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Original Research Article

Comparison of video laryngoscopy and direct laryngoscopy during endotracheal intubation- A prospective comparative randomized study

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ABSTRACT

Introduction: Direct laryngoscopy is most widely used method of oro-tracheal intubation but at times it could be difficult, and may lead to adverse effect on cardiovascular system. Video laryngoscopy in contrast provides better visualisation of airway making oro-tracheal intubation easy. The aim of this study was to prospectively compare the use of Video laryngoscope (Glidescope) versus the direct (Macintosch) laryngoscope blade for routine airway management

Materials and Methods: A prospective randomised comparative study was done by randomly allocating patients undergoing elective surgery to one of two Groups comprising 50 patients in each as: Group I-indirect laryngoscope (Video) and Group D-Direct (Macintosh) laryngoscope. After induction patients were intubated according to group allotted. Ease of intubation and other haemodynamic parameters were recorded at numerous intervals as follow: baseline, after induction of anaesthesia, one and five minutes after intubation.

Results: Time required for the laryngoscopy and tracheal intubation in Group I i.e. indirect (18.50 seconds) was more as compared to Group D direct (11.76 seconds) with statistical significance. The Group I procedure significantly reduced tracheal intubation difficulty score and the ease of intubation was statistically insignificant as compared to that of Group D. It was found that there was a significantly better Modified Cormack Lehane Grade in Group I(100%) as compared to Group D(65%).

Conclusion: Video laryngoscopy (Glidescope) is considered advantageous over conventional direct laryngoscope (Macintosh) in terms of lower intubation difficulty score (IDS), better ease of intubation and lower grades of Modified Cormack Lehane Grade with indirect laryngoscopy). It can be used as a teaching tool for novice intubators and offers a new approach to tracheal intubation.

1. Introduction

Intubating the trachea and securing the airway remains a challenge, although it is a routine practice for the anesthesiologist. There is no single factor to predict the existence of a difficult airway and so Difficult airway is not recognized until the induction of anesthesia.[1] The American Society of Anesthesiologists (ASA) defines difficult endotracheal intubation as 3 attempts at endotracheal intubation when an average laryngoscope is used or when endotracheal intubation takes 10 min or more.[2] But difficult intubation is very subjective and it is difficult to measure the degree of difficulty.

Laryngoscopy and passage of endotracheal tube through the larynx can lead to some amount of sympathetic stimulation. The adverse effects of the change in hemodynamic parameters during laryngoscopy and tracheal intubation is related to the degree of manipulation during laryngoscopy.

The Macintosh laryngoscope (MCL) has been the 'gold standard' device for direct laryngoscopy and tracheal intubation since its invention by Foregger in the 1940s.[3]

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In practice, high forward and upward force is applied on the Laryngoscope handle to visualize glottis by aligning oral, pharyngeal and laryngeal axes. As per theory, tracheal intubation performed by indirect (video) laryngoscopy needs comparatively less degree of manipulation of the airway and so we expect less hemodynamic stress responses by using video laryngoscope.

In the present study we have tried to prospectively compare Video Laryngoscopy and Direct Laryngoscopy during Endotracheal Intubationby comparing the duration of the tracheal intubation procedure, comparing the visualization of airway and comparing intubation difficulty score.

2. Materials and Methods

After approval of Institutional ethics committee, a prospective and randomized comparative study was conducted on 100 patients undergoing elective surgery under general anaesthesia, having ASA physical status I and II, aged 18-60 years with Mallampati grade 1 or 2 were included in study. Patients with known history of difficult intubation or having oxygen saturation less than 92% after bag and mask ventilation or with known risk of aspiration were excluded from study.

Written informed consent was obtained from all patients. Patients were randomly allocated by online computer-generated randomizer (http://www.randomizer.org) to one of two Groups comprising 50 patients in each: Group I-indirect laryngoscope (Video) and Group D-Direct (Macintosh) laryngoscope-GlideScope ® video laryngoscope (GVL; Verathon Medical Bothell,[4] USA).

All laryngoscopy and intubation procedures were performed by a single investigator. The same investigator preoperatively recorded patient's characteristics and airway assessments which included Modified Mallampati score and Thyromental distance.

Patients of both groups received Inj. Ondansetron (4mg), Inj.Glycopyrrolate (0.2mg), Inj.Midazolam (0.02mg/kg), and Inj.Fentanyl (2μg/kg).) As Premedication 10 min. before Induction of Anaesthesia, which does not have any Interaction with other Inducing Agents,

All the patients received fluid as per requirement and standard monitors were attached to them. Intra-operative monitoring included pulseoximetry, electrocardiogram, and noninvasive arterial pressure.

All the patients were preoxygenated with 100% oxygen through a face mask forthree minutes, then general anesthesia was induced with intravenous administration of propofol 2 mg/kg, and atracurium 0.5 mg/kg.

Systolic BP, diastolic BP, mean arterial pressure (MAP), and heart rate (HR)were recorded at numerous intervals as follow: baseline, after induction ofanesthesia, one and five minutes after intubation. An assistant was made the time keeper.

The polyvinyl chloride tracheal tubes with an internal diameter of 7.0 to 9.0mmwere used for all the patients. In the group I, an intubating stylet is adequately lubricated with a silicone-based jelly, inserted into the tracheal tube and kept ready.

2.1. The primary endpoints were

1. To determine the duration of the tracheal intubation procedure.
2. To determine Intubation difficulty score.[5]
3. To compare the visualization of airway between the two groups using Modified Cormack lehane grading.

Total intubation time (in seconds) is defined as the time from insertion of the assigned intubating device into the mouth up to the time the tracheal tube positioned between vocal cords.Duration of the intubation sequence is defined as the time from the first attempt at insertion of the laryngoscope to the confirmation of tube placement in the trachea by clinical method.

1. Intubation difficulty was assessed with the Intubation difficulty score (IDS).

2.2. The secondary endpoints were

1. Number of intubation attempts required or Rate of successful placement of Endotracheal Tube in the trachea.
   An attempt is defined as the action of inserting a laryngoscope into the oropharynx. Every time the laryngoscope removal and reinsertion was counted as a subsequent attempt whether by the First or the second senior operator.
   First-attempt success is noted when the trachea is intubated during the first insertion of the laryngoscope. A failed intubation attempt was defined as an attempt in which the trachea was not be intubated, or which require > 120 s to perform.
2. Lowest Oxygen saturation during intubation attempts.
3. To compare the haemodynamic stability while the insertion of ET Tube between the two groups**:-** Pulse Rate, Systolic and Diastolic blood pressure, were recorded at following interval:
   a. Baseline (just before fentanyl administration
   b. After induction (after propofol administration
   c. After 1 minute
   d. After 5 minute
   e. Ease of use of instruments[6]

Ease of intubation is assessed on a score of 1 to 3

1. Easy – tracheal intubation without maneuver.
2. Satisfactory – tracheal intubation with maneuvers.
3. Difficult – tracheal intubation not even with maneuvers.

2.3. Statistical analysis

Categorical variables were shown in number or as a percentage (%) and continuous variables were shown as mean ± SD and median. Normality of data was tested by Kolmogorov-Smirnov test. If the normality was rejected then non parametric test were used. Quantitative variables were compared using Independent t test/Mann-Whitney Test between the two groups. Qualitative variables were correlated using Chi-Square test. The p value of <0.05 was considered to be statistically significant. The data was entered in MS EXCEL spread sheet and analysis was done using SPSS (IBM Corp. Released 2013. IBM SPSS Statistical Package for Windows, Version21.0. Armonk, NY:IBM Corp).

3. Results

In our study mean duration of tracheal intubation attempts in Group I was 18.50 ± 11.25 seconds and Group D was 11.76 ± 4.44 seconds. This difference in time of insertion was gross and statistically highly significant giving a P value of < 0.05 (P value=0.000). This shows that time required for tracheal intubation in Group I was significantly more as compared to Group D. Time to intubation was found to be significantly longer in the Glide Scope (15.9 ± 6.7 seconds) than in the Macintosh group (7.8 ± 3.7 sec) (P< 0.001). The patients in Group I of our study showed 34 (68%) patients were in Intubation difficulty Grade 0, 12(24%) were in the Intubation difficulty Grade 1 and 3 (6%) patients were in Intubation difficulty score Grade 2, 1(2%) in Grade 3 and In Group D, 10 (20%) patients were in Intubation difficulty Grade 0, 21 (42%) were in the Intubation difficulty Grade 1, 18(36%) were in the Intubation difficulty Grade 2 and 1(2%) patients were in Intubation difficulty score Grade 3. This shows significantly reduced Tracheal intubation difficulty score in Group I. In Group I, 0 (0%) patients were in Ease of intubation Grade 1, 49 (98%) were in the Ease of intubation Grade 2 and 1 (2%) patients were Ease of intubation Grade 3 as compared with Group D, where 33 (66%) patients were in Ease of intubation Grade 1, 17 (34%) was in the Ease of intubation grade 2 and 0 (0%) patients were in Ease of intubation Grade 3. In our study 47 patients were successfully intubated on the first attempts in Group I and 3 required two attempts whereas 44 were successfully intubated in first attempt in group D and 6 required second attempt. In GVL group, 74% of first attempt success was seen compared with 40% in the DL group (p < 0.001). All of the unsuccessful direct laryngoscopy patients were successfully intubated with Glidescope video laryngoscopy, and 82% on the first attempt.

In our study the incidence of post operative complication like throat pain was less in the Group I, 37(74%) patients were in Throat pain Grade 0, 13 (26%) were in the Throat pain Grade 1 and 0 (0%) patients were in Throat pain Grade 2, as compared to group D, 10 (20%) patients were in Throat pain Grade 0, 32 (64%) were in the Throat pain grade 1 and 8 (16%) patients were Throat pain Grade 2, which was statistically significant. The curvature of GVL Blade and presence of camera leads to less force during laryngoscopy and so causes less tissue trauma. That is again the reason for less post operative pain in the GVL group. A similar finding has been reported in a few reports.

The Modified Cormack Lehane[7] comparison was statistically significant(P<0.05), showing that higher Cormack grade in direct group in comparison to the indirect group.

4. Discussion

In this prospective and randomized comparative study, 100 patients of the age Group 18 to 60 years of ASA grade I & II and Mallampatti[8] classification I & II were included. All these patients were comparable in regards to their demographic profile. The patients in two groups were comparable in relation to the age wise distribution, sex wise distribution, metabolic indices, and also American society of anaesthesiologist (ASA) grade. The Groups were also comparable in relation to the airway measurements such as mouth opening, Thyromental distance, Mallampatti classification and mean neck circumference.

In our study mean duration of tracheal intubation attempts in Group I was 18.50 ± 11.25 seconds and Group D was 11.76 ± 4.44 seconds. This difference in time of insertion was gross and statistically highly significant giving a P value of < 0.05 (P value=0.000) {Table 1}. This shows that time required for tracheal intubation in Group I was significantly more as compared to Group D.

Our study goes in hands with the study done in June 2009 by, Pei-Chin Lin, Jimmy Ong[9] at Buddhist Tzu Chi General Hospital, Intubation time was found to be significantly longer in the Glidescope group in easy airway intubation (61.4 ±4.8 seconds vs. 40.6 ±5.3 seconds; p<0.001).

Similar results were obtained in the study done by Rasoul Akram in July 2013[10] at Iran University of Medical Sciences, Tehran. Time to intubation was found to be significantly longer in the GlideScope (15.9 ± 6.7 seconds) than in the Macintosh group (7.8 ± 3.7 sec) (P< 0.001). The patients in Group I of our study showed 34 (68%) patients were in Intubation difficulty Grade 0, 12(24%) were in the Intubation difficulty Grade 1 and 3 (6%) patients were in Intubation difficulty score Grade 2, 1(2%) in Grade 3 and In Group D, 10 (20%) patients were in Intubation difficulty Grade 0, 21 (42%) were in the Intubation difficulty Grade 1,18(36%) were in the Intubation difficulty Grade 2 and 1(2%) patients were in Intubation difficulty score Grade 3. This shows significantly reduced Tracheal intubation difficulty score {Table 2} in Group I.

In Group I, 0 (0%) patients were in Ease of intubation Grade 1, 49 (98%) were in the Ease of intubation Grade

Table 1: Comparison of mean duration of tracheal intubation between the two groups

Mean Time(sec.)	Group I (indirect)±SD n=50	Group D (Direct) ±SD n=50	't' value	P Value
Mean Duration of tracheal intubation(Sec.)	18.50 ± 11.25	11.76 ± 4.44	3.942, df=98	0.000*

Unpaired 't' test applied. P value = 0.000, Significant

Table 2: Comparison of Intubation difficulty score (IDS) between the two Groups (N=100)

	Group I (Indirect) ±SD n=50		Group D (Direct) ±SD n=50		P Value
	No.	%	No.	%	
Intubation difficulty score Grade 0	34	68.0	10	20.0	0.000*
Intubation difficulty score Grade 1	12	24.0	21	42.0	
Intubation difficulty score Grade 2	3	6.0	18	36.0	
Intubation difficulty score Grade 3	1	2.0	1	2.0	
Total	50	100.0	50	100.0	

$\chi 2$ value = 26.260, df=3, P value = 0.000, Significant

Table 3: Comparison of ease of intubation within the group (N=100)

Ease of intubation	Group I (Indirect) ±SD n=50		Group D (Direct) ±SD n=50		P Value
	No.	%	No.	%	
Ease of intubation Grade 1	0	0.0	33	66.0	0.000*
Ease of intubation Grade 2	49	98.0	17	34.0	
Ease of intubation Grade 3	1	2.0	0	0.0	
Total	50	100.0	50	100.0	

$\chi 2$ value = 96.080, df=2, P value = 0.000, Significant

Table 4: Comparison of throat pain between the groups (N=100)

Throat pain	Group I (Indirect) ±SD n=50		Group D (Direct) ±SD n=50		P Value
	No.	%	No.	%	
Throat pain Grade0	37	74.0	10	20.0	0.000*
Throat pain Grade 1	13	26.0	32	64.0	
Throat pain Grade 2	0	0.0	8	16.0	
Total	50	100.0	50	100.0	

$\chi 2$ value = 31.533, df=2, P value = 0.000, Significant

Table 5: Comparison of modified cormack lehane grade between the groups

Modified Cormack Lehane Grade	Group I(indirect) ± SD n=50		Group D(Direct) ± SD n=50		P Value
	No.	%	No.	%	
Modified Cormack Lehane Grade I	40	80.0	25	50.0	0.003*
Modified Cormack Lehane Grade II	7	14.0	11	22.0	
Modified Cormack Lehane Grade III	3	6.0	14	28.0	
Modified Cormack Lehane Grade IV	0	0.0	0	0.0	
Total	50	100.0	50	100.0	

$\chi 2$ value = 11.468, df=2, P value = 0.003, Significant

2 and 1 (2%) patients were Ease of intubation Grade 3 as compared with Group D, where 33 (66%) patients were in Ease of intubation Grade 1, 17 (34%) was in the Ease of intubation grade 2 and 0 (0%) patients were in Ease of intubation Grade 3 {Table 3}.

The difference between both the Groups regarding intubation difficulty score and Ease of intubation was statistically significant (P<0.05).

Similar results were obtained in study done in March 2010 by C. Karsli, in Toronto.$ There was a significant improvement in the laryngoscopic grade obtained using the GlideScope compared with direct laryngoscopy, both with (p = 0.003) and without (p = 0.004) backwards, upwards, right laryngeal pressure.

The mean baseline Pulse rates between Groups I (86.96±7.22) and Group D (86.28±6.72) were comparable (P value=0.627) The mean pulse rates in two groups at induction were also comparable with a value of 86.44± 6.22 in group I and 84.56± 3.59 in group D. In Group I the value of mean Heart Rate were 87.96±6.03 at 1 minute, and 85.86±6.26 at 5 minute while in Group D it was 88.84±4.46 at 1 minute and 86.12±4.43 at 5 minute. The mean systolic and diastolic blood pressure did not show any significant change in response to laryngoscopy and intubation in both the groups (P>0.05). In fact, the indirect laryngoscopy in group I. Patients produced minimum haemodynamic stimulation. Therefore, our finding probably reflects the fact that indirect laryngoscopy provides a better view of glottis without a need to align the oral, pharyngeal and laryngeal axis, and therefore required less force to be applied during laryngoscopy and intubation. Similar results were observed by Rasoul Akram[10] at Firoozgar Hospital, Iran University of Medical Sciences, Tehran, in July 2013. We didn't find a significant difference in mean Pulse oximeter oxygen saturation (SPo2) at the end of intubation in group I was 99% (out of 50 patients) as compared to group D 99% patients in both Groups. These results were supported by the study done Maharaj CH, D. O'Croinin et al[11] in 2006, where in mean of the Pulse oximeter oxygen saturation (SPo2) at the end of intubation in group I was 99.1% (out of 30 patients) as compared with group D was 99% (30 patients). In our study 47 patients were successfully intubated on the first attempts in Group I and 3 required two attempts whereas 44 were successfully intubated in first attempt in group D and 6 required second attempt. Michael J. Silverberg in October 2013, in Chicago[12] did a comparative study on Glidescopevs Direct Laryngoscope and had obtained similar results.

First-attempt success was achieved in 74% of the Glidescope video laryngoscopy group compared with 40% in the direct laryngoscopy group (p < 0.001). All unsuccessful direct laryngoscopy patients were successfully intubated with Glidescope video laryngoscopy, 82% on the first attempt.

In our study the incidence of post operative complication like throat pain was less in the Group I, 37(74%) patients were in Throat pain Grade 0, 13 (26%) were in the Throat pain Grade 1 and 0 (0%) patients were in Throat pain Grade 2, as compared to group D, 10 (20%) patients were in Throat pain Grade 0, 32 (64%) were in the Throat pain grade 1 and 8 (16%) patients were Throat pain Grade 2{Table 4 } which was statistically significant. This result was supported by a study done in Feb 2006 at University of Tehran. The curvature of GVL Blade and presence of camera leads to less force during laryngoscopy and so causes less tissue trauma that is again the reason for less post operative pain in the GVL group. A similar finding has been reported in a few reports.

In Group I, 40(80%) patients had Modified Cormack Lehane Grade I, 7(14%) patients had Modified Cormack Lehane Grade II, 3(6%)patients had Modified Cormack Lehane Grade III and 0(0%) patients had Modified Cormack Lehane Grade IV whereas in Group D, 25(50%) patients had Modified Cormack Lehane Grade I, 11(22%) patients had Modified Cormack Lehane Grade II, 14(28%)patients had Modified Cormack Lehane Grade III and 0(0%) patients had Modified Cormack Lehane Grade IV, which was statistically significant(P<0.05), showing that higher Cormack grade in direct group in comparison to the indirect group{Table 5}. The magnified view provided by the video laryngoscope allows for better visualization of airway structures in difficult airways and further help in facilitating securing the airway. The study done by Ashwani k Chibber, in USA in 2014,[13] did a study on infants and observed that in all cases the best view obtained by direct and videoscopic laryngoscopy was grade 3 or lower and grade 2 or lower respectively. The grade of laryngeal view on the video monitor was significantly improved when compared with that of direct laryngoscopy (p<0.05).

5. Conclusion

This prospective and randomized comparative study shows lower intubation difficulty score (IDS), better ease of intubation and lower grades of Modified Cormack Lehane Grade in group I patients as compared to group D Patients, thereby indicating superiority of indirect laryngoscopy (Glidescope) over direct laryngoscopy (Macintosh). However the duration of intubation in Group I was more than that in Group D.

No significant increase in heart rates and mean blood pressure was found in both the groups I and D. Both the groups showed no statistically significant difference in postoperative complications. Therefore considering above mentioned findings, it can be concluded that indirect laryngoscope (Glidescope) is a superior device than the conventional direct laryngoscope (Macintosh). It can be used as a teaching tool for novice intubators and offers

a new approach to tracheal intubation. These findings also demonstrate the efficacy of indirect laryngoscope (Glidescope) in this clinically important group of patients and add to the evolving body of knowledge regarding this potentially useful device.

6. Source of Funding

None.

7. Conflict of Interest

None

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