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Research Article

Comparison of the Effects of Inhaled and Injectable Lidocaine on Postoperative Complications and Hemodynamic Responses to Endotracheal Intubation in Adults

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ABSTRACT

Background: Airway management is an important procedure for adequate oxygenation and ventilation, opening a pathway between the environment and the lungs to allow air to flow. Several complications can occur after endotracheal intubation, leading to functional loss. The use of intravenous lidocaine is another preventive measure to reduce the incidence of postoperative airway complications, which is commonly used by anesthesiologists. This study aimed to "determine and compare the effects of inhaled and injectable lidocaine on postoperative complications and hemodynamic responses to endotracheal intubation in adults with ENT surgery."

Methods: This study is a quasi-experimental study conducted in 2025 at Amiralam Hospital, Tehran, on 150 patients with head and neck surgery. Patients were selected on a convenience basis and then randomly assigned to three groups: injectable lidocaine (n = 50), nebulizer (n = 50), and a control group (n = 50). Patients in the inhaled lidocaine group received 4% inhaled lidocaine (5 ml) 15 min before anesthesia induction. Patients in the intravenous lidocaine group received 1.5 mg/kg of lidocaine 90 seconds before intravenous intubation. However, patients in the control group did not receive lidocaine. The hemodynamic status of patients was assessed and recorded at intervals during anesthesia and postoperative intubation complications. Data were analyzed using SPSS version 25 software.

Results: The average age of patients in the nebulizer (47.52±13.64), injectable (49.16±11.64), and control (46.52±13.13) groups ($P>0.05$). Based on statistical tests, the mean blood oxygen level as well as the mean systolic, diastolic, and mean blood pressure of the patients in the injection group were higher than those in the nebulizer group at the time intervals immediately, one minute, three minutes, and five minutes after intubation ($P<0.05$). The prevalence of impaired blood oxygen saturation and bradycardia in the nebulizer group was higher than that in the injection group, while the prevalence of laryngospasm and coughing after surgery was higher in the injection group than in the nebulizer group ($P<0.05$).

Conclusion: The use of both injectable and nebulized lidocaine methods immediately before intubation reduces hemodynamic responses and postoperative complications. Also, each of the nebulized and injectable lidocaine has a better effect on a number of items of hemodynamic status and complications after intubation of patients. Accordingly, the use of lidocaine is recommended in patients undergoing ear, throat, and nose surgery under general anesthesia.

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Introduction

Airway management is an important procedure for adequate oxygenation and ventilation, opening a pathway between the environment and the lungs to allow air to flow. In this procedure, the airway is positioned—using devices such as various masks, endotracheal tubes, and oral/nasal airways—to establish optimal airflow, and the maintenance of this airflow is ensured. This procedure is frequently employed in cases involving reduced levels of consciousness, respiratory distress or failure, and certain surgical interventions [1]. Airway management, particularly endotracheal intubation, is recognized as a crucial clinical skill for relevant specialists [2]. The endotracheal tube was first used reliably in the 1900s. In its simplest form, it is made of polyvinyl chloride and is inserted into the trachea to deliver inhaled gases—such as anesthetic gases and oxygen—to the lungs. The endotracheal tube prevents blood and gastric contents from entering the lungs. With advances in anesthesia and surgery, there have been advances in endotracheal tubes [3]. Indications for endotracheal intubation include decreased level of consciousness, rapid changes in mental status, high risk of aspiration, laryngeal trauma, airway injury, or imminent airway compromise; respiratory failure; apnea; and major surgical procedures requiring general anesthesia [2,4]. Initial (relative) contraindications for oropharyngeal endotracheal tube (ETT) placement include situations where safe tracheal intubation is not possible (e.g., severe airway obstruction or trauma), the need for complete patient immobilization (e.g., severe cervical spine injury), and patients with a Mallampati classification of III or IV, indicating difficult airway management. Also, the main contraindications to avoid ETT placement with a nasotracheal approach include active nosebleeds, oropharyngeal trauma, patients with apnea, head trauma related to skull base fracture, facial trauma, and expanding neck hematoma [5]. Direct visualization using a laryngoscope is employed to assess the placement of the endotracheal tube (ETT). Other methods include clinical assessment, ultrasonography, chest radiography, and the evaluation of capnography and end-tidal carbon dioxide (EtCO2) readings. Among these verification methods, continuous waveform capnography-combined with clinical assessment-is recognized by specialists as the most reliable approach. In certain operating room settings, other techniques such as portable ultrasonography are also utilized, while other practitioners frequently rely on chest radiography [1]. Several complications can occur following endotracheal intubation that result in loss of function. Some complications resulting from the physical placement of the tube include: perforation of the oropharyngeal region; infection; damage to the teeth, oral tissues, and lips; bleeding; misplacement of the tube in the esophagus; and hoarseness (damage to the vocal cords) [3]. In other words, other potential complications of this procedure include the inadvertent placement of the tube into the patient's right bronchus or esophagus. Esophageal intubation and respiratory failure—as complications of endotracheal intubation—can lead to respiratory arrest. Furthermore, airway trauma may result in vocal cord injury, soft tissue swelling, and hemorrhage. Tension pneumothorax and air leakage—particularly in cases of chest trauma—are also recognized as foreseeable complications of this procedure [1]. These are of greater importance in head and neck surgery. Neck and head surgery often involves vital airway structures, extensive tissue manipulation, and prolonged operative time [6]. Chronic diseases, particularly when accompanied by complications, cause extreme fatigue in patients [7], which can lead to a reduced quality of life; therefore, appropriate measures to alleviate and manage these issues are essential [8]. General anesthesia is the most common method of anesthesia selected by anesthesiologists for head and neck surgeries [9], which requires better management of complications associated with endotracheal intubation. In head and neck surgery under general anesthesia, the use of appropriate anesthetic and anesthetic-related drugs before endotracheal intubation is usually of critical importance [10] because they reduce postoperative complications associated with endotracheal intubation. More specifically, many interventions have been proposed to reduce the incidence of postoperative airway complications, including extubation under deep general anesthesia, intravenous opioid administration, and topical or intracuff administration of lidocaine. Anesthesiologists typically administer injectable lidocaine as a preventive measure to suppress the patient's cough. Other potential mechanisms of action for lidocaine include the suppression of airway sensory fibers, the reduction of electrical discharge in peripheral nerve fibers, and the selective inhibition of pain signal transmission in the spinal cord [11].

Lidocaine is known as a local anesthetic, although it was initially used to treat cardiac dysrhythmias. Additionally, due to its analgesic effects, this injectable drug can potentially be beneficial in the preoperative setting. It has anti-inflammatory and opioid-reducing effects, a combination of properties that result in a range of effects such as reduced postoperative pain and opioid use and reduced duration of gastrointestinal ileus. It also has antithrombotic, antimicrobial, and antitumor effects [12]. In a study involving adult surgical patients, Yang et al. (2020) administered injectable lidocaine before and during surgery; the results demonstrated a significant reduction in postoperative sore throat and coughing during tracheal extubation. Furthermore, the use of the drug did not pose any specific risks to the patients.

Consequently, the researchers—along with anesthesiologists—recommended the use of injectable lidocaine, particularly for high-risk surgical patients, citing its low cost and favorable safety profile [11].

Lidocaine was developed in the 20th century and, following extensive scientific testing, was approved for human use in 1948. Initially, the injectable form was utilized for postoperative pain relief. Subsequent research confirmed the analgesic and postoperative pain-relieving properties of intravenous lidocaine. Today, clinicians use the injectable form as a pre-operative analgesic in various hospital settings, including intensive care units and operating rooms. Lidocaine exhibits anti-inflammatory, analgesic, and antipyretic effects; these properties likely account for its observable and sustained impact in the hours following the conclusion of the infusion [13].

The effectiveness of lidocaine in ENT surgeries has not yet been well established, and whether injectable or inhaled lidocaine is more effective remains controversial. Accordingly, this study aimed to "determine and compare the effects of inhaled and injectable lidocaine on postoperative complications and hemodynamic responses to endotracheal intubation in adults undergoing ENT surgery."

Methods

This study is a quasi-experimental trial conducted in 2025 at Amir-A'lam Hospital (affiliated with Tehran University of Medical Sciences) involving 150 patients undergoing ear, nose, and throat (ENT) surgery. Following the approval of the research by the university's ethics committee, the researcher visited Amiralam Hospital and obtained the necessary authorizations from the relevant officials at the facility. Then, in the operating room, patients with ENT surgery who are candidates for neck and airway surgery based on the diagnosis of the treating physician and recorded in the medical record were identified. These patients were initially selected based on inclusion criteria and on an available basis. All study objectives were explained to the patients, and informed consent was obtained following their agreement to participate in the research. Inclusion criteria included being between 18 and 50 years of age, providing informed consent, having ASA status I-II, undergoing airway and neck surgery under general anesthesia, having easy intubation, having an absence of cardiovascular disease, arrhythmia, or beta-blocker use, having an absence of pregnancy, and having no history of reactive airway disease.

Included age between 18 and 50 years, provision of informed consent, patients with ASA status I-II, airway and neck surgery under general anesthesia, easy intubation, absence of cardiovascular disease, arrhythmia, or beta-blocker use, absence of pregnancy, and no history of reactive airway disease. Exclusion criteria included allergy to lidocaine, anticipated difficult airway, and problems or complications during intubation. The sample size for this study was calculated using G*POWER software with a test power of 95%, an effect size of 0.80, a significance level of 0.05, and a confidence interval of 95% (M±SD= 3.66±1.98, df=82). The sample size formula calculated 42 individuals per group, with a dropout rate of 50 individuals considered for each group, resulting in a total sample size of 150 individuals. Patients in the operating room were randomly assigned to three groups: intravenous lidocaine (50 individuals), nebulized lidocaine (50 individuals), and a control group (50 individuals). Initially, a fixed green Angiokat was inserted in all patients, and 1 liter of normal saline was connected to it. Patients were intubated with an ETT by a single attending physician (the principal investigator). The endotracheal tube size was the same in all patients (the usual difference between endotracheal tube sizes in men and women was not considered). Patients were induced with anesthesia, and general anesthesia was administered using the same drugs. Intravenous midazolam (0.03 mg/kg) was administered as premedication. Patient monitoring in the operating room included heart rate, ECG, non-invasive blood pressure, and blood oxygen saturation. Anesthesia was induced using propofol (2 mg/kg), atracurium (0.6 mg/kg), and fentanyl (2 µg/kg). ETT was performed 90 seconds after the administration of the muscle relaxant. Patients in the inhaled lidocaine group received 4% lidocaine (5 mL) via inhalation 15 minutes prior to the injection of anesthetic agents. In the intravenous lidocaine group, lidocaine (1.5 mg/kg) was administered intravenously 90 seconds before intubation. Patients in the control group did not receive lidocaine. The drugs were administered in identical syringes by an anesthesiologist who was not involved in the post-operative assessment, ensuring that the researcher collecting the outcome data was blinded. All other aspects of anesthesia and surgical care were standardized across the groups to minimize confounding variables. The hemodynamic status of the patients was assessed and recorded immediately after intubation (T0), 1 minute after (T1), 3 min after (T3), and 5 min after intubation (T5). Intubation complications were also assessed and recorded postoperatively and after extubation in the recovery room. Much of the necessary information was recorded in each participant's medical file, which we used. The data collection tool was a researcher-made checklist (including patients' demographic characteristics, including age, gender, type of surgery, and ASA status) as well as vital signs, including temperature, heart rate, respiratory rate, blood pressure (mean arterial pressure, systolic, and diastolic), and postoperative complications, including cough, laryngospasm, bradycardia, and hypoxemia. Patient temperatures were measured using a standard digital thermometer available in the operating room, and the

accuracy of this device was evaluated daily before use using another standard mercury thermometer. Diastolic blood pressure ≥90 mmHg or Systolic blood pressure ≥140 mmHg was considered hypertension, measured twice using a calibrated central sphygmomanometer. Also, a heart rate of 60 to 100 beats per minute was considered normal and continuously monitored with a central monitoring device. Oxygen saturation levels (SpO2) between 94 and 99 percent were considered normal and continuously measured using a pulse oximeter. Data analysis was performed using SPSS software (version 25). Statistical tests such as the t-test, one-way ANOVA, Tukey's post-hoc test, the chi-square test, and Fisher's exact test were employed.

Results

The participants in this study were 150 patients referred for surgery to Amiralam Hospital of Tehran University of Medical Sciences, who were studied in three groups: nebulizer (50 people), intravenous (50 people), and a control group (50 people). The mean age of patients in the nebulizer (47.52±13.64), intravenous (49.16±11.64), and control (46.52±13.13) groups. Based on the results of the one-way ANOVA test, there was no statistically significant relationship between the groups in terms of the age variable (F= 0.539, DF=2, P=0.584). The mean weight of patients in the nebulizer (73.70±10.11), intravenous (71.14±11.26), and control (73.00±12.67) groups (F=0.673, DF=2, P=0.511). Other demographic characteristics of the nebulizer, intravenous, and control groups are presented in Table 1. The findings indicated that the mean systolic blood pressure of patients immediately after the operation, and at one and three min post-operation, was higher in the injection group than in the nebulizer group. However, at the fifth minute post-operation, it was higher in the nebulizer group than in the injection group. One-way ANOVA did not reveal a statistically significant difference between the three groups (P > 0.05). Furthermore, the Tukey post-hoc test also showed no statistically significant difference between any of the groups (P > 0.05). The mean diastolic blood pressure and the mean arterial pressure of patients immediately after the operation and one, three, and five min post-operation were higher in the injection group than in the nebulizer group. One-way ANOVA showed no statistically significant difference between the three groups (P > 0.05). Conversely, the mean heart rate of patients immediately after the operation and one, three, and five min post-operation was higher in the nebulizer group than in the injection group (P > 0.05). Based on the study findings, one-way ANOVA revealed that the mean blood oxygen saturation of patients immediately after the operation and one, three, and five min post-operation was significantly higher in the injection group than in the nebulizer group (P < 0.05). The Tukey post-hoc test also indicated that this statistically significant difference immediately after the operation was related to the difference between the nebulizer and placebo groups (P = 0.092). At the first minute post-operation, this difference was related to the placebo and nebulizer groups (P = 0.000) and also the placebo and injection groups (P = 0.001). At the fifth minute post-operation, this difference was related to the nebulizer and placebo groups (P = 0.006) (Table 2).

Regarding postoperative complications, the findings showed that the incidence of oxygen desaturation and bradycardia was higher in the nebulizer group than in the injection group, while the incidence of laryngospasm and coughing after the operation was higher in the injection group than in the nebulizer group (p > 0.05) (Table 3).

Discussion

This study aimed to "determine and compare the effects of inhaled and intravenous lidocaine on postoperative complications and hemodynamic responses to endotracheal intubation in patients with ENT surgery." Our study is among the first to compare the effect of two lidocaine administration methods in patients with ENT surgery. Airway securing with intubation causes hemodynamic responses such as tachycardia, hypertension, and dysrhythmia due to sympathoadrenal stimulation.

These responses are more pronounced in patients with heart problems or hypertension than in healthy individuals. The force applied by the laryngoscope to lift the epiglottis during endotracheal intubation, along with the irritation caused by the tube entering the trachea and subsequent cuff expansion, can lead to cardiovascular responses.

A 10-second laryngoscopy can create hemodynamic stress responses and plasma catecholamine levels similar to those observed in laryngoscopy followed by tracheal intubation [14].

Table 1- Comparison of demographic characteristics in the three nebulizer, injectable, and control groups

Groups		Nebulizer (N=50)		Injection (N=50)		Control (N=50)		P value
		Frequency	Percent	Frequency	Percent	Frequency	Percent	
Gender	Male	37	74.0	31	62.0	31	62.0	X^2=2.139
	Female	13	26.0	19	38.0	19	38.0	Df= 2
								P= 0.343
ASA	I	30	60.0	24	48.0	28	56.0	X^2=1.506

	II	20	40.0	28	52.0	22	44.0	Df= 2 P= 0.471
Surgery	Head-face	6	12.0	7	14.0	3	6.0	X^2=7.130
	Nasal	11	22.0	5	10.0	15	30.0	Df= 4
	neck	33	66.0	38	76.0	32	64.0	P= 0.129

Table 2- Comparison of hemodynamic status of patients at different time intervals in the three nebulizer, injection, and control groups

Groups		Nebulizer (N=50)		Injection (N=50)		Control (N=50)		One Way Anova
		Mean	SD	Mean	SD	Mean	SD	P value
Blood Pressure (Systolic)	BP.0*	137.54	21.15	140.58	20.34	137.60	21.26	F=0.345, P=0.709
	BP.1**	116.92	32.08	118.54	25.37	120.44	23.87	F=0.208, P=0.813
	BP.3	110.28	25.21	114.98	24.85	114.14	21.40	F=0.551, P=0.578
	BP.5	112.14	23.78	118.86	26.09	117.92	26.04	F=1.032, P=0.359
Blood Pressure (Diastolic)	BP.0	84.64	11.96	87.18	11.54	85.78	14.26	F=0.506, P=0.604
	BP.1	73.16	18.15	75.68	20.18	79.60	16.80	F=1.549, P=0.216
	BP.3	71.64	17.14	75.00	18.17	74.94	14.92	F=0.655, P=0.521
	BP.5	70.64	17.69	77.34	15.27	75.14	17.95	F=2.013, P=0.137
Blood Pressure (Mean)	BP.0	108.34	15.42	112.26	15.7	107.64	16.8	F=1.210, P=0.301
	BP.1	89.78	22.17	91.48	23.08	96.76	19.05	F=1.432, P=0.242
	BP.3	86.68	19.65	92.60	20.73	91.26	17.55	F=1.285, P=0.280
	BP.5	88.14	19.73	96.18	19.80	92.74	20.65	F=2.020, P=0.136
HR	HR.0	88.48	22.58	86.98	16.85	82.66	15.79	F=1.312, P=0.272
	HR.1	87.18	19.78	83.32	17.27	84.14	16.50	F=0.645, P=0.526
	HR.3	82.88	17.75	80.08	15.50	81.34	16.19	F=0.361, P=0.698
	HR.5	81.38	15.86	79.58	15.08	79.40	14.67	F=0.259, P=0.772
SpO_2	SpO2.0	97.48	1.11	97.50	1.48	98.02	1.22	F=2.847, P=0.061
	SpO2.1	98.16	.84	98.26	2.26	99.30	.70	F=9.424, P=0.000
	SpO2.3	98.94	.68	99.00	1.65	99.32	1.75	F=0.997, P=0.272
	SpO2.5	99.28	.67	99.40	1.08	99.78	.50	F=5.404, P=0.005

*=Immediately after ETT. **=min after ETT

Table 3- Comparison of postoperative intubation complications in the three nebulizer, injection, and control groups

Complications Groups		Nebulizer (N=50)		Injection (N=50)		Control (N=50)		P value
		F*	%**	F	%	F	%	
Coughing	Yes	3	6.0	4	8.0	6	12.0	X^2= 1.179
	No	47	94.0	46	92.0	44	88.0	Df= 2 P= 0.555
Laryngospasm	Yes	1	2.0	2	4.0	1	2.0	X^2= 0.514
	No	49	98.0	48	96.0	49	98.0	Df= 2 P= 0.773
Desaturation	Yes	2	4.0	0	0.0	1	2.0	X^2= 2.041
	No	48	96.0	50	100.0	49	98.0	Df= 2 P= 0.360
Bradycardia	Yes	2	4.0	1	2.0	2	4.0	X^2= 0.414
	No	48	96.0	49	98.0	48	96.0	Df= 2 P= 0.813

*=Frequency. **=Percentage

Based on the results of our research, the use of lidocaine reduced hemodynamic responses, such as blood pressure and heart rate, in patients with ENT surgery under general anesthesia. Comparing the two groups, intravenous and nebulized lidocaine, the mean systolic, diastolic, and mean arterial blood pressure of patients in the intravenous group were generally higher than those in the nebulizer group immediately, 1, 3, and 5 minutes after intubation. In other words, the use of nebulized lidocaine significantly improves blood pressure control in patients. Lidocaine is an aminoethylamide and the prototype of the amide local anesthetic group. The World Health Organization (WHO) considers it effective, safe, and cost-effective. The benefits of lidocaine include analgesic properties, anti-arrhythmic effects on the heart, peripheral vasodilation, direct depression of cardiac function, and the inhibition of airway reflexes caused by tracheal mucosal stimulation. It is a standard agent and is

widely recommended in various centers to reduce blood pressure response. It reduces the increase in HR, arterial pressure, and intracranial pressure associated with intubation and laryngoscopy [15]. The mechanism of action of intravenously administered lidocaine is not fully understood. However, some suggest that pre-surgical lidocaine administration reduces afferent input from injured peripheral nerves, thus mitigating secondary hyperalgesia. Potential mechanisms include NMDA receptor blockade, direct action via opioid receptors, or reduced excitability and conduction in unmyelinated C-fibers. Effective lidocaine management may lead to decreased sympathetic nervous system activation and alterations in cardiovascular system variability [16]. Uzeda et al. (2014) demonstrated that systolic and diastolic BP were lower at all-time points post-injection in patients receiving injectable lidocaine as a local anesthetic for dental surgery [17]. Sinlao et al. (2018) reported that a 1.5 mg/kg dose of lidocaine, administered 1 minute before laryngoscopy and tracheal intubation, significantly reduced hemodynamic responses (e.g., BP and HR) in patients undergoing general anesthesia [15]. Similar results were reported by Mendonça et al. (2017), who concluded that injectable lidocaine is effective and safe for hemodynamic control during intubation and laryngoscopy and is a suitable option for reducing upper airway irritation in patients under general anesthesia [18]. The effectiveness of lidocaine in reducing hemodynamic responses to airway management (ETT) has been investigated and confirmed in several other studies [19-20]. This may be because the drug lidocaine acts on NMDA receptors and sodium channels (exerting antagonistic effects), reduces the release of substance P, and possesses glycinergic effects, all of which lead to reduced airway reactivity and, consequently, attenuated hemodynamic responses [18]. Saeed et al. reported in a study that the use of lidocaine, both topically and intravenously, reduced the hemodynamic response to ETT and laryngoscopy. However, inhaled lidocaine was more effective than intravenous lidocaine in attenuating procedure-induced hypertension (associated with intubation and laryngoscopy) [14], and the results of that study were consistent with our findings.

Our study showed that the use of lidocaine increased blood oxygen levels and reduced laryngospasm and postoperative coughing in patients with ENT surgery under general anesthesia. However, when comparing the two groups, lidocaine and nebulizer, the mean blood oxygen levels of patients immediately, 1, 3, and 5 minutes after intubation were significantly higher in the intravenous group than in the nebulizer group. In other words, intravenous lidocaine resulted in a greater and better increase in patients' blood oxygen levels after intubation. On the other hand, other findings of the present study regarding postoperative complications showed that the incidence of oxygen desaturation and bradycardia was higher in the nebulizer group than in the intravenous group, while the incidence of laryngospasm and postoperative coughing was higher in the intravenous group than in the nebulizer group. In other words, intravenous lidocaine is better than the nebulizer method in controlling the complications of oxygen desaturation and bradycardia, while the use of nebulized lidocaine before intubation results in a better reduction of laryngospasm and postoperative coughing in patients. Saeed et al. write in this regard: Intravenous lidocaine, known for its antiarrhythmic and central depressant effects, is known to be effective in minimizing hemodynamic responses. The pharyngeal nerves can be anesthetized by inhalation of inhaled lidocaine. The glossopharyngeal nerve innervates the mouth, soft palate, posterior part of the tongue, and the pharyngeal surface of the epiglottis. Topical application of lidocaine to the larynx and trachea remains a common and standard practice. However, the rate and extent of its absorption after topical application depend on the concentration, administered dose, site of action, and duration of exposure [14]. Yang et al. (2020), in a study titled "Intravenous Lidocaine for Prevention of Postoperative Airway Complications in Adults," reported that intravenous lidocaine significantly reduced the incidence of cough after extubation, as well as the incidence of sore throat at 1 and 24 hours postoperatively. This effect may be due to the suppression of airway-stimulating sensory C fibers and the release of sensory neuropeptides by intravenous lidocaine. This, in turn, may reduce throat inflammation and irritation, leading to a faster return to normal function in the post-anesthesia recovery room, potentially due to more regular and comfortable breathing, as well as more optimal blood oxygen levels [11]. Oon et al. (2019) reported in a case report that intraoperative laryngospasm occurs in less than 1% of cases. Risk factors for laryngospasm include secretions, patient-related factors (such as smoking), the use of pungent inhalational anesthetic agents, shared airway procedures, and pediatric surgery. Management strategies include the administration of muscle relaxants, deepening the level of anesthesia, applying jaw thrust, using positive airway pressure, and removing irritating stimuli. Inhaled lidocaine can be used to anesthetize the vocal cords. These researchers also reported successfully treating an adult patient—who remained conscious and whose refractory postoperative laryngospasm had not responded to standard interventions—using inhaled lidocaine [21]. In the study by Yüksel et al., topical lidocaine administered via nebulizer also significantly reduced cough, the most common complication of bronchoscopy, for which the researchers recommended its use [22]. Elnaggar et al. (2024) also reported in this area that inhaled lidocaine (60 mg) before induction of anesthesia can significantly reduce certain post-extubation complications, such as hoarseness, coughing,

sore throat, and even laryngospasm [23]. Inhaled lidocaine exerts adverse effects on the airway—such as the suppression of local circulatory reflexes—which appear to result from the drug's direct local anesthetic action rather than from systemic absorption. This technique is a simple, effective, and low-cost method used to reduce and prevent coughing and hyperdynamic reflex responses [24]. These findings are consistent with the results of our study.

Conclusion

Ultimately, the results of this study indicated that using both injectable and nebulized lidocaine immediately before intubation reduces hemodynamic responses, increases blood oxygen levels during general anesthesia, and also decreases laryngospasm and postoperative coughing in patients with ENT surgery undergoing general anesthesia. However, it seems that each of the nebulized and injectable lidocaine types has a better effect on certain items of hemodynamic status and post-intubation complications in patients. Accordingly, the use of lidocaine is recommended in patients with ENT surgery undergoing general anesthesia.

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