DOI: 10.7860/JCDR/2018/29241.11067

Original Article

Anaesthesia Section

To Compare the Efficacy of Local Anaesthetic Administration via Spray as you Go Technique and Ultrasonic Nebulisation for Awake Fiberoptic Intubation

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ABSTRACT

Introduction: Awake fiberoptic intubation using local anaesthetics is the most dependable procedure to secure a difficult airway. It is electively done under various techniques of local anaesthesia which include administration of local anaesthetic via nebulisation, airway blocks and spray as you go with or without sedation.

Aim: To compare the efficacy of nebulisation with 4% lignocaine versus spray as you go technique for awake fiberoptic intubation.

Materials and Methods: Sixty patients of American Society of Anesthesiologists (ASA) grade I-III were randomly divided into two groups (group N and group S). Patients in group N were nebulised with 4mL of 4% lignocaine while group S patients received four aliquots of 1mL 4% lignocaine through the working channel of the fiberoptic bronchoscope. The patients were compared for haemodynamic parameters, intubating conditions, intubation attempts, time taken for intubation and patient satisfaction score. The results were statistically analysed using SPSS version 22.0 software and compared.

Results: On comparing the intubating conditions, the patients in group S showed better intubation score than the patients in group N (p-value <0.004). The time taken for intubation was lesser (4.56±0.85 minutes in group S and 4.0±0.45 minutes in group N) and the patient satisfaction score was also better in the spray as you go group.

Conclusion: Spray as you go technique offers more effective local anaesthesia and better patient satisfaction as compared to nebulisation for awake fiberoptic intubation.

Keywords: Anaesthesia, Bronchoscopy, Fiberoptic technology, Intubation, Lignocaine, Local, Patient satisfaction

INTRODUCTION

Endotracheal intubation is the basic skill that every anaesthesiologist is required to learn and master in order to secure any routine, potentially difficult or difficult airway [1]. Although, whenever faced with a difficult airway most of the anaesthesiologists prefer awake intubation using fiberoptic intubating bronchoscope. This not only provides a definitive view of the airway but also gives a chance to maintain spontaneous ventilation and at the same time lessens the risk of loss of airway. For awake intubation, it is mandatory to anaesthetise the upper airway adequately so that the patient is comfortable as well as cooperative. This can be performed under local anaesthesia or a combination of local anaesthesia and sedation. However, local anaesthetic along with premedication remains the popular choice. The various techniques for local anaesthesia of the airway include nebulisation using an ultrasonic nebuliser, spraying local anaesthetic directly over the mucosa through the working channel of the fiberoptic scope which is also called 'spray as you go' technique or by giving nerve blocks [2]. All the above methods attenuate the gag, swallow and cough reflexes that produce hindrance in the passage of the scope.

Topical instillation of local anaesthetic is an easy and effective method of anaesthetising the airway. Usually 2-4% lignocaine is sprayed directly over the respiratory mucosa through the working channel of fiberoptic bronchoscope as it is maneuvered through the respiratory tract. The spray as you go technique offers an advantage of direct instillation and increased efficacy of local anaesthetic. Nebulisation via atomiser or simple nebuliser is also an effective method for anaesthetising upper and lower airway. It is a simple technique with no patient discomfort and requiring least expertise by the provider [3]. Awake intubation can be accomplished with any of the above techniques. However, the patient comfort, satisfaction, ease of intubation and time taken for intubation determine the acceptability of the procedure [4-6]. The present study compares the efficacy of nebulisation technique versus the spray as you go technique for awake fiberoptic intubation.

MATERIALS AND METHODS

A prospective randomised observational study was conducted on 60 patients in the age group of 18-60 years with ASA grade I to III in the months of December 2015 to June 2016 at the department of anaesthesia, Goverment Medical College, Amritsar. All the patients had anticipated difficult airway with mallampatti grade III or IV. After approval from the institutional ethics committee and obtaining a written informed consent, a thorough preoperative evaluation was done. Taking into account parameters like intubating conditions and in consultation with the statistician, patients were divided into two groups of 30 each to get the power of the study >85% patients were randomly divided into two groups. Randomisation was done using computer generated randomisation programme.

After detailed pre-anaesthetic check up, including complete airway examination, routine fasting guidelines and anti-aspiration prophylaxis was given. Injection glycopyrrolate 0.2mg was administered intramuscularly 45 minutes before starting the bronchoscopy.

On the operation table standard monitoring lines including electro-cardiography, non-invasive blood pressure and pulse oximetry were applied in all the patients. Intravenous access was established and ringer lactate was started. After recording the baseline blood pressure, heart rate and oxygen saturation, all patients were given injection butorphanol 2 mg along with injection midazolam 1 mg, 15 minutes before the introduction of fiberoptic bronchoscope. The fiberoptic bronchoscope was prepared and loaded with

endotracheal tube. Patients with history of asthma, status epilepticus or bradyarrythmias were excluded from the study. Patients who refused to give consent were also excluded.

In Group S, patients were administered four puffs of 10% lignocaine into the oropharynx, two puffs at each tonsillar fossa. Patients were asked to gargle the excess solution trickling down the throat, following which intubation was done using the spray as you go method. Lignocaine 4% was administered in aliquots of 1 mL each through the working channel of the fiberscope at four levels: epiglottis, glottis, subglottis and in distal trachea after visualisation of the carina (total lignocaine dose = 200 mg). After instilling each aliquot, the bronchoscopist waited for 30 to 40 seconds before proceeding further. In group N, patients were nebulised with 4 mL of 4% lignocaine (lignocaine dose = 160mg) for 10 minutes, starting 20 minutes before the procedure. Additional dose of 1 mL lignocaine was administered through the working channel of the fiberoptic bronchoscope if any difficulty was encountered during the procedure. However, the total dose of lignocaine was calculated and never allowed to exceed 5 mg/kg of the body weight.

The Fiberscope was introduced orally through the ovassapian airway and maneuvered visualising the airway structures until the visualisation of the carina. After intubation general anaesthesia was induced using injection propofol 1-2 mg/kg and maintained with injection vecuronium 0.1 mg/kg along with isoflurane, oxygen, nitrous oxide and intermittent positive pressure ventilation.

Patients were monitored for the following parameters during the procedure of awake fiberoptic intubation:

- Haemodynamic parameters including the Mean Arterial Pressure (MAP) and the Heart Rate (HR) of every minute till the patient was intubated and endotracheal tube placement was confirmed using capnography.
- Intubation time was the time taken from the introduction of the fiberoptic bronchoscope till the appearance of end tidal carbon dioxide curve on the capnometer.
- Intubating conditions were graded according to the four point intubation score (formulated by the authors themselves) as follows:

Grade 1 vocal cords open, no cough, no limb movements, no reaction by the patient, cooperative patient.

Grade 2 vocal cords slightly moving, slight coughing and limb movements, slight grimacing and restless patient.

Grade 3 vocal cords close, moderate coughing and limb movements, heavy grimacing and severe resistance by patient.

Grade 4 vocal cords closed, severe coughing and limb movements, severe resistance by the patient.

- Attempts at intubation.
- Patient satisfaction score was assessed in the recovery room where the patients were enquired for recall of any unpleasant events and were asked to grade their experience as excellent, good, reasonable or poor.
- Any complications due to the procedure or signs of lignocaine toxicity were monitored and recorded.

STATISTICAL ANALYSIS

The results were recorded in proforma and statistically analysed using SPSS version 22.0 software. The mean±SD values for age, weight, mean arterial pressure, heart rate, intubation time were calculated and analysed using yates chi-square test. The intubating conditions and patient satisfaction were graded according to the respective scores and p-values were generated. The qualitative data was expressed as numbers or ratios. A probability value (p-value) of <0.05 was considered statistically significant.

RESULTS

The demographic profile of both the study groups was comparable [Table/Fig-1].

Both groups were similar in haemodynamic status without any stastically significant difference in the MAP and HR at all the time intervals (p-value NS). The mean arterial pressure and the heart rate rose from the baseline during the procedure in both the groups however, the statistical difference was found to be non-significant [Table/Fig-2a,b].

The intubating conditions in each patient were graded according to the four point intubation score. (p-value with Yates chi-square 0.0004) showing highly significant statistical difference amongst the two groups [Table/Fig-3].

Awake Fiberoptic Bronchoscope (FOB) guided intubation was successfully accomplished in all the patients in both the groups. However, supplemental doses of lignocaine had to be given in patients included in grade 3 and 4 which was seen only in group N. Maximum dose of 2 mL of 4% lignocaine (80 mg) was given in one patient in group N with intubation score grade 4. No procedure in any group was cancelled due to patient discomfort.

The intubation time was observed to be more in group N which was 4.56±0.85 minutes as compared to group S, in which it was recorded to be 4.0±0.45 minutes [Table/Fig-4]. This was found to be highly significant (p-value <0.0023).

More than one intubation attempts were required only in one patient in group N who was included under grade 4 of intubating condition. Rest, all the patients in both groups could be intubated in single attempt.

Patient satisfaction score was assessed in the recovery room for grading their experience as well as recall of any unpleasant memories. Out of 30 patients included in group S, 15 patients graded the intubating procedure as excellent and 15 as good. On the contrary, only four patients in group N graded it excellent, ten patients found it good, 15 graded it to be reasonable and one patient reported it to be poor [Table/Fig-5]. (p-value with Yates chi-square test was 0.000277). The difference between two study groups was found to be highly significant.

No patient in any of the groups suffered from any complications like apnea, bradycardia, arrhythmia, seizures or bleeding.

DISCUSSION

Awake fiberoptic bronchoscopy is the mainstay for management of difficult airway scenario as the tone of the airway structures is not lost [7]. Various authors have explored its potential in management of difficult airway as it offers various advantages over intubation after induction of general anaesthesia, major being the preservation of spontaneous ventilation [8]. This needs meticulous pharmacological preparation of the patient along with mental preparation of the patient to allievate anxiety and achieve patient comfort during the procedure. Upper airway topicalization is commonly done using lignocaine gel, spray, lozenges, viscous while lower respiratory tract anaesthesia is given using local anaesthetic instillation via working channel of fiberoscope, nebulisation or transtracheal injection [9].

The present study was undertaken to compare the efficacy of two techniques of administration of local anaesthesia viz., nebulisation and spray as you go, to facilitate awake fiberoptic intubation. The parameters noted were the haemodynamics including mean arterial pressure and heart rate, intubating conditions, intubation attempts, time taken for intubation, patient satisfaction score and complications.

The demographic profile including age, sex and weight were found to be comparable in both the groups on statistical analysis. The

Demographic data	Group S	Group N	p-value
Age(years)	36.7±6.71	36.6±5.21	0.9335 (NS)
Weight(kilograms)	66.9±8.6	68.7±8.07	0.4066 (NS)
Sex(M:F)	18:12	17 :13	

[Table/Fig-1]: Demographic profile.
(NS:Non-Significant).

Haemodynamic profile			
Time	MAP Group S (mmHg)	MAP Group N (mmHg)	p-value
Baseline	95.87±4.73	94.06±4.09	0.1183 (NS)
1 minute	97.88±4.84	100.27±5.43	0.0771(NS)
2 minutes	97.52±4.38	96.78±4.71	0.5255 (NS)
3 minutes	97.15±4.25	95.40±3.93	0.1031 (NS)
4 minutes	95.32±3.52	93.76±4.28	0.1148 (NS)
5 minutes	94.57±4.27	92.44±4.33	0.06 (NS)

[Table/Fig-2a]: Mean arterial pressure (mmHg).
NS: p>0.05.

Haemodynamic profile			
Time	HR Group S (bpm)	HR Group N (bpm)	p-value
Baseline	80±4.24	80.46±8.69	0.79
1 minute	81.7±8.08	82.5±8.50	0.71
2 minutes	83.26±9.28	83.96±9.45	0.77
3 minutes	83.53±8.88	85.5±9.14	0.40
4 minutes	84.07±8.077	86.56±9.59	0.28
5 minutes	82±8.36	86.46±9.71	0.06

[Table/Fig-2b]: Heart rate (beats per minute).

	Range	Group S	Group N
GRADE 1	5 – 8	23	7
GRADE2	9 – 11	7	10
GRADE3	12 – 15	0	12
GRADE4	15 -18	0	1

[Table/Fig-3]: Four Point score for intubating conditions.
p-value: 0.0004 (highly significant)

	Group N	Group S
Time	4.56±0.85 minutes	4.0±0.45 minutes

[Table/Fig-4]: Time taken for intubation.
p-value <0.0023 (highly significant)

	Group S	Group N
Excellent	15	4
Good	15	10
Reasonable	0	15
Poor	0	1

[Table/Fig-5]: Patient satisfaction score.
p-value = 0.000277 (highly significant)

two groups showed comparable haemodynamic parameters that included the mean arterial pressure and the heart rate which were recorded at one minute intervals from the start of bronchoscopy till the end of endotracheal tube placement. The HR and MAP readings showed a rise in both the groups during airway manipulation and intubation. The rise in haemodynamics was more in group N, who received local anaesthesia with nebulisation but the differences in both the groups were statistically non-significant. The increase in the haemodynamic parameters were minimal and returned to baseline after intubation. The rise in haemodynamic parameters could be due to tracheal stimulation caused by bronchoscopy and intubation [10] which can be attenuated by effectively instilling the local anaesthetic [11-13]. A study conducted by Kundra P et al., quoted that patients who received lignocaine nebulisation had higher stress levels during endotracheal intubation, leading to higher mean arterial pressure and heart rate [13]. Our results are in consonance with a previous study conducted by Dhasmana S et al., who found comparable haemodynamics in the two groups of their study comparing nebulisation versus spray as you go airway topical anaesthesia in patients with temporomandibular joint ankylosis [14]. Similar results were also reported by, William KA et al., Xue FS et al., and Patil V et al., who also did not find any major haemodynamic variations while intubating using nebulisation or spray as you go technique [8,11,15].

While observing the intubating conditions, the intubation score was poorer in group N as compared to group S. In a study conducted by Sethi N et al., it was reported that patients undergoing intubation with spray as you go technique had decreased episodes of coughing which were significantly greater in their nebulisation group [9]. They also noted greater incidence of stridor in this group which could be due to incomplete airway anaesthesia with the nebulisation technique. Similar results were observed by Gupta B et al., in their study, where significantly higher number of patient's nebulised with lignocaine had coughing and gagging episodes during the procedure [16]. Due to this, the authors had to use more of supplemental lignocaine in that particular group. They also observed completely adducted cords in seven patients during bronchoscopy and partially adducted cords in twelve patients out of 25, in the nebulisation group. Kundra P et al., reported higher grimace score in patients who received lignocaine via nebulisation, during the insertion of endotracheal tube [13]. Previous studies done by authors state that nebulisation technique is not precise and unpredictable amount of local anaesthetic is deposited over the cords and in the trachea which leads to inadequate attenuation of airway reflexes [9,17].

The time taken for intubation in our study was 4.56±0.85 minutes in group N and 4.0±0.45 minutes in group S. All the patients in both the groups could be intubated in single attempt except one patient in group N, for whom two attempts were required. This could be attributed to the poor intubating conditions seen in patients of group N as compared to group S. The above said patient was included under grade 4 of intubating conditions score, while all other patients were under grades 1-3. Gupta B et al., reported that the patients in nebulisation group took more time for intubation (200.4±72.4 seconds) due to more number of coughing and gagging episodes and poor intubating conditions [16]. These results resonate with our study as far as nebulisation group is concerned. Other studies done by Sethi N et al., and Bansal P et al., also echo similar results [9,18].

On comparing the patient satisfaction score in both the groups, all the patients in group S showed either excellent or good satisfaction scores. However, in group N only four found the procedure excellent and ten found it to be good. The results were highly significant in terms of statistical difference showing better patient satisfaction with spray as you go technique. Similar results were quoted by Xeu FS et al., who recorded excellent or good patient satisfaction in all the patients who underwent fiberoptic bronchoscopy using spray as you go technique [11]. Similary, Gupta B et al., state that nebulisation may not provide adequate intubating conditions and require higher doses to effectively anaesthetise the airway [16]. Also, patient recall of unpleasant events was more in the nebulisation group in their study. Poor patient comfort associated with more episodes of cough and gag was also reported by Graham DR et al., and Reasoner DK et al., on using local anaesthesia by nebulisation method [17,19]. Sethi N et al., assessed the patients using Visual Analogue Scale (VAS) and found scores to be better and least distressing in patients in whom spray as you go technique was used as compared to nebulisation group [9]. As assessed by the endoscopists, the spray as you go technique was more preferable according to them.

In our study, the total dose of lignocaine used in group S was 200 mg and in group N was 160 mg. Supplemental doses of lignocaine had to be provided to 13 patients (12 of intubation score grade 3 and one of grade 4) in group N. The maximum supplemental dose we had to use was 2 mL of 4% lignocaine (80 mg). This was given to one patient in group N who had grade 4 intubating conditions. The safe dose of lignocaine has been quoted by many authors. Kortilla V et al., reported that total dose of lignocaine should not be > 300-400 mg as it is absorbed very quickly from the respiratory mucosa [20]. The British thoracic society (2001) recommended the total maximum dose of lignocaine to be not more than 8.2 mg/kg. Majority of the authors have reached a consensus of not exceeding the dose more than 7-8 mg/kg [21]. However, signs and symptoms of lignocaine toxicity must be observed. A major limitation of study was that we could not measure the serum lignocaine concentration of the patients in our institution. Furthermore, the blinding was not possible which could have led to bias in our study.

CONCLUSION

From our study results, we conclude that spray as you go technique is a better and more effective technique as compared to nebulisation with local anaesthetic for awake fiberoptic intubation. It provides better intubating conditions, good haemodynamic stability, more patient comfort and better patient satisfaction.

ACKNOWLEDGEMENTS

We extend our thanks to the operation theatre staff for their help.

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FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Apr 13, 2017**
Date of Peer Review: **Jun 24, 2017**
Date of Acceptance: **Aug 23, 2017**
Date of Publishing: **Jan 01, 2018**