Original Article

Comparison of Tracheal Extubation Comfort between Two Endotracheal Tube Filling in Laparoscopic Cholecystectomy

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Abstract

Background: Post-intubation airway complications such as cough and sore throat are common complaints after anesthesia. After intubation, filling the endotracheal tube will close the tube space and stimulate the endotracheal tube. It is used to fill the cuff with air or liquids such as normal saline, lidocaine, etc. The purpose of this study was to compare the comfort of tracheal extubation between the two methods of filling the tracheal cuff with lidocaine 2% and filling with air in patients undergoing laparoscopic cholecystectomy.

Methods and materials: In this single-blind clinical trial study, 70 patients were randomly divided into two groups of air and lidocaine. In the lidocaine group, the endotracheal tube cuff was filled with 2% lidocaine and in the air cuff group the cuff pressure reached 20 to 25 cm of water. Blood pressure and heart rate of patients before induction, after induction, 30 and 60 minutes after and before and after extubation, as well as complications of intubation including bucking, cough and sore throat during recovery, 6 hours and 12 hours later were compared. Data were analyzed using SPSS software version 16.

Results: The results of this study showed that there were no significant differences in heart rate at different intervals of the study including pre-induction, post-induction, 30 and 60 min, before and after extubation. But the systolic and diastolic blood pressure after extubation were significantly lower in the lidocaine group than in the air group, although at other intervals there was a significant difference between the two parameters in the study groups. After extubation, sore throat complications were significantly lower at all study intervals.

Conclusion: According to the results of the same study, it seems that filling the cuff with lidocaine over the air leads to more hemodynamic stability and less side effects after extubation.

Keywords: Intubation, Lidocaine, Complications

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Introduction

Endotracheal tube is a catheter that is inserted into the trachea to create and maintain a safe airway for the gas. Different types of this device have been developed for different conditions (1, 2). Known complications when using the endotracheal tube include complications during and after intubation and complications after removal of the endotracheal tube which can be reduced by continuous control (3, 4).

Complications such as fear (5), trauma, laryngospasm and bronchospasm (6, 7), cardiac dysrhythmias, misalignment of the endotracheal tube, excessive tube insertion (8, 9), possible vomiting and aspiration (10), hypoxia due to delayed operation (11), upper airway trauma may be Occurs during intubation of the Tracheal (12, 13). There may also be complications during tube placement such as endotracheal tube obstruction (4, 13), cuff leakage (14), upper airway injury (7, 8), tracheal injury (7), bleeding (15), infection (16), accidental tube removal (1). Post-endotracheal complications can include spasm or laryngeal edema (17), stridor and acoustic violence (18, 19), laryngeal and Tracheal granuloma formation, tracheal stenosis and Tracheomalacia (20), laryngeal stenosis (21), paresis, or vocal cord paralysis (22).

Lidocaine is a type of amino-acid anesthetic that is used in cases such as small surgeries or dental surgeries (23). Lidocaine competes with calcium in neural membrane receptors to control the passage of sodium across the cell membrane and reduces the potential depolarization phase of action. These effects inhibit the initiation and conduction of nerve waves by reversibly stabilizing the nerve cell membrane, thereby reducing the permeability of the membrane to the sodium ion. If lidocaine absorbed in large quantities, it can have an irritant effect first and then a weakening effect on the central nervous system (24).

Lidocaine is the most commonly anesthetic used topical. Possible neurotoxicity Horse tail syndrome (occurs when lidocaine is prescribed for spinal anesthesia) is particularly persistent. These symptoms generally appear within the first 2 to 4 hours after surgery and improve within 3 days. Pain is self-limiting but may be severe. Non-steroidal anti-inflammatory drugs are relatively effective (25, 26). In addition to hand tremors, restlessness, tinnitus, blurred vision, or diplopia, other complications of lidocaine include: Overdose can also reduce heart rate, seizures, cardiac arrest and respiratory arrest (26).

Tracheal intubation is one of the aggressive practices used in patients undergoing surgery or with decreased consciousness, which causes many problems for patients in the postoperative phase (27, 28), although endotracheal intubation is largely successful; however, the consequences of doing so, are sometimes very dangerous and life-threatening (29, 30). These are worrying issues. One of the relatively common complications after tracheal intubation is sore throat, which is due to damage to the throat during intubation and is seen in 26% of the procedures (31), reducing their quality and dissatisfaction with the patient (32). Therefore, there are always different ways to reduce or reduce the incidence of this complication (33). Therefore, the use of compounds that have more effective analgesic effects is important. One of the methods used to reduce the severity of sore throat in the post-intubation phase can be the use of anesthetics, especially lidocaine, which have extra anesthetic effects, thus temporarily reducing pain and sore throat, cough, and hoarseness of voice (34, 35).

Altintaş et al. studied the clinical and hemodynamic changes of endotracheal tube filling with lidocaine 2% in Sahal 2 in Turkey and found that lidocaine was associated with less hemodynamic, bucking, and sore throat changes than normal saline for filling the endotracheal tube (36). In India, a comparative study of the use of 4% air or lidocaine for filling the endotracheal tube and its effect on postoperative sore throat and postoperative cough complications, Gaur et al. Endotracheal cuff filling is very effective in preventing complications of extubation (37).

Based on the importance of the subject, in this study we compared the endotracheal tube filling with lidocaine and air filling in intubated patients undergoing cholecystectomy.

Methods

This study had the morality code of "IR. QUMS.REC.1397.274", research ethics committee,

Table 1: Variable Frequency of Age in Patients under Study.

	Mean (age)	Standard deviation (age)	Maximum (age)	Minimum (age)	P value (man Whitney)
Lidocaine group (n =35)	44.14	8.43	58	28	0.813
Air group (n=35)	43.8	8.49	57	29	

Deputy of Reseacrh and Technology, Qazvin University of Medical Sciences that was approved and registered in the Iranian Clinical Trial Registry Database (IRCT) coded "IRCT20150803023473N5".

The sample size was calculated as 35 people in each group and 70 people in total based on similar studies. This study consisted of patients under cholecystectomy and the required information was collected through a checklist; including 3 sections.

- The first section includes demographic information (age, gender, height, and patient weight)
- The second part includes patient hemodynamic information (heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure) at different intervals before induction, after induction, 30 and 60 min after and before extubation and after extubation.
- Third component side effects of extubation including bucking during extubation and sore throat in recovery, 6 hours later and 12 hours later in this single-blind randomized clinical trial study.

Patients who were underwent laparoscopic cholecystectomy in Velayat Hospital (an Academic Medical Center), Qazvin, Iran; during 2017–2018. Inclusion criteria included female gender and age between 20 to 60 years and ASA 1 and 2.

Exclusion criteria included ASA more than 2, heart block, heart failure, unstable hemodynamics, depression, renal or hepatic insufficiency, lidocaine sensitivity, tracheal deformity, patient dissatisfaction

Table 2: Frequency of variable height in the studied patients.

	Mean (cm)	Standard deviation (cm)	Maximum (cm)	Minimum (cm)	P value (t test)
Lidocaine group (n =35)	155.9	5.27	168	146	0.948
Air group (n=35)	157.2	7.5	172	145	

Table 3: Frequency of variable weight in studied patients.

	Mean (Kg)	Standard deviation (Kg)	Maximum (Kg)	Minimum (Kg)	P value (man Whitney)
Lidocaine group (n =35)	69.2	9.55	90	56	0.902
Air group (n=35)	67.8	6.9	88	57	

Table 4: Heart rate at different intervals in the study groups.

Heart rate at different intervals	Lidocaine group (n =35)	Air group (n=35)	P value
Before induction	11.2 ± 73.1	10.7 ± 75.1	0.641 (T test)
After induction	11.4 ± 72.7	10.5 ±73.4	0.832 (man Whitney)
30 minutes later	13.5 ± 70.5	7.9 ± 72.3	0.507 (T test)
60 minutes later	13.9 ± 73.1	7.7 ± 71.9	0.68 (T test)
Before extubation	14.1 ±72.1	7.8 ± 71.7	0.901 (T test)
After extubation	12.7 ± 79.1	6.5 ± 80.9	0.446 (T test)

to complete the form according to selected criteria and inclusion criteria. After obtaining informed consent, they were randomly divided into two groups, A and B. For this purpose, after determining the number of samples according to statistical formula, randomization was performed using randomization software and patients were not informed again.

All patients were intubated with cuffed ETT size 7 and intubation was performed by an experienced person. No gels or sprays were used on the endotracheal tube or inside the patient's mouth.

For premedication used midazolam 0.02 mg / kg and fentanyl, 2 µg/kg. For induction of anesthesia used propofol 1- 2 mg/kg. Then, atracurium 0.5 mg/kg was used as a muscle relaxant.

Patients were monitored with TOF and intubated after approximately 3 minutes after entering the block intense phase. When four reactions were recorded in TOF, the patients were revers. In the lidocaine group, the endotracheal tube cuff was filled with 2% lidocaine and in the air cuff group it filled with air until the cuff pressure reached 20 to 25 cm of water. Propofol 100 µg/kg and remifentanil 0.1 µg/kg were used to maintain anesthesia. Blood pressure and heart rate were measured before induction, after induction, 30 and 60 min before and after extubation and recorded

Table 5: Systolic blood pressure at different intervals in the study groups.

Systolic blood pressure	Lidocaine group (n =35)	Air group (n=35)	P value
Before induction	15.8 ± 129.6	16.5 ± 128.7	0.782 (man Whitney)
After induction	17.3 ± 131.8	15.1 ± 133.6	0.645 (T test)
30 minutes later	14.7 ± 131.1	14.9 ± 127.5	0.352 (T test)
60 minutes later	15.5 ± 133.5	15.3 ± 127.5	0.11 (T test)
Before extubation	16 ± 124.7	14.1 ± 126.9	0.534 (T test)
After extubation	14.6 ± 132.9	13.1 ± 139.9	0.034 (T test)

Table 6: Diastolic blood pressure at different intervals in the study groups.

Diastolic blood pressure	Lidocaine group (n =35)	Air group (n=35)	P value (T test)
Before induction	12.9 ± 79.9	11.5 ± 80.6	0.808
After induction	11.9 ± 77.5	11.25 ± 80.5	0.09
30 minutes later	10.4 ± 76.9	8.7 ± 77.7	0.071
60 minutes later	13.8 ± 80.8	11.2 ± 80.4	0.887
Before extubation	13.1 ± 75.3	9.5 ± 78.7	0.224
After extubation	12.9 ± 81.2	9.2 ± 89.8	0.002

in informational form. In addition, intubation complications including bucking (involuntary resistance due to positive pressure in intubated patients), cough and sore throat in recovery, 6 and 12 hours later were compared in both groups and were added to the data form. The relationship between the independent variables of the study was compared with the dependent variables between the two groups as well as the relationship between the variables at different time intervals.

Results

The aim of this study was to compare the comfort of tracheal extubation between two methods of endotracheal tube filling with lidocaine 2% and air filling in patients undergoing laparoscopic cholecystectomy. In total, 70 females were randomly divided into two groups: lidocaine and air. Initially, the Shapiro-Wilk test was used to investigate the distribution of samples in the statistical population. Results showed that distribution of data was non-parametric in age, height, post-induction heart rate and systolic blood pressure after induction (p=0.5). The other variables had normal distribution (p <0.05). Therefore, parametric tests (p <0.05) were used in these cases.

The mean age of patients in the lidocaine group was 44.14 years with a standard deviation of 8.43 years. The youngest patients in this group were 28 years old and the oldest were 58 years old. Compared with the lidocaine group, the mean age of the patients in the air group was 43.8 years with a standard deviation of 8.49 years. The results of Mann-Whitney test showed that there was no significant difference between the two groups in terms of age (p=0.813).

The mean height of patients in lidocaine group

Table 7: Frequency of Bucking Complication in Study Groups Study.

	Lidocaine group (n =35)	Air group (n=35)	Total (n= 70)	P value (Chi-square)
Bucking (%)	6 (17.1)	15 (42.6)	21 (30)	0.018
No Bucking (%)	29 (82.9)	20 (57.4)	49 (70)	

Table 8: Frequency of cough complication at different intervals in study groups.

Cough complication	Lidocaine group (n =35)	Air group (n=35)	Total (n= 70)	P value (Chi-square)
Recovery (%)	5 (14.3)	13 (37.1)	18 (25.7)	0.027
6 hours after Extubation (%)	1 (2.8)	7 (20)	8 (11.4)	0.02
12 hours after Extubation (%)	1 (2.8)	3 (8.5)	4 (5.7)	0.307

was 155.9 cm with standard deviation of 5.27 cm. The maximum height in this group was 168 cm and the minimum height was 146 cm. groups, in the air group the mean height of patients was 157.2 cm with standard deviation. Maximum height of patients in this group was 172 cm and minimum was 145 cm. The results of t-test showed that there was no significant difference between the two groups in terms of height (p=0.948).

The mean weight of patients in the lidocaine group was 69.2 kg with a standard deviation of 9.55 kg. The maximum weight in this group was 90 kg and the minimum was 56 kg. In the air group the mean weight of patients was 67.8 kg with a standard deviation of 6.9 kg. The maximum weight of the patients in this group was 88 kg and the minimum was 57 kg. The results of Mann-Whitney test showed that there was no significant difference between the two groups in terms of patient's weight (p=0.902).

In Table 4, the results of this study using Mann-Whitney and t-tests showed a statistically significant difference in heart rate at different study intervals including pre-induction, post-induction, 30 and 60 minutes before extubation and after extubation, there was no difference between the two groups ($p<0.05$).

In Table 4-5, the results of this study using Mann-Whitney and t-tests showed a statistically significant difference in systolic blood pressure at different intervals of the study before and after induction. Before 30 and 60 min and after extubation were not significantly different between the two groups ($p<0.05$), whereas systolic blood pressure after extubation in the lidocaine group was significantly lower than in the air group (p=0.034).

In Table 6, the results of this study using Mann-Whitney and t-tests showed a statistically significant difference in diastolic blood pressure at different study

Table 9: Frequency of sore throat at different intervals in study groups.

Sore throat	Lidocaine group (n =35)	Air group (n=35)	Total (n= 70)	P value (Chi-square)
Recovery (%)	8 (22.9)	16 (45.7)	24 (34.3)	0.038
6 hours after Extubation (%)	4 (11.4)	12 (34.3)	16(22.9)	0.022
12 hours after Extubation (%)	2 (5.7)	8 (22.9)	10 (14.3)	0.042

intervals including pre-induction, post-induction. After 30 and 60 minutes and before extubation there was no difference between the two groups ($p<0.05$), but post-extubation diastolic blood pressure was significantly lower in the lidocaine group ($p=0.002$).

In Table 7, the frequency of bucking in lidocaine group was six cases (17.1%) and in air group were 15 cases (42.6%). In this case, data were analyzed using Chi-square test, showed that bucking effect was significantly lower in lidocaine group than in air group ($p=0.018$).

In Table 8, the incidence of cough at recovery time, 6 hours after extubation and 12 hour after extubation are demonstrated and compared between study groups. The results of data analysis using Chi-square test showed that cough was significantly lower in lidocaine group at recovery intervals and 6 hours after extubation ($p = 0.05$).

As shown in Table 9, the incidence of sore throat at recovery time, 6 hours after extubation and 12 hour after extubation in the lidocaine group was in 5 cases, 1, 1 case respectively and in the air group were 13, 7, 3 cases respectively. The results of data analysis using Chi-square test showed that throat complications were significantly lower in lidocaine group at all intervals than in air group ($P <0.05$).

The results of this study showed that there were no significant differences in heart rate at different intervals of the study including pre-induction, post induction, 30 and 60 days post-extubation and post-extubation. In addition, it was found that systolic and diastolic blood pressure after extubation were significantly lower in the lidocaine group than in the air group, although no significant differences were observed in the two groups at the other intervals.

Discussion

Soares et al. conducted a comparative study of the effect of tracheal cuff filling with air, normal saline, or lidocaine on hemodynamic changes and laryngeal morbidity in children in Brazil in 2017. There was no significant difference in heart rate between the two groups in comparison with the results of this study (38). The results of a study by Navarro et al in Brazil, which compared air and lidocaine to fill the endotracheal tube, indicated that systolic blood pressure at the time of extubation in the lidocaine group was significantly lower, but there was no statistically significant difference in blood pressure at different intervals and mean heart rate (39). Compared with the results of the present study, systolic and diastolic blood pressure after extubation were lower in the lidocaine group and heart rate was not different from the air group. Other studies have compared the effect of alkaline lidocaine and lidocaine in the endotracheal cuff on the frequency of cough after endotracheal removal and have showed that the effects of intra-cuff lidocaine were lower than lidocaine alone and saline. Coughing and sore throat at 10 and 30 days after recovery after tube extraction were significantly effective, which were consistent with the present study. In addition, Ghalibaf et al. reported in 2010 that lidocaine was used (40). To be injected into the endotracheal cuff to reduce coughing, straining and laryngitis spasm during the procedure the patient anesthetic is superior to the results of this study.

The results of a study by Altintaş et al, were in line with the results of the present study and, on the other hand, indicate the safety of lidocaine for endotracheal cuff filling (36).

Gaur et al., 2017 in India showed that the incidence of postoperative cough and sore throat during extubation at 2 and 24 hours postoperatively was significantly higher in the air group than the lidocaine group, which was the same as with the results of the present study (37). The results of Venkatesan et al, compare the use of 4% lidocaine for endotracheal cuff filling and lidocaine injection of 0.8 mg/kg for complications of extubation suggesting that there was a significant difference between groups regarding cough. The hemodynamic response to endotracheal tube extubation was unchanged. However, there was no control group in this study which could justify the difference between the results of this study and the present study (41).

Conclusion

The results showed that there was no significant difference in heart rate at different intervals of study, although systolic and diastolic blood pressure after extubation was significantly lower in the lidocaine group than in the air group. Besides, regarding post-extubation complications, the results of this study showed that baking in the lidocaine group was

significantly less than the air group. Also, in the lidocaine group, the cough was significantly lower at recovery time and 6 hours after extubation and sore throat at all intervals.

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Conflicts of Interest

The authors declare that they have no conflict of interest.

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