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Research Article

VIDEOLARYNGOSCOPE VERSUS TRADITIONAL LARYNGOSCOPY FOR COMPARISON OF EASE OF INTUBATION AND HEMODYNAMIC CHANGES – A PROSPECTIVE RANDOMIZED STUDY

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ABSTARCT

Objective: The objective of the study is to compare ease of intubation and hemodynamic changes with video laryngoscope (VL) (C-MAC) versus traditional laryngoscopy and to assess any complication such as arrhythmias, local injuries, bleeding, laryngospasm, regurgitation during intubation, and sore throat post-intubation.

Methods: This prospective randomized study was conducted on 200 patients of Mallampati (MP) Grades 1 and 2, ASA-PS I and II, randomly allocated to Group M (Macintosh) and Group V (C-MAC) (n=100 each). Hemodynamic changes (heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure [MAP], SpO_2, and $EtCO_2$) were recorded at baseline, during pre-oxygenation, during laryngoscopy, and during intubation, at 1 min, 3 min, 5 min, and then, at 10 min after endotracheal intubation. Ease of intubation and any complications were also recorded.

Results: Laryngeal view was significantly better in Group V. The mean heart rate during laryngoscopy and intubation (L&I) and after endotracheal intubation at 3rd min (ETI3); mean systolic blood pressure during L&I and after ETI1, ETI3, and ETI5 min; mean diastolic blood pressure after ETI1 and ETI min; and mean MAP during L&I and after ETI1 min were found to be significantly higher in Group M as compared to Group V ($p<0.05$). The difference in mean SPO2 and ETCO2 between the two groups was not found to be significant at any time interval. No significant difference was observed with respect to complications.

Conclusion: Group V (VL C-MAC) showed better ease of intubation, decreased hemodynamic response, and fewer complications as compared to Group M (Macintosh laryngoscope).

Keywords: Comparison, Hemodynamics, Ease, Intubation.

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INTRODUCTION

Laryngoscopy and endotracheal intubation have been well recognized as a gold standard in airway management and are considered important components of general anesthesia [1]. A direct laryngoscopy (DL) allows visualization of the larynx. It is used during general anesthesia, surgical procedures around the larynx, and resuscitation [2]. DL requires a direct line of sight to align airway axis (oral-pharyngeal-laryngeal) for optimal glottic visualization. Often, manipulations to align these axes include head extension, neck flexion, laryngeal manipulation, and other stressful movements. Macintosh DL lifting forces can require 35–50 N to expose the glottis. These manipulations of the airway have adverse implications from significant hemodynamic disturbance, cervical instability, injury to oral and pharyngeal tissues, and dental damage [3,4].

Video laryngoscopy (VL) has emerged as an effective alternative to DL use. The past two decades have witnessed several different VL devices in the market. The C-MAC video laryngoscope (VL) holds a promising future in the management of both normal and difficult airway. C-MAC VL blade is similar to the Macintosh, with additional advantage of a video camera. The distal end of the blade incorporates a small digital camera and high-power light-emitting diode. The clinical advantages provided by C-MAC VL include the ability to convey a video image, less stress imposed on the airway, help to view the larynx with less mouth opening and can be handled with a skill similar to that of conventional DL. In contrast to many previous video laryngoscopes, the C-MAC scope has the unique advantage of obtaining both direct laryngoscopic view and a camera view that are displayed on the video screen. In patients with predicted or known difficult airways, C-MAC VL can achieve a better laryngeal view, a higher intubation success rate, and a shorter intubation time than DL. Furthermore, the option to perform direct and VL with the same device makes C-MAC VL exceptionally useful for emergency intubation [5,6].

Due to the paucity of data regarding the comparison of VL with traditional laryngoscopy with respect to ease of intubation and hemodynamic changes, the present study was planned and conducted to compare the ease of intubation and hemodynamic response to orotracheal intubation in traditional Macintosh laryngoscopy and C-MAC VL.

MATERIALS AND METHODS

This prospective randomized study was conducted on 200 patients of either gender or aged between 18 years and 60 years belonging to Mallampati (MP) grades 1 and 2, ASA-PS I and II, scheduled for elective surgeries under general anesthesia at Rajindra Hospital/Government Medical College, Patiala. The patients were randomly allocated to Group M (Macintosh) and Group V (VL C-MAC) of 100 patients each.

Exclusion criteria included patients with thyromental distance <6 cm, any type of A-V block in ECG, thrombocytopenia or coagulopathy, mentally ill patients, pregnant females, drug abuse, patient's refusal, ASA-PS > III and body mass index > 30, and patients with deranged liver function tests

Pre-anesthetic checkup was done in every patient and a written informed consent was obtained. For pre-medication, patient was given tablet alprazolam 0.25 mg and tablet ranitidine 150 mg orally at night.

Methods

All patients were given inj. glycopyrrolate 0.2 mg iv, inj. midazolam 1 mg iv, inj. ondansetron 4 mg iv, and an analgesic agent butorphanol

20 µg/kg iv, 15 min before induction. After pre-oxygenation with 100% O_2 for 3 min, induction was done with inj. propofol (2 mg/kg) iv. Muscle relaxation was achieved with inj. vecuronium (0.1 mg/kg) iv. After 3 min of controlled ventilation, laryngoscopy was performed with Macintosh and C-MAC VL depending on the allocated group (Group M or Group V) and vocal cord visualization was done using Cormack and Lehane's grading [7,8] as shown in Table 1 and endotracheal tube was passed through vocal cords under vision. For obtaining the Cormack–Lehane grading, the VL monitor in the case of C-MAC and direct visualization of the glottis in the case of Macintosh laryngoscope were used. Modified Mallampati scoring [9] is shown in Table 2.

Clinically patients were monitored, and ease of intubation and hemodynamic changes were recorded during the course of intubation. Successful intubation time is defined as the time from when the anesthesiologist picks up the scope in hand until the first breath of the patient is confirmed by capnography. Heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure (MAP), SpO_2, and $EtCO_2$ were recorded at baseline, during pre-oxygenation, during laryngoscopy, and during intubation, at 1 min, 3 min, 5 min, and then, at 10 min after endotracheal intubation. Any arrhythmia and other complications such as local injuries, bleeding, laryngospasm, and regurgitation during laryngoscopy and intubation (L&I) were noted. All the recorded data were tabulated and subjected to statistical analysis.

RESULTS

The distribution of two groups based on age, gender, weight, Mallampati (MP) grading, and ASA-PS was not found to be statistically significant.

In Group V, all participants (100%) were intubated in single attempt, whereas in Group M, 96% participants were intubated in single attempt and remaining 4% required 2 attempts. Upon statistical analysis, this was not found to be significant. The mean time taken for intubation in Group V and Group M was 25.40±7.53 s and 24.90±6.09 s, respectively. This was not found to be statistically significant.

In Group V, 95% participants had CL score 1% and 5% participants had CL score 2. On the other hand, in Group M, 38% participants had CL score 1, 28% participants had CL score 2, and 34% participants had CL score 3. Upon statistical analysis, this was found to be significant.

The mean heart rate was found to be significantly higher in Group M as compared to Group V at L&I and after endotracheal intubation at 3 min (ETI3) as shown in Table 3.

The mean systolic blood pressure was found to be significantly higher in Group M as compared to Group V at L&I, after ETI1, ETI3, and ETI5 min as shown in Table 4.

The mean diastolic blood pressure was found to be significantly higher in Group M as compared to Group V after ETI1 and ETI3 min as shown in Table 5.

The mean MAP was found to be significantly higher in Group M as compared to Group V at L&I, after ETI1 min as shown in Table 6.

The difference in mean SPO_2 between the two groups was not found to be significant at any time interval as shown in Table 7.

The difference in mean ETCO2 between the two groups was not found to be significant at any time interval as shown in (Table 8).

Local injury was observed in 1% cases in Group V and 3% cases in Group M. Bleeding was not observed in any of the cases in Group V, but it was observed in 1% of cases in Group M. Post-operative sore throat was observed in 16% cases in Group V and 18% cases in Group M. Upon statistical analysis, these were not found to be significant. Arrhythmia, laryngospasm, and regurgitation were not noted in any of the cases in Group V and Group M.

Table 1: Modified Cormack–Lehane classification

Grade	Description
1	Full view of glottis
2a	Partial view of glottis
2b	Only posterior extremity of glottis seen or only arytenoid cartilages
3	Only epiglottis seen, none of glottis seen
4	Neither glottis nor epiglottis seen

Table 2: Modified Mallampati scoring

Class I: Soft palate, uvula, fauces, pillars visible
Class II: Soft palate, major part of uvula, fauces visible
Class III: Soft palate, base of uvula visible
Class IV: Only hard palate visible

Table 3: Comparison of mean heart rate between two groups

Mean heart rate (bpm)	Group V	Group M	p value	Significance
Baseline	73.94±5.67	73.73±6.88	0.814	NS
During pre-oxygenation	72.85±4.92	72.96±6.38	0.892	NS
During L&I	76.06±4.69	80.72±7.49	0.000	HS
During ETI1	77.55±4.34	79.05±7.82	0.095	NS
During ETI3	77.10±6.20	79.68±6.54	0.005	S
During ETI5	76.36±6.70	76.77±7.04	0.673	NS
During ETI10	75.57±6.41	76.39±7.60	0.410	NS

L&I: Laryngoscopy and intubation, ETI1: Endotracheal intubation at 1 min

Table 4: Comparison of mean systolic blood pressure between two groups

Mean systolic blood pressure (mmHg)	Group V	Group M	p value	Significance
Baseline	116.51±5.06	116.62±5.45	0.883	NS
During pre-oxygenation	117.27±1.87	117.54±7.04	0.711	NS
During L&I	122.87±3.31	126.50±7.52	0.000	HS
During ETI1	122.19±4.93	124.74±6.92	0.003	S
During ETI3	118.16±2.57	119.95±7.23	0.021	S
During ETI5	115.26±4.94	117.41±5.73	0.005	S
During ETI10	117.27±4.45	117.72±5.83	0.540	NS

L&I: Laryngoscopy and intubation, ETI1: Endotracheal intubation at 1 min

Table 5: Comparison of mean diastolic blood pressure between two groups

Mean diastolic blood pressure (mmHg)	Group V	Group M	p value	Significance
Baseline	73.37±7.07	73.59±7.14	0.827	NS
During pre-oxygenation	75.12±6.51	75.53±7.99	0.691	NS
During L&I	82.27±6.34	83.16±8.03	0.386	NS
During ETI1	80.11±6.65	83.09±8.17	0.005	S
During ETI3	77.98±5.46	81.14±8.07	0.001	S
During ETI5	76.57±5.62	77.63±7.28	0.251	NS
During ETI10	75.11±5.88	75.07±7.18	0.966	NS

L&I: Laryngoscopy and intubation, ETI1: Endotracheal intubation at 1 min

DISCUSSION

Majority of patients were intubated in the first attempt in both groups, which is consistent with the findings of study conducted by Rajan

Table 6: Comparison of mean MAP between two groups

Mean MAP (mmHg)	Group V	Group M	p value	Significance
Baseline	96.05±3.73	95.11±4.20	0.096	NS
During pre-oxygenation	95.88±4.07	94.85±4.99	0.111	NS
During L&I	99.06±4.85	101.79±5.49	0.000	HS
During ETI1	98.45±4.50	102.89±5.27	0.000	HS
During ETI3	98.19±4.17	98.69±5.13	0.450	NS
During ETI5	97.27±4.23	97.94±5.03	0.309	NS
During ETI10	95.17±4.00	96.39±5.02	0.059	NS

MAP: Mean arterial pressure,

Table 7: Comparison of mean SPO_2 between two groups.

Mean SPO_2 (%)	Group V	Group M	p value	Significance
Baseline	97.30±1.11	97.54±1.17	0.137	NS
During pre-oxygenation	98.45±0.69	98.63±0.65	0.058	NS
During L&I	99.12±0.64	99.02±0.43	0.195	NS
During ETI1	98.73±0.68	98.69±0.51	0.637	NS
During ETI3	98.41±0.75	98.51±0.50	0.271	NS
During ETI5	98.00±0.82	98.09±0.79	0.430	NS
During ETI10	98.44±0.50	98.37±0.76	0.443	NS

L&I: Laryngoscopy and intubation, ETI1: Endotracheal intubation at 1 min

Table 8: Comparison of mean ETCO2 between two groups

Mean ETCO2 (mmHg)	Group V	Group M	p value	Significance
Baseline	38.70±2.27	39.05±2.08	0.257	NS
During pre-oxygenation	38.13±3.07	38.39±2.52	0.513	NS
During L&I	38.91±1.40	38.95±3.57	0.917	NS
During ETI1	39.42±1.20	39.45±3.09	0.928	NS
During ETI3	39.52±1.72	39.37±2.95	0.661	NS
During ETI5	40.44±1.68	40.13±3.03	0.372	NS
During ETI10	40.02±1.36	39.53±2.55	0.092	NS

L&I: Laryngoscopy and intubation, ETI1: Endotracheal intubation at 1 min

et al. [10]. Similarly, Kumar *et al.* [11] also observed in their study that C-MAC video laryngoscope had the highest percentage of individuals (80%) with a successful intubation at the first attempt in comparison to Macintosh (60%).

No significant difference in the total intubation time between the C-MAC and the Macintosh laryngoscope group was noted in our study which is in accordance with the findings of Cattano *et al.* [12]. On the contrary, the time to intubate was significantly shorter in Group V as compared to Group M (24 s vs. 68 s) in study by Rajan *et al.* [10]. As this study included participants with MP 3 and 4 which are predictors of difficult airway, while in our study, the participants were of MP 1 and 2 only. In study by Yoosamran and Sengnon [13], intubation time was significantly less in DL group (14.6±4.4 s) when compared with C-MAC group (18.9±6.3 s), which is not consistent with our study. The reason being the experience of the anesthetist was also defined and taken into consideration by Yoosamran and Sengnon [13], which was not specified in our study.

More appearance of Cormack and Lehane score 1 as seen in this study was also seen with the C-MAC video laryngoscope in study by Aggarwal *et al.* [14], Aziz *et al.* [15], and Shin *et al.* [16]. Thus, the C-MAC video laryngoscope displayed a better visibility of the glottis in comparison to those intubated with the Macintosh laryngoscope.

In our study, the mean heart rate was found to be statistically significant in Group M as compared to Group V during L&I and ETI3. Our study is similar to Archana *et al.* [17] where the heart rate changes showed variation in C-MAC group compared to Macintosh Laryngoscope group at 1st, 3rd, and 5th min. Kumar *et al.* [11] also observed a significant difference in heart rate at 0, 1, 3, and 5 min post-intubation, to be higher in Macintosh laryngoscopy than in C-MAC VL. On the contrary, Rajan *et al.* [10] observed that there was no statistically significant difference in heart rate in traditional Macintosh laryngoscope group and VL group. The reason might be the nasal intubation performed in their study as compared to oral intubation in our participants. Other reason could be the difference in maximum dose of propofol (2.5 mg/kg of body weight in study by Rajan *et al.* [10] as compared to 2 mg/kg of body weight in our study).

The mean systolic blood pressure was found to be statistically significant in Group V as compared to Group M during L&I, ETI1, ETI3, and ETI5. This is in accordance with the findings of Archana *et al.* [17] and Kumar *et al.* [11]. On the contrary, Rajasekhar *et al.* [18] also observed in their study that systolic blood pressure during L&I using Macintosh or McCoy or CMAC laryngoscope was statistically insignificant between the three groups and provided that the depth of anesthesia is maintained constant. The reason could be that the depth of anesthesia was constantly monitored through entropy monitoring, which was not done in our study. Other reason could be the use of thiopentone as the induction agent, while we used propofol.

In our study, the mean diastolic blood pressure was found to be statistically significant in Group M as compared to Group V at ETI1 and ETI3. This is in accordance with the findings of Kumar *et al.* [11] and Archana *et al.* [17]. On the contrary, Rajan *et al.* [10] observed that there was no statistically significant difference in the diastolic blood pressure in traditional Macintosh laryngoscope group and VL group.

The mean MAP was found to be statistically significant in Group M as compared to Group V during L&I and ETI1. Our findings are consistent with those of Varsha *et al.* [19] which showed that there was a significant increase in mean arterial pressure at 2nd, 3rd, and 4th min in the Macintosh group as compared to video laryngoscope group. However, this is contrary to the findings of Rajan *et al.* [10].

In our study, the difference in mean SPO_2 and mean $ETCO_2$ between the two groups was found to be non-significant at any time interval. Similar results in terms of SPO_2 were also obtained in study by Kumar *et al.* [11].

No significant difference was observed between the two groups in terms of complications in this study. In study by Archana *et al.* [17], there were no obvious airway injuries noted in the two groups except for one patient in Macintosh group who had slight bleeding from the lips following L&I. Rajan *et al.* [10] observed that mucosal trauma was significantly more frequent in Group M. Tosh *et al.* [20] and Yoosamran and Sengnon [13] observed that as compared to Group M, number of patients who had post-operative sore throat were significantly low in Group V.

Thus, our study reflected better performance of VL in terms of better glottic view, better hemodynamic stability, and lesser complications. Similarly, Lewis *et al.* also concluded by their studies that VLs reduce the number of failed intubations, particularly among patients presenting with a difficult airway by improving the glottic view and reducing laryngeal/airway trauma [21,22].

CONCLUSION

The present study showed better ease of intubation, decreased hemodynamic response to L&I, and was less traumatic in Group V (VL C-MAC) as compared to Group M (Macintosh laryngoscope). However, no significant difference was observed in the percentage of oxygen saturation and end-tidal CO_2 between the participants of two groups. Fewer complications were observed in Group V as compared to Group M in this study. Further studies with larger sample size are required to validate the findings of the study.

Limitations

There were some limitations in the present study. It was an open-label study and no blinding was possible. The experience of the anesthetist performing the procedure was not taken into consideration. The skill acquisition of the C-MAC VL requires a brief period of learning and regular practice. All patients had Mallampati scores I or II, so the results may not conform to patients who had potentially difficult airways.

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AUTHORS'CONTRIBUTIONS

Dr. Tanya Singh, Dr. Balwinder Kaur Rekhi, Dr. Parmod Kumar, and Dr. Mandeep Kaur did the literature review, acquisition of data, statistical analysis, interpretation of data, drafting, and reviewing, and editing of the manuscript.

CONFLICTS OF INTEREST

There were no conflicts of interest.

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