Original Research Paper

Volume - 14 | Issue - 02 | February - 2024 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Anaesthesiology

COMPARATIVE ASSESSMENT OF INTUBATING CONDITIONS IN ADULT PATIENTS USING C-MAC VIDEO LARYNGOSCOPE AND MACINTOSH BLADE

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ABSTRACT **Introduction:** The use of video laryngoscope for tracheal intubation is recommended in cases with difficult airways. The present study with the objective of comparing of duration of successful endotracheal intubation, visualization of anatomic structures, use of optimization maneuvers and first attempt success rate by direct laryngoscopy using Macintosh laryngoscope and C-MAC ®Video laryngoscope (Storz). **Methodology:** After Ethical committee approval, CTRI registration, patient consent,102 ASA I/II patients, aged 18 to 45 years, with Mallampati class I/II, posted for elective surgeries under General Anaesthesia were randomly allocated into two groups of 51 each, to undergo Direct Laryngoscopy (Group A) or Video Laryngoscopy (Group B). **Results:** No significant difference in the duration for successful endotracheal intubation was observed. There was significant difference in bougie usage, 11 patients requiring bougie in A group and only 2 patients in B group (p value= 0.016) Also significant difference was noted in the glottic view assessed by modified Cormack lehanne grade, 17 patients had grade I in group A while 38 patients in group B showed grade I. Other parameters were similar in both groups. **Conclusion:** Storz C-MAC® Video laryngoscope is associated with better visualization of laryngeal structures but it was associated with similar duration of intubation as Macintosh laryngoscope, higher use of bougie(alone) and also combined use of BURP and bougie. In conclusion, C-MAC® Video laryngoscope can be a suitable alternative to conventional Macintosh laryngoscope in routine practice.

KEYWORDS : Video laryngoscope, Intubation, Macintosh laryngoscope, failed intubation, visualize vocal cords

INTRODUCTION

Endotracheal intubation is one of the most essential skills performed by specialists in order to secure airway of the patients during general anaesthesia or in critical care for various conditions to provide sufficient oxygenation and ventilation.[1] Multiple techniques have been available in this regard, including the visualization of the vocal cords by a direct non flexible laryngoscope to video visualization laryngoscope. The procedure involves direct placement of the endotracheal tube into the trachea via cricothyrotomy and fiberoptic visualization of the vocal cords via the nasal or oral route.[2,3]

While conducting the above procedure, the incidence of airway-related complications will be increased with an increase in the number of attempts at laryngoscopy. Also, the failed airway management in these cases can lead to serious complications such as hypoxemia, aspiration, neurological damage, cardiovascular complications, and even death.[4-6]

Macintosh laryngoscope is one of the most commonly used devices for direct visualization of the structures of the larynx and facilitating tracheal intubation.[5] Advancement in the field of clinical practice has provided the most convenient and better visualization procedure, video laryngoscopes (VLS), based on the principles of indirect laryngoscopy.[7] It is important to evaluate such newer devices with the goal of improving airway management. Various clinical studies of different types of VLs including C-MAC have been conducted on patients requiring laryngoscopy and endotracheal intubation in the emergency department, intensive care unit (ICU) to evaluate their effectiveness in failed intubation with direct laryngoscopy, in predicted difficult airway and in lateral position by various researchers globally[6-8] but we could not find much researches conducted in the Indian population.

Hence, the present study was aimed at comparing the intubating conditions with C-MAC video laryngoscope and Macintosh laryngoscope in adult patients posted for surgery under general anaesthesia with the primary objective to compare the time for successful endotracheal intubation and secondary objectives are to compare and Glottic view (by modified Cormack-Lehanne grade), first attempt success rate, need for optimization maneuvers and hemodynamic parameters which includes heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, oxygen saturation.

MATERIALS AND METHODOLOGY

We had conducted a prospective, Randomized, comparative study by recruiting the 102 patients in the age group of 18-45 years, of ASA I and II posted to undergo surgery under general anesthesia at the major OT Complex, Dept. of Anesthesiology, VIMS, Ballari for a period of one year. Study was started after obtaining the Institutional ethical committee clearance and Clinical Trials Registry Of India (CTRI) registration with the registration numbers (MCI-53(3)/97-MED/1912) and (CTRI/2021/03/031707) respectively. After explaining the detailed study protocol, the written informed consent was taken from the study participants.

We had included adult patients of both the genders aged between 18-45 years who were scheduled for any elective surgery under General Anesthesia, with American Society of Anesthesiologists physical status I to II and Modified Mallampati (Samsoon & Young) Airway class I and II on pre anesthetic evaluation. Whereas the patients with full stomach posted for emergency surgeries, with co-morbid conditions and known congenital anomalies also, those refused to be the part of study were excluded.

Sample size was calculated to be 102, based on previous data which showed that rate of successful orotracheal intubation increased by 15% (from 65% to 80%) by using video laryngoscope.[9] Assuming this proportion to increase by 25% i.e from 65% to 90%, with type I error set at 5% and type II error set at 10%, 51 patients need to be included in each group (i.e. 102 patients total).

After thorough pre-anesthetic evaluation and overnight fasting, patients shifted to operation theatre and following monitors were connected/ routine monitors were connected. Patients were randomly allocated into 2 groups (Group A and Group B) as per computer generated randomization table. The randomization scheme was generated by using https://www.sealedenvelope.com. Allocation concealment was done using sequentially numbered, opaque sealed envelope (SNOSE) technique.

Patients were premedicated with Inj. Midazolam 0.03mg/kg and Inj. Fentanyl 2 µg/kg after connecting to the routine preinduction monitors. Baseline vitals were recorded.

All patients were preoxygenated for three minutes. Intravenous induction of general anaesthesia with Inj. Propofol 2mg/kg followed by Inj. Succinyl choline 2mg/kg. Laryngoscopy was carried out with either Macintosh laryngoscope (Group A) or C- mac video laryngoscope (Group B). Hemodynamic parameters were noted at

following time periods: before induction, after induction, at laryngoscopy, after intubation at 1min, 3min, 5min, 10min and 20 minutes. Patients were maintained with Oxygen, Nitrous oxide, Isoflurane, vecuronium, with positive pressure ventilation and reversed at the end of surgery using appropriate doses of neostigmine and glycopyrrolate. Time for successful intubation, Glottic view (by Modified Cormack Lehanne grading), first attempt success rate, need for optimization maneuver, hemodynamic parameters and the oxygenation status were monitored and noted.

Time for successful endotracheal intubation was defined as the time taken from insertion of laryngoscope blade between the teeth until the endotracheal tube is placed through vocal cords, as evidenced by visual confirmation by the anesthetist performing laryngoscopy.

Statistical Analysis:
Statistical analyses were performed using IBM SPSS Statistics for Windows, Version. 25.0. Armonk, NY: IBM Corp.

RESULTS

On analysis, the mean age of patients in group A was 37.51±6.86 years and in group B it was 35.76±7.71 years, with p value of 0.23. Hence, age in both the groups were comparable. Also, the distribution of gender, height, weight, BMI and ASA status were also similar between the both groups with no significant variation. Mean BMI in group A was 23.79±4.11 and in group B was 24.92±4.34 with p value of 0.17. Hence, BMI in both groups were comparable.

Table 1: ASA-Physical status

ASA	Group A	Group B	P value
I	26 (50.98%)	24 (47.05%)	0.841
II	25 (49.01%)	27 (52.94%)	

All the patients selected for the study belonged to ASA I and II. Out of 102 patients 50 were ASA-PS I of which 26 and 24 were in group A and B respectively. Of the 52 belonging to ASA-PS II 25 were in Group A and 27 were in group B with no significant differences between two groups.% All the patients included in the study belonged to modified Mallampati class I and II. Out of 102 patients, 33 patients belonged to class I, of which 16 were in group A and 17 in group B. Among 69 patients from class II, 35 were in group A and 34 in group B, no significant differences between the two groups, the same is depicted as graph below.

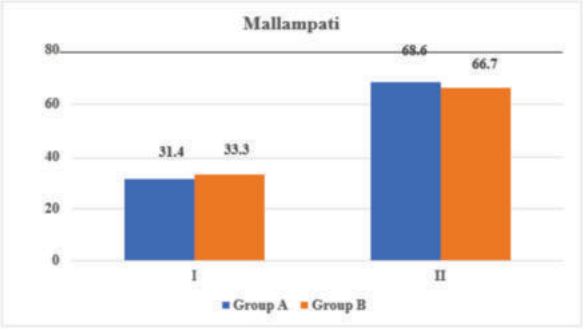

Figure 1: Distribution of Mallampati class

Table 2: Time for successful endotracheal intubation

Variable	Group A (Mean±SD)	Group B (Mean±SD)	p value
ET in time	30.92±3.60	31.05±2.66	0.82

Time taken for successful endotracheal intubation in group A was 30.92±3.60 seconds and in group B it was found to be 31.05±2.66 seconds. No statistically significant difference was observed between the two groups. (p value = 0.82)

Table 3: Modified Cormack lehanne grade

CLG	Group A N (%)	Group B N (%)	p value
1	17(33.3)	38(74.5)	0.001*
2A	16(31.4)	11(21.6)	
2B	16(31.4)	2(3.9)	
3	2(3.9)	0	

During laryngoscopy in group A, 33.3% showed Cormack lehanne grade 1, 31.4% grade 2a and 31.4% grade 2b. In group B 74.5% showed grade 1, 21.6% grade 2a and 2% grade 2b. The difference between the two groups was found to be statistically significant

Table 3: First attempt success rate

Attempts	Group A n(%)	Group B n(%)	p value
1	50(98.0)	50(98.0)	1.00
2	01(2.0)	01(2.0)	

98% of patients in group A as well as group B were intubated in first attempt with P value of 1.

Table 4: Optimization maneuver used

VARIABLES	GROUP A (n)	GROUP B (n)	P value
M1 (BURP maneuver)	13	8	0.016
M2(Stylet)	1	0	
M3(BOUGIE)	2	11	

69.23% of patients in group A and 63.46% of patients in group B were intubated without need for optimization maneuver. 19 patients in group B required some optimization maneuver (Bougie 11, BURP 8) that is significantly high compared to Group A (Bougie 2, BURP 13). An increase in heart rate was observed at laryngoscopy in both the groups but it was not statistically significant. We did not find any significant variation or deviation of the heart rate, pulse, SBP, DBP and MAP either intra group or inter groups. Although there was an increase in mean arterial pressure was observed at laryngoscopy in group A but the difference was insignificant. This is depicted as line graph below.

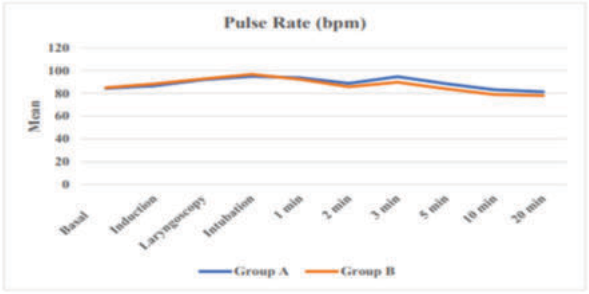

Figure 2: Distribution of variation in the Pulse rate between two groups.

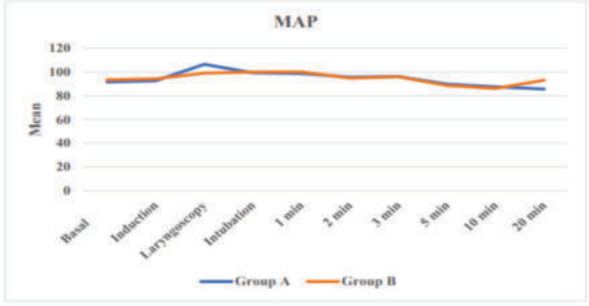

Figure 3: Distribution and comparison of variation in the MAP between two groups.

DISCUSSION

The use of video laryngoscope for endotracheal intubation is well established and has been extensively supported in the literature for managing the difficult airway. But its use for routine elective cases has not been studied in detail. Thus, we prospectively evaluated the intubating conditions in 102 patients; 51 in each group using Macintosh direct laryngoscope and Storz C-MAC ®Video laryngoscope.

Demographic characteristics like age, sex, weight, height, BMI and ASA physical status in both the groups were comparable and were not statistically significant. In our study we observed that the duration of successful endotracheal intubation was similar in both groups i.e.with Macintosh laryngoscope mean duration was 30.92 seconds and 31.05 seconds with C-MAC video laryngoscope (p value- 0.82). This was comparable with results of **Mathew A et al**[10], which showed mean duration of intubation with Macintosh laryngoscope was 42.5 seconds and with C-Mac video laryngoscope it was 42.8seconds (p value- 0.908).

The additional cognitive processing required for indirect laryngoscopy

may affect the total intubation time and success rate when used in routine clinical practice, particularly when used by novices. As this would have been a learned skill, requiring minimal cognitive processing. Therefore, the delay in time to achieve laryngoscopy and intubation, using the video laryngoscope, must reflect the second stage of learning, which is in task execution. [10] Although video laryngoscopes provide a good view of the larynx, they may not guarantee an easy tracheal intubation and may prolong the time of successful intubation.[11] The glottic view by modified Cormack lehanne grade was observed to be significantly better in the group intubated with C-MAC video laryngoscope than with Macintosh laryngoscope (p value=0.001).

Direct laryngoscopy with a standard Macintosh blade showed distribution of classification of grades from I /IIa/ IIb/III of: 17/16/16/2, whereas C-Mac video laryngoscopy showed a distribution of: 38/11/2/0. Similar results were reported by **Bauer AJ et al**[12], they observed that video laryngoscopy provided a significantly better view of laryngeal structures than direct laryngoscopy (p<0.0001). `

We found that the first attempt success rate for intubation was 98% with both Macintosh laryngoscope and C-MAC video laryngoscope (p value=1). But this was inconsistent with the study by **Liu DX et al**[1] in which they observed that first attempt success rate was 96.2% using video laryngoscope versus 90.1% using direct laryngoscope (p value=0.024). In another meta-analysis conducted by **Lewis SR et al**[13], they concluded that though video laryngoscope improved the glottic view but no evidence indicated that use of video laryngoscope reduces the number of intubation attempts.

As per literature, for good glottic exposure, video laryngoscopy requires the application of lesser force as compared to direct laryngoscopy to the base of the tongue. Therefore, video laryngoscopy is less likely to stimulate stressor response and induce local tissue injury. Hemodynamics were well maintained and were comparable in both groups. Heart rate increased in both the groups at laryngoscopy and intubation, but had returned to baseline within 5 min in both the groups, with no inter group differences. The mean arterial pressure was also increased in both groups at laryngoscopy but inter-group difference was less. Our study results correlated with the study conducted by **McElwain J et al**.[14]

Although we had planned for a single blinded study, it was difficult follow as we could not hide the scope, which is used to intubate. We did not include patients with difficult airway in our study, which could have been provided us the additional outcome about successful intubation among such patients but now the outcome cannot be extrapolated to patients with difficult airway. We did not measure the time to visualize the cords with either scope, which may have been less with CMAC due to camera optics. We further would like to conduct the similar study by considering all these limitations in order to provide the better data in this regard.

CONCLUSION

Storz C-MAC Video laryngoscope and Macintosh Direct laryngoscope both were similar in the duration of intubation and first attempt success rate but C-MAC video laryngoscope was associated with better visualization of glottic structures and also higher use of optimization maneuvers (bougie and BURP maneuver) for intubation.

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