Original Article

Effect of 4% nebulized lignocaine versus 2% nebulized lignocaine for awake fibroscopic nasotracheal intubation in maxillofacial surgeries

ABSTRACT

Introduction: Securing a difficult airway during maxillofacial surgeries is a great challenge for anesthetists, and the flexible fiber-optic bronchoscope is the gold standard while managing such cases. While passing the flexible bronchoscope by the nasal route, the success rate is higher as compared with oral approach as the nasopharynx is in line with the larynx and prevents acute angulation in the oropharynx.

Materials and Methods: A randomized control trial was planned in 73 patients out of whom sixty patients gave consent for the procedure. The patients we randomly divided into two groups ($n = 30$) with application of 4% nebulized lignocaine in one group and the use of 2% nebulized lignocaine in the other group, and the patient's comfort was noted using five-point Puchner scale.

Results: The mean value of patient comfort Puchner scale of Group A was 1.30 ± 0.08 and of Group B was 2.23 ± 0.12. The mean value of Puchner scale of Group B was significantly higher (41.8%) as compared to Group A ($t = 6.208$; df = 51; $P < 0.0001$). The secondary outcome measures were optimal intubating conditions and hemodynamic changes during awake fiber-optic nasotracheal intubation. The procedural time of two groups when compared showed that the mean procedural time of Group A was shorter (29.67 ± 5.40 min) than the time consumed in Group B (34.93 ± 5.52 min).

Conclusion: Four percent nebulized lidocaine provided adequate airway anesthesia and optimal intubating conditions along with stable hemodynamics for awake fiber-optic intubation as compared to 2% nebulized lidocaine.

Keywords: Fiber-optic intubation, nebulized lignocaine, patient's comfort

INTRODUCTION

Direct laryngoscopy at times presents difficulty during intubation in conditions such as limited jaw movement, micrognathia, morbid obesity, cervical spine problems, and the inability to open mouth, for example, intermaxillary fixation, temporomandibular joint ankylosis and trauma, rheumatoid arthritis, contractures, deformity, and distorted airway anatomy. The difficult airway is defined as the clinical situation in which a conventionally trained anesthesiologist experiences difficulty with mask ventilation, difficulty with tracheal intubation, or both.[1] It is estimated that one-third of all anesthetic deaths are due to failure to intubate and ventilate; during routine anesthesia, the incidence of difficult tracheal intubation has been estimated at 3%–18%.[2] In cases of anticipated difficult intubations, the American Society of Anesthesiologists (ASA) and many European authors recommend awake fiber-optic intubation as during this procedure, an open airway and spontaneous breathing are maintained up to the point of securing the airway, and

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Received: 23 November 2017, **Revised:** 09 January 2018, **Accepted:** 26 December 2019, **Published:** 18 June 2020

Access this article online	
Website: www.njms.in	Quick Response Code
DOI: 10.4103/njms.NJMS_71_17	

How to cite this article: Kumar L, Abbas H, Kothari N, Kohli M, Dhasmana S. Effect of 4% nebulized lignocaine versus 2% nebulized lignocaine for awake fibroscopic nasotracheal intubation in maxillofacial surgeries. Natl J Maxillofac Surg 2020;11:40-5.

life-threatening "can't intubate, can't ventilate scenario" can be avoided while the patient is awake.[3]

The flexible fiber-optic bronchoscope is the gold standard of difficult airway management and is done both nasally and orally, out of which the nasal route is usually easier and has a higher success rate as compared with oral approach. The main advantage of nasal approach is a straight route to the larynx and trachea, and the endotracheal tube passes more easily. Awake intubation requires that patient remains calm and co-operative, and the airway reflexes are blunted so as to facilitate easy intubation. Therefore, it is necessary to provide sufficient anxiolysis, analgesia, and topical anesthesia for the airway without compromising the airway. In order to achieve this, airway has to be anesthetized using topical anesthetic agents in order to minimize patient's discomfort. A properly anesthetized airway would reduce the chances of airway trauma and secretions that may otherwise happen in inadequately prepared airway due to gagging, coughing, or movements of the patient during the process of intubation.[4]

Topical lignocaine (4%) is commonly used pharmacological agent for anesthetizing the cornea for cataract surgeries and is also used during fiber-optic bronchoscopy.[5,6] The present study is undertaken to compare the effectiveness of two different concentrations, 2% lignocaine and 4% lignocaine, in nebulized form for airway anesthesia during awake fiber-optic nasotracheal intubation in terms of patient's comfort and optimal intubating conditions, hemodynamic changes, and intubation time.

MATERIALS AND METHODS

After approval by the institutional ethics committee and written informed consent, patients of either sex, between 18 and 55 years of age belonging to ASA Class I–II, with anticipated difficult airway planned for elective surgery were included for this study. All patients were counseled about the nature of difficult airway and management to the minute details and educated regarding the procedure during the preoperative evaluation. Patients were randomly allocated into two groups (A and B) based on sealed envelope method [Figure 1]; patients and observers were blinded using prefilled syringes of lignocaine. Exclusion criteria were patients who refuse to give consent, who had a nasal mass bleeding disorder, known allergy to study medication, uncontrolled hypertension, pregnancy, ischemic heart disease, hepatic or renal disorders, and with a history of recent nasopharyngeal surgery were excluded from the study.

All patients were kept nil per oral for 8 h before the surgery. After shifting the patient to operation theater, standard monitoring (heart rate [HR], blood pressure, and oxygen saturation) was applied, and baseline hemodynamic variables

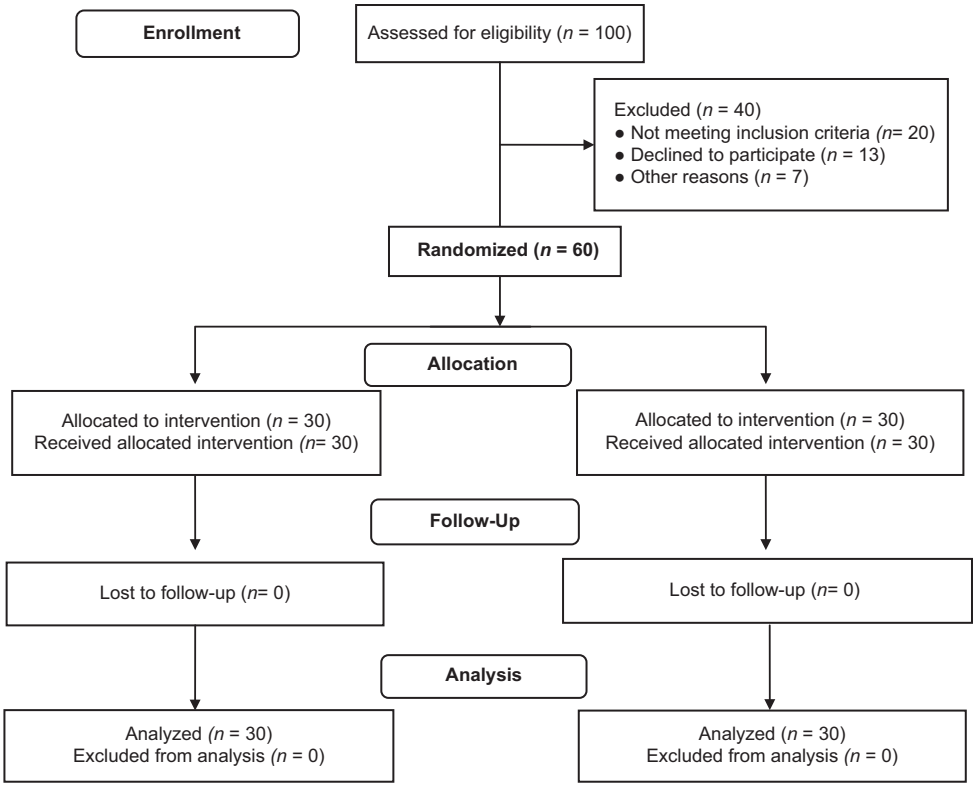

Figure 1: Consort statement as per 2010 guidelines

were recorded. Intravenous (i.v.) line was established, and lactated Ringer's solution started at 100 ml/h. Fifteen minutes before the procedure, all the patients were premedicated with injection (inj.) glycopyrrolate 0.2 mg i.v, inj. dexamethasone 4 mg i.v., and two drops of 0.1% xylometazoline through each nostril, for nasal decongestion.

One group of patients was nebulized with 10 ml of 4% lignocaine and another group with 10 ml of 2% lignocaine (present in prefilled syringes which were coded) through ultrasonic nebulizer for about 10 min, followed by inj. midazolam 0.05 mg/kg i. v and inj. fentanyl 1 mg/kg i.v just before the procedure. Superior laryngeal nerve block was given bilaterally, using 2 ml of 2% inj. lignocaine. With the patient lying in the 30° propped-up position, the fiber-optic bronchoscope was introduced through more patent nostril, and the other nostril was used for oxygen insufflation (3–4 L/min). After orientation and localization of the laryngo-epiglotic region, the fibrescope was introduced through the glottic opening entering the trachea visualizing the tracheal rings and the carina and then the endotracheal tube railroaded through the fiberscope into the trachea (flexometallic tube size 7.0–7.5 mm diameter in men, 6.5–7.0 mm diameter in women).

After successful passage of the tube through the vocal cords and after identification of the carina, the tube was secured and the cuff inflated. Propofol 1 mg/kg i.v. and injection vecuronium bromide 0.08 mg/kg were used to induce general anesthesia and establish mechanical ventilation.

The primary outcome measurements were noted and subjected to statistical analysis. Patient's comfort and tolerance to fiberscope was assessed by Puchner comfort scale [Table 1].

Statistical analysis

The observations in both the groups were compared using two tailed unpaired t-test. The values are represented as mean±SD. Groups were also compared by two factor general linear models, and the significance of mean difference within and between the groups was done by Tukey's *post hoc* test. Discrete (categorical) groups were compared by Chi-square (χ^2) test. A two-sided ($\alpha = 2$) $P < 0.05$ ($P < 0.05$) was considered statistically significant. All the analyses were performed on GraphPad Prism version 6.00 for Windows, GraphPad Software, La Jolla California USA.

Table 1: Puchner five-point fiber-optic intubation comfort scale

Patient's response	Score
No reaction	1
Slight grimacing	2
Heavy grimacing	3
Verbal objection	4
Defensive movements of head and hands	5

RESULTS

A total of 73 patients were enrolled in the study, out of which 13 patients refused for awake fibroscopic intubation, so these patients were excluded from the study [Figure 1]. Remaining sixty patients were randomized into two groups and were nebulized either with 4% lignocaine (Group A) or with 2% lignocaine (Group B). Patients in both the groups were comparable with the age ranging from 18 to 50 years in Group A and 18–52 years in Group B with mean (± standard deviation) 31.67 ± 10.41 years and 27.53 ± 9.30 years, respectively. In both the groups, the frequency (%) of males was higher than females with higher being in Group B (73.3%) than Group A (70.0%), and the χ^2 test revealed similar proportions of males and females in two groups ($\chi^2 = 0.08$, $P = 0.774$). Among the study group (Group A), four patients required additional sedation, compared to 11 patients in control group (Group B), and were given additional inj. fentanyl 1 mg/kg i.v.

The primary outcome measure was patient's comfort during awake fiber-optic nasotracheal intubation. The mean patient comfort Puchner scale score of Group A was 1.30 ± 0.08 and of Group B was 2.23 ± 0.12. The mean value of Puchner scale of Group B was significantly higher (41.8%) as compared to Group A [$t = 6.208$; $df = 51$; $P < 0.0001$; Figure 2]. The secondary outcome measures were optimal intubating conditions and hemodynamic changes during awake fiber-optic nasotracheal intubation. The procedural time of two groups when compared showed that the mean procedural time of Group A was 29.67 ± 5.40 min and in Group B, it was 34.93 ± 5.52 min. The mean procedural time of Group B was significantly higher (15.1%) as compared to Group A [$P < 0.001$; Figure 3]. The number of intubation attempts in Group A ranged from one to two and in Group B, it ranged from one to three attempts, but the mean number of intubations attempts did not differed between the two groups (1.07 ± 0.25 vs. 1.20 ± 0.48, $t = 1.34$; $P = 0.187$) though it was 11.1% higher in Group B as compared to Group A.

The pre and post nebulization HR in both the groups were similar, showing no adverse effect of increased concentration of lignocaine on HR. Further, the mean HR in Group A was 85.97 beats/min (50–99.00 beats/min), whereas in Group B was 101.90 beats/min, comparing the mean HR of two groups; unpaired "*t* test" revealed

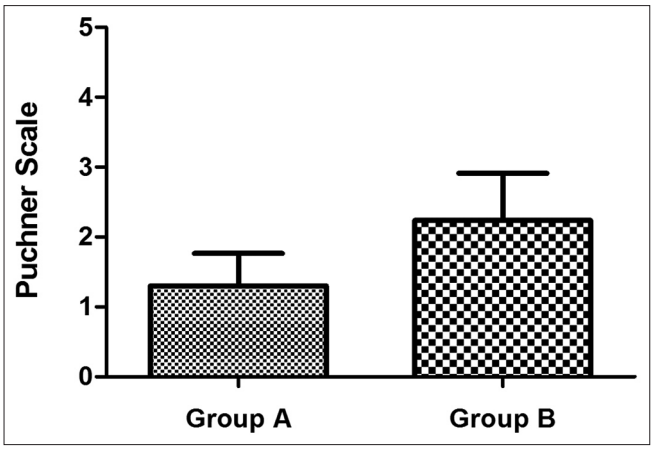

Figure 2: Five-point Puchner scale. Group A (4% lignocaine) having more patient comfort with mean value of score 1.30 ± 0.08, as compared to Group B (2% lignocaine) having a mean value of 2.23 ± 0.12 ($P < 0.001$)

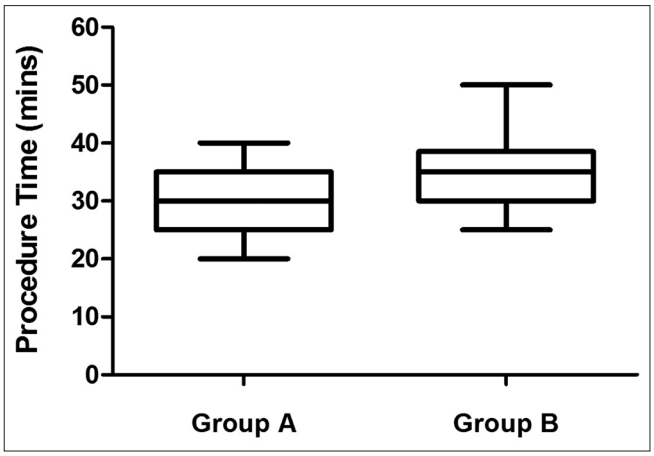

Figure 3: The mean procedural time to secure airway in Group A (4% lignocaine) was 29.67 ± 5.40 min and in Group B (2% lignocaine), it was 34.93 ± 5.52 min. The difference in mean time duration was statistically significant ($P < 0.001$)

insignificant effect of groups ($P = 0.549$). The mean arterial blood pressure (MAP) of the two groups remains almost similar during the procedure. The mean of MAP in Group A ranged from 85.47 mmHg (20 min) to 91.93 mmHg (35 min), whereas in Group B, it ranged from 84.10 mmHg (5 min) to 89.43 mmHg (30 min). Comparing the mean MAP of two groups over the periods together, unpaired *t*-test revealed insignificant effect of both the groups ($F = 0.96$, $P = 0.331$) and periods ($F = 0.90$, $P = 0.542$) on MAP. The additional sedation requirement of the two groups was also compared. The requirement (%) of sedation of Group B was significantly higher as compared to Group A (13.3% vs. 36.7%, $\chi^2 = 4.36$, $P = 0.037$).

DISCUSSION

While managing patients with difficult airway, the safest option for securing the airway would be awake intubation, preferably by flexible fiber-optic bronchoscopy which is the gold standard of difficult airway management under topical anesthesia. In our study, we compared the efficacy of 2% and 4% nebulized lignocaine for providing adequate airway anesthesia in sixty patients divided into two groups. The outcome measurements included patient comfort and optimal intubating conditions (Puchner Comfort scale), hemodynamic changes, procedural time, additional sedation requirements, and side effects or any complications.

Raval and Rashiduddin reported a case of submandibular abscess in which they performed awake fiber-optic intubation after topical anesthesia, using 4% lignocaine as injections through suction port for airway anesthesia.[7] The additional sedation was supplemented with i. v. remifentanil in a dose of 0.03 mcg/kg; they successfully intubated the patient using fiber-optic intubation. In our study, we also observed that 4% lignocaine is better than 2% lignocaine for airway anesthesia, though we used the nebulized form for awake fiber-optic intubation. Koirala *et al*. conducted a study on topical anesthesia of the vocal cords by nebulized lignocaine inhalation to facilitate fiber-optic nasotracheal intubation in a head-size parotid tumor patient.[8] They described a successful fiber-optic nasotracheal intubation in a 62-year-old female patient with difficult airway, nasal fiber-optic intubation was performed by maintaining spontaneous breathing under propofol infusion at a dose of 25 mcg/kg/h, and airway anesthesia was achieved using oxygen to nebulized 4% lignocaine from the side port of the fiber-optic bronchoscope. This study emphasized the possibility of fiber-optic intubation in a sedated yet spontaneously breathing patient by nebulized lignocaine which is similar to our study as we also used nebulized 4% lignocaine to achieve airway anesthesia but with ultrasonic nebulizer and performed awake fiber-optic intubation. Woodruff *et al*. conducted a study on awake fiber-optic intubation in the morbidly obese patients using 40 ml of atomized lidocaine for airway topical anesthesia and evaluated the two doses of lidocaine 1% and 2%, and they observed that patients who received lidocaine 1% had a longer mean procedural time than those receiving lidocaine 2% as compared to our study, the mean procedural time of 2% group was significantly higher than 4% group.[9] The hemodynamic responses to topicalization and airway manipulation were similar in both the groups which is true in our study also. A study by Andruszkiewicz *et al*. on awake fiber-optic intubation in three male patients with Mallampati scores 2, 3, and 4.[10] The topical anesthesia of the airway achieved with 4 mL of 2% lidocaine and administered from a nebulizer through a face mask. In addition, oral cavity and nose were sprayed with 10% lidocaine solution; the patients also received 2 mg

of midazolam i.v. and 0.05 and 0.1 ∝g/kg of fentanyl. Oxygen and additional doses of lidocaine were administered through the working channel of the scope. All the three patients were intubated successfully under topical anesthesia without any complications. Although in our study, we used only 10 ml of 2% lidocaine alone administered through ultrasonic nebulizer, most of the patients were intubated successfully under optimal conditions. Song *et al*. performed awake fiber-optic nasotracheal intubation in patients undergoing cervical spine surgery using remifentanil in combination with i.v. midazolam and topical lidocaine for surgery.[11] They observed that remifentanil in combination with midazolam and topical airway anesthesia with lidocaine provided conditions for smooth nasotracheal fiber-optic intubation under conscious sedation. Similarly, in our study, we used topical airway anesthesia with either 2% or 4% nebulized lidocaine in combination with i. v. midazolam, and fentanyl also provided optimal conditions for smooth nasotracheal fiber-optic intubation in most of the patients, though 4% lidocaine was better. Xue *et al*. compared 2% and 4% lidocaine by spray-as-you-go through the fiber-optic bronchoscope for airway topical anesthesia in patients with difficult airway similar to our study but by different technique.[12] Although both the groups exhibited acceptable intubating conditions, the total dosages of lidocaine were significantly smaller in 2% group than in 4% group. In our study, in both the groups which received 10 ml of nebulized lidocaine either 2% or 4% through an ultrasonic nebulizer provided acceptable intubating conditions, but 4% nebulized lidocaine provided better intubating conditions in terms of patient comfort and ease of intubation than 2% lidocaine. In a study conducted by Williams *et al*. to observe the complications of awake fiber-optic intubation without sedation under topical airway anesthesia which was achieved with 5 ml of 4% lidocaine through a nebulizer and through spray-as-you-go technique up to 9 mg/kg of lidocaine, and nostril topicalization with 2 ml 5% lidocaine containing 0.5% phenylephrine, complications included nasal bleeding, rigors, and lower respiratory tract infection.[13] They concluded that fiber-optic intubation under local anesthesia is associated with complications, notably those of infections, airway trauma, and side effects potentially attributable to lidocaine administration. In a case study by Saini *et al*. about anesthetic challenges in a patient with Ludwig's angina, they performed awake fiber-optic intubation under local anesthesia in a 19-year-old mentally challenged male patient with Ludwig's angina with restricted mouth opening posted for incision and drainage.[14] Two percent lignocaine, followed by 10% lignocaine spray in the oropharynx, provided adequate topical anesthesia of the airway for intubation, and they managed the case successfully. In our study, 2% lignocaine provided good topical anesthesia in most, but not all patients though we administered it through a nebulizer. Hawkyard *et al*. studied hypertensive response to laryngoscopy and endotracheal intubation using awake fiber-optic intubation.[15] They conducted a study in which blood pressure and pulse rate measurements were recorded in 35 patients who underwent endotracheal intubation during general anesthesia and in 35 patients who underwent awake fiber-optic intubation under local anesthesia. Results showed that the mean arterial pressure in Group A rose by a mean of 35 mmHg immediately after intubation, compared with a mean fall of 9 mmHg in Group B. The mean pulse rate in Group A increased by 24 beats per min (b.p.m.) immediately after intubation, compared with a rise of 3 b.p.m. in Group B. Both these differences were statistically significant ($P < 0.0001$ and $P < 0.001$, respectively). In our study, we compared efficacy of two concentrations of lidocaine for topical anesthesia during awake fiber-optic intubation. The mean pulse rate fell by 9 b. p. m. in Group A and 13 b. p. m in Group B from the baseline. This did not reach statistical significance, so inference from both the study is awake fiber-optic intubation successfully reduces the pressor response to endotracheal intubation.

CONCLUSION

Four percent nebulized lidocaine provided better patient's tolerance to awake fiber-optic intubation by establishing adequate airway anesthesia and stable patient's hemodynamics; however, large-scale trials are required to establish 4% lignocaine as a better topical anesthetic agent for awake fiber-optic intubation as compared to 2% lignocaine.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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