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Original article

# COMPARISON BETWEEN LIGNOCAINE NEBULIZATION AND AIRWAY NERVE BLOCKS FOR AWAKE FIBEROPTIC NASOTRACHEAL INTUBATION IN ORAL CANCER SURGERY PATIENTS

## Running title: Airway Management in Oral Cancer Patients

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## *Abstract*

***Intro duction:*** *Awake fiberoptic bronchoscope-guided intubation is the preferred airway management strategy in a patient with a difficult airway and limited mouth opening. The aim is to compare the efficacy of nebulization and airway nerve block using lignocaine to provide airway anesthesia in awake patients using fiberoptic bronchoscope for nasal intubation to make the patient comfortable, cooperative, and agreeable.* ***Methods:*** *In this randomized, prospective, single-blinded study, sixty adult patients scheduled for oral cancer surgeries were divided into two equal groups. Nebulization with 4% lignocaine (10 ml) was performed in Group N, and superior bilateral laryngeal and trans-laryngeal recurrent laryngeal nerve blocks used 2% lignocaine (2 ml) were given in Group B. Nasotracheal intubation using fiberoptic bronchoscope were performed. Intravenous midazolam and fentanyl were used for sedation and analgesia. We recorded the ease of intubation, coughing episodes, vocal cord status, hemodynamic variables, patient recall, and lignocaine toxicity. Student's t-test and Chi-square tests were used for appropriate data. Statistical significance was considered for P < 0.05 (SPSS Version 20, IBM, USA).* ***Results:*** *The intubation time was shorter with better intubating conditions in Group B (120.3 ± 42.6 s) than Group N (200.4 ± 60.3 s) (P < 0.001). Cough severity and patient recall for untoward effects were lower in Group B. Intubation were done successfully in all patients.* ***Conclusion:*** *Airway nerve blocks provided better airway anesthesia characterized by easier fiberoptic intubation and patient comfort than lignocaine nebulization. Nebulization can be considered a suitable alternative when nerve blocks are not feasible due to distorted neck anatomy.*


**Keywords:** *Airway blocks; bronchoscopy; lignocaine; nasotracheal intubation; nebulization*

## *Introduction*

The mainstay of the difficult airway with limited mouth opening is flexible fibreoptic bronchoscope (FOB) guided intubation[1]. Nasal intubation is indicated for intraoral and oropharyngeal surgery[2,3]. Airway nerve blocks result in early and profound airway anesthesia. Nebulization is a comfortable alternative[4,5]. Awake intubation requires upper airway anesthesia with sedation and analgesia[6]. Few studies have compared these two techniques. This study aimed to compare the efficacy of nebulization with airway nerve block for producing airway anesthesia for awake nasal intubation with the help of FOB. The primary objective was to compare the intubation time, and assessment of airway anesthesia quality and patient satisfaction were secondary objectives.

## *Methodology*

After ethical committee approval of the institute (Number - IRC/ 2020 /P-117) and written informed consent, we included 60 adult patients of the American Society of Anaesthesiologists (ASA) grade 1 and 2, undergoing elective oral cancer surgery at our institute, for the study of 10 months. Patients included in the study had buccal mucosa cancer, upper and lower alveolus, and tongue. A difficult airway was anticipated (Modified Mallampatti grade 3 and 4) in all patients. The exclusion criteria were uncooperative patients, not ready to provide consent, allergy to local anesthetic (LA), asthma, epilepsy, coagulopathy, hemodynamic instability, or infection at the local site.

All patients were preoperatively evaluated, and a complete airway evaluation was done. According to

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standard guidelines, patients were kept nil by mouth, and tablet ranitidine 150 mg was given. Explanation about the awake FOB-guided intubation during preoperative assessment was done. Half an hour before the intubation procedure, injection glycopyrrolate (8 μg/kg) was given intramuscularly. The baseline pulse oxymetry ($SpO_2$), heart rate (HR), and non-invasive blood pressure (BP) were recorded. After securing an intravenous (IV) line, ringer lactate was started. Injection midazolam (0.02 mg/kg i.v.) and injection fentanyl (1 μg/kg) were given i.v.

In this randomized study, we divided patients using computer-generated tables of random numbers into two groups containing thirty patients in each group. Two drops of oxymetazoline 0.05% nasal drops were instilled into each nostril, and nebulization, as well as blocks, were given by an independent anesthesiologist to ensure investigator blinding. Ultrasonic nebulizer (Omron nebulizer, Ne C 28 C 1, India) was used to provide nebulization with 4% lignocaine, 10 ml for 15 min in Group N (N = 30). Bilateral superior laryngeal nerve and recurrent laryngeal nerve blocks were performed using 2% lignocaine, 2 ml for each nerve block in Group B ($N$ = 30), with prior application of 2% lignocaine jelly, 1 ml to the nasal mucosa of each nostril, and 2% viscous lignocaine, 5 ml gargle once for approximately 2–3 min. When Group B patients had hoarseness of voice, and Group N patients had heaviness of tongue, airway anesthesia was considered adequate. Supplemental oxygen was provided through nasal prongs. A 5.9 mm sized FOB (Olympus BF Type PE2/TE2, Japan) guided nasotracheal intubation was performed by a senior anesthesiologist, who was blinded for the airway anesthesia technique and had experienced a minimum of 25 successful fiberoptic bronchoscopy-guided intubations. Supplemental LA was given using the „spray-as-you-go" technique with 2% lignocaine (1 ml aliquots) with 4 ml air in a 5 ml syringe through FOB. For nasotracheal intubation, the endotracheal tubes used were 8 mm internal diameter for males and 7 mm inner diameter for females. After confirmation of intubation with capnography and securing the airway, propofol 2 mg/kg i.v. and vecuronium 0.1 mg/kg i.v. were administered. Time for intubation (Time from the insertion of FOB to the connection of circuit with endotracheal tube) was recorded (Figure1). Intubation conditions, cough reflex, endoscopic vocal cord position (relaxed, moving,

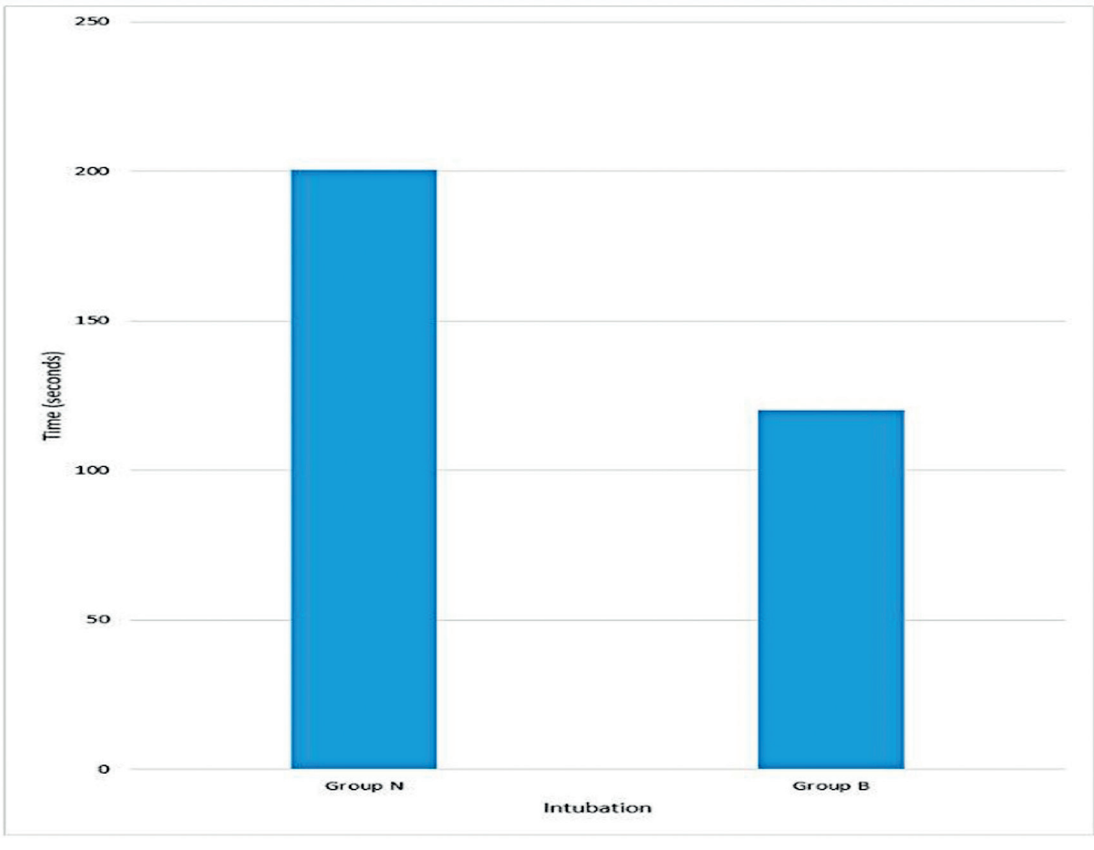


**Figure 1:** Mean intubation time in each group. Time for FOB guided nasotracheal intubation was shorter in Group B as compared to Group N (P < 0.001).

or adducted) were also recorded by the anesthesiologist performing the intubation with FOB guidance (Figure 2). Patient recall (experience during the process of FOB intubation - good /poor) was asked postoperatively and was also recorded by the same anesthesiologist who performed intubation. [Figure 2]. Vital signs at the time of intubation and 1 minute, 3 minutes, and 5 minutes after intubation were noted (Figure 3). Signs and symptoms related to lignocaine toxicity, such as ECG changes, seizures, and bronchoconstriction, were also regularly checked and recorded.

Based on the pilot study, the sample size calculation was 40 patients of both the groups to show a 40% difference in intubation time with 80% power and presuming a 95% confidence interval at type 1 error of 0.05. To allow for error and attrition, we selected a total of 60 patients. The statistical analysis was carried out using SPSS (version 20, IBM Corp., USA) software. The unpaired Student's *t*-test was used for continuous variables, expressed as mean ± standard deviation. Categorical variables, expressed as numbers, were analyzed using the Chi-square test with Yates's correction. $P < 0.05$ was considered statistically significant, $P < 0.001$ was considered highly significant, and $P > 0.05$ was regarded as insignificant.

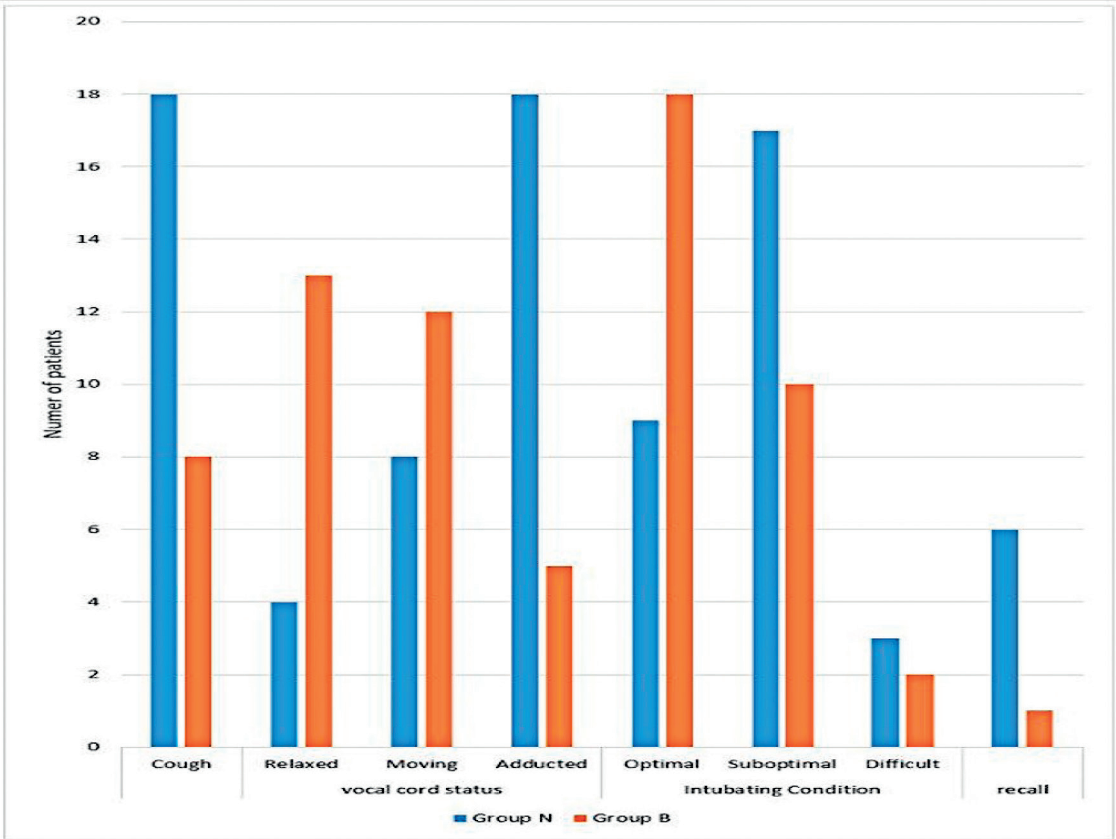


**Figure 2:** Comparison between the number of patients experiencing intubating condition and recall between Group N and Group B. Postoperative recall for unpleasant memories during intubation, did not differ. Better intubating conditions were noted in Group B ($P < 0.05$). Data are presented as number of patients.

## *Results*

Gradings for ease of intubation are mentioned in (Table 1). There was no significant difference between the groups concerning demographic variables and difficult airway grading *($P > 0.05$)* (Table 2). FOB-guided nasotracheal intubation needed a shorter time in Group B (120.3 ± 42.64 s) compared to Group N (220.4 ± 60.3 s), showing a highly significant difference. *($P < 0.001$)* (Figure 1).

Optimal intubating conditions were observed in eighteen patients in Group B compared to 9 patients in Group N ($P = 0.03$). For intubation, the vocal cord position was better in Group B than in Group N. In Group N, only four patients had completely relaxed vocal cords compared to thirteen

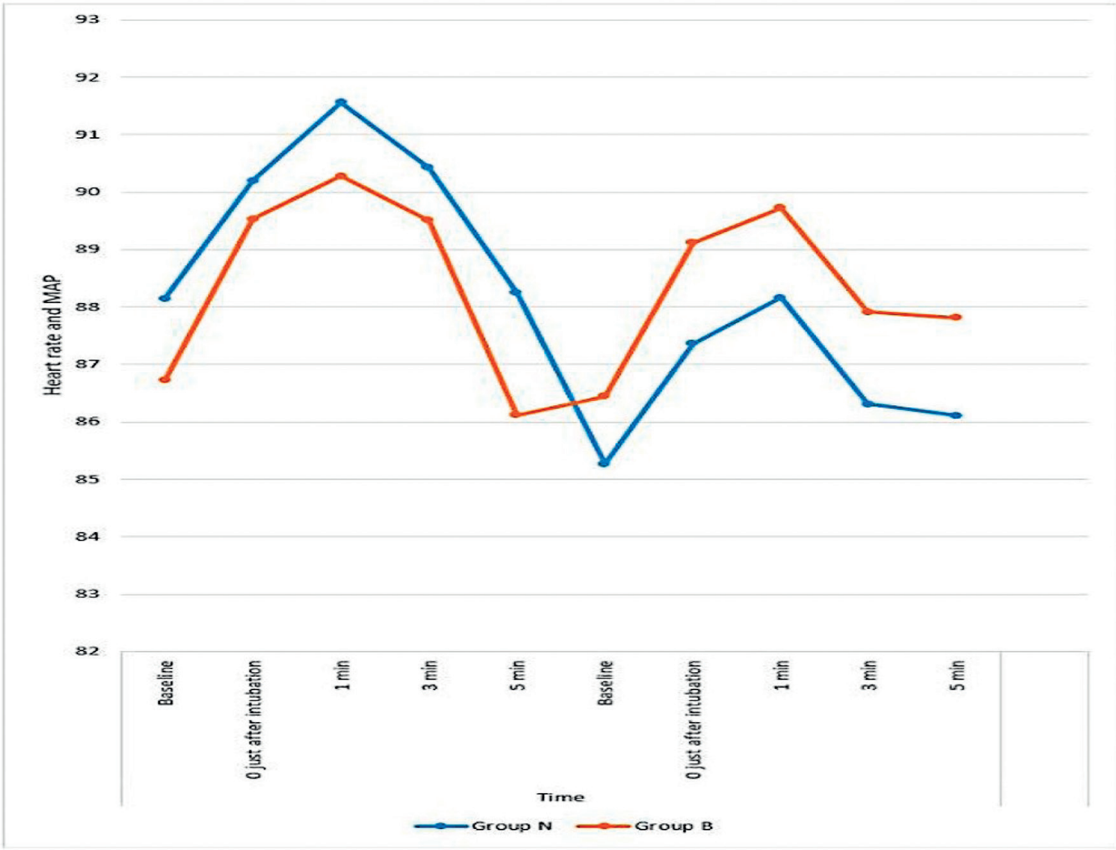


**Figure 3:** Comparison of Hemodynamic Between Group N and Group B. No significant difference was observed in both the groups. Data presented as mean (SD).

patients in Group B *(P = 0.021)*. Vocal cords were partially relaxed or moving in eight patients in Group N compared to twelve patients in Group B *(P = 0.411)*. Vocal cords were completely adducted in eighteen patients in Group N and only five patients in Group B *(P < 0.001);* However it was transient without affecting ease of intubation. It may be due to supplemental LA installation through the working channel of FOB. Patient comfort was assessed by coughing episodes during intubation. It was higher in Group B than in Group N *(P = 0.019)*. Postoperative recall for unpleasant memories during intubation was nonsignificant between the two groups *(P = 0.107)* [Figure 2].

However, with supplemental LA installation, intubation was successful in all patients. Supplemental LA Installation was 1.02 ± 0.91 ml in Group N and 0.5 ± 0.58 ml in Group B *(P = 0.63)*. The average dose of lignocaine used in our study was 6.4 mg/kg through nebulization using the face mask. Hemodynamic parameters were comparable between the groups during the study period (Figure 3). All the patients remained cooperative with the procedure, and there was no evidence of lignocaine toxicity.

## *Discussion*

Dr. Shigeto Ikeda invented the flexible fibrotic bronchoscope in 1966[8]; Dr. Peter Murphy performed the first FOB-guided endotracheal intubation using a choledoscope in 1967[9]. Adequate airway anesthesia ensures comfortability and acceptability of awake fiberoptic intubation for patients. A safe and straightforward method of endotracheal intubation under direct vision is awake intubation using flexible fiberoptic bronchoscope[6,16].

Nasotracheal intubation is indicated for intraoral, oropharyngeal, maxillofacial surgery and when the oral route of intubation is not possible due to trismus or reduced mouth opening to radiation therapy, and in patients with a history of previous head and neck surgery. Nasotracheal intubation has the distinct advantage of providing good accessibility for surgical maneuvers in operations of the mouth, pharynx, larynx, and neck[2,3,7].

Awake fiberoptic intubation requires anesthesia of the upper airway with topical application of local anesthetics, airway nerve blocks, and psychological assurance to suppress airway reflexes and

**Table 1:** Intubating Condition Grades

| **Grade** | **Description** |
|---|---|
| Optimal | No hold-up / collision of endotracheal tube with vocal cords |
| Suboptimal | Hold-up, relieved by one rotation of the endotracheal tube |
| Difficult | Hold-up, relieved by more than one rotation of the endotracheal tube or change of the patient's head or neck position |
| Failure | Failed attempt at Awake FOB* guided nasotracheal intubation |

*FOB: Fiberoptic bronchoscope

**Table 2:** Demographic Data and Airway Assessment by Study Group. Data are presented as mean (SD) or number. Demographic variables and difficult airway grading were comparable in both the groups.

| | Group N | Group B | P-value |
|---|---|---|---|
| Age (yr) | 42 (7) | 44 (6) | 0.96 |
| Sex (M/F) | 28/2 | 29/1 | 0.55 |
| Weight (kg) | 62.3 (10.2) | 64.1 (9.6) | 0.48 |
| ASA* Physical Status (1/2) | 20/10 | 19/11 | 0.78 |
| Modified Mallampatti Grade (3/4) | 3/27 | 5/25 | 0.70 |

*ASA: American Society of Anesthesiologists

make patients comfortable during bronchoscopy and intubation.[14] Awake tracheal intubations with FOB preserve spontaneous ventilation, and topical airway anesthesia alone maintains airway muscle tone and is specifically used for patients with potentially difficult airways[18].

Several techniques to provide airway anesthesia have been compared by different authors. Webb et al. compared the „spray-as-you-go" technique and transcricoid injection method using lignocaine for awake fiberoptic bronchoscopy[10]. Williams KA et al. used a combination of „spray-as-you-go" and nebulization technique for the airway topicalization and found favorable conditions for fibreoptic endoscopy and intubation[11]. Khandelwal et al. demonstrated the usefulness of combined lignocaine nebulization and airway blocks for awake fiber-optic intubation[14]. Comparison of nebulized Lignocaine and airway nerve block was done in sixty adult patients posted for surgical procedures under general anesthesia for awake fiberoptic nasotracheal intubation by Pooja et al. and concluded that airway nerve blocks provide superior-quality airway anesthesia with consideration of nebulization as an alternative airway anesthesia method when a nerve block is not possible[6].

Nebulization of lignocaine for airway anesthesia results in depositing small nebulized particles of lignocaine over the mucosa, producing anesthesia. Using this technique, multiple painful injections are avoided. In addition to this, less detailed knowledge of anatomy is required. It can be performed with less experience with fewer skills. It is also valuable for patients when their neck anatomy is distorted due to previous head and neck surgery and radiation therapy. In addition, it is helpful in patients with massive lesions of the neck where nerve blocks are challenging to perform. The use of the nebulization method is limited because of the late onset of action and the need for large doses of lignocaine as there is the possibility of wastage of drug during administration[4,5].

The most commonly used local anesthetic for airway anesthesia is lignocaine. The average dose of lignocaine used in our study was 6.4 mg/kg, which was lesser than the maximum recommended dose through nebulization using the face mask. Many previous studies have safely used such a dose of lignocaine and reported for FOB. Langmack *et al*. measured the serum lignocaine levels in 51 asthmatic volunteers undergoing FOB with topical lignocaine. The average 600 mg (8.2 mg/kg) of the total dose was observed to be safe in all patients, as noticed by serum lignocaine concentrations[12]. In the study by Reasoner et al., 20 mL of 4% lignocaine (815 ± 208 mg) was used for nebulization compared to 349 ± 44 mg of lignocaine for nerve blocks. With such high doses, however, measured plasma lignocaine concentration was below the toxic level 5 μg/mL and so did not find any systemic effects of lignocaine toxicity[19]. In 1997, Parkes *et al.* used 6 mg/kg of 10% lignocaine solution through a nebulization mask for fiberoptic intubation[13]. The highest serum lignocaine levels obtained were 0.45 mg/l. However, vigilant monitoring is required for signs and symptoms of lignocaine toxicity while using large doses.

The base of the tongue, posterior surface of the epiglottis, aryepiglottic folds, and arytenoids are anesthetized by blocking the superior laryngeal nerve bilaterally. It abolishes the glottis closure reflex. Anesthesia of the upper trachea and infraglottic larynx is provided by blocking recurrent laryngeal nerve using translaryngeal injection. It blocks the cough reflex. Airway nerve block helps provide early and deep anesthesia with less local anesthetic doses. The vigorous cough that follows the translaryngeal injection of LA spreads the local anesthetic onto the vocal cords from below. However, there are certain disadvantages while using nerve block, as it needs knowledge of airway anatomy, experience, and operator skill for correct technique. There are chances of nerve injury and intravascular injection during the procedure of airway nerve blocks, and it is not applicable in patients with distorted neck anatomy and local infection[5]. Antisialogogues such as glycopyrrolate provide a dry field with good visibility. There is less dilution of LA with airway secretions resulting in a better quality of topical anesthesia during flexible fibreoptic aided intubation. Oxymetazoline hydrochloride nasal drops (0.05%) as vasoconstrictor can be used for nasal decongestion.

Babita et al. recorded a mean intubation time of (123.0 ± 46.7 s) in the airway nerve block group compared to (200.4 ± 72.4 s) in the lignocaine nebulization group (P = 0.047)[15]. In our study, the time required for intubation was less in Group B than in Group N. Pooja et al. also observed findings for intubation time similar to our study[6]. In our study, Group B patients had superior intubating conditions compared to Group N. Similar findings were noticed in the two other studies[6,10]. However, Gupta et al. found that the difference in intubating conditions was nonsignificant. In our study, we did not observe intubation failure in any patient of the two groups[15].

Comparison of patient satisfaction was based on coughing severity and patient recall in both groups. The number of coughing episodes was higher in group N, but lignocaine installation through the working channel of FOB resulted in successful intubation in all patients. „Spray as you go" technique through the suction channel with a continuous flow of oxygen maintains oxygenation, resulting in clearance of secretions and deposition of local anesthetic onto the airway structures distal to the fibrescope[17]. In our study, patient recall, as suggested by good or poor experience during intubation, was recorded postoperatively. The endotracheal tube was in situ for 24 hours after surgery for all patients. The patient recall was recorded after extubation; satisfaction was higher in Group B than Group N. The reason may be the deposition of local anesthetic near nerves. While, during nebulization, lignocaine gets deposited at a distant place from the nerves, so a relatively greater amount of lignocaine is needed. Additionally, the amount of lignocaine deposited is unpredictable, resulting in patchy, less effective anesthesia. Our findings follow some other studies[6,15]. We used a low dose of midazolam and fentanyl during the procedure for sedation and analgesia, resulting in hemodynamic stability in our patients. Gupta et al. also found comparable hemodynamic parameters and sedation between both the groups while using fentanyl as a sedative agent[6].

In this study, all patients received supplemental oxygen through a nasal cannula, and we did not observe desaturation in any patient during intubation and fiberoptic bronchoscopy procedure. The lowest saturation found was 96% in group N. There were no side effects like bronchospasm, severe hypotension, bradycardia, or convulsion due to lignocaine toxicity in any patient. The limitation of our study is that we did not measure plasma lignocaine level because of the unavailability to measure it in our institute.

## *Conclusion*

Airway nerve blocks provide better airway anesthesia in terms of superior intubating conditions and patient satisfaction compared to nebulization for awake fiberoptic bronchoscopy aided nasal intubation. As complications related to lignocaine nebulization were not observed and all patients were intubated successfully, it can be considered a suitable airway topicalization method when nerve blocks cannot be performed due to distorted neck anatomy.

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