Original Article

Comparison of Intubating Conditions using "Spray-as-You-Go" Technique versus Transtracheal Instillation of Lignocaine for Airway Topical Anesthesia during Awake Nasal Fiberoptic Intubation

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Abstract

Introduction: Awake fiberoptic intubation (AFOI) is the gold standard for the management of recognized difficult airway. Good airway anesthesia along with sedation is necessary to ensure patient comfort. **Aim:** The aim of the study was to evaluate topical lignocaine administered by "spray-as-you-go" versus transtracheal injection technique on intubating conditions during AFOI. **Patients and Methods:** After obtaining written informed consent, 36 patients were randomly allocated to one of two groups: Group T – transtracheal technique and Group S – Spray-as-you-go technique. All patients were sedated with intravenous dexmedetomidine infusion titrated to a Ramsay Sedation Score of 2–3 during AFOI. All patients received oral gargle and nasal packing with lignocaine 2%. Patients in Group T received 2 mL lignocaine 2% intratracheally just prior to beginning fiberscopy. Patients in Group S received 2 mL lignocaine 2% spray over the vocal cords and another 2 mL below the vocal cords during fiberscopy. Tracheal intubation was then performed. Primary outcome measure was a composite score of patient comfort. Secondary measures were intubation and fiberscopy time, adverse effects, and postoperative patient evaluation. **Results:** The demographic data were comparable. A composite score of <10 was considered optimal, 10–15 as acceptable, and >15 unacceptable. Significantly more patients in Group T had optimal composite score compared to Group S. There were no differences between the two groups as regards postintubation score, ease of intubation, and postoperative survey. **Conclusion:** During awake nasal fiberoptic intubation, in comparison with spray-as-you-go technique, the transtracheal instillation of lignocaine improves patient tolerance and comfort during tracheal intubation and provides better patient satisfaction.

Keywords: Composite score, difficult airway, transtracheal instillation

Introduction

Management of difficult airway is always a challenge for the anesthesiologist. Awake fiberoptic intubation (AFOI) is widely regarded as the gold standard for the management of recognized difficult airway.[1] Awake technique is chosen when it is considered unsafe to anesthetize the patient in view of anticipated difficulty in bag mask ventilation or laryngoscopy and endotracheal intubation. AFOI can be performed through oral or nasal route. The nasal route is preferred as it is better tolerated by the patients when compared to oral route.

Topicalization of the airway plays an important role in AFOI. Topicalization of airway may be achieved by swishing/gargling with 4% viscous lignocaine, use of local anesthetic-soaked cotton pledgets placed in the nasal cavity to anesthetise nasal mucosa prior to AFOI, addition of adrenaline (1:200,000) for reducing nasal congestion and bleeding. Nebulized lignocaine at least 15–30 min prior to the procedure gives reasonably good level of topical anesthesia. Additional nerve blocks such as glossopharyngeal nerve block, superior laryngeal nerve block,

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and recurrent laryngeal nerve block help in anesthetizing the airway posterior to the tongue, thereby suppressing gag reflex. Administering antisialogogues prior to the procedure helps to reduce secretions and gives a better fiberoptic view. Sedation reduces patient awareness and discomfort. Dexmedetomidine, a highly specific agonist at alpha2 receptors, has recently been demonstrated to be useful adjunct for providing sedation and analgesia during AFOI. Dose of 1 μg/kg over 10 min followed by infusion of 0.2–0.7 μg/kg/h has provided superior sedation and analgesia when compared to fentanyl and midazolam.[1]

Patients comfortable during nasal fiberscopy but experiencing discomfort only during railroading of the endotracheal tube into the trachea suggests inadequate anesthesia of glottis/infraglottic airway. This study was done to compare transtracheal instillation of lignocaine with conventional "spray-as-you-go" technique for AFOI in patients sedated with dexmedetomidine infusion.

The primary objective was to observe intubating conditions during fiberscopy using a composite score. Secondary outcomes included time taken for fiberscopy and intubation, number of attempts at intubation, hemodynamic changes, and postoperative complications.

Patients and Methods

The study was a randomized controlled trial. Patients above 18 years of age, of either gender requiring awake nasal fiberoptic intubation and consented for it were included. Patients with American society of Anaesthesiologists physical status IV, raised intracranial pressure, uncontrolled seizure, psychiatric illness, patients in whom dexmedetomidine is contraindicated, known cardiac disorder, and renal and hepatic dysfunction were excluded from the study.

After obtaining institutional Ethics committee approval, CTRI/2012/07/002839 registered retrospectively. Eligible patients were identified. One day prior, patients were informed regarding the procedure. Written informed consent was obtained. Patients were kept nil per oral 6 h for solids and 2 h for clear fluid. Sedative premedication was avoided. Oxymetazoline drops (0.05%) were instilled into each nostril on the morning of surgery. Intravenous (IV) access was established, and IV glycopyrrolate 0.2 mg was administered. Baseline vitals which included oxygen saturation, heart rate, and blood pressure were noted. Lignocaine viscous 2% 5 ml was given to patients to gargle. The nasal passages were then packed with gauze soaked in 5 ml of 2% lignocaine with 1:200,000 epinephrine. In the operating room, serial dilatation of the nostril with increasing sizes of nasopharyngeal airway coated with lignocaine jelly was performed.

Patients were randomly allocated into one of the following two groups and allocation concealment was ensured using sequentially numbered, opaque, sealed envelopes. Observer 1: postgraduate evaluated the patient, obtained consent, and prepared the airway. Observer 2: anesthesia consultant familiar with AFOI, performed the transtracheal instillation of lignocaine, and performed the intubation. Fiberscopy was commenced using 3.5 mm external diameter (FI-10BS/10RBS Pentax corporation, Tokyo, Japan) scope. Cuffed endotracheal tubes (Portex) of suitable size were mounted onto the fiberscope (7.0 or 7.5 mm ID for men and 6.5 or 7 mm ID for women).

Group S – Patients in this group received 1 μg/kg of IV dexmedetomidine over 10 min, followed by infusion titrated between 0.2 and 0.7 μg/kg/h to maintain Ramsay Sedation Score (RSS) of 2–3. Observer 2 (anesthesia consultant) performed the AFOI through nasal route. Immediately after completion of the bolus of dexmedetomidine, these patients received 2 ml of lignocaine spray above and 2 ml below the vocal cords atomized with 2 L/min oxygen. After a minute following spray below the vocal cords, the fiberscope was advanced down the trachea and the endotracheal tube was railroaded over the scope.

Group T – A minute prior to completion of bolus 1 μg/kg of dexmedetomidine, transtracheal instillation of 2 ml of 2% lignocaine using 22 G IV cannula was done at the end of inspiration. Infusion of dexmedetomidine was titrated to keep the RSS 2–3. Fiberscopy by the nasal route commenced immediately after the completion of the bolus of IV dexmedetomidine. These patients received 2 ml of lignocaine infiltration above the vocal cords, atomized using 2 L/min oxygen. After a minute following the spray of lignocaine above the vocal cords, the fiberscope was advanced down the trachea, and the tube was railroaded into the trachea under vision.

Once the tube was railroaded into the trachea and position confirmed, general anesthesia was then administered. Vitals were noted throughout the procedure.

As soon as the intubation was complete, the postintubation score and the composite scores were noted. The postintubation score was graded from 1 to 3, 1 – being cooperative, 2 – restless, and 3 – severe resistance (general anesthesia given immediately). Composite score was a composite of five parameters with a score of 1–5 for each parameter, 1 indicating best possible condition and higher scores indicating worsening of the conditions for intubation [Table 1]. The maximum score was 25. A score of <10 was considered optimal, 10–15 acceptable, and >15 unacceptable.

Endoscopy time was defined as the time from insertion of the fiberoptic scope in the nostril to visualization of carina. Intubation time was defined as the time from insertion of the tracheal tube into the nose to confirmation of tracheal intubation with capnogram. The number of attempts at intubation was noted. Perception of ease of intubation by the intubator was noted as easy, difficult, or impossible.

Hemodynamic response was noted as change in heart rate and blood pressure >20% from baseline in either direction was considered significant. Complications such as bradycardia <50/min was treated with IV atropine 0.6 mg and

Table 1: Composite score

Parameter	Score				
	1	2	3	4	5
Sedation	Awakens to voice (eye opening/contact) >10 s	Light sedation, briefly awakens to voice (eye opening/contact)	Moderate sedation, movement or eye opening. No eye contact	Deep sedation, no response to voice but movement or eye opening to physical stimulation	Unarousable, no response to voice or physical stimulation
Calmness	Alert and calm	Anxious, apprehensive, but not aggressive	Frequent nonpurposeful movements	Pulls or removes tube(s); aggressive	Combative, violent
Respiratory response	No coughing and no spontaneous respiration	Spontaneous respiration	Occasional cough	Coughing regularly	Frequent coughing or choking
Physical movement	No movement	Occasional slight movement	Frequent slight movements	Vigorous movement limited to the extremities	Vigorous movements including torso and head
Facial tension	Facial muscle totally relaxed	Facial muscle tone normal, no facial muscle tension evident	Tension evident in some facial muscles	Tension evident throughout facial muscles	Facial muscles contorted and grimacing

hypotension <90 mmHg was treated with incremental doses of mephentermine. A postoperative interview was done 24 h later, when the patient was fully awake (Appendix 1). They were also asked to rate the pain they had felt during AFOI on a visual analog scale (VAS) scale, with score from 1 to 10, 1 being worst possible pain and 10 being pain free. The questions asked were related to the comfort and pain during the procedure.

To obtain a difference of two in the composite score with a standard deviation of two, for >80% power with a confidence interval of 95%, a total of 32 patients with 16 in each group needed to be included in the study. We included 36 patients (18 per group) in the study. A $P < 0.05$ was considered statistically significant. Quantitative data were analyzed using independent samples *t*-test and qualitative data were analyzed using Fisher's exact test or Chi-square test as appropriate.

Results

The demographic data are given in Table 2. Patient comfort during intubation as assessed by composite score is given in Table 3. The composite score was analyzed using criteria of a score of <10 as optimal intubating conditions and score of more than 10 as acceptable conditions. The composite score was analyzed using Fisher's exact test and showed that patients who received transtracheal instillation of lignocaine were significantly more comfortable than those who received the "spray-as-you-go" technique [Figure 1]. Time to fiberscopy was shorter in Group T, but intubation time was similar between the two groups [Table 4]. Although there were no differences between the two groups as regards postintubation score, ease of intubation, and postoperative survey, the VAS scores also showed that patients in the transtracheal instillation group were more comfortable [Tables 5-8]. No patient in either group had a score of <5.

Discussion

Awake nasal fiberoptic intubation is the gold standard technique for the management of difficult airway as this helps preserve the airway patency and spontaneous efforts of the patient till the airway is definitively secured and confirmed. Nasotracheal intubation is passage of endotracheal tube through the nose, nasopharynx, oropharynx, vocal cords, and then to trachea. This path is rich with the presence of irritant receptors and any stimulation would elicit significant cough and gag responses necessitating very good anesthesia of the airway for allowing the process of fiberscopy and intubation to proceed. Anesthesia to this path of airway may be provided by topicalization or nerve blocks. Topicalization involves gargling, packing, and spraying of the local anesthetic to the mucosa that needs to be anesthetized. This is the more preferred technique as this is easy to perform, noninvasive, does not require knowledge of anatomy, and has minimal complications. Although it provides adequate anesthesia to the airway above

Table 2: Demographic data

Parameter	Group S ($n=18$)	Group ($n=18$)	*P*
Age (years), mean (SEM)	43.83 (3.14)	44.00 (3.97)	0.9 (NS)
Gender (male/female)[#]	16/2	15/3	NS
Weight (kg), mean (SEM)	60.39 (2.58)	53.11 (2.14)	0.03 (S)

Independent samples *t*-test, [#]Chi-square test. NS: Not significant, S: Significant, SEM: Standard error of mean

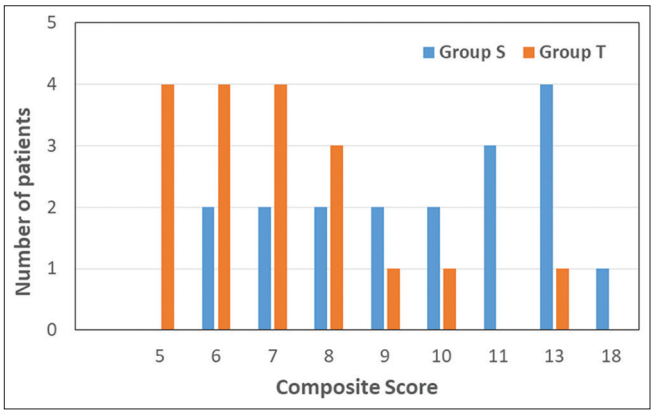

Figure 1: Distribution of composite score among patients in both the groups

Table 3: Composite score

Group	Composite score			*P**
	≤10 (optimal)	11-15 (acceptable)	>15 (unacceptable)	
Group S (*n*=18)	10	8	1	0.0178 (S)*
Group T (*n*=18)	17	1	0	

*Fisher's exact test. S: Significant

Table 4: Fiberscopy and intubation time

Parameter	Group S	Group T	*P**
Fibrescopy time (s), mean (SEM)	196.67 (16.67)	146.67 (12.10)	0.021 (S)*
Intubation time (s), mean (SEM)	172.17 (26.37)	143.22 (17.31)	0.365*

*Independent samples *t*-test. S: Significant, SEM: Standard error of mean

Table 5: Postintubation score

Group	Postintubation score		*P**
	Cooperative	Restless	
Group S (*n*=18)	11	7	0.12
Group T (*n*=18)	16	2	

*Fisher's exact test

Table 6: Ease of intubation

Group	Ease of intubation		*P*#
	Easy	Difficult	
Group S (*n*=18)	12	6	0.228 (NS)
Group T (*n*=18)	16	2	

#Fisher's exact test. NS: Not significant

Table 7: Postoperative survey

Parameter	Group S (*n*=18)	Group T (*n*=18)	*P**
Pain (no/mild to moderate)	6/12	9/9	0.449
Quantity of sedation (right/more/less)	14/4/0	15/2/1	0.42
Quality of sedation (good/poor)	14/4	15/3	0.67
Awareness at the start of procedure (no/yes)	2/16	3/15	0.6
Awareness during the procedure (no/yes)	9/9	10/8	0.7
Awareness at the end of procedure (no/yes)	15/3	18/0	0.228

**P* value. Chi-square test

Table 8: Patient satisfaction (Visual analogue scale score)

Group	VAS score		*P*
	5-7	8-10	
Group S (*n*=18)	14	4	0.04 (S)#
Group T (*n*=18)	7	11	

#Fisher's exact test, S: Significant, VAS: Visual analog scale

the vocal cords, anesthesia to the tracheal mucosa does not appear to be satisfactory when spray-as-you-go technique was used to provide infraglottic anesthesia.[2,3] Another option to anesthetize this area (transtracheal technique) is invasive requiring piercing the cricothyroid membrane and spraying the local anesthetic drug.

Despite adequate topicalization of the airway, it requires a great degree of understanding and cooperation from the patient so that the procedure can be carried out successfully. In order to enhance patient cooperation, several pharmacological interventions that can provide sedation, analgesia, or both have been attempted. IV dexmedetomidine, a highly selective α_2 agonist, appears to offer excellent procedural sedation without compromising the airway or hemodynamics.

Hence, this study involved IV dexmedetomidine for sedation in all patients and compared the two different techniques of anesthetizing the airway below the vocal cords, i.e., spray-as-you-go and transtracheal instillation of local anesthetic agent.

The primary outcome variable, composite score (a group of five different patient responses to fiberscopy and intubation) showed that the conditions for AFOI were optimally suitable in only ten patients with Group S as compared to the majority of patients (17/18) in Group T ($P = 0.0178$, statistically significant). The postintubation score too shows that more patients were restless with Group S than Group T at completion of tracheal intubation (7 vs. 2, $P = 0.12$). This was further substantiated by independent scoring done by the intubator on ease of intubation where difficult conditions for intubation were observed more in Group S than Group T (6 vs. 2, $P = 0.228$). One study done with similar methodology but had used "spray-as-you-go" technique for topicalization of infraglottic airway and dexmedetomidine for sedation found that the patient response was more at the time of tracheal intubation.[3] Most important manifestation during tracheal intubation in "spray-as-you-go" group was movement of limbs of the patients which was similar to previously quoted experiences in literature.[3-6] Our study also shows that good topicalization technique for airway anesthesia above the vocal cords along with dexmedetomidine infusion provides excellent conditions for flexible fiberscopy, while transtracheal instillation of lignocaine is superior to administration of lignocaine by spray-as-you-go technique for the process of advancement of the tracheal tube below the vocal cords.

The postoperative survey regarding patient's assessment of the suitability and knowledge of topical anesthesia and intubation was comparable between the groups [Table 5]. The patient satisfaction (assessed on a visual analog scale of 0–10, where 0 – not at all satisfied and 10 excellent satisfaction)

showed better patient satisfaction in Group T than Group S ($P = 0.04$).

All intubations were carried out in single attempt. Two patients in Group T required the tracheal tube to be rotated 180° counterclockwise to aid in passage across the vocal cords. The fiberscopy time was significantly more with spray-as-you-go technique. However, this is due to the fact that the intubator had to wait for 60 s after spraying lignocaine below the vocal cords before advancing the tracheal tube in this group of patients. Although the conditions for advancing the tracheal tube into trachea were suboptimal in several patients in the spray-as-you-go group, this did not translate into increased time duration for the process of tracheal intubation as the time for intubation was comparable between both groups.

There were no significant hemodynamic disturbances requiring pharmacological intervention. None of the patients had desaturation to <95% during the study period. Rescue midazolam was not administered to any of the patients as they remained cooperative till the point of tracheal intubation in both the groups. Since IV general anesthesia was induced soon after tracheal intubation and confirmation, rescue midazolam was not administered to those who were restless at that point. These findings are similar to another study.[3] Three patients in Group T had mild sore throat when evaluated 24 h after the study that subsided in the next 2 days without requiring any treatment. A study comparing topical local anesthesia using transtracheal (transcricoid) injection and "spray-as-you -o" technique during AFOI of oral cancer patients posted for elective surgery concluded that, during AFOI using topical local anesthetic by transtracheal injection is better than "spray-as-you-go" technique.[7]

A study done on efficacy of atomised local anaesthetic versus transtracheal topical anaesthesia for awake fibreoptic intubation showed that topical anaesthesia of airway with transtracheal injection resulted in lesser patient discomfort, faster intubation and comparable haemodynamic parameters during AFOI in patients with anticipated difficult airway as compared to topical anaesthesia using atomiser.[8]

Conclusion

During awake nasal fiberoptic intubation, in comparison with "spray-as-you-go" technique, the transtracheal instillation of lignocaine improves patient tolerance and comfort to tracheal intubation and provides better patient satisfaction also.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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Appendix

Appendix 1

A postoperative interview was done 24 h later, when the patient was expected to have recovered from the anesthetic and fully awake, and the following questions were asked:

a) "How was the sedation for your procedure?"
1 = Excellent

2 = Good

3 = Fair 4 = Poor

b) "Do you think you needed any adjustment in the amount of sedation you received?"
1 = Needed less

2 = Right amount 3 = Needed more

c) "Do you remember the start of the procedure when the scope was inserted?"
1 = No

2 = Yes

d) "Do you remember being awake during the procedure?"
1 = No

2 = Yes

e) "Do you remember the end of the procedure when the scope was removed?"
1 = No

2 = Yes

f) "How much discomfort or pain did you experience during the procedure?"
1 = None

2 = Mild

3 = Moderate

4 = Severe

g) "Overall, using this visual analog scale, where 0 is complete dissatisfaction and 10 is complete satisfaction, how would you rate your satisfaction with your intubation?"
10 = Complete satisfaction

0 = Complete dissatisfaction