed out that Remifentanil infusion up to 0.05 μg/kg/min reduces agitation and provides sedation (2).

We indicated Remifentanil more effectively controlled hemodynamic responses than lidocaine during emergence from anesthesia, in agreement to our results Hall et al. showed Remifentanil significantly attenuated the hemodynamic response to laryngoscopy and orotracheal intubation (17), additionally, Wilhelm et al. signified that Remifentanil can controlled hemodynamic responses during anesthetic induction with propofol, thiopental, and etomidate (18).

The main limitation of the present study was absence of control group for comparing the effects of i.v. lidocaine on response to the trachealtube. So, it was more challenging to find out whether i.v.lidocaine essentially decreases coughing or not; because the frequency of cough in the lidocaine group was 71%, which is comparable to the overall incidence of cough (73%) in a proceeding report (13). Therefore, further controlled investigations are recommended to validate the findings reported here.

In conclusion, IV Remifentanil reduced cough and controlled hemodynamic responses during the emergence from general anesthesia more effectively than lidocaine in patients undergoing general surgery. In addition, Remifentanil and i.v.

lidocaine revealed comparable recovery profiles as VAS scoring, sedation level and pethidine consumption.

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Conflict of Interest

The authors declare no conflict of interest.

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