VOLUME - 11, ISSUE - 11, NOVEMBER - 2022 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

Anaesthesiology

COMPARATIVE EVALUATION OF DIRECT AND VIDEO LARYNGOSCOPY FOR EXPECTED DIFFICULT TRACHEAL INTUBATION - A PROSPECTIVE STUDY

Dr. Puneet Sharma	HOD & Associate Director, Deptt. of Anaesthesia and Surgical Intensive Care Unit,Max Super Speciality hospital, Shalimar bagh, New Delhi.
Dr. Gagan Behl	Senior Consultant, Deptt. of Anaesthesia and Surgical Intensive Care Unit, Max Super Speciality hospital, Shalimar bagh, New Delhi.
Dr. Surinder Singh Sodhi*	DNB, Senior Resident, Deptt. of Anaesthesia and Surgical Intensive Care Unit, Max Super Speciality hospital, Shalimar bagh, New Delhi. *Corresponding Author
Dr. Sachin Sinha	DNB, Junior Resident, Deptt. of Anaesthesia and Surgical Intensive Care Unit, Max Super Speciality hospital, Shalimar bagh, New Delhi.

ABSTRACT

Aims: Difficult tracheal intubation is one of the main factor which contributes to anaesthesia related morbidity and mortality. Poor field of view of laryngeal structures and multiple attempts at tracheal intubation are main disadvantage of conventional laryngoscopes. The recently introduced video assisted devices have considerably improved the ease of tracheal intubation by their superior laryngeal visualisation, although the duration of tracheal intubation may vary. In our present study, we compared the ease of tracheal intubation using Macintosh conventional direct laryngoscope and BPL video laryngoscope in patients with expected difficult tracheal intubation. **Materials And Methods:** A total of 120 patients undergoing elective surgery under general anaesthesia with Modified Mallampati Class 3 and 4 found during the preoperative airway assessment were included in our study with 60 patients in each group. We compared the duration of tracheal intubation, visualisation of the laryngeal inlet, additional optimising manoeuvres required, and number of attempts at tracheal intubation and incidence of oral trauma assessed at tracheal extubation between the two groups. **Statistical Analysis:** Analysis done using Statistical Packages for the Social Sciences (SPSS) software; Windows version 11.0 (SPSS Inc., Chicago, IL, USA). **Results:** Intubation time was significantly longer in patients with Video laryngoscope than Direct laryngoscope (P 0.0001) whereas visualisation of laryngeal inlet was significantly better with Video laryngoscope (P 0.001). Additional optimising manoeuvres (P 0.001) and incidence of oral trauma (P 0.012) were significantly less with Video laryngoscope whereas intubation attempts were found comparable (P 0.586). **Conclusion:** Though Video laryngoscope provided significantly better laryngeal view with less need for optimising manoeuvres and less oral trauma compared to Direct laryngoscope, the duration of intubation was significantly more with the former.

KEYWORDS :

INTRODUCTION

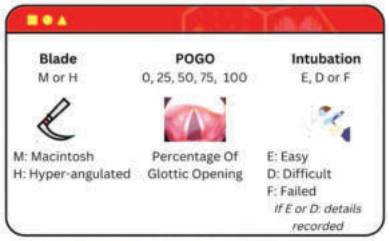
Advanced airway devices have made intubation easier but DL still holds the position of gold standard technique for intubation. It dictates the development of a "line-of-sight" between the operator and the laryngeal inlet. The success of Dl relies on optimal head positioning, laryngoscopic techniques, adequate opening of mouth, maintaining eye to glottic level and a accordant anatomy of patient's airway for which oral, pharyngeal and laryngeal axes should be in alignment with each other more or less to a straight line.[1] However, VL has proven to be effective in anticipated difficult airway, failed intubation with DL, limited neck movements including trauma victims.[2] In this technique the optical axis alignment is not required to get the optimum laryngeal view, but good hand-eye coordination is needed for intubation with help of monitor.[3] According to the institutional protocol for first line device, C-MAC VL with D blade was used for the management of anticipated difficult airway. Comparing the ease of tracheal intubation with DL and VL visibility of laryngeal structures and duration of intubation in anticipated difficult airway was decided as primary objective. The secondary objectives decided was the requirement for any optimizing manoeuvres, number of attempts at intubation and evidence of trauma at extubation.

MATERIAL & METHODS

After getting written informed consent from all the patients and approval from the institutional review board, the study was carried out as a prospective observational study in 120 Patients in direct laryngoscopy group was observed during the period April 2022 to July 2022 and those with Video laryngoscopy from November 2021 to February 2021 (4 months each). Patients with American Society of Anaesthesiologists (ASA) Physical Status 1 and II of either sex in the age group 18-65yrs, having body weight between 40-75 kgs, Modified Mallampati Class (MMC) 3 and 4 posted for elective surgery under general anesthesia were included in the study. Patients having oral cancers obscuring airway assessment, who cannot protrude their tongue out, those underwent intraoral surgeries, limited neck movements due to ankylosis or significant systemic illness, interincisor distance less than 3 cms were excluded from the study.

The Video Classification of Intubation (VCI) score

This score was developed to reduce the potential harm from miscommunication about airway management



I=0-25% , II=26-50%, III=51-75%,IV=76-100%
For eg - M,III,E Means Macintosh blade is used. Percentage of glottic opening(POGO) is 51-75%.
E means Easy tracheal Intubation

After a detailed airway examination during the preanaesthetic evaluation, those found to have MMC 3 and 4 were randomly allocated to either of the groups namely

conventional laryngoscopy group using Macintosh laryngoscope (A group) with 3/4 size blade and Video laryngoscopy group (B group) where a BPL VL (BPL INDIA LTD,India) with adult D blade was used. MMC assessment was again carried out on the day of anaesthesia by a second observer.

Aneasthetic premedication with an anxiolytic and H2 blocker was given to the patient. Afterwards the patients were taken to the operation theatre where all the standard pre induction monitors were attached to patient for monitoring. Intravenous (IV) line was secured to the patient following a local anaesthetic, injection midzolam 100 μg/kg, injection glycopyrolate 5 μg/kg and IV fentanyl 2 μg/kg were given. After pre oxygenation, induction with IV propofol 2 mg/kg, lidocaine 1.5mg/kg (preservative free) and vecuronium 0.1mg/kg was given for muscle paralysis after confirming competence of mask ventilation. Tracheal intubation was carried out using conventional Macintosh laryngoscope in A group and VL in B group by experienced anaesthesiologists. Anaesthesia was maintained with oxygen in air (50:50) and sevoflurane up to 3% to maintain Minimum Alveolar Concentration at least 1. Finally, residual paralysis was antagonized, patient extubated and shifted to postanaesthesia care unit. Variables were assessed during the procedure .

Duration Of Tracheal Intubation -

defined as the time from the introduction of the laryngoscope blade into the patient's mouth until a persistent capnographic waveform obtained on the monitor. Cormack and Lehane (CL) grading was used for visualisation of laryngeal inlet and structures:

Grade I – Most of the vocal cord visible
Grade II – Less than half of vocal cord or only posterior commissure visible
Grade III – Only epiglottis visible

Grade IV – Even epiglottis not visible.I=0-25% , II=26-50%, III=51-75%,IV=76-100%
For eg - M,III,E Means Macintosh blade is used. Percentage of glottic opening(POGO) is 51-75%.
E means Easy tracheal Intubation I,II,III,IV

Optimising manoeuvres used for a better view were:

- External manipulation of the larynx by backward, upward and rightward pressure (BURP)
- Use of a stylet/bougie
- Changes in head positioning were recored.

In case the anaesthesiologist was not able to intubate regardless all the above manoeuvres, it was declared as a failed intubation and those were excluded from the study. Only three intubation attempts were allowed for the study patients. if intubation failed at first attempt, the second attempt was performed with help of stylet/bougie (Eschmann stylet)/change of position of head. If second attempt failed in the A group, VL was used for third attempt. In the B group, a third attempt was done with intubating laryngeal mask airway (iLMA) after the use of bag and mask ventilation to bring oxygen saturation to more than 95% if required in between the attempts. According to standard guidelines iLMA was used as the rescue airway device with fibreoptic bronchoscope in order to proceed with airway management. Oral trauma as evidenced by blood stain at the tip of tracheal tube or during suction were noted at the time of extubation in both the groups Based on a previous study by Jungbauer A et al. [3] Sample size was calculated as 112. With 95% confidence interval and level of significance at 5% it was rounded to 120. Data were entered in Microsoft Excel and analysis done using Statistical Packages for the Social Sciences (SPSS) software; Windows version 11.0 (SPSS Inc., Chicago, IL, USA). Quantitative data were described as Mean and Standard Deviation. Qualitative data were described by frequency distribution. To compare between the groups, qualitative variables were assessed by Chi square test and comparison of quantitative variables by student's t-test for normally distributed variables. Normality was assessed using Kolmogorov- Smirnov test. Results were considered statistically significant for P-value <0.05.

RESULTS

A total of 120 patients were enrolled for the study. None of the candidates abandoned the study. The recruitment of patients is described in Chart 1.

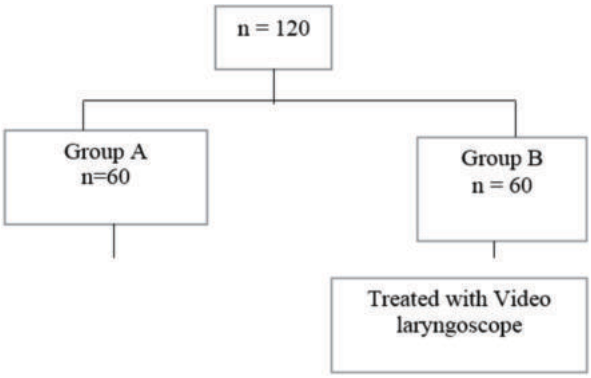


Table 1 is representing the demographic data of both groups which shows that the mean age in either group came around 52 (P 0.987). The mean value for female population was found to be 62.9% and 60% and that for male was 37% and 40% in A and B group respectively (P 0.728). BMI of <25 was noted in 34% and 43% whereas it was 65% and 57% respectively in A and B groups with BMI less than 25 (P 0.298). Therefore, both the groups were statistically significant in regards to age, gender and BMI. The mean time required for tracheal intubation was 29.6 s in A group and 47.5 s in B group which was assessed by student's t-test and found statistically significant (P 0.0001) as shown in Table 2. DL in A group showed a distribution of the CL grades from I to IV as 28.6%/45.7/20%/5.7% respectively in comparison to 54%/42.9%/2.9%/0% respectively in B group which was also statistically significant as P 0.001 (Table 2).

Out of 60 patients in B group, 55 didn't require any optimising maneouvers compared to 29 patients in A group. Those who required one optimizing maneouver (27 versus 9) and more than one (14 versus 6) were more in A than in B group which was again significant as P 0.001 (Table 2). It can also be seen from Table 2 that the incidence of oral trauma assessed using Fisher's exact test was significantly less in B compared to A group (4 versus 15) with P- 0 .012. Number of attempts required for intubation was compared using Chi-Square test and in almost 90% of patients it was less than 2 attempts in either group. More than 2 were required for 9 patients in A and for 6 in B group which was insignificant (P 0.586).

Table 1: Comparison of sample based on age, gender and BMI

Variables	Direct Laryngoscopy	Video Laryngoscopy	P-value
Age	52.24 (9.71)	52.21 (11.04)	0.987
Sex			
Female	44 (62.9%)	42 (60.0%)	0.728
Male	26 (37.1%)	28 (40.0%)	
BMI			
Up to 25	24 (34.3%)	30 (42.9%)	0.298
>25	46 (65.7%)	40 (57.1%)	

Table 2: Comparison of duration of scopy, laryngeal view, optimizing manoeuvres, trauma and attempts at intubation

Variables	Direct Laryngoscopy	Video Laryngoscopy	P-value
Duration	29.61 (20.6)	47.53 (15.48)	*0.0001
CL Grade			
1	20 (28.6%)	38 (54.3%)	0.001
2	32 (45.7%)	30 (42.9%)	
3	14 (20%)	2 (2.9%)	
4	4 (5.7%)	0 (0%)	
Maneouvers			
No method	29 (41.4%)	55 (78.6%)	0.001
1 Method	27 (38.6%)	9 (12.9%)	
More than one method	14 (20.0%)	6 (8.6%)	
Trauma			
No	55 (78.6%)	66 (94.3%)	0.012
Yes	15 (21.4%)	4 (5.4%)	
No of Attempts			
<2	61 (87.1%)	64 (91.4%)	0.586
>2	9 (12.9%)	6 (8.6%)	

DISCUSSION

Following the invention of DL technique by Macintosh and Miller, Several technological advancements had taken place in the form of video or optic fibre assisted devices to improve the glottic visualisation leading to an easy intubation. Kaplan and Berci introduced the Storz VL into clinical practice back in 2003 which working principle is indirect laryngoscopy.[5] In this technique viewing angle has been changed to 60 compared to 15 degrees in DL which allows a better view of larynx accompanied by application of properties of light such as refraction and optics.[5] With the Macintosh blade of VL, both a direct and an indirect view of the glottis at the monitor are made possible. However, in BPL D blade , we can "see around the corner" which offers an good field of view of the laryngeal inlet enhancing the ease of laryngoscopy because of its extreme curvature with a more distally placed camera.[2] Since last three decades, the use of video assisted devices has significantly reduced the stress of anaesthesiologists by an improved glottic visualisation and success of tracheal intubation by using high resolution micro cameras with portable flat-screen monitors which has transmogrified difficult airway management[6]. Fourth generation VL consisting of complementary metal oxide semiconductor chip, LED light output with Lithium-Ion battery which made the system efficient, portable and highly versatile. The incidence of difficult laryngoscopy and intubation depends mainly on the laryngeal view as well as the profile of the patient.[7] DL requires sufficient mouth opening to position the scope and tongue need to moved into sub mandibular space for anaesthesiologist to view the glottis. On the other hand, VL provides a clear, direct and amplified view of the laryngeal structures which helps in improving the success of intubation with mouth opening.[8] Various national and international organisations have put forward Guidelines/algorithms by including VL as first line or alternate airway equipment in difficult airway management. Various studies have shown that laryngeal view have been better with VL compared to DL with various airway scenarios, and particularly novices have demonstrated improved success rates with normal airway.[9-11]

We compared the duration of intubation which was statistically significant with VL compared to DL due to difficulty in changing the position of tube between the cords because of the curved blade regardlesss of an excellent laryngeal view.[12-14] Our results were similar to studies done on anticipated difficult airway and in manikin simulated patients. In spite of that certain studies found the duration of intubation with VL and DL comparable. In our present study, VL provided a significantly better laryngeal view than DL which was comparable to other studies as well. [3,12–15] Poor glottic view was found in DL only. VL also helps supporting staff to envision structures adjacent to the glottis from the monitor which is unattainable with DL. Jungbauer et al. [3] used Macintosh VL as the control group and afterwards it was compared to the view on the monitor, he didn't find any statistical significance. In some cases secretions like blood or vomittus found surrounding the light or battery failure can hamper the glottic view on the monitor, a direct glottic visualisation can be an important fall-back strategy when Macintosh VL is used. [16]

In our present study only 21.6% in B group required one or more optimising manoeuvres compared to 58.6% in A group which was comparable with the observation made by Kaki et al. [17] where they found that external laryngeal pressure was mostly needed for DL (84%) followed by BPL laryngoscope (16%) and none for Airtraq or Glidescope. Airtraq is another optical laryngoscope of immense value in the management of normal and difficult airway situations. In a study where Airtraq was compared with Macintosh and McCoy laryngoscopes in patients with cervical spine immobilisation, Airtraq was found to significantly improve glottic view, lowered CL grades with less optimisation manoeuvres. [18] When Airtraq was compared with BPL in a similar situation, both devices had similar success rates of intubation taking less time with the latter.[19] We also found a significant increase in the incidence of oral trauma in A. group compared to B group. Studies have shown that the force exerted on maxillary incisors during laryngoscopy was lower with VL compared with DL which may be attributed to manipulations to align the axes. [20] Lifting forces exerted by DL can range from 35-50 N in order to expose the glottis and resultant trauma whereas VL requires less force (5-14 N) to the base of the tongue leading to less stress response and local tissue injury. [21] Though statistically not significant, we found lesser intubation attempts in B group compared to other studies which can be attributed to a better view of the glottis. [3,12,15] In another recent study, BPL D blade resulted in less time to visualise the glottis, to intubate, better first attempt success rate and less number of complications in obese patients with anticipated difficult airway when compared to King Vision VL though not significant statistically. [22] When BPL VL D blade was compared with Macintosh DL for nasotracheal intubation, the former provided superior view, less intubation time and less trauma which was significant. [23] Even videoendoscope have comparable results with BPL VL D blade and found superior to Truview EVO2 and DL in anticipated difficult airway and provides a cheaper alternative to VL. [24] Regarding limitations in our study, we chose MMC alone to predict difficult intubations which might have lead to subjective variations. Though MMC III and IV holds good for the prediction of difficult intubation, it has high number of false positive ratings and a low predictive value. [25] Use of multiple tests can lead to a better assessment. Subjective variations might have occurred in the grading of laryngoscopic view put forward by CL as intubation was performed by multiple persons. Its appropriateness with VL is yet to be proven.

CONCLUSIONS

Use of various video assisted and optic devices has lead to a superior laryngeal view providing an ease of intubation in terms of less number of attempts and trauma offering a stress free airway management to the practicing anaesthesiologist particularly when difficult airway is anticipated. Varying results on duration of intubation between VL and DL are found in the literature which needs further larger trials to substantiate the cause. Anaesthesiologists including novices should practice normal airway management with such devices to be confident in using it when need arises particularly in difficult airway scenarios, ICU's, emergency department of the hospital. VL has considerably reduced airway related morbidity and mortality and made the anaesthesiologist stress free to practice safe anaesthesia.

Source of Funding: None.

Conflict Of Interest: The authors declare that there is no conflict of interest.

REFERENCES:

1. Finucane BT, Santora AH. Principles of airway management. Heidelberg: Springer; 2003
2. Healy DW, Maties O, Hovord D, Kheterpal S. A systematic review of the role of videolaryngoscopy in successful orotracheal intubation. BMC Anesthesiol. 2012;12(1):32.doi:10.1186/1471-2253-12-32.
3. Jungbauer A, Schumann M, Brunkhorst V, Börgers A, Groeben H. Expected difficult tracheal intubation: a prospective comparison of direct laryngoscopy and video laryngoscopy in 200 patients. Br J Anaesth. 2009;102(4):546–50.doi:10.1093/bja/aep013.
4. Kaplan MB, Ward DS, Berci G. A new video laryngoscope—an aid to intubation and teaching. J Clin Anesth. 2002;14(8):620–6. doi:10.1016/s0952-8180(02)00457-9.
5. Zundert A, Pieters B, Doerges V, Gatt S. Videolaryngoscopy allows a better view of the pharynx and larynx than classic laryngoscopy. Br J Anaesth. 2012;109(6):1014–5. doi:10.1093/bja/aes418.
6. Rose DK, Cohen MM. The airway: problems and predictions in 18,500 patients. Can J Anaesth. 1994;41(5):372–83. doi:10.1007/bf03009858.
7. Su YC, Chen CC, Lee YK, Lee JY, Lin KJ. Comparison of video laryngoscopes with direct laryngoscopy for tracheal intubation: a meta-analysis of

randomised trials. Eur J Anaesthesiol. 2011;28(11):788–95.
8. Peterson GN, Domino KB, Caplan RA, Posner KL, Lee LA, Cheney FW. Management of the Difficult Airway. Anesthesiology. 2005;103(1):33–9. doi:10.1097/00000542-200507000-00009
9. Sedeh PN, Schumann M, Groeben H. Laryngoscopy via Macintosh blade versus GlideScope success rate and time for endotracheal intubation in untrained medical personnel. Anaesthesiol J Am Soc Anaesthesiol. 2009;110(1):32–9.
10. Low D, Healy D, Rasburn N. The use of the BERCI DCI® Video Laryngoscope for teaching novices direct laryngoscopy and tracheal intubation*. Anaesthesia. 2008;63(2):195–201. doi:10.1111/j.1365-2044.2007.05323.x.
11. Howard-Quijano KJ, Huang Y, Matevosian R, Kaplan MB, Steadman RH. Video-assisted instruction improves the success rate for tracheal intubation by novices. Br J Anaesth. 2008;101(4):568–72. doi:10.1093/bja/aen211.
12. Aziz MF, Dillman D, Fu R, Brambrink AM. Comparative Effectiveness of the C-MAC Video Laryngoscope versus Direct Laryngoscopy in the Setting of the Predicted Difficult Airway. Anesthesiology. 2012;116(3):629–36. doi:10.1097/aln.0b013e318246ea34.
13. Rabiner JE, Auerbach M, Avner JR, Daswani D, Khine H. Comparison of GlideScope Videolaryngoscopy to Direct Laryngoscopy for Intubation of a Pediatric Simulator by Novice Physicians. Emerg Med Int. 2013;2013:1–6. doi:10.1155/2013/407547.
14. Tan BH, Liu EHC, Lim RTC, Liow LMH, Goy RWL. Ease of intubation with the GlideScope or Airway Scope by novice operators in simulated easy and difficult airways - a manikin study. Anaesthesia. 2009;64:187–90. doi:10.1111/j.1365-2044.2008.05753.x.
15. Cavus E, Thee C, Moeller T, Kieckhaefer J, Doerges V, Wagner K. A randomised, controlled crossover comparison of the C-MAC videolaryngoscope with direct laryngoscopy in 150 patients during routine induction of anaesthesia. BMC Anesthesiol. 2011;11(1). doi:10.1186/1471-2253-11-6.
16. Cavus E, Callies A, Doerges V, Heller G, Merz S, Rosch P, et al. The C-MAC videolaryngoscope for prehospital emergency intubation: a prospective, multicentre, observational study. Emerg Med J. 2011;28(8):650–3. doi:10.1136/emj.2010.098707.
17. Kaki AM, Fawzi HM, AlMarakbi WA, Boker AM. Use of Airtraq, C-Mac, and Glidescope laryngoscope is better than Macintosh in novice medical students hands: A manikin study. Saudi J Anaesth. 2011;5(4):376–81. doi:10.4103/1658-354x.87266.
18. Hosalli V, Arjun BK, Ambi U, Hulakund S. Comparison of AirtraqTM, McCoyTM and Macintosh laryngoscopes for endotracheal intubation in patients with cervical spine immobilisation: A randomised clinical trial. Indian J Anaesth. 2017;61(4):332–7. doi:10.4103/ija.ija_517_16.
19. Ahmed SM, Doley K, Athar M, Raza N, Siddiqi OA, Ali S. Comparison of intubation time in neutral position between C MAC and Airtraq laryngoscope - A prospective Randomized control trial. Indian J Anaesth. 2017;61:338–43.
20. Pieters B, Maassen R, Eig E, Maathuis B, Dobbeisteen J, Zundert A. Indirect videolaryngoscopy using Macintosh blades in patients with non-anticipated difficult airways results in significantly lower forces exerted on teeth relative to classic direct laryngoscopy: A randomized crossover trial. Minerva Anaesthesiol. 2015;81:846–54.

Chemsian RV, Bhananker S, Ramaiah R. Videolaryngoscopy. Int J Crit Illn Inj Sci. 2014;4(1):35–41. doi:10.4103/2229-5151.128011.