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Airway Anaesthesia for Awake Fibreoptic Intubation-A Comparision between Transtracheal Lignocaine Instillation versus Nebulised Lignocaine

Dr Amrapali Sen[1], Dr Archana Roy[2], Dr Manabendra Sarkar[3]
[1]Senior Resident, [2]Assistant Professor,[3]Professor,
Department of Anaesthesiology, Nilratan Sircar Medical College and Hospital, Kolkata

***Corresponding Author:**
Dr Archana Roy
Assistant Professor, Department of Anaesthesiology, Nilratan Sircar Medical College and Hospital, Kolkata

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Abstract

Background and Aims

Since its inception in 1966, flexible fibreoptic bronchoscopy has become the mainstay for establishment of a secure airway conduit in patients with anticipated as well as unforeseeable difficult airways. This prospective randomized study compares efficacy of two modes of topical airway anaesthesia- transtracheal lignocaine instillation versus nebulised lignocaine delivered via inhalation.

Materials and Methods

Fifty adult patients of either sex, belonging to ASA I-II with anticipated difficult airway (Mallampati score 3 and 4) were randomly allocated into two groups. Patients in Group T received 4 ml of 4% lignocaine transtracheally along with 10% lignocaine spray into each nostril and oropharynx whereas Group N was nebulised with 7 ml of 4% lignocaine. Nasotracheal awake fibreoptic intubation was then performed. Heart Rate, Systolic Blood Pressure, Diastolic Blood Pressure, Mean Arterial Pressure and SPO_2 were recorded prior to, during intubation and then at 1 min, 3 minutes, 5 minutes after intubation. Patient comfort score, cough and gag score and total time taken for intubation were also recorded for each patient.

Results

The total time consumed for intubation in Group T (72±7.70 sec) was remarkably lesser than that recorded for Group N (84±10.66 sec). Moreover, patients in Group T had fewer cough and gag episodes than in Group N thereby contributing to greater patient comfort.

Conclusion

Transtracheal instillation of lignocaine result in better quality of airway anaesthesia as evidenced from patient comfort score, cough and gag score and total time taken to complete intubation procedure.

Keywords: fibreoptic bronchoscopy, awake intubation, transtracheal, nebulisation

INTRODUCTION

In 1854, a vocal pedagogist, Manuel Garcia decided to look at the “voice box” of his pupils with the help of a dental mirror leading to his invention of the first laryngoscope [1]. Thereafter bronchoscopy has traversed a long and often arduous path around the globe to Dr. Shigeto Ikeda who in collaboration with the Machido Inc., Japan gifted the world its first flexible fibreoptic bronchoscope in 1966 [2]. Since then, flexible fibreoptic bronchoscopy has become the mainstay for establishment of a secure airway conduit in patients with difficult airways.

For a successful fibreoptic bronchoscopy, optimal airway anaesthesia is of utmost importance. Transtracheal instillation,“spray-as-you-go”, nebulisation or atomization of airway and complex nerve blocks with 1-5% Lignocaine are employed for awake fiber optic intubation(AFOI) [3,4]. The feasibility and patient compliance of any one method over the other is yet to be decided.

This study aimed to compare the efficacy of two modes of topical airway anaesthesia: Transtracheal instillation of 4% lignocaine through cricothyroid membrane versus 4% nebulised lignocaine delivered via a nebulizer for AFOI.

METHODOLOGY

After obtaining permission from our Institutional Ethics Committee and informed patient consent, fifty adult patients of either sex, ASA physical status I and II having Mallampati score III or IV scheduled for any operation under general anaesthesia were selected for the present randomized prospective single blinded comparative study.

The selected patients were randomly allocated into one of two groups, Group N or T using a sealed envelope technique. Patients having Mallampati Grade I and II, ASA physical status 3 or more, with known history of allergy to drugs under study, on anticoagulants, having sepsis or local site infection, any cardio-respiratory problems, with hepato-renal disorders and drug abusers were excluded from the study.

On the day of operation, each of the selected patients received glycopyrrolate 0.2 mg and ondansetron 4 mg IV along with two drops of 0.1% xylometazoline nasal drops into each nostril 15 min before the start of the procedure. The patients were premedicated with fentanyl 2 ug/kg and midazolam 0.05 mg/kg to achieve an oriented, calm patient (Modified Ramsay Sedation Score of 2). (Figure 1).

The baseline hemodynamic parameters namely heart rate (HR), Systolic Blood Pressure (SBP), Diastolic blood pressure (DBP), Mean Arterial Pressure (MAP) and SPO_2 were recorded for every patient.

The patients in Group N were nebulised with 7 ml of 4% lignocaine for 15 min via the Rossmax^{TM} NA 100 Nebuliser with particle size 2.4u. The flexible fibreoptic bronchoscope carrying a suitable sized cuffed endotracheal tube was then advanced through the more patent nostril while the other nostril was used to deliver oxygen at 2-3 L/min through a single pronged nasal cannula. Once the vocal cords were visualized, the scope was advanced through the glottic opening, past the tracheal rings to the carina, where upon the endotracheal tube was railroaded over the scope into the trachea.

On the other hand, after achieving required level of sedation, patients in Group T were given 10% Lignocaine spray through the nostril (1 puff through each nostril, 10 mg per puff) to reach nasopharynx and one puff each on either side of oropharynx near the faucial pillars with the help of an applicator. Stabilizing the trachea at the level of the thyroid cartilage with one hand, a 22 gauge needle attached to a syringe containing 4ml of 4% lignocaine was inserted perpendicular to skin through the cricothyroid membrane with continuous aspiration. The drug was rapidly instilled inside the trachea as soon as air bubbles appeared inside syringe. This resulted in a bout of cough which helped to spread the drug over a considerable length of the tracheal tube and blocked the recurrent laryngeal nerve.

Flexible fibreoptic bronchoscopy was then performed 3 min after instillation of drug.

The procedure of airway anaesthesia was performed in a separate room and the patient was then shifted to the operation theatre where an experienced anaesthesiologist, who was blinded about the type of topical anaesthesia technique applied, carried out the AFOI.

Successful placement of the tube in the trachea was ascertained by capnography tracing and bilaterally equal vestibular breath sounds on auscultation. General anaesthesia was then induced.

Hemodynamic parameters namely heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and SPO_2 were recorded at pre-intubation, during the AFOI and then at 1min, 3min, 5 min post intubation for every patient by an independent observer not involved in the study. Cough and Gag score and Patient comfort score (Figure 2) during the procedure were also recorded by the same observer [5].

The total time taken for intubation in each patient calculated from the introduction of scope through the nostril to the confirmed placement of tube inside the trachea by capnograph was also noted.

RESULTS

Out of 60 patients were taken from our Pre-anaesthetic clinic for the present study, 50 patients were shortlisted and randomly allocated into two groups. So, data from 25 patients in each group was analysed. Calculated sample size was 23.5 for each group.

All data were analysed using MS-Excel spreadsheet and SPSS software version 25.0. Groups were compared using Unpaired 't' test for two independent means. *P* value less than 0.5 was considered statistically significant.

Both groups were comparable with regards to their demographic parameters and midazolam and fentanyl required to achieve the desired level of sedation (Ramsay sedation score 2) (Table 1 and 2). Also, hemodynamic variables i.e., heart rate (HR), mean arterial pressure (MAP) and SpO2 recorded at pre-intubation, during procedure and at 1 min, 3 min and 5 min post intubation were similar between the groups. (Table 3).

The cough and gag scores were significantly higher in Group N as compared to Group T. (Table 4). 3 patients (12%) of Group N had Cough and Gag Score 4 while no patient in Group T had similar coughing and gagging.

Only 3 patients (12%) of Group T had cough and gag score 3 as compared to 14 patients (56%) of Group N. 6 patients of Group T (24%) had cough and gag score 1 during introduction of FOB and 16 of them (64%) had minimal cough that is <3 times (cough and gag score 2). None of the patients in Group N recorded a Cough and Gag score of less than 2.

The patients in Group N were distinctly more uncomfortable than the other group based on the patient comfort score with 3 of them (12%) registering Patient Comfort score 4 (Uncomfortable patient) and 6 patients (24%) registered Patient Comfort score 3 (needed to be pacified). Whereas all patients in Group T were extremely calm and comfortable (Patient Comfort scores 1 and 2) compared to only 16 (64%) out of 25 patients of Group N.

Endotracheal intubation was faster in Group T (average 72 secs) as compared to Group N (average 84 secs) which was statistically significant. (Table 6). Also, Group N required an extra 15 minutes for preparation prior to awake FOI to achieve airway anaesthesia via nebulisation.

DISCUSSION

Awake endotracheal intubation has proved to be a boon to anaesthesiologists presented with the task of securing a difficult airway prior to induction of general anaesthesia as spontaneous ventilation is preserved, thus minimizing the risk of aspiration and desaturation. But in lieu of it being an awake procedure it can prove to be quite an uncomfortable and painful experience for the patient in the absence of optimal topical anaesthesia of the airway. So adequate patient preparation using antisialogogues, sedatives and local anaesthetic agents prior to introduction of fibroscope is of utmost importance. [6]

All the patients included in our study had anticipated difficult airway with modified Mallampati score 3 or more. We aimed to elucidate the difference between the level of anaesthesia achieved by 4% nebulised Lignocaine inhalation and instillation of 4% transtracheal Lignocaine.

Patients in both the groups under study had nearly similar hemodynamic changes during and after the procedure from baseline levels. All of them received Fentanyl 2 ug/kg and Midazolam 0.05 mg/kg prior to the procedure to achieve a Ramsay sedation score of 2. [7] Though some authors do not recommend the use of sedative benzodiazepines like Midazolam because of the associated risk of respiratory depression and hypoxia, none of our patients suffered from any such episodes during intubation. We chose to sedate the patients with Midazolam because of its added advantage of preventing unpleasant recall post procedure.

We noticed that most of the patients in Group T had reduced cough reflex while manipulating the scope through upper airway as compared to the patients in Group N (88% versus 32%, *P* value 0.000017) (Table 4). In a similar study conducted by Vasu et al used Cough and Gag score and Patient Comfort Score and concluded that topical anaesthesia by transtracheal injection in patients with anticipated difficult airway made AFOI easier and faster with better patient comfort compared to atomizer with no clinically significant untoward side effects. Similar scoring

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system has also been employed by Malcharek et al. [8]

In our study, in an attempt to rule out subjective bias, an independent anaesthetic assistant, not involved in the study was asked to record the patient's responses objectively according to the Patient comfort score. Analyzing this score between the two groups we found that patients in Group T were better compliant and more comfortable during AFOI as compared to Group N (Table 5).

The total time required for intubation in the nebulisation group (84±10.66 secs) was also noted to be remarkably more than the transtracheal group (72±7.70 secs, *P* value 0.000017) probably owing to the difficulty in maneuvering the scope while the patient coughed and retched. It could also be due to the fact that better airway anaesthesia was achieved with transtracheal injection than nebulisation of airway.

We have used 4ml of 4% Lignocaine in Group T and 7 ml of 4% Lignocaine in Group N. For the nebulisation group we carried out preliminary trials with 4ml, 5ml and 6ml of 4% Lignocaine but the anaesthesia was less than optimal till 7ml of 4% lignocaine was nebulised for a period of 15 min. so the dose of lignocaine did not exceed 9 mg/kg body weight in any of our patients, as has been suggested by a previous study with anaesthetists as subjects. [9] Vasu *et al* compared the level of anaesthesia achieved by transtracheal injection of 4 ml of 4% Lignocaine and 4-5 ml of 4% Lignocaine delivered via atomizer. [4] Atomization has the distinct advantage of producing finer particles than nebulisation which helps in spreading the drug over a larger area with minimal wastage. [10] This is probably why we required a larger volume of drug during nebulisation as compared to atomization in our study.

It has also been noted in past studies on the topic that both 2% and 4% lignocaine are equally effective in anaesthetizing the upper airway and larynx via the transtracheal route or atomization. [3,4,11] Infact even lower concentration, for example 1% lignocaine has been found to be sufficient for awake intubation in patients scheduled for diagnostic flexible bronchoscopy. [12] But these studies have been conducted in patients with normal airway. As our study population is comprised of patients with anticipated difficult airway we opted for identical 4% Lignocaine solutions in both the groups.

Although the transtracheal technique is unpleasant for the patient and has concerns like bleeding from trachea, accidental injection of local anaesthetic into major vessels and local anaesthetic toxicity, none of our patients experienced any such untoward effects. On the other hand nebulised lignocaine bypasses the aforementioned problems associated with transtracheal injection but result in poorer intubation condition and patient comfort when compared to the other group.

The results of our study concur with the findings of Mathur *et al* who compared jet nebulization to bilateral superior laryngeal and transtracheal recurrent laryngeal nerve blocks and concluded that time taken for intubation was significantly shorter in patients who received blocks and degree of patient comfort was better. [13] Kundra et al achieved similar results as well. [14]

In our study in addition to transtracheal, patients in Group T also received one puff of 10% Lignocaine spray into each nostril and a puff on either side of the oropharynx near the faucial pillars with the help of an applicator. It was our prerogative to determine if ideal intubating conditions could be achieved with the combination of only these two instead of superior laryngeal and recurrent laryngeal nerve blocks used in previous studies. The patient compliance and ease of intubation reflected in the results demonstrate this procedure can be a suitable procedure in patients with vague anatomical landmarks.

The main limitation of our study was our inability to examine the upper airway anatomy via nasal endocopy and direct laryngoscopy prior to the procedure which could have helped us predict the level of difficulty to be possibly encountered during AFOI more accurately than Mallampati score. Though the total dose of lignocaine used was almost identical in both the groups, serum lignocaine level immediately post procedure could have given us a better idea of the exact amount of drug absorbed via both routes. This couldn't be accomplished owing to non-availability of such services in our institute.

This is probably the first study of its kind which combines the use of 10% topical lignocaine spray in

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adjunct to transtracheal instillation of 4% Lignocaine and compares it to the level of anaesthesia achieved by a nebulizer delivering 4% lignocaine in patients with anticipated difficult airway. The procedures were conducted by expert anaesthesiologists well versed in all modes of AFOI. This could be a possible reason behind no notable complications during procedure and might be difficult to emulate for beginners.

We suggest using transtracheal 4% Lignocaine preferably ultrasound guided along with generous spraying of nasal and oral cavity with 10% Lignocaine spray for airway anaesthesia over nebulisation of the airway for AFOI in difficult airway cases. However, whether increasing the dose of nebulised drug could lead to more acceptable conditions for bronchoscopy is yet to be determined.

CONCLUSION

In conclusion, transtracheal instillation of Lignocaine for local airway anaesthesia for AFOI is more feasible, requires lesser preparation time and is more comfortable for the patient as compared to nebulisation.

REFERENCES

1.Tanmay S., Panchabhai, Atul C. Mehta; Historical Perspectives of Bronchoscopy, Connecting the Dots; Ann Am Thorac Soc Vol 12, No 5, May 2015 pp 631–641.

2. Prakash, Udaya B. S. “Never Give Up”: Professor Shigeto Ikeda, 1925–2001; Journal of Bronchology: April 2002 - Vol 9, Issue 2, p 83-84

3. Dhasmana S, Singh V, Pal US. Nebulisation Versus Spray-as-You-Go Airway Topical Anaesthesia in Patients with Temporomandibular Joint Ankylosis using 2 % Lignocaine. *J Maxillofac Oral Surg*. 2015;14(2):398–402. doi:10.1007/s12663-013-0613-5

4. Vasu BK, Rajan S, Paul J, Kumar L. Efficacy of atomized local anaesthetic versus transtracheal topical anaeshesia for awake fibreoptic intubation. Indian J Anaesth 2017;61:661-6.

5. Anaesthesia for Awake Fiberoptic Intubation: Ultrasound-Guided Airway Nerve Block versus Ultrasonic Nebulisation with Lignocaine - Scientific Figure on ResearchGate.

6. Ramkumar V. Preparation of the patient and the airway for awake intubation. Indian J Anaesth 2011;55:442-7.

7. Jacobi J, Fraser GL, Coursin DB, Riker RR, Fontaine D, Wittbrodt ET, Chalfin DB, Masica MF, Bjerke HS, Coplin WM, et al. Clinical practice guidelines for the sustained use of sedatives and analgesics in the critically ill adult. Crit Care Med. 2002;30:119–141. doi: 10.1097/00003246-200201000-00020.

8. Malcharek MJ, Bartz M, Rogos B, Günther L, Sablotzki A, Gille J, *et al.* Comparison of Enk Fibreoptic Atomizer with translaryngeal injection for topical anaesthesia for awake fibreoptic intubation in patients at risk of secondary cervical injury: A randomised controlled trial. Eur J Anaesthesiol 2015;32:615-23.

9. Williams KA, Barker GL, Harwood RJ, Woodall NM. Combined nebulization and spray-as-you-go topical local anaesthesia of the airway. Br J Anaesth 2005;95:549-53.

10. 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.

11. Wieczorek PM, Schricker T, Vinet B, Backman SB. Airway topical anaesthesia in morbidly obese patients using atomised lidocaine: 2% compared with 4%. Anaesthesia 2007;62:984-8.

12. Mainland PA, Kong AS, Chung DC, Chan CH, Lai CK. Absorption of lidocaine during aspiration anesthesia of the airway. J Clin Anesth 2001;13:440-6.

13. Mathur PR, Jain N, Kumar A, Thada B, Mathur V, Garg D. Korean J Anesthesiol. 2018 Apr; 71(2):120-126. Epub 2018 Apr 2.

14. Kundra P, Kutralam S, Ravishankar M. Local anesthesia for awake fibreoptic nasotracheal intubation. Acta Anaesthesiol Scand. 2000; 44:511–6.

Tables

Table 1: Demographic Characteristics

Parameter	Group N (n=25)	Group T (n=25)	P Value
Age(Years) (Mean±SD)	45.35±9.32	41.13±11.09	0.084
Sex : Number of patients (%)			0.5
Female	15(60)	18(72)	
Male	10(40)	7(28)	
BMI (Mean±SD)	22.99±2.02	22.06±2.22	0.64
ASA: No. of patients(%)			0.5
I	14(56)	13(52)	
II	11(44)	12(48)	
MPS			0.5
III	18(72)	16(64)	
IV	7(28)	9(36)	

Table 2: Fentanyl and Midazolam Consumption

Drug	Group N (Mean±SD)	Group T (Mean±SD)	P Value

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Fentanyl (ug)	109.57±12.52	115.73±15.88	0.0750
Midazolam (mg)	2.89±0.4	2.74±0.3	0.751

Table 3: Hemodynamic Parameters

Parameters	Time	Group N (Mean±SD)	Group T (Mean±SD)	P value
HR	Pre-intubation	77.22±14.41	83.39±13.44	0.700
	During intubation	90.91±13.37	89.13±13.90	0.329
	1min	84.13±11.23	86.08±13.68	0.299
	3 min	79.74±9.50	81.04±12.52	0.397
	5 min	74.65±7.34	77.82±11.56	0.136
MAP	Pre-intubation	92.38±9.12	96.35±9.30	0.075
	During intubation	101.64±8.67	101.74±10.31	0.485
	1 min	96.72±7.15	98.01±9.90	0.345
	3 min	95.46±7.20	97.52±8.90	0.345
	5 min	87.75±6.69	90.43±8.18	0.115
SpO2	Pre-intubation	99.22±0.80	99.35±0.71	0.280
	During intubation	99.39±0.66	99.34±0.65	0.411
	1 min	99.65±0.49	99.82±0.39	0.093
	3 min	99.61±0.50	99.56±0.67	0.401
	5 min	99.78±0.42	99.89±0.34	0.223

Table 4: Cough and Gag Score

Score	Group T	Group N	P Value

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	n (%)	n (%)	
1 (none)	6 (24)	0	0.000017 (significant)
2 (<3 times cough/gag)	16 (64)	8 (32)	
3 (Mild cough / gag lasting <1 min)	3 (12)	14 (56)	
4 (Persistent cough/ gag)	0	3 (12)	
5 (Rescue topical anaesthesia needed)	0	0	

Table 5: Patient Comfort Score

Score	Group T n(%)	Group N n(%)	P Value
1 (Excellent, calm patient)	15 (60)	2 (8)	0.000423 (significant)
2 (Good, comfortable patient)	10 (40)	14 (56)	
3 (Need to pacify patient)	0	6 (24)	
4 (Uncomfortable patient)	0	3 (12)	
5 (Agitated patient)	0	0	

Table 6: Comparison of total time taken

Group	Mean Time(secs) (Mean±SD)	P Value
T (Transtracheal)	72±7.70	0.000017

N (Nebulisation)	84±10.66	(Significant)

Figures

Figure 1: The modified Ramsay sedation scale

Response	Level
Awake and anxious, agitated, or restless	1
Awake, cooperative, accepting ventilation, oriented, or tranquil	2
Awake, responds only to commands	3
Asleep, brisk response to light, glabella tap, or loud noise	4
Asleep, sluggish response to light, glabella tap, or loud noise	5
Asleep, no response to light, glabella tap, or loud noise	6

Figure 2: Cough and gag score, Patient comfort score*

Factors	Score
Cough and gag score	1. None
	2. Minimal coughing and gagging <3 times
	3. Mild cough and gag lasting for >3 times, <1 min
	4. Persistent coughing and gagging
	5. Need of rescue topical anesthesia
Comfort score	1. Excellent, calm patient
	2. Good, comfortable patient
	3. Moderately comfortable, need to pacify the patient
	4. Poor, uncomfortable
	5. Agitated

*Available from: https://www.researchgate.net/figure/Cough-and-gag-score-comfort-score_tbl1_351915737