ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

Original Research Article

COMPARISON OF TWO TECHNIQUES OF LOCAL ANAESTHESIA I.E. TRANSTRACHEAL INJECTION AND SPRAY AS YOU GO TECHNIQUE FOR FIBEROPTIC INTUBATION – A CLINICAL STUDY

Dr. Sonal Awasya[1], Dr. Kirti Sisodiya[2], Dr. Upendra Ghure[3] & Dr. Chandrakant[4]

(Dept. of Anesthesiology, Professor, GMC Bhopal)[1]
(Dept. of Anesthesiology, Assistant Professor, ABVGMC, Vidisha)[2]
(Dept. of Paedatrics, Consultant, Apollo Sage Hospital, Bhopal)[3]
(Dept. of Anesthesiology, Associate Professor, ABVGMC, Vidisha)[4]

Corresponding Author: Dr. Chandrakant

1. INTRODUCTION

Fiberoptic aided intubation of trachea is an established and less stimulating technique for obtaining a secure airway in patients for whom standard direct laryngoscopy is difficult or unsafe for intubation. It can be performed through oral or nasal route efficiently as it contains flexible fiberoptic bundle. The components of a fiberoptic bronchoscope(1) include, an eyepiece on top and a control section, which include of angulation lever, a suction port and a working channel port. An image is transmitted through the length of the scope by an organized coherent bundle of fibers that have the exact orientation at both ends of the scope. The transmission of visual image through a flexible fibreoptic bundle was first reported in 1954(2). Since then it is used in anticipated difficult airways(3) identified on the basis of predictive airway tests, history of difficult or failed intubation and patient characteristics, e.g. obstetrics, morbid obesity and in unanticipated difficult airways as a primary or secondary 'rescue' techniques for tracheal intubation. It provides diagnostic information before deciding on subsequent airway management plan. It is preferred in patients with poor dentition and loose teeth and in patients with high risk of aspiration where awake technique is advantageous. In unstable cervical spine or vertebrobasilar artery insufficiency it allows repeat neurological assessment after intubation and operative positioning before induction of general anaesthesia. It is also used for confirming the position of airway devices, assessing endotracheal tube depth, tracheostomy insertion and positioning, double lumen tube and bronchial blocker placement and depth assessment.

Prior to endoscopy, several techniques had been used to provide airway anaesthesia eg: topically anaesthetizing the upper airway with local lignocaine spray or gel. Various modalities of applying local anaesthetic to the larynx and lower respiratory tract include injection via the fiberoptic bronchoscope, transtracheal injection of local anaesthetic or delivery of local anaesthetic via a nebulizer(4).

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

The aim of this study is to compare the two techniques of local anaesthesia i.e. spray as you go and transtracheal injection for patients undergoing fiberoptic intubation. It is also proposed to study the acceptability and suitability of these techniques to the patient with objective measurement of cough, stridor, intubation time and total dose of anaesthetic used. Further, fiberoptic intubation is safe technique with a higher success rate as it provides preserved muscle tone avoiding airway collapse by keeping the airway patent. Preservation of spontaneous breathing provides a wide margin of safety with minimal patient discomfort, minimal chances of desaturation and keeping the obstructed airway passages open.

AIMS AND OBJECTIVES

To study and compare the two techniques of local anaesthesia i.e. spray as you go and transtracheal injection for patients undergoing fiberoptic intubation. It is also proposed to study the acceptability and suitability of these techniques with objective measurement of intubation time, ease of intubation and total dose of anaesthetic used.

2. METHODS

Design:

We undertook a Clinical Observational Hospital based Study was conducted in department of Anaesthesiology, GMC Bhopal and associated Hamidia Hospital in patients posted for various elective surgeries and required fiberoptic intubation to secure airway.

Settings:

The study was conducted in department of Anaesthesiology, GMC Bhopal and associated Hamidia Hospital. The hospital runs eight theatres during normal working hours and two theatres during emergency. Consultant anaesthetic supervision is available if required.

Participants:

Recruitment of patients scheduled for fiberoptic intubation from 2018 till 2021. For this analysis we included 60 patients of ASA grade 1, 2 posted for various elective surgeries and required fiberoptic intubation with age ranging from 18-60 years with Mallampati grades 3 and 4 were selected. Patients with age < 18yrs and > 60yrs, ASA grades 4 and more, who did not provide consent, had an allergy to any study drug, pregnant, asthmatic, epileptic, hemodynamically unstable or deranged coagulation profile and patients who required more lignocaine dose were excluded from analysis.

Management and data collection:

After pre-anaesthetic checkup and a written informed consent a common standard anaesthetic regimen will be followed for all the patients who included fasting at least for 8 hours prior to surgery and lignocaine sensitivity test. Further 0.1% xylomethazoline 2 drops were instilled in both nostrils and nebulisation with 4 ml of 4% lignocaine was done in all the patients for 20 min before starting the procedure.

Relevant patient data recorded during the initial assessment included clinical history, assessment of airway, neck movement, mouth opening, teeth, mallampati score, thorough

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

physical and systemic examination, routine investigation which includes complete blood count, urine (routine and microscopy), blood sugar, renal function test, serum electrolytes, coagulation profile, X-ray chest PA view, ECG, HIV, HBsAg, HCV markers and any special investigation if required. In the operation theatre, an intravenous access was established and monitoring was instituted with electrocardiogram (ECG), oxygen saturation (SpO2), non-invasive blood pressure (NIBP) and baseline parameters were recorded.

All subjects received injection glycopyrrolate 0.04 mg/kg body weight, injection ondansetron 0.08 mg/kg body weight, injection midazolam 1mg/kg body weight and injection fentanyl 2 μg/kg bodyweight intravenously before starting of the procedure. Patients were allocated in one of two groups as per the discretion of anaesthetist. The patency of the nostril was checked, and in the more patent nostril, 2 ml of 2% lignocaine gel was applied in all the patients. Fiberoptic bronchoscope is held in a manner for proper identification of structures, the recognizable landmarks are kept in the centre of the view along the desired path.

The fiberoptic bronchoscope's tip is then advanced until it is beyond the base of the tongue. A jaw thrust provided by an assistant can aid in bronchoscope passage through the oropharynx, then the uvula and further downwards to the epiglottis, which is the first landmark. After the identification of epiglottis, the tip can then be directed to the laryngeal opening and further introduced into the supraglottic space. The next step was aimed to achieve laryngo- tracheal anaesthesia prior to fiberoptic intubation.

In Group T (n=30) patients, transtracheal injection technique was used. The cricothyroid membrane is marked by a shallow depression in between the cricoid and thyroid cartilages. Procedure was done under aseptic precaution and the patients were warned that the voice box would get numb. The area was punctured with a 20-22 G needle attached to 5 ml syringe filled with 4 ml of 4% lignocaine.. After the confirmation of correct placement of needle by aspiration of air, 4ml of 4% lignocaine is instilled by needle through the cricothyroid membrane and waited for 60-90 seconds.

In Group S (n=30) patients, spray as you go technique was used. 4ml of 4% lignocaine was instilled in 2 parts; first 2 ml on to vocal cords and after 60-90 sec fiberscope was further proceeded. 2ml of 4% lignocaine was instilled into the trachea by visualizing through fiberscope and waited for 60-90 seconds.

The fiberscope was introduced through the glottis opening entering the trachea visualizing the tracheal rings and the carina and then suitable sized endotracheal tube was railroaded through the fiberoptic bronchoscope into the trachea. The successful passage of the tube through the vocal cords confirmed by identification of the carina through bronchoscope and again position of the tube was reconfirmed by mainstream capnograph and then tube was secured and the cuff inflated. After intubation general anaesthesia was administered using injection propofol 2 mg/kg IV and atracuronium 0.5 mg/kg IV with isoflurane and establishing mechanical ventilation. During this entire procedure that is, from the passage of the tube into the nares and the manipulation of the scope till placement of the tube in the trachea, vital parameters were observed at baseline, before procedure, every 1 minute, 5minutes, 10 minutes and after intubation. Intubation time (i.e. time from introduction of the fiberscope till the first measurement of end-tidal carbon dioxide was recorded) and number of attempts were recorded. Incidents of cough (abrupt expiratory sounds), stridor (musical inspiratory sounds)

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

and other complications were noted. Data were manually recorded by the attending anaesthetist, entered into a Microsoft Excel 2013 spreadsheet and then checked by one of the study investigators to ensure data fidelity. Data were exported to a statistical program for further analysis.

To assess the parameters, grading scale used is:

Intubation grading scale (as assessed by anaesthesiologist**)**

1. No coughing/gagging in response to intubation.
2. Mild coughing/gagging that did not hinder intubation. No adverse events, cooperative and well tolerated.
3. Moderate coughing/gagging that interfered minimally with intubation, cooperative with reassurance, tolerated the tube well.
4. Severe coughing/gagging, required additional local anaesthesia and/or other change in technique. Uncooperative, did not allow scope to pass beyond glottis.

To assess the severity of symptoms, severity scale ranging from 1 to 5 will be employed to assess the patients' quality of anaesthesia and intubation.

Severity scale (reported by patient)

Not unpleasant -1

Uncomfortable- 2

Unpleasant -3

Most unpleasant -4

Intolerable -5

After the procedure, patients were kept in recovery room for 2 hrs at the end of which they were asked to document their experience on any discomfort experienced during the procedure. Post operative satisfaction was graded accordingly.

STATISTICAL ANALYSIS

Results were expressed as mean ± standard deviation. Student t-test was applied for demographic data and hemodynamic parameters. Chi square test was applied for non parametric data like intubation grading scale, severity scale, grading of overall intubating condition. Sample size was calculated to be 30 patients in each group. To allow for study error and attrition, a total of 90 patients were included in this study. The observed difference in intubation grading between two groups was statistically significant ($p<0.05$).

P Value denotes level of significance:

- P >0.05 Insignificant
- P < 0.01 Highly Significant (significant at 99% confidence level)
- p< 0.001 Very Highly significant (significant at 99.9% confidence level)

3. OBSERVATIONS AND RESULTS

A total of 60 patients fulfilling inclusion criteria were enrolled and were allocated into two groups of 30 each. Group T intubated via fiberscope with transtracheal injection (cricothyroid puncture) and Group S intubated via intubating fiberscope with "spray as you go" technique.

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

One patient in the spray group required additional 2 ml of 4% lignocaine instilled on to the vocal cords.

All patients were demographically similar. Mean age of patients of group T was 43.83±10.22 years whereas mean age of patients in group S was 44.7±13.7 years. However, the observed difference in age composition between two groups was statistically insignificant ($p>0.05$). The difference in mean heart rate (bpm), systolic blood pressure (mmHg), mean arterial pressure (mmHg) in group T was 79.97±5.04, 124±3.52, 99.33±1.953 at 1 minute as compare to 90.13±5.37, 129.73±3.00, 102.17±2.65 in group S. At 5 minutes, mean heart rate (bpm), systolic blood pressure (mmHg), mean arterial pressure (mmHg) in group T was 79.68±5.07, 121.73±2.08, 95.27±1.780 and group S was 84.23±4.75, 128.07±2.59, 100.03±3.102 respectively. At 10 minutes, difference in systolic blood pressure (mmHg), mean arterial pressure (mmHg) in group T was 117.53±3.17, 92.57±2.445 as compare to126±4.034, 96.53±4.015 in group S. And after intubation difference in systolic blood pressure (mmHg), mean arterial pressure (mmHg) in group T was 118.2±3.57, 88.77±2.459 as compare to120.27±2.9, 90.73±2.019 in group S respectively, which was statistically significant (p value<0.05).

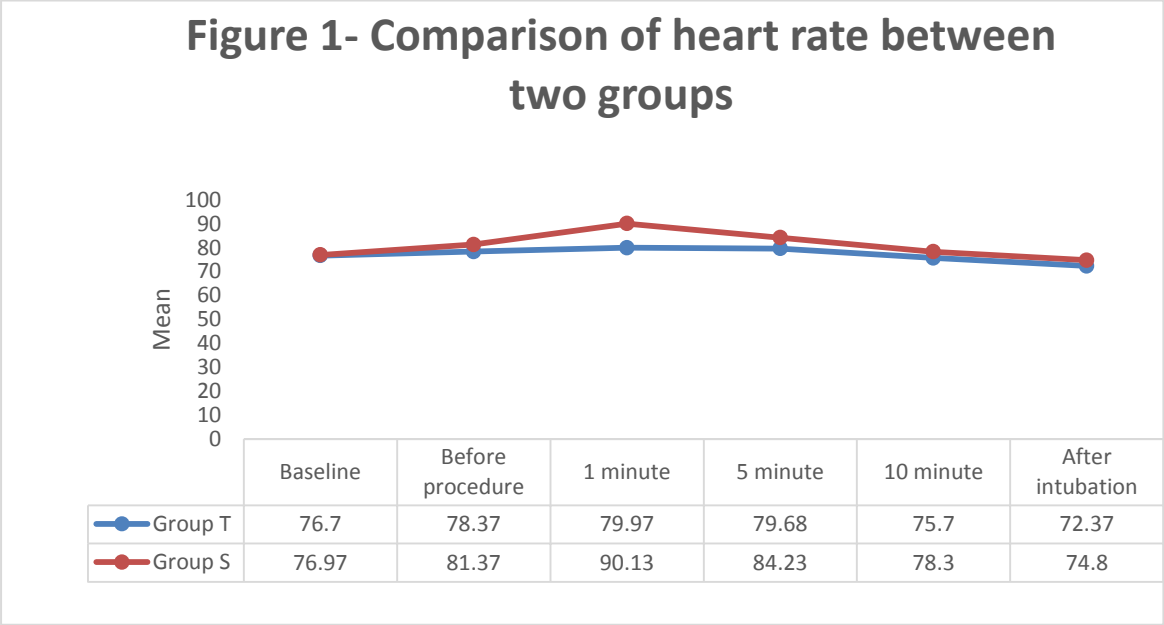
Intubation grade I and grade II were documented in 20% and 0% patients in group T as compared to 40% and 10% patients in group S. Severity grading of 1 was observed in 80% patients in group T as compared to 50% cases of group S, respectively, which was statistically significant p value =0.012. Complications like cough was observed in 5 patients of group T and 14 patients of group S, stridor in 1 patient of group T and 4 patients of group S respectively. Only 1 patient of group S showed bleeding, which was statistically significant ($p<0.05$).

Post-operative patient satisfaction scores in Group T and S, 29 (96.6%) and 8 (26.6%) patients rated their experience of fiberoptic intubation as excellent or good. In Group T and S, one (3.3%) and 6 (20%) patients rated the experience as poor respectively.

Table 1 - Demographic data

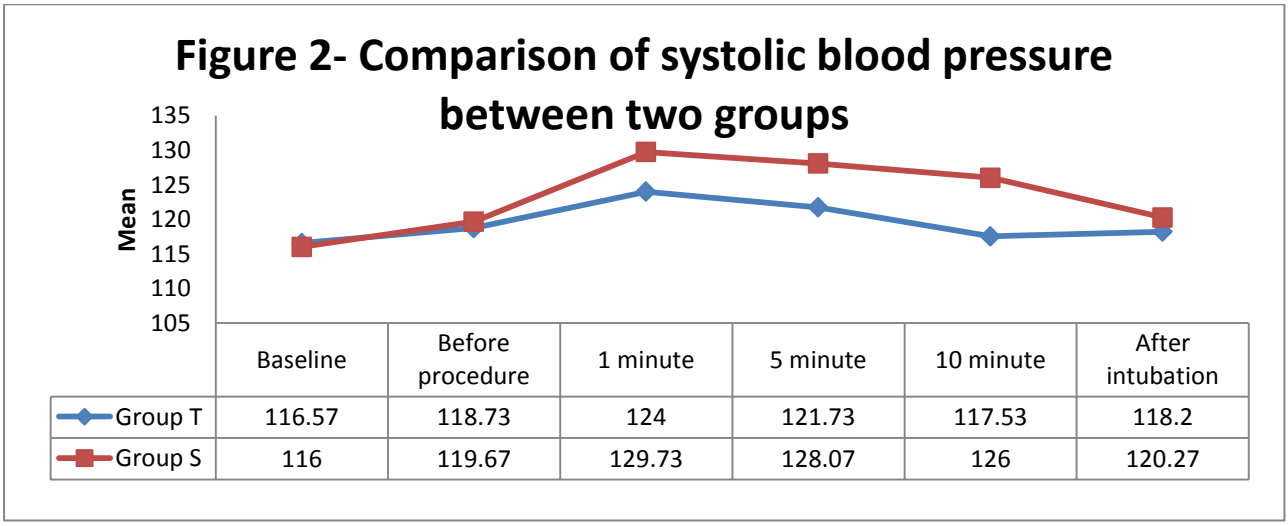
Age (in Years)	Group T (N = 30)		Group S (N = 30)	
	Frequency	Percentage (%)	Frequency	Percentage (%)
≤30	4	13.3	2	6.7
31-40	8	26.7	7	23.3
41-50	7	23.3	9	30
51-60	9	30	6	20
>60	2	6.7	6	20
Mean age	43.83±10.22		44.7±13.7	
χ^2=3.58; p=0.47				

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023



	Baseline	Before procedure	1 minute	5 minute	10 minute	After intubation
Group T	76.7	78.37	79.97	79.68	75.7	72.37
Group S	76.97	81.37	90.13	84.23	78.3	74.8

Figure 1 shows in the present study difference in mean heart rate between group T and group S at baseline and before procedure was statistically insignificant ($p>0.5$). However, after intubation, mean heart rate in group T was 79.97±5.04 at 1 minute as compared to 90.13±5.37 in group S. Similarly, mean heart rate at 5 minute in group T and group S was 79.68±5.07 and 84.23±4.75 which was statistically significant. At 10 minute was 75.70±4.72 and 78.30±4.145 and after intubation was 72.37±2.68 and 74.80±3.2 in group T and group S respectively which was not significant.



	Baseline	Before procedure	1 minute	5 minute	10 minute	After intubation
Group T	116.57	118.73	124	121.73	117.53	118.2
Group S	116	119.67	129.73	128.07	126	120.27

Figure 2 shows mean systolic blood pressure (mmHg) in both the groups were comparable at baseline and before procedure ($p>0.05$) whereas after intubation, mean systolic blood pressure were observed to be significantly higher in patients of Group S as compared to group T throughout the intubation period and even after intubation ($p<0.05$).

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

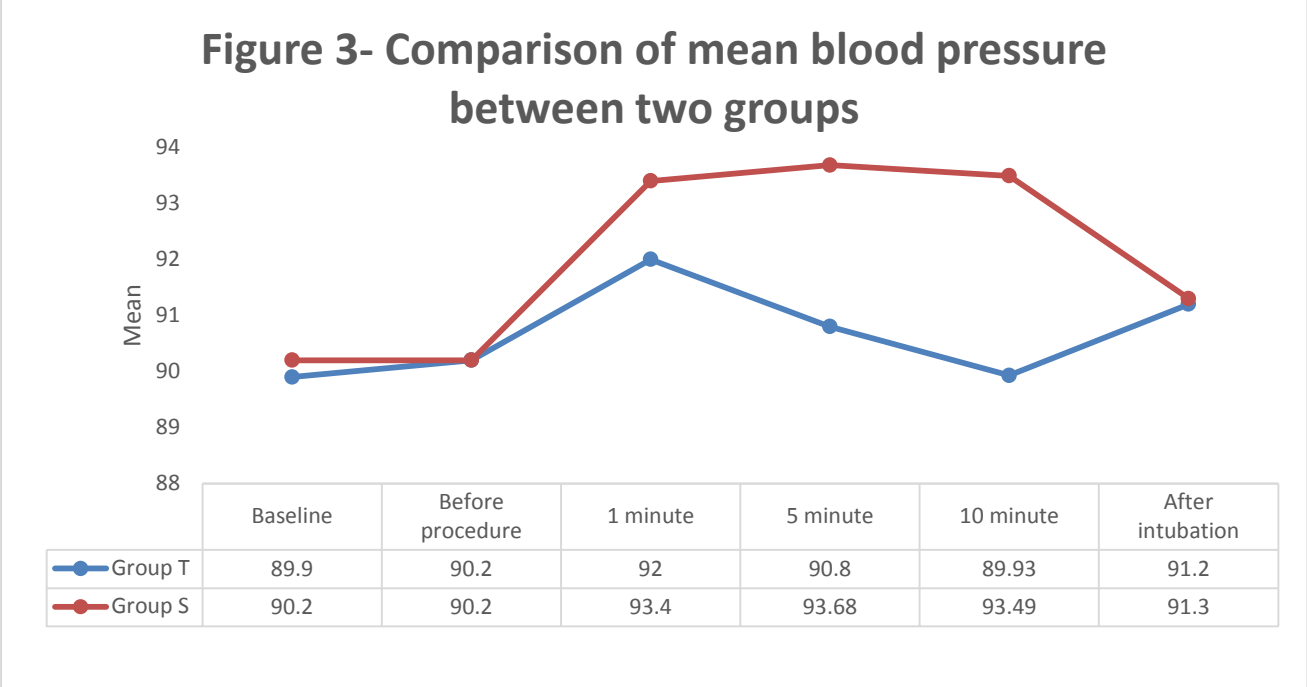


Figure 3 shows, in present study, mean arterial pressure in both the groups was comparable at baseline and before procedure ($p>0.05$) whereas after intubation, mean arterial pressure in group T was 92±2.7 at 1 minute as compare to 93.4±2.41 in group S. Similarly, mean arterial pressure at 5 minute in group T and group S was 90.8±2.93 and 93.68±2.74, at 10 minute was 89.93±3.11 and 93.49±3.91 and after intubation was 91.2±2.17 and 91.3±2.03 respectively, which was significantly higher in patients of group S as compared to group T ($p<0.05$).

Table 2- Comparison of Intubation time between two groups

Intubation Time (Minutes)	Group T (N = 30)	Group S (N = 30)
Mean	2.65	3.09
SD	0.45	0.55
p=0.001		

Table 2 shows the mean intubation time required to transverse the vocal cord for group T (2.65±0.45) minutes was shorter than that for group S (3.09+0.55) minutes. The bronchoscopy took longer time in group S than in Group T. The observed difference in intubation time between two groups was statistically significant (p=0.0013).

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

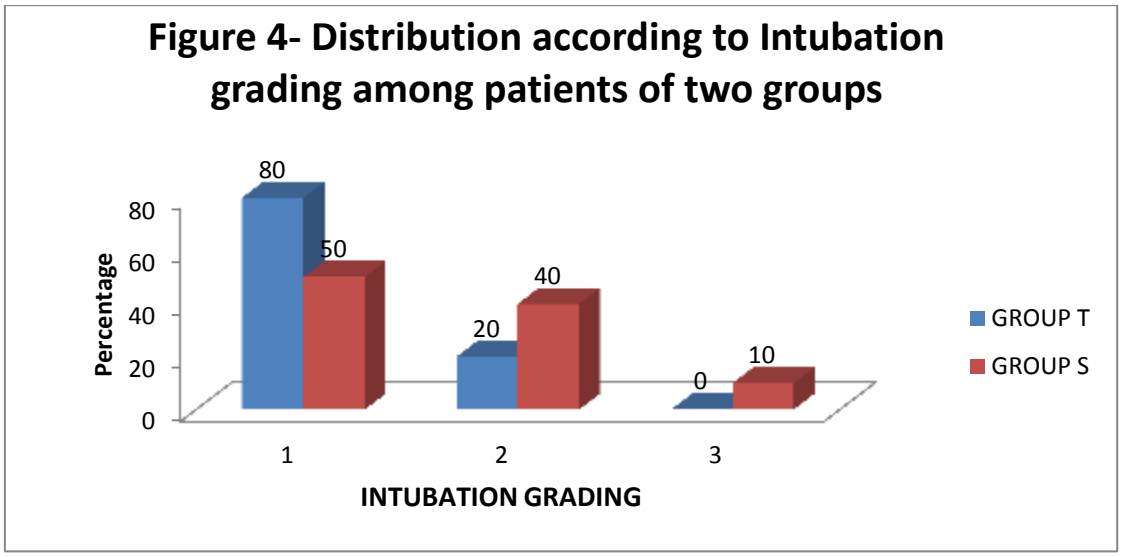


Figure 4 shows that 80% patients in group T had intubation grading of I as compared to 50% cases of group S. However intubation grade II and grade III were documented in 20% and 0% patients in group T as compared to 40% and 10% patients in group S respectively, which was statistically significant (p value =0.012)

Table 3- Comparison of severity scale between two groups

Severity scale	Group T (N = 30)		Group S (N = 30)	
	Frequency	Percentage	Frequency	Percentage
1	24	80	15	50
2	6	20	12	40
3	0	0	3	10
χ^2=5.93; p=0.012				

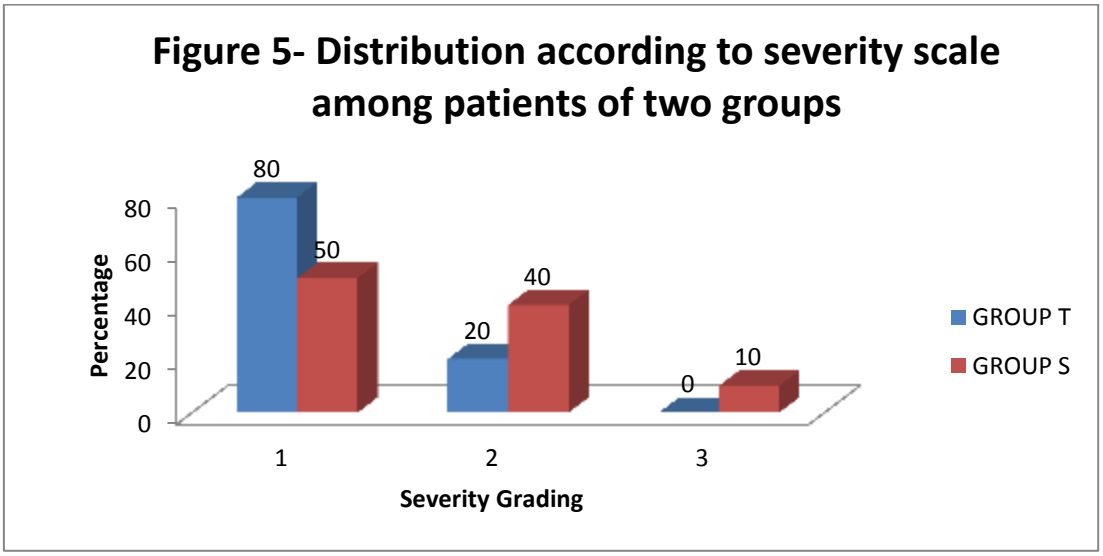


Figure 5 shows severity scale. Severity grading of 1 was observed in 80% patients in group T as compared to 50% cases of group S. However intubation grade II and grade III were

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

documented in 20% and 0% patients in group T as compared to 40% and 10% patients in group S respectively, which was statistically significant p value =0.012).

Table 4- Comparison of complications between two groups

Complications	Group T (N = 30)		Group S (N = 30)		χ^2	P value
	Frequency	Percentage (%)	Frequency	Percentage (%)		
Cough	5	16.7	14	46.7	6.24	0.012
Stridor	1	3.3	4	13.3	1.96	0.16
Bleeding	0	0	3	10	3.2	0.076

In Table 4, shows mean cough count was significantly higher in group S (14) as compared to group T (5) with p value 0.012. Similarly, occurrence of bleeding and stridor was also higher in group S as compared to group T. The present study observed significantly higher incidence of cough in group S as compared to group T ($p<0.05$).

4. DISCUSSION

This Clinical Observational Hospital based Study aimed to compare two techniques of local anaesthesia i.e. transtracheal injection and "spray as you go" technique for fiberoptic intubation.

Difference in *mean heart rate* in group T and group S at 1 minute was 79.97±5.04 and 90.13±5.37, at 5 minute was 79.68±5.07 and 84.23±4.75, at 10 minute was 75.70±4.72 and 78.30±4.145 and after intubation was 72.37±2.68 and 74.80±3.2 respectively, statistically significant ($p<0.05$) which is also comparable in Alka et al (2011)(5) (8.23+10.22 in transcricoid group and 87.06+10.20 in spray group), but it increased significantly in spray group when measured 5 min after the procedure (90.46+9.30 in transcricoid group and 97.36+9.03 in spray group). Naresh et al (2018)(6) observed that the base line pulse was 78.40 ± 4.61 bpm in transcricoid (Group A), 80.73 ± 6.00 bpm in spray (Group B) and 78.53 ± 6.00 bpm in nebulization (Group C).

Mean systolic blood pressure in group T was 124±3.52 at 1 minute as compare to 129.73±3.00 in group S. Similarly, systolic blood pressure at 5 minute in group T and group S was 121.73±2.08 and 128.07±2.59, at 10 minute was 117.53±3.17 and 126±4.034 and after intubation was 118.2±3.57 and 120.27±2.9 respectively, which was significantly higher in patients of Group S as compared to group T throughout the intubation period and even after intubation which is also comparable in Alka et al (2011)(5) who observed that mean basal values of systolic blood pressure in both the groups i.e. 119.46±5.89 and 120.26±7.26 mmHg which was comparable before starting the procedure.

Mean arterial pressure in group T was 99.33±1.953 at 1 minute as compare to 102.17±2.65 in group S. Similarly, mean arterial pressure at 5 minute in group T and group S was 95.27±1.780 and 100.03±3.102, at 10 minute was 92.57±2.445 and 96.53±4.015 and after intubation was 88.77±2.459 and 90.73±2.019 respectively, which was significantly higher in patients of group S as compared to group T comparable to Alka et al (2011)(5) and Naresh et

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

al (2018)(6) study (p<0.02) who observed that the base line MAP was 92.73.± 5.64 mmHg in transcricoid group A, 94.46± 5.82 mmHg in spray Group B and 92.33± 7.32 mmHg in nebulization Group C. In Group A the MAP increased up to 99.33± 6.33 mmHg, in Group B was 107.42± 8.95 mmHg and in Group C was 102.70± 8.11 mmHg. In contrast, Dhasmana et al (2009)(8), Bindu et al (2017)(9), Karan et al (2019)(10) observed the baseline values of all the variables were comparable. Harpreet et al (2018)(11) observed the rise in mean arterial pressure was more in group who received local anaesthesia with nebulisation but the differences in both the groups were statistically non-significant.

Mean intubation time required to transverse the vocal cord for group T (2.65±0.45) minutes was shorter than that for group S (3.09+0.55) minutes, which was statistically significant (p<0.05) and comparable with, Alka et al (2011)(5) found that mean time to reach carina was significantly lesser in transcricoid group (57.33±12.98s) as compared to spray as you go group (79.33±22.35s) during fiberoptic bronchoscopy. Malcharek et al (2015)(12) who observed that awake FOI was significantly faster using the translaryngeal technique (mean, 191 s; range, 123 to 447 s; SD, 83.5) than the Enk Fibreoptic Atomizer (mean, 430 s; range, 275 to 773 s; SD, 124.9).Naresh et al (2018)(6) who observed that intubation was successful in all patients. The mean intubation time for transcricoid group (70.72±14.32 s) was shorter than that for spray group (127.83±33.30 s) & nebulization group (89.83±25.34 s) (P=0.029).In contrast, Webb et al (1990)(4) , Sethi et al (2005)(13), Bansal P et al(2018)[16] reported that the patients in nebulisation group took more time for intubation. Harpreet Kaur et al (2018)(11) who observed that the intubation time was to be more in nebulized group as compared to spray group, which was found to be highly significant (p-value <0.0023).(2)

Severity scale grading in group T and group S was 80% patients and 50% patients in grade 1, 20% patients and 40% patients in grade 2, 0% patient and 10% patients in grade 3 respectively, which was statistically significant (p value = 0.012). According to severity scale patients were more comfortable during procedure in group T than group S which were comparable to following studies Bindu et al (2017)(9), Naresh et al (2018)(6), they observed quality of anaesthesia was significantly better in transcricoid group as evidenced by significantly higher patients (76.6%) showed procedure was not unpleasant (Grade 1). Karan et al (2019)(10) who observed that satisfaction and VAS score (mean [standard deviation], cricothyroid, 7.86 [1.39], and spray-as-you-go, 6.86 [1.59], p < 0.0001), it was significantly greater in the cricothyroid group. In contrast, Sethi et al (2005)(13) and Webb et al (1990)(4) who observed that neither local anaesthetic technique was associated with a more unpleasant bronchoscopy for the patient.

Cough counts were observed in 46.7% cases of group S whereas it was observed in only 16.7% cases of group T which was statistically significant with p value equal to 0.012. It is also comparable with following studies, Webb et al (1990)(4) found that the cough rate was lower in the transcricoid group, the mean rate being 3.56 coughs/min compared with 5.89 coughs/min in the spray group (t = 2.24, p < 0 05). A reduction in cough count seen with Graham et al (1992)(14). Sean C. et al (2004)(15) who observed that the incidence of coughing before tracheal extubation was less frequent in the lidocaine group (26%) than in the placebo group (66%,P<0.01). Khalid et al (2014)(16) who observed that cough score was significantly higher in spray group as compared to cricothyroid injection group (p < 0.001).

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

Dattatraya et al (2017)(17) who observed that mean cough count for transcricoid group was 14 and spray group was 22. From this cough count for transcricoid group was significantly lower than spray group ($P < 0.05$). In this study transcricoid group showed less cough count than spray group. In contrast, D. Keane et al (1992)(18) and Sethi et al (2005)(13) reported that the patients in nebulisation group have more number of coughing and gagging episodes and poor intubating conditions.

Study limitations

We did not use a cough recorder device to objectively measure the cough count. Recent reports have described the use of ultrasound as a useful modality for accurate localization of the cricothyroid membrane especially in females, wherein it may be difficult to accurately localize using anatomic palpation alone. We did not use ultrasound for localization prior to transtracheal puncture due to operator familiarity and experience. However, it might be useful for bronchoscopists who wish to introduce the transtracheal method into practice to consider the use of ultrasound to familiarize themselves with the anatomy of the puncture site and subsequently they can perform the procedure with anatomic localization alone. Majority of the procedures in the study were performed without the administration of intravenous sedation. Although one would expect the findings to be similar in settings with use of mild or moderate amounts of sedation for bronchoscopy, findings may be different in settings where deep sedation is used for bronchoscopy. Another potential limitation of the study is excluding cough measurement in the initial transtracheal puncture step, and ideally the whole procedure should be included. For making our study unbiased, we excluded the patients using extra dose of lignocaine. So, similar dose is given to each patient on our study.

5. CONCLUSION

Based on our experience in the present study, we conclude that the transtracheal method can be recommended as a safe method of topical anaesthesia for fiberoptic intubation. As the primary reason for topical anaesthesia of the respiratory mucosa is, to reduce cough with minimal haemodynamic variation. The reduced rate of cough produced by the transtracheal technique and a significant reduction in the total time of fiberoptic intubation is a clear advantage of this technique for our practice. There were no complications associated with transtracheal injection and the minor bleeding associated with the technique did not interfere with the procedure which was acceptable to the patients. In conclusion, the transtracheal method was more effective than the "spray as you go" method for fibreoptic intubation.

6. BIBLIOGRAPHY

1. Collins SR, Blank RS. Fiberoptic intubation: an overview and update. Respir Care. 2014 Jun;59(6):865–78; discussion 878-880.
2. HOPKINS HH, KAPANY NS. A Flexible Fibrescope, using Static Scanning. Nature. 1954 Jan 1;173(4392):39–41.

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

3. Sellers WFS. A response to "Difficult Airway Society guidelines for management of the unanticipated difficult intubation", Henderson JJ, Popat MT, Latto IP and Pearce AC, Anaesthesia 2004; 59: 675-94. Anaesthesia. 2004 Nov;59(11):1152.
4. Webb J. Local anaesthesia for fibreoptic bronchoscopy--where are we now? Respir Med. 1990 Sep;84(5):349–50.
5. Chandra A, Banavaliker JN, Agarwal MK. Fibreoptic bronchoscopy without sedation: Is transcricoid injection better than the "spray as you go" technique? Indian J Anaesth. 2011 Sep;55(5):483–7.
6. Department of Anaesthesia, Sardar Patel Medical College & AGH, Bikaner, Rajasthan, Sharma NK. A comparative evaluation of three different methods used to achieve local anaesthesia for fiberoptic guided intubation under sedation. J Med Sci Clin Res [Internet]. 2018 Mar 31 [cited 2020 Oct 11];6(3). Available from: http://jmscr.igmpublication.org/v6-i3/211%20jmscr.pdf
7. Sutherland AD, Williams RT. Cardiovascular responses and lidocaine absorption in fiberoptic-assisted awake intubation. Anesth Analg. 1986 Apr;65(4):389–91.
8. 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 Jun;14(2):398–402.
9. 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 Aug;61(8):661–6.
10. Madan K, Mittal S, Gupta N, Biswal SK, Tiwari P, Hadda V, et al. The Cricothyroid versus Spray-As-You-Go Method for Topical Anesthesia during Flexible Bronchoscopy: The CRISP Randomized Clinical Trial. Respir Int Rev Thorac Dis. 2019;98(5):440–6.
11. Kaur H, Khetarpal R, Chatrath V, Kaur H, Khanna P. To Compare the Efficacy of Local Anaesthetic Administration via Spray as you Go Technique and Ultrasonic Nebulisation for Awake Fiberoptic Intubation. J Clin Diagn Res [Internet]. 2018 [cited 2020 Sep 22]; Available from: http://jcdr.net/article_fulltext.asp?issn=0973-709x&year=2018&volume=12&issue=1&page=UC01&issn=0973-709x&id=11067
12. 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 Sep;32(9):615–23.
13. Sethi N, Tarneja VK, Madhusudanan TP, Shouche S. Local Anaesthesia for Fiberoptic Intubation : A Comparison of Three Techniques. Med J Armed Forces India. 2005 Jan;61(1):22–5.
14. Graham DR, Hay JG, Clague J, Nisar M, Earis JE. Comparison of three different methods used to achieve local anesthesia for fiberoptic bronchoscopy. Chest. 1992 Sep;102(3):704–7.
15. Minogue SC, Ralph J, Lampa MJ. Laryngotracheal topicalization with lidocaine before intubation decreases the incidence of coughing on emergence from general anesthesia. Anesth Analg. 2004 Oct;99(4):1253–7, table of contents.

ISSN: 0975-3583, 0976-2833 VOL14, ISSUE12, 2023

16. Razzaq K, Khan KA, Tariq KM. COMPARISON OF EFFICACY OF LIGNOCAINE ANESTHESIA OF VOCAL CORDS BY "SPRAY AS YOU GO" THROUGH A BRONCHOSCOPE WITH LIGNOCAINE INJECTION THROUGH THE CRICOTHYROID MEMBRANE. Pak Armed Forces Med J. 2014 Jun;64(2):273–6.
17. Gangurde D, Bhagat HP. Comparative Study of Topical Local Anesthesia using Transtracheal (Transcricoid) Injection and "Spray as You Go" Technique during Awake Fiberoptic Intubation of Oral Cancer Patients Posted for Elective Surgery. 2017;4(11):3.
18. Keane D, McNicholas W. Comparison of nebulized and sprayed topical anaesthesia for fibreoptic bronchoscopy. Eur Respir J. 1992 Oct 1;5(9):1123.