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ORIGINAL RESEARCH

Comparative study of direct laryngoscopy versus video laryngoscopy in adult patients undergoing tracheal intubation

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ABSTRACT
Endotracheal intubation is commonly performed using direct laryngoscope. Video laryngoscope is a newer device for intubation and is considered to be more effective but time consuming than direct laryngoscopy. After the approval of institutional ethical committee, 100 patients were randomized for intubation by direct laryngoscopy (DL) and video laryngoscopy (VL), 50 in each. The following parameters were compared, time for intubation, visualisation of glottis by Cormack-Lehane (CL) grading, optimization manoeuvres and number of attempts. In DL group 14 and 36 patients had Cormack-Lehane grade I and II, in VL group 36 and 14 patients had Cormack-Lehane grade I and II (p value=0.000011). Head positioning was required in 50(100%) in DL group none in VL group (p value=0). Number of attempts were one in both groups. To conclude video laryngoscopy provided better visualisation of glottis and required lesser optimization manoeuvre but the time taken for intubation was more than direct laryngoscope.

Key words: Direct laryngoscope, cormack-lehane grade, video laryngoscope

INTRODUCTION

Endotracheal intubation, considered to be the gold standard in securing the airway, is commonly performed using a direct laryngoscope. Despite careful airway assessment, direct laryngoscopy occasionally yields unexpectedly poor laryngeal views [1]. Difficult tracheal intubation still contributes to anaesthesia-related morbidity and mortality [2]. Although poor glottis visualisation is encountered between 1% and 9% of attempts, success can generally be achieved with additional force, external laryngeal manipulation, or the use of gum elastic bougies and stylets [3]. Alternative strategies have been evaluated and demonstrated higher success rate. Using direct laryngoscopy visualisation of vocal cords are made possible by alignment of oral, pharyngeal and laryngeal axis by sniffing position, which is slight flexion (25º-30º) of the neck (atlanto axial joint) and extension (85º) of the head (atlanto occipital joint). Conventional laryngoscopy also requires lateral traction of tongue, forward traction of lower jaw and sometimes external laryngeal manipulations like cricoid pressure.

Video-assisted techniques offer the advantage of abandoning the need for alignment of the optical axis in the pharynx and mouth to visualize the entrance of the larynx [1]. They provide improved visualisation of glottis therefore, video laryngoscopy is considered to be more effective, but it can be more time consuming. Due to variable learning curve of practitioners, these techniques prolong duration for intubation in pioneers. In 2003, Kaplan and Berci, introduced the Storz video laryngoscope into clinical practice [4].The Storz video laryngoscope is built like a standard Macintosh laryngoscope with an integrated video camera. The system has been shown to be very effective in a large study in patients with an expected normal intubation [5]. Video Laryngoscopes have revolutionized the practice of airway management, and their use may become standard not only for difficult airways, but also for routine airways as well [6].

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This study undertaken to compare video assisted laryngoscopy and direct laryngoscopy in adult patients with non-difficult airway.

METHODOLOGY

Data was collected from the consented patients who were scheduled for elective surgery under general anaesthesia with endotracheal intubation in Department of Anaesthesiology, pain and critical care. 100 patients were enrolled for this study, 50 in each group with below mentioned inclusion and exclusion criteria.

INCLUSION CRITERIA

1. Patients willing to give consent.
2. American Society of Anaesthesiologists (ASA) grade 1 and 2 patients.
3. Mallampati score I and II.
4. Aged between 18-60 years of either gender.
5. Undergoing elective surgery under general anaesthesia.

EXCLUSION CRITERIA

1. Patients with Mallampati score III and IV.
2. American society of Anaesthesiologists (ASA) grade > 2 patients.
3. Patients with history of previous difficult intubation, mouth opening of < 2cm.
4. Patients with upper airway pathology.
5. Pregnant patients.
6. Patients with neck mass and cervical spine injury.
7. BMI > 30.

After obtaining ethical clearance and detailed examination, informed written consent was obtained from the patients who fulfilled the above mentioned inclusion and exclusion criteria after explaining the merits and demerits of the procedure. Patients were randomized into two groups by computer generated randomization table into DL group (direct laryngoscopy group) and VL group (video laryngoscopy group), 50 in each group.

Pre anaesthetic evaluation was done day prior to surgery. A detailed history was noted and a complete general and systemic examination was done. On the day of surgery, after confirming the NPO status patients were shifted to the operating room. Anaesthesia workstation and oxygen delivery system were checked. Airways, crash cart and all resuscitation equipments and drugs were kept ready. Monitors were connected which include 5 lead ECG, NIBP, SpO2, HR and RR. The baseline readings were noted. Intravenous access secured with 18G intravenous (IV) cannula and patients were preloaded with 500ml of ringers' solution or normal saline 0.9%. The patients were premedicated with IV midazolam 0.05mg/kg and IV glycopyrrolate 0.01mg/kg. Patients were preoxygenated for 3 minutes before intubation. Anaesthesia was induced with propofol 2mg/kg, fentanyl 2mcg/kg. Induction was facilitated by injection vecuronium 0.1mg/kg. Intubation was done using either direct laryngoscope or video laryngoscope as per randomization.The following parameters were noted:

- Time for intubation: taken from the time of insertion of laryngoscope till the endotracheal tube cuff was inflated.
- Cormack-Lehane grading of laryngoscope as modified by Yentis and Lee [7]
- Use of Optimization manoeuvres like external manipulation (BURP manoeuvre, gum elastic bougie, stylet and head positioning).
- Number of attempts. If not able to intubate after 3 attempts it was taken as failed intubation and excluded from the study.

STATISTICAL ANALYSIS

Sample size was calculated based on a previous study by Aziz MF *et al.* [8] in which it was observed that intubation time mean in C-MAC group was 46±16.89 and in direct laryngoscopy was 33±10.5.In the present study assuming a similar difference in the mean, considering power of 90% and α error of 5% minimum sample size was calculated to be 25 in each group. In view of lesser sample size estimated it was decided to double the sample size. Hence the final sample size proposed to be 50 in each group. All the data collected were entered in a Microsoft excel worksheet and analyzed using statistical software SPSS 20.0. The qualitative characteristics like CL grade, BURP, stylet, bougie, head positioning were expressed in frequency with percentage. For continuous variable like duration of intubation was expressed in mean with standard deviation (SD), and median with (Q1-Q3) interquartile range (IQR), and percentages were calculated. To find the association between the attributes chi-square test and fisher exact test were used. To compare study variables between any groups Mann-Whitney U-Test were applied. All the date expressed in tables.

RESULTS

Table 1: Mean Time for Intubation between the Study Groups

Time for intubation	Mean ± SD	p-value
Direct Laryngoscopy	19.0±2.81	0.0000 (significant)
Video Laryngoscopy	28.72±2.63	

The mean time for intubation in Direct Laryngoscopy group was 19.0seconds, and in Video Laryngoscopy group was 28.72seconds. With p-value of 0.000, the mean time for intubation among the groups were statistically significant.

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Table 2: Number of Patients with Cormack-Lehane Grades I, II, III and IV between the Study Groups

CL Grade	Direct Laryngoscopy		Video Laryngoscopy		Total	p-value
	n	%	n	%	% (n=100)	
I	14	28.0	36	72.0	50.0	0.000011 (significant)
II	36	72.0	14	28.0	50.0	
III	0	0.0	0	0.0	0.0	
IV	0	0.0	0	0.0	0.0	

When comparing the groups as CL grade I and II, the CL Grade in DL group was 28% (14) I and 72% (36) II, and in VL group was 72% (36) I and 28% (14) II. With a p-value of 0.000011, the distribution of CL grades among the groups were statistically significant.

Table 3: Number of Patients with Cormack-Lehane I, IIa AND IIb

CL Grade	Direct Laryngoscopy		Video Laryngoscopy		Total
	n	%	n	%	% (n=100)
I	14	28.0	36	72.0	50.0
II a	34	68.0	14	28.0	48.0
II b	2	4.0	0	0.0	2.0

Visualisation of glottis was Cormack- Lehane grade I in 14 (28%) of DL group and 36 (72%) of VL group. In DL group 34 (68%) patients were CL grade IIa and 2 (4.0%) CL grade IIb. In VL group 14 (28%) of patients were CL grade IIa and patients with CL grade IIb was 0.

Table 4: Number of Patients Who Required Burp Manoeuvre between the Study Groups

Study Variable	Direct Laryngoscopy		Video Laryngoscopy		Total	p-value
BURP	n	%	n	%	% (n=100)	
Yes	9	18.0	0	0.0	9.0	0.003 (Significant)
No	41	82.0	50	100.0	91.0	

The BURP manoeuvre used in DL group was 18% (9), and in VL group was 0. With a p-value of 0.003, the distribution of patient's required BURP manoeuvre among the groups were statistically significant.

Table 5: Number of Patients Who Required Stylet between the Study Groups

Study Variable	Direct Laryngoscopy		Video Laryngoscopy		Total	p-value
Stylet	n	%	n	%	% (n=100)	
Yes	0	0.0	50	100.0	50.0	0.000 (Significant)
No	50	100.0	0	0.0	50.0	

In the VL group, the stylet was employed in 100% (50) of the cases, but not in the DL group (50). Additionally, there was a statistically significant difference (p value 0.000) between the groups.

Table 6: Displaying the Difference in the Number of Patients Who Needed Bougie among the Study Groups

Study Variable	Direct Laryngoscopy		Video Laryngoscopy		Total	p-value
Bougie	n	%	n	%	% (n=100)	
Yes	2	4.0	0	0.0	50.0	0.495 (not significant)
No	48	96.0	50	100.0	50.0	

The bougie was used in 4% (2) cases in DL group and in VL group bougie was not used in 100% (50). With a p-value of 0.495, there was also no statistically significant difference between the groups.

Table 7: Number of Patients Who Needed Head Positioning between the Study Groups

Study Variable	Direct Laryngoscopy		Video Laryngoscopy		Total	p-value
Head Positioning	n	%	n	%	% (n=100)	
Yes	50	100.0	0	0.0	50.0	0.000 (Significant)
No	0	0.0	50	100.0	50.0	

The Head Positioning was done in 100% (50) patients in DL group and in VL group it was not done in 100% (50) of the patients. A statistically significant difference was found between the groups with p value of 0.000.

Table 8: Number of Attempts for Intubation between the Study Groups

Study Variable	Direct Laryngoscopy		Video Laryngoscopy		p-value
No. of Attempts	n	%	n	%	

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1	50	100.0	50	100.0	1.000
2	0	0.0	0	0.0	(not significant)

The number of attempts taken for all intubations in both groups were one, hence it is 100%. And there is no statistical significance in the data since the p value of 1.

DISCUSSION

Laryngoscopes are used to view the larynx and adjacent structures, most commonly for the purpose of inserting a tube into the tracheobronchial tree. They range from simple rigid scopes with light bulb to complex fiberoptic video devices.[9] There are few studies comparing direct laryngoscope and video laryngoscope in non-difficult airway.

The mean time for intubation in DL group was 19seconds and in VL group was 28.72seconds, which was significant with p value of 0 in our study. Aziz MF *et al.* [8] in their study in 300 patients with predicted difficult airway found the mean time for intubation was 33s for direct laryngoscopy and 46s for C-MAC video laryngoscopy with p value of <0.001, which was significant. Amaniti A *et al.* [10] in their study in 178 patients with difficult airway showed time for best glottis view was 10.82 seconds for C-MAC video laryngoscope and 12.08 seconds in direct laryngoscope. P value was 0.19 which is not significant. In a study conducted by Grensemann J *et al.* [11] in 54 intensive care patients showed no difference in median time for intubation with direct laryngoscope 35s and video laryngoscope 34s. In a randomized cross over manikin study by Ruetzler K *et al.* [12] 93 paramedics doing intubation with 5 different airway management scenarios, the mean time for intubation was 17s by direct laryngoscopy with Macintosh blade, 18s with McGrath video laryngoscope and 27s with TruView video laryngoscope in normal airway. In tongue oedema scenario mean time for intubation was 44 Seconds for Macintosh, 22 Seconds for McGrath and 39 Seconds for TruView. This showed a significant difference between the groups. There are wide variations in the results of the above studies both in duration and also statistical difference between direct laryngoscopy and video laryngoscopy. But we in our study have found significant difference between the groups. These variations can be attributed to the difference in patient selection (normal versus difficult airway), experience of the attending persons, difference in the sample size and difference in the wide variety of video laryngoscopes selected for the studies from different manufacturers.

In our study Cormack Lehane Grade I was found in 14 (28%) and 36 (72%) patients and grade II in 36 (72%) and 14 (28%) patients in DL group and VL group respectively, which was statistically significant with a p value of < 0.00001. In the study conducted by Jungbauer A *et al.* [13] comparing video laryngoscopy and direct laryngoscope in expected difficult tracheal intubation in 200 patients, 100 in each group, 45 patients had CL grade I, 45 patients had grade II and 10 had CL grade III in the video laryngoscopy group. In direct laryngoscopy group 23 patients had CL grade I, 41 patients had grade II, 26 patients had grade III and 10 patients had grade IV (p<0.0001), statistically significant. Video laryngoscopy provided significantly better view of glottis than direct laryngoscopy in their study. Sedeh PN *et al.* [14] in their study conducted in 202 patients for endotracheal intubation by untrained medical personnels using Glidescope and direct laryngoscope found better glottic view with GlideScope than direct laryngoscope with p value <0.01, which is statistically significant. In their study 66 patients had CL grade I and 26 patients had CL grade II in GlideScope group and 32 patients had CL I, 18 patients CL II and 37 patients CL grade III in direct laryngoscopy group. Cooper RM *et al.* [1] in their study comparing direct laryngoscope with GlideScope in 133 patients showed better visualisation of the glottis using Glidescope. In their study for the 35 patients with CL grade 3 or 4 views by direct laryngoscope, the view improved to CL grade I in 24 patients and CL grade II in 3 patients. All the above mentioned study results were comparable to our study. This improved view by video laryngoscope may be attributed to the wide angle of vision of the video laryngoscope due to more degree of curvature in the blade than conventional laryngoscope blade and the indirect view through monitor attached.

In our study we had used 4 types of optimization manoeuvres like stylet, gum elastic bougie, BURP manoeuvre and head positioning depending on type of manoeuvre required. In our study BURP manoeuvre was required in 9 patients (18%) in DL group and it was not required in VL group. This was statistically significant with p value of 0.003. Stylet was used in 50 patients (100%) in VL group but it was not required in DL group. It was statistically significant since p value was 0. This may be attributed to the technicality of the video laryngoscope we used. The highly angulated blade caused difficulty in advancing the endotracheal tube into the trachea since the glottis was not under direct vision. In our study Gum elastic bougie was required in 2 cases (4%) in DL group and it was not required in VL group. This was not statistically significant since p = 0.495. Head positioning was required in 50 (100%) patients in DL group whereas it was not required in VL group. This was significant with p value of 0. In the study conducted by Jungbauer A *et al.* [13] in 200 patients in expected difficult tracheal intubation comparing video laryngoscopy and direct laryngoscopy, 31 versus (vs) 20 patients required external laryngeal manipulation, 7 vs 16 patients required additional use of gum elastic bougie and finally 1 vs 23 patients required change in head positioning with a p value of < 0.001 which is statistically significant. In a study conducted by Low

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D *et al.* [15], they have used BERCI DCI video laryngoscope for teaching endotracheal intubation using manikins in 49 novices, n=24 (control group) and n= 25 (study group), bougie was used in 11 patients (45.8%) in control group and 14 patients (56%) in Laerdel Airway trainer in normal airway and 20 patients in control group (83.3%) and 19 patients (76%) in SimMan difficult airway. In the above mentioned studies, optimization manoeuvres requirement is highly variable between video laryngoscope and direct laryngoscope. This is because of the difference in the methodology of the studies.

In our study all patients in both the group were intubated in 1st attempt with p value of 1, which was not significant. In the study conducted by Liu DX *et al.* [16] comparing video laryngoscopy and direct laryngoscopy in 360 patients, 172 (96.1%) and 163 (90.1%) patients were successfullyintubated in one attempt in video and direct laryngoscope groups respectively. 7(3.9%)patients and 8(4.4%) patients required 2 attempts for successful intubation in video and direct laryngoscope groups respectively. There was statistically significant difference in the number of patients intubated in 1st attempt between the groups with a p value of 0.024.. Grensemann J *et al*. [17] in their study in 54 critically ill patients comparing Video laryngoscope and conventional intubation, 25(96%) patients and 25 (93%) patients were intubated in 1st attempt in video laryngoscope and conventional group respectively, which was statistically not significant. This difference in the data in above mentioned studies maybe due to their differences in the experience and expertise of the care provider and type of video laryngoscope used.

CONCLUSION

In our study comparing video laryngoscope versus direct laryngoscope in normal adult intubation, the time taken for intubation was more with video laryngoscope than direct laryngoscopy. Video laryngoscopy provided better visualisation of glottis than direct laryngoscopy. Optimization manoeuvres like BURP, head positioning and gum elastic bougie were required to aid direct laryngoscopy and stylet was required in video laryngoscopy. To conclude video laryngoscopy provide better visualisation of glottis and requires lesser optimization manoeuvres which makes it better than direct laryngoscopy for intubation.

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