*Original Research Article*

Indian Journal of Anesthesia and Analgesia
2019; 6(2) (Part - II): 577-583
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.6219.32

# Awake Fiberoptic Intubation with Two Different Techniques of Local Anaesthetic Administration (Transtracheal Injection Versus Ultrasonic Nebulization) in Patients Undergoing Maxillofacial Surgery

**Karuna Sharma[1], Anil Kumar Bhiwal[2], Chintan Mukesh Kumar Patel[3]**

[1,2]Assistant Professor, [3]Junior Resident, Department of Anaesthesia, Geetanjali Medical College and Hospital, Udaipur, Rajasthan 313001, India.

**Abstract**

*Background and Aims:* Awake fiberoptic intubation (AFOI) is considered the gold standard for anticipated difficult intubation in maxillofacial surgery. Regional anaesthesia of the airway is essential for awake fiberoptic intubation. The aim of this study was to compare the efficacy of two different techniques of local anaesthetic administration namely; nebulization and transtracheal injection for AFOI. *Materials and Method:* This prospective randomised double blind study was conducted on 60 patients of age more than 18 years, ASA grade I-III undergoing maxillofacial surgery who had anticipated difficult intubation. Patients were divided into two group; Group T received transtracheal injection with 4 ml of 4% lignocaine and Group N received ultrasonic nebulization with 4 ml of 4% lignocaine before performing AFOI. All patients received procedural sedation with fentanyl and dexmedetomidine. Time taken to intubate the patient, ease of intubation assessed by cough severity score, patient comfort score, the quality assessment of the entire procedure with post-intubation patient satisfaction and hemodynamic changes were recorded and compared. The data were presented as mean ± SD, median and range. Statistical analysis was done by student t-test for quantitative variables and chi-square test for categorical variables. p value < 0.05 was considered statistically significant. *Result:* Time taken to intubate the patient was significantly less in Group T 131.27 ± 71.81 sec vs 220.97 ± 102.45 sec in Group N; (p=0.0002). Cough severity, patient comfort and quality of procedure with post-intubation patient satisfaction score were also significantly better in Group T (p=0.0023, 0.0018, 0.0001) while haemodynamic variables were comparable in both the groups. *Conclusion:* Transtracheal technique provided better quality of anaesthesia with shorter intubation time as compared to the nebulization technique for AFOI in patients undergoing maxillofacial surgery.

**Kewword:** Awake fiberoptic intubation (AFOI); Nebulization; Transtracheal injection; Local anaesthetic.

**How to cite this article:**

Karuna Sharma, Anil Kumar Bhiwal, Chintan Mukesh Kumar Patel. Awake Fiberoptic Intubation with Two Different Techniques of Local Anaesthetic Administration (Transtracheal Injection Versus Ultrasonic Nebulization) in Patients Undergoing Maxillofacial Surgery. Indian J Anesth Analg. 2019;6(2):577-583.

## Introduction

Patients with maxillofacial trauma present unique airway management challenges for anaesthesiologist. Intubation of patients with recent oral facial injuries may be difficult because of bone fractures, dislocated temporomandibular joints and blood in the oral cavity [1]. Assessment of airway by Mallampati scoring of these cases may be suboptimal due to limited mouth opening by pain,

**Corresponding Author: Anil Kumar Bhiwal**, Assistant Professor, Department of Anaesthesia, Geetanjali Medical College and Hospital, Udaipur, Rajasthan 313001, India.
**E-mail:** anilbhiwal@yahoo.co.in
**Received on** 05.02.2019, **Accepted on** 06.03.2019

or swelling. Difficulty in providing an air-tight seal with the face mask in patients with mid-face injury can results in air being forced into the facial soft tissue during positive pressure ventilation. Hence such patients are consider potentially difficult to ventilate and intubate [2].

Furthermore, surgeons often request for nasal intubation according to the type of maxillofacial surgery. Fiberoptic-assisted nasotracheal intubation is the best method to manage difficult airways because of airway pathology, anatomical variations, airway trauma, morbid obesity or unstable cervical spine [3].

AFOI is technically challenging even for the experienced anaesthesiologists and often uncomfortable for the patients so it is essential to calm the patients and anaesthetize the nose, oropharynx, larynx and trachea to suppress the gag, swallow and cough reflexes prior to AFOI. This can be achieved by various techniques including topical anaesthesia (with the mucosal application of local anaesthetic as spray, gargles, lozenges, soaked cotton pledgets and nebulization) or nerve blocks (superior laryngeal, glossopharyngeal, recurrent laryngeal nerve block) [4].

Airway nerve blocks provide rapid and deep anaesthesia and require a smaller dose of local anaesthetic drug. Nebulization with local anaesthetic drugs is another technique which is simple, painless, comfortable and avoid risk of inadvertent intravascular injection.

Ultrasonic nebulizer has been designed to deliver liquid drugs in the form of droplets with diameter of 3.5 μm to the airway and due to this fine mist of vaporized anaesthetic drug lower dose of lignocaine is required and hence the probability of toxicity due to over dose is avoided [5].

Sedation is used with these techniques to allay anxiety so that patient is more cooperative during procedure. Dexmedetomidine and fentanyl are most commonly used for sedation before AFOI [6]. This study was conducted to compare the efficacy of two anaesthesia techniques, nebulization versus transtracheal nerve block by local anaesthetic to achieve airway anaesthesia for AFOI. The primary objective was to compare the intubation time while the secondary objectives of this study were to comparing the ease of intubation process (cough severity), the degree of patient comfort, and quality of procedure along with post-intubation patient satisfaction.

## Material and Methods

After approval from Institutional Ethics and Scientific Committee this prospective randomised double blinded study was conducted on 60 patients (male and female), aged ≥18 years with American Society of Anaesthesiologists (ASA) physical status grade I-III and anticipated difficult airway undergoing maxillofacial surgery under general anaesthesia. Patients with coagulopathy and those on anticoagulants or antiplatelet agents, mental disability or forms of delirium, allergy to local anaesthetics and contraindication to the performance of transtracheal injection (thyroid swelling, local infection, or laryngeal disorder) were excluded from the study.

The patients were randomly allocated into two groups by computer-generated random sequence series. Group T (n=30) received transtracheal injection of 4 ml of 4% lignocaine and Group N (n=30) received 4 ml of 4% lignocaine by ultrasonic nebulizer.

All patients underwent a pre-anaesthetic evaluation including airway (mouth opening, mallampati classification, thyromental distance, temporomandibular joint and neck mobility) by experienced anaesthesiologists. Patients were explained about the AFOI procedure and the informed consent was obtained.

### *Anaesthesia protocols*

After fasting for 6 h or more, the selected patients were first taken to the anaesthesia procedure room and baseline parameters such as heart rate, non- invasive blood pressure, oxygen saturation and electrocardiographic data were recorded. An intravenous line (IV) line was secured and ringer lactate was started. All patients received glycopyrrolate 0.2 mg and ondensetron 4 mg intravenously 15 min pre-operatively. Patients received fentanyl 1–2 μg/kg IV in incremental doses and dexmedetomidine 1 μg/kg IV over 10 min to obtain a Ramsay sedation scale of 2 for procedural sedation (1. Anxious, agitated or restless, 2. Cooerative, oriented and tranquil, 3. Responds to command only, 4-.Brisk response to light glabellar tap or loud auditory stimulus, 5. Sluggish response to light glabellar tap or loud auditory stimulus, 6. No response to light glabellar tap or loud auditory stimulus). Patients in Group T received transtracheal injection of 4 ml of 4% lignocaine with 24 G needle whereas patients of Group N nebulized with 4 ml of 4% lignocaine by anaesthesiologist who was not involved in study. Patients were asked to take full vital capacity breaths to anaesthetize the pharynx, glottis and subglottic structures. Adequate local anaesthesia was confirmed by the heaviness of the tongue in group N and by hoarseness of voice in group T and patient were shifted to the operative room.

Supplemental oxygen was given by nasal prongs and nasal xylometazoline drops were instilled in both the nostril. After applying of 1 ml of 2% lignocaine jelly in nasal mucosa fiberoptic bronchoscopy (Olympus BF Type TE 2, Olympus Medical System Corp, Tokyo, Japan) guided nasal intubation was performed with flexometallic endotracheal tube with an internal diameter of 7.0 mm for female and 7.5 mm for male. After conformation of intubation by capnography, general anaesthesia was induced using propofol (2 to 3 mg/kg) and atracurium (0.5 mg/kg) immediately after successful intubation and anaesthesia was maintained by administering sevoflurane.

*Data collection*

The time for intubation was calculated as the time taken from the beginning of the bronchoscopy from the nostril to the confirmation of the tube in the trachea by end-tidal capnography. Ease of intubation process which was assessed using cough severity, comfort during intubation, the quality assessment of the entire procedure with post-intubation patient satisfaction were recorded by another anaesthesiologist who was blinded to the group assignment (Table 1). The heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) and oxygen saturation were recorded initially as the baseline values, after giving sedation, after intubation, 1 min and 5 min after intubation.

*Sample size:* Sample size was calculated by assuming α error 5% and power of study 90% and effect size 0.70 for time required for intubation based on previous study, total 60 patients were taken for study.

*Statistical analysis*

Data were collected, tabulated and analyzed by using SPSS 20.0 version. The results were presented as means ± standard deviation (SD), median and range. The quantitative variables were analyzed by using Student's t – test while the categorical variables were analyzed by using Chi-Square test. p value < 0.05 was considered statistically significant.

**Results**

There was no significant difference in demographic data regarding age, weight, height, sex, ASA physical status between two groups (Table 2).

AFOI was successful in all patient in both the group and the procedure was not abandoned due to discomfort in any patient. The intubation time was significantly less in group T (131.27 ± 71.81 sec) than group N (220.97 ± 102.45 sec) (p=0.0002) (Table 2).

There was no statistically significant difference between two groups for HR and MAP at base line, after sedation, after intubation, 1 min and 5 min after intubation.

The group N had higher cough score as compared to group T (p=0.0023). Twenty five patients had cough in group N, while in group T only 12 patients had cough (Fig. 1).

Patient comfort during intubation was better in group T as compared to group N (p=0.0018). Twenty patients had grimacing (Grade-2) and three patients had verbal objection (Grade-3) in group N while only ten patients had grimacing and none patient had verbal objection in group T (Fig. 2).

The quality of procedure and post-intubation patient satisfaction was better in group T as compared to group N (p=0.0001). The procedure was found to be excellent with patients comfortable (Grade-1) in twenty five patients, good with still

**Table 1:** Grading system used to asses cough severity, patient comfort and quality assessment of procedure with post-intubation patient satisfaction.

| Grade | Cough severity | Comfort during intubation | Quality assessment of procedure after intubation |
|---|---|---|---|
| 1 | No cough | No reaction | excellent, patient comfortable |
| 2 | Cough ≤2 | Grimacing | good; patient still comfortable |
| 3 | Cough >2, for less than 1 min | Verbal objection | moderate, patient occasionally uncomfortable; |
| 4 | Persistent cough | Defensive movement | poor, patient uncomfortable |

comfortable (Grade-2) in four patients and moderate with occasionally uncomfortable (Grade-3) in one patient in group T while ten patients had excellent, twenty patient had good, and six patients had moderate in group N. The poor quality of procedure (Grade-4) was not found in any group and none patient in any group was found uncomfortable who required immediate general anaesthesia (Fig. 3).

## Discussion

Awake fiberoptic intubation was first described by Dr. Peter Murphy in 1967 in patients with difficult airway and regional anaesthesia for the airway made intubation comfortable and acceptable for patients [7].

**Table 2:** Comparison of demographic data and intubation time between two groups. Data are presented as mean ± SD

| | Group T | Group N | p-Value |
|---|---|---|---|
| Age (year) | 32.57 ± 12.68 | 31.90 ± 14.31 | 0.573 |
| Weight (kg) | 62.60 ± 6.23 | 60.53 ± 5.46 | 0.917 |
| Sex M/F | 28/2 | 27/3 | 0.640 |
| Height (cm) | 166.77 ± 6.77 | 167.43 ± 4.46 | 0.329 |
| ASA grade I/II/III | 18/10/2 | 16/11/3 | 0.833 |
| Intubation time (sec) | 131.27 ± 71.81 | 220.97 ± 102.45 | 0.0002 |

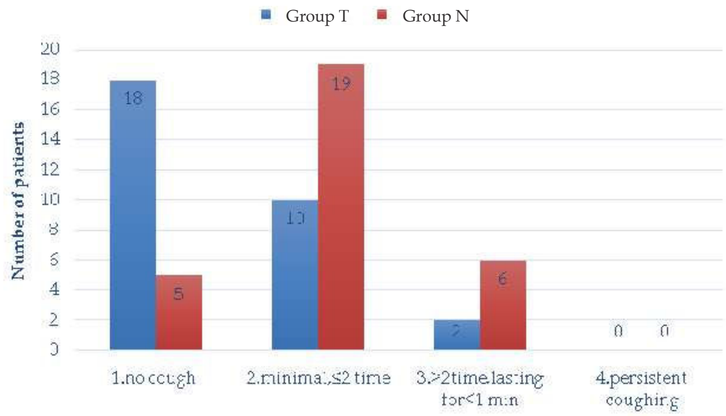


**Fig. 1:** Comparison of cough severity score between two groups. Data are presented as the number of patients. (p= 0.0023)

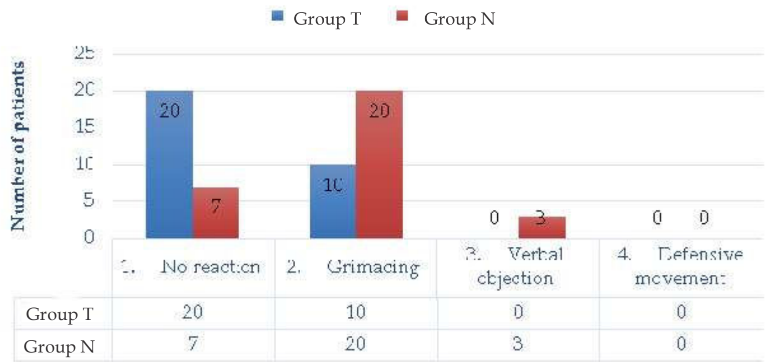


**Fig. 2:** Comparison of comfort score during intubation between two groups. Data are presented as the number of patients. (p=0.0018)

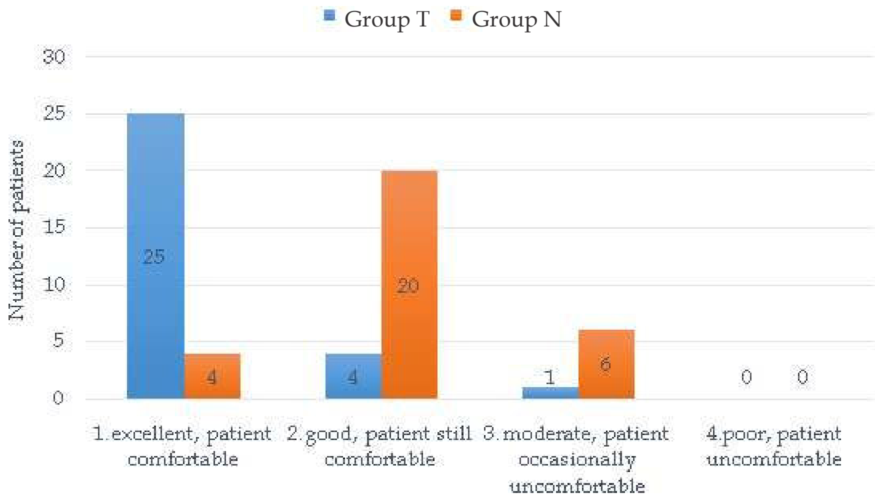


**Fig. 3:** Comparison of quality of procedure and post-intubation patient satisfaction score between two groups. Data are presented as the number of patients. (p=0.0001)

Various techniques are used for regional anaesthesia to facilitate AFOI including topical anaesthesia with nebulization by local anaesthetic, gargles, lozenges, spray-as-you-go technique and nerve blocks. Webb et al. [8] in 1990 compared trans-cricoid lignocaine injection with use of spray-as-you-go technique for awake fiberoptic bronchoscopy in 70 adults patients. Kundra et al. [9] in 2000 compared nebulized 4 ml of 4% lignocaine with combined regional nerve block for AFOI in 48 patients. Cullen et al. [10] found that lignocaine nebulization decreased the discomfort of nasopharyngeal instrument like nasogastric tube insertion. Technivate et al. [11] in 2007 found that 2% lignocaine nebulization and topical application to the nose provide adequate airway anaesthesia for fiberopticnasotracheal intubation. lignocaine 2% and 4% both are shown to have similar efficiency for transtracheal injection [3,12].

Airway nerve blocks technique for AFOI are considered a gold standard which include: glossopharyngeal nerve block, which anaesthetize the oropharynx and block the gag reflex; bilateral laryngeal nerve block, which anaesthetize the larynx above the level of vocal cord and block glottic closure reflux and transtracheal nerve block, which anaesthetize the larynx below the level of the vocal cord, trachea and block the cough reflex. Nerve block techniques provides rapid and deep anaesthesia with only small dose of local anaesthetic drugs. The procedure also involves a risk of accidental intravascular injection, nerve injury and tracheal or laryngeal bleeding. It also required a thorough knowledge of regional anatomy, operator skills and experience but not feasible when there is distorted anatomy, such as massive neck swelling, limited mouth opening and local infection [13].

Nebulization by local anaesthetic drugs is an alternative technique that deposits fine droplets of local anaesthetic directly over the mucosa, thus anaesthetizing the airway and avoid the need of multiple painful injections so patient acceptability is better with nebulization. It also has some disadvantage including the requirement of large dose of LA, a higher chance of failure and a delayed onset of action.

This study was planned to compare the efficacy of transtracheal injection and nebulization by lignocaine for AFOI in patient with difficult intubation undergoing maxiollofacial surgery. Glossopharyngeal and superior laryngeal nerve blocks were not possible in our study due to limited mouth opening and edema so we used only transtracheal injection with 4 ml of 4% lignocaine in group T and ultrasonic nebulization with 4 ml of 4% lignocaine in group N.

The intubation time in our study was significantly less in group T (131.27 ± 71.81 sec) as compared to group N (220.97 ± 102.45 sec) (p=0.0002) which was similar to finding of Gupta et al. [14] in 2014 who found the intubation time 123 ± 46.7 sec in nerve block group and 200.4 ± 72.4 sec in nebulization group (p=0.047). SmilarlyMathur et al. [15] in 2018 also found that intubation time was significantly less in nerve block group than nebulization group (p=0.029). Vasu et al. [16] in 2017 also found significantly less intubation time in transtracheal group (48.5 ± 38.6 sec) as compared to nebulization group (80.8 ± 36.3) (p=0.019) but intubation time was less in both the groups as compared to our study. Malcharek et al. [17] in 2015 also found similar result but time taken was more than our study because they also included the time taken for administration of topical anaesthesia. However, Reasoner et al. [18] in 1995 and Kundra et al. [9] in 2000 found no significant difference in intubation time between nerve block group and topical anaesthesia group.

The cough reflex during AFOI was found in 25 patient and severity was high in group N as compared to group T in which only 12 patients had cough reflex and severity was also less (p=0.0023). Regional block was considered adequate if no event of cough or gag reflex (score of 1) occur during the AFOI. Most of the patients in both the groups in our study scored 1-3 and no one in either group required rescue measures. The similar result were found by Gupta et al. [14] who also observed significant coughing in nebulization group compared to nerve block group (p=0.009). Mathur et al. [15] and Vasu et al. [16] also found cough severity high in nebulization group compared to nerve block group. However Malcharek et al. [17] did not found any significant difference in cough severity (p=0.098).

Patient comfort during intubation in our study was better in group T as compared to group N (p=0.0018). Twenty patients had no reaction and only ten patient had grimacing in group T while twenty patients had grimacing reaction and three patients had verbal objection in group N. Similarly Gupta et al. [14], Mathur et al. [15] and Kundra et al. [9] also found better comfort in nerve block group compared to nebulization group. This can be attributed to the deposition of local anaesthetic drug in the vicinity of the nerves in nerve block group while during nebulization the local anaesthetic is deposited over the mucosa and unpredictable deposition amounts due to wastage can lead to patchy, less effective anaesthesia.

The quality of procedure and patient satisfaction after intubation was better in group T as compared to group N (p=0.0001). The procedure was excellent in twenty five patients in group T while in four patients in group N. Similar results were found by Gputa et al. [14], Mathur et al. [15] and Vasu et al. [16] while Reasoner et al. [18] did not found any difference in the quality of airway anaesthesia between nebulized and nerve block groups.

Haemodynamic parameters like HR, MAP, $SpO_2$ were stable and no significant difference was found between two groups at different time intervals. Although we observed reduction in MAP and HR after sedation as compared to base line in both the groups which was normalized after intubation and no patient required any pharmacological intervention. There was no sympathetic stimulation during intubation in our study due to use of dexmedetomidine (1 μg/kg over 10 min) infusion and fentanyl intravenously before the procedure in both groups which were effective in producing good sedation (Ramsay sedation score of 2) and analgesia without marked alteration of the haemodynamic parameters and also preserved respiration thus preventing desaturation and hypoxia. Similarly Reasoner et al. [18] and Gupta et al. [14] also found no significant difference in haemodynamic parameter between two groups however Gupta et al. found increased MAP and HR during intubation. Vasu et al. [16] also found that similar haemodynamic changes occurred during intubation compared to baseline levels in both the groups as they used fentanyl 1-2 μg/kg for sedation. Kundra et al. [9] reported a progressive increase in HR and high MAP in nebulization group which was different from our study.

The difference in results of our study and other studies might be due to specific population, sample size, study design, local anaesthetic technique (dose, concentration and methods), preoperative sedation (midazolam, dexmedetomidine, fentanyl) and anaesthesiologist experience.

The total dose of lignocaine used in our study was 170 mg in both groups which was far less than maximum recommended dose for AFOI. World federation of societies of anaesthesiologists recommended a dose of maximum 9 mg/kg of lignocaine for topical anaesthesia in adults [19]. Parks et al. [20] used 6 mg/kg of 10% lignocaine solution through nebulization mask for fiberoptic intubation and highest serum lignocaine levels was found 0.45 mg/l which was below the accepted threshold of 5 mg/l. Wu et al. [21] reported seizures in a patient after administration of a total dose of 300 mg topical lignocaine during AFOI.

The limitation of our study was that we could not measure the plasma lignocaine levels due to the non-availability of this facility at our institution however we did not observe any LA related toxicity in any patients. We also did not recorded patients satisfaction scores postoperatively and after 24h.

## Conclusion

This study concluded that transtracheal injection by local anaesthetic is superior to lignocaine nebulization for awake fiberoptic intubation in term of intubation time, cough severity, patient comfort during intubation, quality of procedure and post-intubation patient satisfaction. However lignocaine nebulization with conscious sedation may be used as an alternative technique when nerve block technique is not feasible because we did not observe any case of failure and complication in nebulization group.

More studies are required to determine the optimum amount of lignocaine used for nebulization with serum lignocaine levels, use of ultrasound guidance with difficult or vague anatomical landmark, the ideal technique for airway anaesthesia without pain and invasion.

**References**


1. Kellman RM, Losquadro WD. Comprehensive airway management of patients with maxillofacial trauma. Craniomaxillofac Trauma Reconstr. 2008;1:39-47.
2. Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiberger D, et al. A clinical sign to predict difficult tracheal intubation: A prospective study. Can Anaesth Soc J. 1985;32:429-34.
3. Artime CA, Sanchez A. Preparation of the patient for awake intubation. In: Benumof JL, Hagberg CA, editors. Benumof and Hagberg's Airway Management. Philadelphia, PA: Elsevier/Saunders; 2013.p.243-64.
4. Simmons ST, Schleich AR. Airway regional anesthesia for awake fiberoptic intubation. Reg Anesth Pain Med. 2002;27:180-92.
5. British Thoracic Society Bronchoscopy Guidelines Committee, a Subcommittee of Standards of Care Committee of British Thoracic Society. British Thoracic Society guidelines on diagnostic flexible bronchoscopy. Thorax. 2001;56 Suppl 1:I1-2.
6. Dhasmana SC. Nasotracheal fiberoptic intubation: patient comfort, intubating conditions and hemodynamic stability during conscious sedation with different doses of dexmedetomidine. J Maxillofac Oral Surg. 2014;13:53-8.
7. Murphy P. A fibre-optic endoscope used for nasal intubation. Anaesthesia. 1967;22:489-91.
8. Webb AR, Fernando SS, Dalton HR, Arrowsmith JE, Woodhead MA, Cummin AR. Local anaesthesia for fibreoptic bronchoscopy: transcricoid injection or the "spray as you go" technique? Thorax. 1990;45:474-7.
9. Kundra P, Kutralam S, Ravishankar M. Local anaesthesia for awake fibreoptic nasotracheal intubation. Acta Anaesthesiol Scand. 2000;44:511-6.
10. Cullen L, Taylor D, Taylor S, Chu K. Nebulized lidocaine decreases the discomfort of nasogastric tube insertion: Arandomized, double-blind trial. Ann Emerg Med. 2004;44:131-7.
11. Techanivate A, Leelanukrom R, Prapongsena P, Terachinda D. Effectiveness of mouthpiece nebulization and nasal swab stick packing for topical anesthesia in awake fiberoptic nasotracheal intubation. J Med Assoc Thai. 2007;90:2063-71.
12. Ramkumar V. Preparation of the patient and the airway for awake intubation. Indian J Anaesth. 2011;55:442-7.
13. Sethi N, Tarneja VK, Madhusudanan TP, Shouche S. Local anaesthesia forfiberoptic intubation: a comparison of three techniques. Med J ArmedForces India. 2005;61:22–25.
14. Gupta B, Kohli S, Farooque K, Jalwal G, Gupta D, Sinha S, et al. Topical airway anesthesia for awake fiberoptic intubation: comparison between airway nerve blocks and nebulized lignocaine by ultrasonic nebulizer. Saudi J Anaesth. 2014;8(Suppl 1):S15-9.
15. Mathur PR, Jain N, Kumar A, Thada B, Mathur V, Garg D. Comparison between lignocaine nebulization and airway nerve block for awake fiberoptic bronchoscopy-guided nasotracheal intubation: a single-blind randomized prospective study. Korean J Anesthesiol. 2018;71(2):120-126.
16. Vasu BK, Rajan S, Paul J, Kumar L. Efficacy of atomised local anaesthetic versus transtracheal topical anaesthesia for awake fibreoptic intubation. Indian J Anaesth. 2017;61:661-6.
17. Malcharek MJ, Bartz M, Rogos B, Gunther L, Sablotzki A, Gille J, Schneider G. Comparison of Enk Fibreoptic Atomizer with translaryngeal injection for topical anaesthesia for awake fibreoptic intubation in patients at risk of secondary cervical injury. Eur J Anaesthesiol. 2015;32:615–623.
18. Reasoner DK, Warner DS, Todd MM, Hunt SW, Kirchner J. A comparison of anesthetic techniques for awake intubation in neurosurgical patients. J Neurosurg Anesthesiol. 1995;7:94-9.
19. Kritzinger S, Greunen VM. Awake Fiberoptic Intubation: The Basics Anaesthesia Tutorial of the Week 201. Wakefield, UK: World Federation of Societies of Anaesthesiologists; 2010.
20. Parkes SB, Butler CS, Muller R. Plasma lignocaine concentration following nebulization for awake intubation. Anaesth Intensive Care. 1997;25:369-71.
21. Wu FL, Razzaghi A, Souney PF. Seizure after lidocaine for bronchoscopy: Case report and review of the use of lidocaine in airway anesthesia. Pharmacotherapy. 1993;13:72-8.