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Original Research Article

Direct laryngoscopy versus video laryngoscopy for expected difficult tracheal intubation a prospective study

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ABSTRACT

Aims: Difficult tracheal intubation still contributes significantly to anaesthesia related morbidity and mortality. Poor visualisation of laryngeal structures and multiple attempts at intubation are the leading causes with the conventional laryngoscopes. Though the recently introduced video assisted devices have significantly improved the ease of intubation by their superior laryngeal visualisation, the duration of intubation may vary. Here we compared the ease of tracheal intubation using Macintosh conventional direct laryngoscope (DL) and C- MAC videolaryngoscope (VL) in patients with expected difficult tracheal intubation.

Materials and Methods: A total of 140 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 70 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 intubation and incidence of oral trauma assessed at 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 VL than DL (P 0.0001) whereas visualisation of laryngeal inlet was significantly better with VL (P 0.001). Additional optimising manoeuvres (P 0.001) and incidence of oral trauma (P 0.012) were significantly less with VL whereas intubation attempts were found comparable (P 0.586).

Conclusion: Though VL provided significantly better laryngeal view with less need for optimising manoeuvres and less oral trauma compared to DL, the duration of intubation was significantly more with the former.

1. Introduction

DL still remains the gold standard technique for intubation though advanced airway gadgets have made intubation easier. It demands the formation of a "line-of-sight" between the operator and the laryngeal inlet; success of which depends on optimal head positioning, technique of laryngoscopy, adequate mouth opening, maintenance of eye to glottic level and moreover, a consistent anatomy of the patient's airway.[1] This necessitates the alignment of oral, pharyngeal and laryngeal axes more or less to a straight line. VL has proven to be effective in anticipated difficult airway, failed intubation with DL, limited neck movements including trauma victims.[2] Here, the optical axis need not be aligned to get the optimum laryngeal view, but needs good hand-eye coordination for intubation by looking at the monitor.[3]

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In our institute, C-MAC VL with D blade was used for the management of anticipated difficult airway as per the institutional protocol as a first line device. As our primary objective we decided to compare the ease of tracheal intubation with DL and VL with respect to the visibility of laryngeal structures and duration of intubation in anticipated difficult airway. The secondary objectives studied were the need for any optimizing manoeuvres, number of attempts at intubation and evidence of trauma at extubation.

2. Materials and Methods

After getting written informed consent from all the patients and approval from the institutional review board reference number IRB No. 10/2015/08 dated 29/10/2015 (Ethics approval was exempted) the study was carried out as a prospective observational study in 140 Patients in direct laryngoscopy group was observed during the period November 2015 to February 2016 and those with Videolaryngoscopy from March 2016 to June 2016 (4 months each). Patients with American Society of Anaesthesiologists (ASA) Physical Status 1 and 2 of either sex in the age group 18-65yrs, having body weight between 35-80 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 <3 cms were excluded from the study. After a detailed airway examination during the preanaesthetic evaluation, those found to have MMC 3 and 4 were equally included to either of the groups namely conventional laryngoscopy group using Macintosh laryngoscope (M group) with 3/4 size blade and Videolaryngoscopy group (V group) where a C-MAC VL (Karl Storz, Germany) with adult D blade was used. MMC assessment was again confirmed on the day of anaesthesia by a second observer. Following premedication with an anxiolytic and H_2 blocker, patients were taken to the operation theatre where all the standard pre induction monitors attached for patient monitoring. After securing an intravenous (IV) line following a local anaesthetic, injection midazolam 30 μg/kg, injection glycopyrolate 5 μg/kg and IV fentanyl 2 μg/kg were given. Following pre oxygenation, induction with IV propofol 2 mg/kg, lidocaine 1.5mg/kg (preservative free) and vecuronium 0.1mg/kg given for muscle paralysis after ensuring adequacy of mask ventilation. Tracheal intubation was done using either conventional Macintosh laryngoscope or VL in M and V group respectively by experienced anaesthesiologists who were having more than 3 years of experience in either of the laryngoscopic methods and management of difficult airway. Anaesthesia was maintained with oxygen in air (50:50) and sevoflurane up to 3% to maintain Minimum Alveolar Concentration at least 1. At the end, residual paralysis was antagonized, patient extubated and shifted to postanaesthesia care unit.

Variables assessed during the procedure were duration of tracheal intubation which was 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. Visualisation of laryngeal inlet and structures were done according to Cormack and Lehane (CL) grading as follows

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.

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 and changes in head positioning if used were recorded. In case the anaesthesiologist was unable to intubate despite all the above manoeuvres, it was declared as a failed intubation and those were excluded from the study. Regarding umber of intubation attempts, only three intubation attempts were allowed for the study patients. In case if intubation failed at first attempt, a second one was performed with stylet/bougie (Eschmann stylet) or change of position of head. If second attempt failed in the M group, VL was used for third attempt. In the V group, a third attempt with intubating laryngeal mask airway (iLMA) was tried after bag and mask ventilation to bring oxygen saturation more than 95% if required in between the attempts. In either group, iLMA was used as the rescue airway device with fibreoptic bronchoscope standby in order to proceed with airway management according to standard guidelines. 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 132. With 95% confidence interval and level of significance at 5% it was rounded to 140. 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.

2.1. Inclusion criteria

1. ASA 1 and 2.

2. Age group 18-65yrs.
3. Body weight 35-80 kgs.
4. MMC 3 and 4.

3. Results

A total of 140 patients were enrolled for the study. None of the candidates abandoned the study. The recruitment of patients is illustrated in Chart 1.

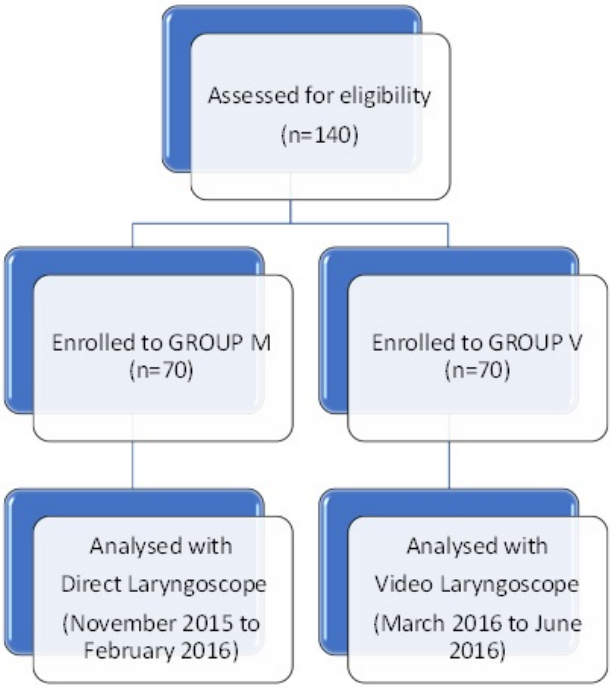

Chart 1: Strobe diagram of the study population

The demographic data of both the groups are listed in Table 1 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 M and V group respectively (P 0.728). BMI of <25 was noted in 34% and 43% whereas it was 65% and 57% respectively in M and V groups with BMI >25 (P 0.298). Thus both the groups were found comparable with respect to age, gender and BMI.

The mean time required for tracheal intubation was 29.6 s in M group and 47.5 s in V group which was assessed by student's t-test and found statistically significant (P 0.0001) as shown in Table 2. DL in M group showed a distribution of the CL grades from I to IV as 28.6%/45.7/20%/5.7% respectively compared to 54%/42.9%/2.9%/0% respectively in V group which was also statistically significant as P 0.001 (Table 2). Out of 70 patients in V group, 55 didn't require any optimising maneouvers compared to 29 patients in M group. Those who required one optimizing maneouver (27 versus 9) and more than one (14 versus 6) were more in M than in V 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 V compared to M 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 M and for 6 in V group which was insignificant (P 0.586).

4. Discussion

Since the invention of DL by Macintosh and Miller, we have witnessed several technological advancements in the form of video or optic fibre assisted devices to improve the glottic visualisation leading to an easy intubation. In 2003, Kaplan and Berci introduced the Storz VL into clinical practice which works on the principle of indirect laryngoscopy.[4] Here the viewing angle has been measured as 60 degrees compared to 15 in DL which allows a better view of larynx with the application of properties of light like 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. But in C- MAC D blade, due to its extreme curvature with a more distally placed camera, we can "see around the corner" offering an extensive view of the laryngeal inlet which enhances the ease of laryngoscopy, but at the expense of a direct view of glottis.[5] However, since three decades, the use of video assisted devices has significantly attenuated the stress of anaesthesiologists by an improved glottic visualisation and success of tracheal intubation using high resolution micro cameras with portable flat-screen monitors which has revolutionised difficult airway management.[2] Now, with the fourth generation VL which incorporates Complementary metal oxide semiconductor chip, LED light output with Lithium-Ion battery, 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.[6] DL requires adequate mouth opening to insert the scope and tongue need to be displaced into the sub mandibular space for the anaesthesiologist to view the glottis. VL on the other hand, provides a clear and magnified view of the laryngeal structures which may improve the success of intubation with mouth opening just required to insert the scope into the oral cavity.[7] Guidelines/algorithms put forward by various national and international organisations have included VL as first line or alternate airway equipment in difficult airway management.[8] 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]

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%)	

As our primary objective, we compared the duration of intubation which was significantly longer with VL probably due to difficulty in manoeuvering the tube between the cords due to the curved blade in spite of an excellent laryngeal view. Our results were similar to studies done on predicted difficult airway and in manikin simulated patients.[12–14] However, certain studies found the duration of intubation with VL and DL comparable.[3,15] VL provided a significantly better laryngeal view than DL in our study which was comparable to other studies as well.[3,12–15] We found the worst glottic view (CL IV) only with DL and not with VL (4 patients in DL versus 0 in VL). VL also allows the supporting staff to visualise structures adjacent to the glottis from the monitor which is not possible with DL. Jungbauer et al.[3] used Macintosh VL as the control group where a direct view was also possible and when that was compared to the view on the monitor he didn't find any statistical significance. In case if secretions like blood or vomittus found surrounding the light or battery failure which can impede 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 study only 21.6% in V group required one or more optimising manoeuvres compared to 58.6% in M 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 C-MAC 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 CMAC VL 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 M group compared to V 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 V group compared to other studies which can be attributed to a better view of the glottis.[3,12,15] In another recent study, C MAC 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 C MAC VL with 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 C MAC VL D blade and found superior to Truview EVO_2 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. It would have been a better comparison if Macintosh VL blade was used instead of the D blade which was not available to us.

5. 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.

6. Source of Funding

None.

7. Conflict of Interest

The authors declare that there is no conflict of interest.

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