Original Article

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TANAFFOS

Comparison of Nebulized Lidocaine and Intratracheally Injected (Spray-as-you-go) Lidocaine in Pain and Cough Reduction during Bronchoscopy

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Background: Patients undergoing bronchoscopy often suffer from pain, coughing, and suffocation. Therefore, lidocaine is prescribed through various methods to induce local anesthesia. This study aimed to compare nebulized lidocaine and intratracheally injected lidocaine in pain and cough reduction during bronchoscopy.

Materials and Methods: This clinical trial was performed on 96 patients, divided into two groups of intervention (receiving lidocaine via a nebulizer before bronchoscopy) and control (receiving lidocaine through the working channel of bronchoscope). Then, the patients' cough frequency was recorded during the procedure, and the pain level was measured using a numerical rating scale at the end of the procedure. The data were analyzed with SPSS software (version 16) using the chi-square and Fisher's exact tests. Moreover, the linear and Poisson regression tests were applied to analyze the main variables in this study.

Results: There was no significant difference between the two groups regarding demographic characteristics (P>0.05). Moreover, the linear regression test revealed that the intervention (nebulized lidocaine) group had significantly lower pain scores (1.54±0.08) than the control (intratracheally injected lidocaine) group (2.5±0.26) (P=0.013). In addition, the Poisson regression test showed a statistically significant difference between the intervention (35.22±2.93) and control (48.85±5.96) groups in terms of cough frequency (P<0.0001).

Conclusion: This study indicated that nebulized lidocaine has higher efficacy in reducing the patients' pain and cough during bronchoscopy than intratracheally injected lidocaine.

Key words: Anesthesia; Bronchoscopy; Cough; Intratracheal Injection; Nebulizer; Pain

INTRODUCTION

The respiratory system has a fundamental and decisive role in maintaining vital processes during the human life cycle (1). Given that adults' respiratory diseases and lung cancer are among the most prevalent clinical disorders, medical personnel (e.g., nurses) in different medical areas from society to intensive care units are confronted with these conditions (2, 3). Various tests, such as bronchoscopy, are increasingly used for pulmonary disease diagnosis (4) (5). A study conducted by Facciolongo et al. in Italy to assess bronchoscopy complications recorded 20,986 bronchoscopy cases during 2002-3 in 90 medical centers (6).

Bronchoscopy is well prescribed for the respiratory tract anatomical investigation and pulmonary disease

diagnosis and management (7). However, due to the invasive nature of the operation, most patients suffer from pain, breathlessness, coughing, nasopharyngeal irritation, and suffocation during this procedure (8, 9). On the other hand, the patients' convenience during bronchoscopy is of great importance since their cooperation facilitates the procedure (10). Moreover, it is necessary that nurses who are among the members of the care team and spend time with patients be aware of the pathophysiology of cough and pain, its psychological and physiological outcomes, and different methods of treatment (11). Accordingly, pain management must be considered an integral part of the clinical care process during bronchoscopy (12). Therefore, one of the prerequisites for bronchoscopy is proper anesthesia of the nose, oropharynx, larynx, and trachea to suppress airway reflexes for reducing pain and cough, thereby preventing the patient's discomfort during bronchoscopy (8, 13).

Topical anesthesia medications are used through different methods, such as nebulizer, laryngotracheal spray, and intratracheal injection, to debilitate cough reflex and minimize patient's discomfort (3, 14, 15). The uniform distribution of lidocaine in the bronchial tree via intratracheal injection might be difficult, leading to insufficient anesthesia (16). In addition, severe coughing attacks occur when the lidocaine is sprayed on the larynx (17). This study aimed to compare nebulized lidocaine and intratracheally injected lidocaine in reducing the pain and cough reflex of patients during bronchoscopy.

MATERIALS AND METHODS

This clinical trial was approved by the Ethics Committee of Sabzevar University of Medical Sciences, Sabzevar, Iran (IR.MEDSAB.REC.1397.038; IRCT20181004041230N1; 2018). Informed consent was obtained from all patients who underwent bronchoscopy before their inclusion in the study.

This study included patients who required diagnostic bronchoscopy and were referred to Vasei Hospital affiliated with Sabzevar University of Medical Sciences, Sabzevar, Iran. The inclusion criteria were 1) ability to cooperate, 2) Glasgow Coma Scale >13, 3) physical and mental health, 4) 18 years of age or older, 5) lack of seizer or coagulation disorders, 6) immunity to lidocaine allergy, and 7) no previous surgical history in the respiratory tract. On the other hand, patients with opium addiction, previous bronchoscopy history, and diabetes history for more than 10 years were excluded from the study.

The participants were selected through a convenience sampling method and randomly (permuted-block randomization) divided into intervention (nebulized lidocaine) or control (intratracheally injected lidocaine) groups. All patients were subjected to bronchoscopy procedures by the same person. In the intervention (nebulized lidocaine) group, the pharynx and tracheal tree were anesthetized using a jet nebulizer (Samin Teb Mehr, Figure 1) 3-5 min before bronchoscopy through the inhalation of 10 ml lidocaine 2% (Rasht Pharmaceutical Company). Moreover, a lidocaine gel was rubbed inside the patients' nostrils before bronchoscopy. On the other hand, the control group was subjected to the lidocaine gel inside their nostril. Moreover, the pharynx and tracheal tree were anesthetized before bronchoscopy by spraying 10 ml (split-up) lidocaine 2% by a syringe via the bronchoscope's working channel.

Figure 1. The mask that was used for nebulizing lidocaine which produced by Samin Teb Mehr company

It is worth mentioning that no anesthesia was used, and the patients were completely conscious and received 3-4 liters of supplemental oxygen through the nasal cannula. Moreover, they were strictly monitored with a cardiac and respiratory monitor during operation. The pain level was measured using a numerical rating scale (0=without pain to 10=maximum pain) at the end of the procedure. The procedure duration was measured by the same nurse after the scope entered the nose until it was removed. In the meanwhile, the frequency of patients' coughs was recorded by the nurse.

The obtained data were analyzed with SPSS software (version 16) using Fisher's exact and chi-square tests for demographic characteristics. The Shapiro-Wilk test was used to assess the normal distribution of the main quantitative variables. Moreover, the *t* and Mann-Whitney tests were utilized to analyze normally and non-normally distributed variables. In addition, the main variables (pain and cough) were analyzed by linear regression and Poisson tests. A p value of less than 0.05 was considered statistically significant.

RESULTS

According to a study performed by Korttila et al. (15), the total number of patients was determined as 87 cases, which was increased by 10% to reach a maximum number of 96 patients using the following formula:
$(n=\frac{2S_p^2(Z_1-\alpha+Z_1-\beta)^2}{d^2}=\frac{2\times1300\times(1.64+1.28)^2}{16^2}\cong 87)$.

Therefore, 96 patients (48 cases per group) were included in this study. However, six patients were excluded from the intratracheal injection group due to biopsy and bleeding (n=4), lack of cooperation (n=1), and the need for consumption of sedative medications during the procedure (n=1). Furthermore, four patients were excluded from the nebulized lidocaine group due to biopsy and bleeding (n=1), deterioration of the hemodynamic condition and need for intubation (n=1), lack of cooperation (n=1) and the need for consumption of sedative medications during bronchoscopy (n=1). Eventually, the study was conducted on 86 participants in the control (intratracheal injection) (n=42) and intervention (nebulizer) (n=44) groups.

Demographic characteristics were collected using a questionnaire designed following a library study. The questionnaire was then approved by a few experienced experts in the respective field. According to the analysis results of demographic characteristics, there was no significant difference between the two groups in terms of age, gender, education, and residency (village/city) (P>0.05).

A numerical rating scale was used to assess the pain level. The validity and reliability of this tool were approved by some experts and based on a study by Ferraz et al. (18). As observed in Table 1, the control (intratracheal injection) group suffered more pain than the intervention group. Although this difference between the two groups was not clinically significant, the linear regression test indicated a statistically significant difference between the two groups (P=0.013).

Table 1. Mean pain score in the two groups and comparison analysis results via Linear regression test

Groups	Mean pain score	Linear regression test			
		Ratio	Standard error	Confidence interval	P-value
Nebulizer	1.54±0.08				
Intratracheal injection	2.5±0.26	0.66	0.27	0.14-1.18	P=0.013

The same nurse recorded the frequency of patients' coughs during the procedure, showing that the intratracheal injection group suffered from more coughs than the intervention group. However, this difference between the two groups was not clinically significant. Nevertheless, the Poisson regression test revealed a statistically significant difference between the two groups in this regard (P<0.0001) (Table 2).

Table 2. Mean number of coughs in the two groups and their comparison via Poisson regression test

Groups	Mean number of coughs	Poisson regression test			
		Ratio	Standard error	Confidence interval	P-value
Nebulizer	35.22±2.93				
Intratracheal injection	48.85±5.96	1.29	0.036	1.24-1.43	P<0.0001

DISCUSSION

The present study aimed to compare the effect of nebulized and intratracheally injected lidocaine on reducing pain and cough during bronchoscopy. According to the results, nebulized lidocaine was more effective than intratracheally injected lidocaine.

Pirlich et al. conducted a study entitled "A comparison of the Enk Fiber Optic Atomizer Set™ with boluses of topical anesthesia for awake fiberoptic intubation." They revealed that the nebulizer method reduced the pain level and coughs, consistent with the present study results (19). In the aforementioned study, the Enk atomizer used for lidocaine nebulizing seemed more effective than lidocaine inhalation by a jet nebulizer. Our study experimentally observed that patients in the nebulizer group had more coughs after passing bronchoscope through the carina, which showed the inefficacy of lidocaine concentration in the inferior respiratory tract with the nebulizer inhalation method. However, despite the above reports, the nebulizer method was more efficient than the method used for the control group in our study.

These results are consistent with a study conducted by Jun that confirmed less pain experienced by the nebulizer group (20). Moreover, the results reported by Sharma and Verma are in line with the findings of this study. In the aforementioned study, bronchoscopy patients were divided into two groups of either nebulizer or both nebulizer and intratracheal injection. According to the results, those who received only an anesthetic nebulizer felt more comfortable than those who received both (17). It is worth mentioning that the study carried out by Sharma and Verma was significantly different from the present study, as they investigated patients who underwent tracheoscopy, whereas this study was conducted on patients who were subjected to bronchoscopy.

However, Muller et al. performed a study to compare the above two methods; all patients underwent bronchoscopy by the same person adopting the same inclusion and exclusion criteria as in the present study. The above study reported no significant difference between the two groups regarding the pain score and cough frequency (21). This lack of difference could be due to sedative medications (midazolam and propofol) used during the procedure.

It is pretty evident that anesthetic medications significantly impact the suppression of the cough reflex and patients' perception of pain, leading to the invalidity of the obtained information. Moreover, in a study conducted by Kaur et al., the intratracheal injection method was more effective than the nebulizer method despite similarities with our study (22). This difference can be attributed to anesthetic and anticholinergic medications for the patients. The other reason might be the administration of 200 mg versus 160 mg lidocaine to the intratracheal injection and nebulizer groups, respectively. Mathur et al. compared the difference between lidocaine nebulizer and laryngeal nerve block methods regarding local anesthetic adequacy for fiberoptic intubation in India. The results represented more satisfaction in laryngeal nerve block patients than in the nebulizer group (13).

Nevertheless, there is a need for further studies to investigate which of the above-mentioned methods is more suited for topical anesthesia of patients during bronchoscopy. Many bronchoscopy centers apply sedative and anesthetic medications, and some others use potent narcotics to suppress cough and relieve pain, each with its specific complications. Besides, some centers do not routinely use any medication for bronchoscopy. Bronchoscopy in our study was performed on conscious patients and using equal lidocaine doses in the two groups. Accordingly, it was determined that the nebulizer method was statistically more effective in pain relief and cough frequency reduction than intratracheal injection through the bronchoscope's working channel; however, this difference was not clinically significant.

CONCLUSION

The present study indicated that nebulizer was statistically more effective in suppressing pain and cough reflex than the intratracheal injection method; moreover, it

provided the patients with more convenience during bronchoscopy.

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