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*Research Article*

# GLIDESCOPE VERSUS FLEXIBLE FIBEROPTIC BRONCHOSCOPE GUIDED ENDOTRACHEAL INTUBATION IN PATIENTS WITH ANTICIPATED DIFFICULT AIRWAY - A RANDOMIZED CONTROL TRIAL

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A B S T R A C T

**Objective:** The Glidescope video laryngoscope (GSVL) is a novel intubating device used for difficult airway management. In this randomised control trial, we have compared glidescope with flexible fibreoptic bronchoscope not only in terms of hemodynamic responses but also through various intubating parameters in anticipated difficult airway. **Methods:** Sixty-eight patients were randomly allocated to either glidescope (Group A) or fibreoptic group (Group B). Non-invasive blood pressure (NIBP), heart rate (HR)mean arterial pressure (MAP) and oxygen saturation ($SpO_2$) were recorded before induction, after induction, before intubation, one, three, five and ten minutes after intubation. Number of attempts required for intubation, intubation time, additional manoeuvre to facilitate intubation, change of performer, mucosal/dental injury, post operative sore throat, Modified Cormack and Lehane grade and POGO score were recorded. **Results:** Intubation time was significantly lower in Glidescope group as compared to Fibreoptic group (67.79±20.79 vs 89.03±20.52) seconds respectively (*P* 0.0001), change of performer seen more with Fibreoptic group, (*P* 0.031). HR and MAP were significantly increased at5 and 10 minutes of post intubation in fibreoptic group as compared to glidescope group. **Conclusion**: Glidescope provides better hemodynamic stability with faster intubation and insignificantly higher first successful intubating attempt.



## INTRODUCTION

The American Society of Anaesthesiologists (ASA) defined difficult airway as "The clinical situation in which a conventionally trained anaesthesiologist experiences difficulty with facemask ventilation, difficulty with tracheal intubation or both*"*.[1]Difficulty with airway management has serious implications, as failure to secure airway can result in hypoxic brain injury or death in a matter of minutes. [2,3]Oxygenation should be maintained when difficulty is experienced with intubation and further attempts to be deferred until oxygenation is restored.[4]The hemodynamic response can be attenuated by reducing time required for intubation and number of attempts needed to successfully intubate.[5]

Glidescope is gaining popularity in difficult intubation since past few years. It consists of a high-resolution digital video camera, embedded into its blade and a liquid crystal monitor with its own light source. The blade of Glidescope is equipped with an anti-fogging system, thickness of 18millimetres and a 60-degree curve, since there is no need for larynx to be visualised directly. Illumination and contrast is provided by the plastic blade of laryngoscope which incorporates red and blue light emitting diodes.[6,7 ]It is not mandatory to place the patient in morning sniffing position for intubation, hence recommended in patients with limited neck extension, including cervical injury.[1]

Dr. Peter Murphy used a flexible fiberscope (FOB) for tracheal intubation for the first time in 1967. It is an important part of difficult airway management algorithm which requires a high degree of expertise to manoeuvre quickly under stressful clinical conditions. It contains insertion cord which is coated with glass fibres. Optical characteristics of very thin (diameter 8-25 $\mu m$) flexible glass fibres is the basis of technology which transmit light over their length. There is a collection of 10,000 fibres in a bundle for good resolution. [5,8] FOB is indicated in reduced mouth opening, patients with difficult airway, cervical spine spondylitis, facial lacerations/fractures, upper airway lacerations, obesity etc.[5,9]Mechanical stimulus to base of tongue and vallecula and receptors in pharyngeal muscles is avoided by FOB which is exerted by laryngoscopy; hence it is helpful in attenuating hemodynamic response.[10]The cornerstone in the management of difficult airway are Glidescope Video Laryngoscope (GSVL) and flexible Fibreoptic Bronchoscope (FOB).[11,12]

There are only limited studies which provide evidence comparing intubation time, number of attempts required for intubation, additional manoeuvre to facilitate intubation, change of performer, hemodynamic response before and after

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intubation, success rate, mucosal/dental injuries between Glidescope and Fiberoptic Bronchoscope in anticipated difficult airway. None of the studies have taken into account all of these factors at once, thus need of this study. Although both these devices have marked utility in difficult airway, detailed comparison of the above-mentioned aspects help understand the clinical use in a more practical manner.

## MATERIAL AND METHODS

Ethics – Methodology of the study is according to Ethical principles for medicine research involving human subjects outlined in the Declaration of Helsinki of 1975, revised in 2000. Approval by the Institutional Ethics Committee (IEC), Rohilkhand Medical College and Hospital (RMCH), Bareilly, Uttar Pradesh, India on 15.10.2020 was obtained (IEC/08/2020/OCT). Informed written consent and approval of each patient for participation in the study was taken. Confidentiality and anonymity of all patients was maintained throughout the study.

Study design – Prospective randomised control trial, single blinding with computer generated randomization technique was used (CTRI No. - CTRI/2021/08/035834 registered on 23/08/2021).

***Selection and Description of Participants***

***Inclusion Criteria***

1. American society of Anaesthesiologists (ASA) grade I (normal healthy) and II (patients with mild systemic disease).[14]
2. Mallampati grade (MPG) III (soft palate and hard palate visible), IV (only hard palate visible).[15]
3. Limited neck mobility
4. Age group 19-65 years. [16,17]

***Exclusion Criteria***

1. Ischemic heart diseases, myocardial infarction, Chronic Obstructive Pulmonary Disease (COPD)
2. $SpO_2$ <95% on room air
3. Nil mouth opening

Randomization of the patients in to groups was done with computer generated random number tableand divided in to 2 groups, Group “A” and “B” containing 32 patients in each group.

**Group “A”**:

Patients were nasally/orally intubated with Glidescope Video laryngoscope (GSVL).

**Group “B”:**

Patients were nasally intubated with flexible Fibreoptic bronchoscope (FOB)

***Pre-anaesthetic monitoring and pre-medication***

Tablet Ranitidine 150 mg and tablet Alprazolam 0.25 mg were given orally, the night before surgery and at 6 a.m. in the morning of surgery. Nil per oral (NPO) order was advised to all patients.

In the pre-operative room, patients were nebulized with 3 mL 4% Lignocaine (plain) half an hour before surgery, instillation of two drops of oxymetazoline nasal drops in each nostril and Inj. Glycopyrrolate 0.2 mg was administered by intramuscular route. Wide bore (16G or 18G) intravenous cannula was secured in non-dominant hand.

In operation theatre all the routine standard ASA monitors like Non-invasive blood pressure (NIBP), electrocardiography (ECG), pulse oximetry ($SpO_2$), respiratory rate (RR) and temperature were attached to the patients. Premedication was done with Midazolam 1mg and Butorphanol 1mg by intravenous route.

***Induction of anaesthesia and intubation***

All patients were preoxygenated with 100% $O_2$ for 3-5 minutes, then induction was done with Propofol 2.0 mg/kg through intravenous route. After achieving end point of induction (loss of verbal command), check ventilation was performed.

In group A, intubation was attempted after keeping the head in neutral position, the Glidescope laryngoscope blade was introduced through midline and advanced till glottis was visualised on the screen. After that Succinylcholine 1.5 mg/kg was given intravenously, after proper visualisation of vocal cords. The endotracheal tube (ETT) of the appropriate size with stylet inside it, was introduced nasally or orally, passed through vocal cords and then stylet was removed.

Group Bpatients also intubated keeping head in neutral position. Flexo-metallic endotracheal tube of appropriate size was rail roaded over bronchoscope. After applying 2% lignocaine jelly over the desired nostril, FOB was guided through oropharynx, hypopharynx and visualisation of vocal cords was done with the aim of visualising cartilaginous rings of trachea. The trachea was entered and bronchoscope was advanced until the carina was in view and finally endotracheal tube was advanced over the fiberscope into the trachea. Endotracheal tube was advanced into the trachea and cuff inflated. End tidal Carbon dioxide ($EtCO_{2)}$ monitor was attached and capnograph was monitored.

All parameters regarding intubation (MPG classification, attempts required for intubation, intubation time, mucosal/dental injury, additional maneuver to facilitate intubation, change of performer, modified Cormack Lehane score and POGO score) were recorded. Recording of heart rate, blood pressure (systolic and diastolic), mean arterial pressure, arterial $O_2$ saturation at baseline, after induction of anaesthesia, then immediately before intubation and subsequently after 1 minute, 3 minutes, 5 minutes and 10 minutes of intubation was done. Anaesthesia was maintained with $O_2$ and $N_2O$ in the ratio 40:60, Isoflurane with the MAC of 0.6 and Vecuronium with the loading dose of 0.08-0.12 mg/kg IV was given. The maintenance dose of vecuronium 0.02 mg/kg IV was administered intermittently. At the end of surgery, anaesthesia was reversed with Neostigmine 0.05mg/kg and Glycopyrrolate 0.008 mg/kg via intravenous route. After spontaneous respiration and regaining of consciousness, extubation was performed. After the patients followed commands and were hemodynamically stable, they were shifted to the Post Anaesthesia Care Unit (PACU). Any complications including post operative sore throat, hoarseness of voice and $O_2$ desaturation were noted. Intubation time was defined as time required from blade insertion to appropriate endotracheal tube placement. Additional manoeuvres to facilitate intubation were BURP (Backward Upward Rightward Pressure), MILS (Manual In line Stabilisation), use of Magill's forceps or jaw lift. A note was also be taken of change of performer in case the performing anaesthesiologist is unable to successfully intubate after 3 attempts. For view of glottis during laryngoscopy, Modified Cormack and Lehane grading was used, higher the grade, more is the difficulty faced during intubation.[18]A scale for the assessment of visualisation of airway during endotracheal intubation is Percentage of Glottic Opening (POGO), which was assessed during direct laryngoscopy.[19]

## RESULTS

Qualitative data was assessed by chi-square test. Quantitative data was represented using mean ± SD (standard deviation) and analysed by t-test. *P* value of <0.05 was considered statistically significant. MS Excel, Statistical Package for Social Sciences (SPSS) Version 23 was used for statistical analysis.

### Observations

#### *Demography*

The mean age of patients in group A was 41.44 ± 9.88 years and in group B was 39.09 ± 11.59 years, *P* value 0.371.There were 25 males and nine females in group A while in group B there were 27 males and seven females, *P* value 0.583.The mean weight of patients in group A was 57.88 ± 9.88 kgand in group B, 57.50 ± 13.37 kg, *P* value 0.894.There was no statistically significant difference in age, weight and gender of patients in between groups A and B.

Twenty-five patients in group A and 23 patients in group B had MPG grade III while 9 patients in group A and 11 in group B had MPG grade IV respectively. The results were comparable (*P* value - 0.595).

Modified Cormack Lehane grade (*P* value 0.841) and Percentage of Glottic Opening (*P* value 0.779) were observed during intubation which revealed no significant difference between the groups.

First attempt success rate was 73.5% in group A as compared to 64.7% in group B. Up to three attempts were required to successfully intubate the patients, which was found to be comparable (*P* value 0.846) shown in Table 1.

Mean intubation time in group A was (67.79 ± 20.79) seconds and in group B was (89.03 ± 20.52) seconds. There was statistically significant difference in intubation time in between patients of groups A and B (*P* value 0.0001) showing group A requiring lesser time (Table 2).

There weresix patients in group A and one patient in group B who required additional maneuver, while 28 patients in group A and 33 patients in group B did not require any additional maneuver respectively to facilitate intubation with *P* value 0.110 which was comparable.

One patient in group A and 8 patients in group B required change of performer, while 33 patients in group A and 26 patients in group B did not require change of performer respectively with *P* value 0.031 which was statistically significant, showing change of performer more in group B (Figure 1).

Occurrence of mucosal or dental injury was higher in Group A (5 patients,14.70 %)as compared to Group B (2 patients, 5.88 %), the difference was not statistically significant with *P* value of 0.425.

While comparing baseline mean heart rate (HR) between group A and B, the value was statistically not significant during different time intervals. After 5 minutes after intubation, mean heart rate between group A and B was (83.62 ± 8.72) versus (90.32 ± 13.61) beats/minute respectively, *P*-value was 0.018 which was statistically significant, increase in heart rate was observed more in group B. After ten minutes of intubation mean heart rate between group A and B was (83.59 ± 8.90) v/s (91.94 ± 13.77) beats/minute respectively, *P*-value was 0.004 which was statistically significant (Table 3). While comparing the mean systolic and diastolic blood pressure between groups A and B during baseline and at different time intervals, the difference was not statistically significant (Table 4). The mean MAP between groups A and B after five minutes of intubation was (90.34 ± 7.93) vs (95.51 ± 9.36) mmHg respectively, *P*-value was 0.016 which was statistically significant. After ten minutes of intubation mean MAP between groups A and B was (92.48 ± 7.23) vs (97.19 ± 10.45) mmHg respectively, *P*-value was 0.034 which was statistically significant. At other time intervals the value was non-significant (Table 4).

The mean baseline oxygen saturation and at various time intervals was not significant.

**Table 1** Intubation attempts

| Intubation Attempts | Group A (n=34) | Group B (n=34) | *P*-value |
|---|---|---|---|
| 1 | 25 (73.5%) | 22 (64.7%) | |
| 2 | 8 (23.5%) | 9 (26.4%) | |
| 3 | 1 (2.9 %) | 3 (8.8%) | |
| Total | 34 | 34 | 0.846# |
| Mean ± SD | (1.29 ± 0.52) | (1.44±0.66) | |

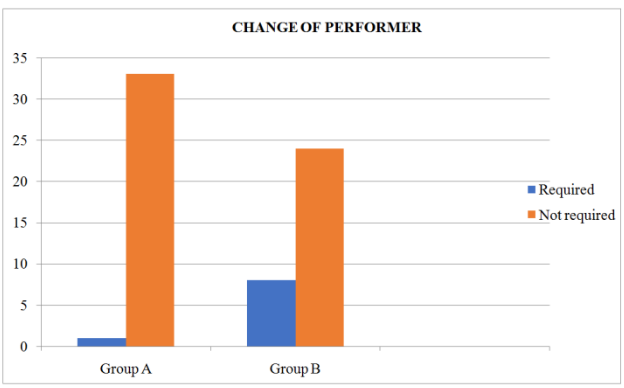
*Statistically not significant

**Table 2** Intubation time

| | Group A (n=34) | Group B (n=34) | |
|---|---|---|---|
| | Mean ± SD | Mean ± SD | *P*-value |
| Intubation time (seconds) | (67.79±20.79) | (89.03 ± 20.52) | 0.0001* |

*statistically significant

**Figure 1** Requirement of change of performer




Not required – one anaesthesiologist successfully intubated trachea; not required – another anaesthesiologist was not required for successful intubation.

**Table 3** Heart rate at different time intervals

| | Group A (n=32) | Group B (n=32) | |
|---|---|---|---|
| **Heart rate (beats/min)** | **(Mean ± SD)** | **(Mean ± SD)** | ***P*-Value** |
| Base line | (83.88 ± 10.13) | (85.06 ± 12.84) | 0.675# |
| After induction | (79.47 ± 10.89) | (82.41 ± 12.77) | 0.310# |
| Before intubation | (78.76 ± 9.99) | (84.56 ± 13.11) | 0.060# |
| After 1 minute | (84.53 ± 12.55) | (88.79 ± 15.64) | 0.219# |
| After 3 minutes | (83.85 ±9.77) | (89.12 ± 14.09) | 0.077# |
| After 5 minutes | (83.62 ± 8.72) | (90.32 ± 13.61) | 0.018* |
| After 10 minutes | (83.59 ± 8.90) | (91.94 ± 13.77) | 0.004* |

**Table 4** SBP, DBP and MAP at different time intervals

| | SBP (mmHg) | | | DBP (mmHg) | | | MAP (mmHg) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Group A (n=32) | Group B (n=32) | | Group A (n=32) | Group B (n=32) | | Group A (n=32) | Group B (n=32) | |
| | (Mean±SD) | (Mean±SD) | *P*-value | (Mean±SD) | (Mean±SD) | *P*-value | (Mean±SD) | (Mean±SD) | *P*-value |
| Base line | (127.94±14.96) | (122.24±13.84) | 0.107# | (79.53±11.17) | (78.79±8.32) | 0.757# | (91.37±10.72) | (93.27 ± 9.42) | 0.523# |
| After induction | (117.76 ±13.29) | (113.35±13.20) | 0.251# | (73.06±11.77) | (71.65±8.78) | 0.577# | (83.96±10.11) | (85.55 ± 9.61) | 0.510# |
| Before intubation | (118.06 ±13.64) | (115.76±12.48) | 0.471# | (74.15±11.51) | (73.47±8.46) | 0.782# | (84.56±9.90) | (87.57 ± 9.11) | 0.200# |
| After 1 minute | (127.32±12.56) | (121.97±12.79) | 0.086# | (81.44±9.67) | (78.26±8.23) | 0.149# | (92.36±9.85) | (92.83 ± 9.06) | 0.838# |
| After 3 minutes | (127.00±12.69) | (122.18±11.64) | 0.113# | (80.56±8.75) | (80.24±8.98) | 0.882# | (91.52±8.69) | (94.22 ± 9.21) | 0.218# |
| After 5 minutes | (124.03±11.26) | (122.94±12.22) | 0.703# | (80.88±9.04) | (81.79±8.98) | 0.696# | (90.34±7.93) | (95.51 ± 9.36) | 0.016* |
| After 10 miutes | (127.29±10.59) | (124.79±12.21) | 0.370# | (82.38± 8.63) | (83.38±10.32) | 0.573# | (92.48±7.23) | (97.19±10.45) | 0.034* |

SBP – Systolic blood pressure, DBP -Diastolic blood pressure, MAP – Mean arterial pressure,
# Statistically not significant, *Statistically significant

## DISCUSSION

Management of an anticipated difficult airway is a skilful task. It includes prior preparedness for airway management and systematic approach towards it, keeping in mind uninterrupted oxygenation and ventilation of the patients.[1,3] In difficult airways, where performing conventional laryngoscopy could be challenging, alternate methods can be executed. The recommended management incorporates modalities like Glidescope video laryngoscope (GSVL), flexible fibreoptic bronchoscope (FOB), supraglottic airway devices to perform intubation in such clinical scenario. They have been proven as rescue intubation techniques in cases which fail by direct laryngoscopy.[18]

In our study Mallampati grade (MPG), Modified Cormack Lehane grade and percentage of glottic opening (POGO) were observed which were not significant as both the groups included patients with comparable difficult airway. In fact by the use of Glidescope, glottic view showed improvement and further eased intubation, which was helpful in difficult airway scenarios, this evidence was supported by Choi GS *et al*.[19] and Benjamin *et al*.[20]

In our study we observed that first attempt of success rate being 73.5% in group A and 64.7% in group B respectively with *P* value of 0.846. Abdelmalak *et al*. found comparable results depicting 95% of the first attempts being successful with the Glidescopeand 86% first-attempt success rate with the flexible Fiberoptic bronchoscope.[21] Wahba SS *et al*. also found similar results, intubations performed with GSVL had success rate of intubation in first attempt of 88% and those intubated with FOB had success rate of intubation in first attempt of 72%.[22] Thus, concluding that successful intubations in the first attempt were more with intubations performed by GSVL as compared to FOB (table 1).

In our study, we found that time required for intubation in group A was (67.79 ± 20.79) seconds and in group B was (84.03 ± 20.52) seconds with *P* value of 0.0001 which statistically significant, depicting that intubation was faster with Glidescope than with Fibreoptic bronchoscope (table 2).Mahran EA *et al*. also concluded that GSVL intubation took lesser time than intubation performed using FOB which was (70.85 ± 8.88) seconds and (90.26 ± 9.41) seconds respectively.[18]Jiang J *et al*. in a systematic review and meta-analysis of randomized control trials of six studies concluded that intubation time was shorter when conducted by glidescope than using FOB with *p* value <0.01.[23]

In our study we found that additional manoeuvre was required during intubation in terms of BURP (backward upward rightward pressure), jaw lift and manual in line stabilisation (MILS). The results were comparable with *P* value of 0.110.Aqil M *et al*. also required the demand external neck manipulation more in Glidescope because of curvature of the blade. Jaw thrust maneuver was applied to all the patients of fibreoptic bronchoscope group which made intubation easier.[24] Arslan ZI *et al*. required more maneuver for optimisation when intubation was carried out with Glidescope similar to our study.[25]

It was observed in our study that a change of performer was required in one patient in groups A and eight patients in group B respectively with *P* value of 0.031 which is statistically significant. Group intubated using FOB witnessed more change of performers may be due to complexity of procedure (figure 1). In accordance to our study Stratigopoulou *et al*. concluded that a second anaesthesiologist was required for passage of endotracheal tube in two out of 15 patients being intubated by fibreoptic bronchoscope.[26]

In our study we observed that mucosal/dental injury occurred in five patients (14.7%) in groups A and two patients (5.8%) in group B respectively with *P* value of 0.425. The difference was not statistically significant. Since, we included patients with MPG 3 and 4 it made the intubation more challenging.

Significant change was detected in heart rate after 5 and 10 minutes of intubation (83.62 ± 8.72, 83.59 ± 8.90) and (90.32 ± 13.61, 91.94 ± 13.77) beats/minute with *P*-value (0.018, 0.004 between group A and B respectively (table 3). Xue FS *et al*. showed similar hemodynamic responses to nasal intubation. HR raised significantly from baseline after intubation in FOB group.[27]Singh R *et al*. studied haemodynamic response to nasal intubation during general anaesthesia with fibreoptic bronchoscopy and similar to our finding, concluded that tachycardia was observed from baseline which was significant.[28]

The increased heart rate was observed more in group intubated by fibreoptic bronchoscope. It could be attributed to the fact that nasotracheal intubation by fibreoptic causes stimulation of nasal cavity, pharynx, glottis and trachea. Singh R *et al*.observed rotationwhile insertion of endotracheal tube into the nostriland in some cases jaw lift was essential.[28]

The results of change in SBP and DBP were comparable between the groups. Similarly, Khudad AM *et al*.and Aqil M *et al*.observed similar rise of BP from baseline in groups being intubated by Glidescope and fibreoptic bronchoscope without any statistically significant difference (table 4).[24,29]

Significant change was noted in MAP after 5 and 10 minutes of intubation (90.34 ± 7.93, 92.48 ± 7.23) and (95.51 ± 9.36, 97.19 ± 10.45) mmHg with *P*-value (0.016, 0.034) between group A and B respectively. The rise in mean arterial pressure was observed more in group intubated by fibreoptic bronchoscope (table 4).Similar to our study, Li XY *et al*.found that MAP increased from baseline after nasotracheal intubation significantly in group intubated by fibreoptic bronchoscope as compared to group intubated by Glidescope.[30]A prolonged intubation time can induce hypercarbia, which results in increased blood pressure which was observed more in fibreoptic group. Also, it causes successive stimulation of nasal cavity, pharynx, glottis and trachea which causes prolonged pressor response.

Mean SpO2 values remained >97% in all the cases at all the different time intervals and no episode of de-saturation was observed.

## CONCLUSION

Both the devices have phenomenal successful intubation rates along with excellent glottic view without any oesophageal or failed intubation. The additional maneuvers to facilitate intubation were required more using Glidescope whereas Fibreoptic bronchoscope required more time and demanded a change of performing anaesthesiologist. Glidescope provides better hemodynamic stability with faster intubation.

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