Section: Anaesthesia

Original Research Article

COMPARISON OF VIDEOLARYNGOSCOPE AND MACINTOSH LARYNGOSCOPE FOR ENDOTRACHEAL INTUBATION IN PATIENTS UNDERGOING GENERAL ANAESTHESIA

Received : 20/01/2024
Received in revised form : 21/03/2024
Accepted : 02/04/2024

Keywords:
Video Laryngoscope; Macintosh Laryngoscope; Airway; Intubation time; Hemodynamic Parameters; Cormack Lehane grading.

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DOI: 10.47009/jamp.2024.6.2.257

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (2); 1285-1291

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Abstract

Background: The aim is to Compare the Video Laryngoscope with Macintosh Laryngoscope for intubating conditions in patients undergoing general anaesthesia. **Materials and Methods:** A prospective observational study was conducted after getting Institutional Ethics Committee clearance and informed consent from 92 patients in the age group of 18 to 60 years belonging to American Society of Anaesthesiologists (ASA) physical status I & II, undergoing elective surgeries under general anaesthesia. 46 patients were intubated with video laryngoscope (Group V) and 46 with Macintosh laryngoscope (Group M). The ease of intubation was measured in terms of number of attempts, time taken for intubation and manipulation required. Laryngeal view obtained measured in terms of Cook's modification of Cormack and Lehane grading, changes in hemodynamic parameters - variation in pulse rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure at 1st minute, 3rd minute and 5th minute after intubation and complications were observed and compared. The data was expressed as mean and standard deviation or frequency proportion. The association between the groups were carried out using Chi-square test for categorical variables, in case of continuous variables unpaired t test or Mann whiney U test was performed based on normality. Significance was defined as p value < 0.05. **Result:** Mean time taken for intubation was lesser in Group V (27.47 ± 3.6 secs) compared to Group M (30.07±4.2secs) which was statistically significant (p value 0.002). Intubation attempts were lesser in Group V compared to Group M (p value 0.04) and was statistically significant. Group V had a laryngoscopic view in terms of Cook's modification of Cormack and Lehane grade 1 in 43 patients and grade 2a in 3 patients whereas Group M had grade 1 in 34 patients and grade 2a in 12 patients which was statistically significant (p value 0.01).The increase in pulse rate after intubation was comparable in both groups. A lesser increase in SBP was noted in Group V compared to Group M which was statistically significant at 5th minute (p value 0.006) after intubation. Group V had a better haemodynamic stability in terms of increase in DBP and MAP at 1st (p value 0.007 & 0.01), 3rd (p value 0.003 & 0.009) and 5th (p value 0.003 & 0.003) minute respectively, after intubation compared to Group M and was statistically significant. **Conclusion:** This study showed that videolaryngoscope offers better intubating conditions compared to Macintosh laryngoscope for endotracheal intubation in patients undergoing General anaesthesia.

INTRODUCTION

Securing the airway with an endotracheal tube is a challenging procedure and still one of the most important skills in anaesthesia. The morbidity and mortality associated with anaesthesia continue to be impacted by difficult tracheal intubation.[1]

Direct laryngoscopy (DL) has been the go-to method for tracheal intubation for many years. However, numerous other intubation devices have been created over the past 20 years.[2] Alternative intubation tools have emerged, such as the video laryngoscope and fibre optical laryngoscope, which have many advantages over direct laryngoscopy. These tools allow for easier laryngeal exposure without lining up the pharyngeal, oral, and tracheal axes and the ability to obtain a laryngeal view despite anatomy that is not ideal for direct laryngoscopy.

Additionally, it gives other professionals the chance to witness and observe the process.[2] The most important advancement in airway management this century has been video laryngoscopy. The method of managing airways has undergone a significant alteration with the introduction of video laryngoscopy. A variety of clinical situations have seen the usage of video laryngoscopes as a lifesaving tool. It is gaining importance in the hands of both experts and nonexperts. The videolaryngoscope's indirect view of the upper airway improves glottic visibility, including suspected or actual difficult intubation. Video camera technology is used in video laryngoscopy (VL) to visualize airway features and make endotracheal intubation easier (ETI). Due to the enormous advancement in technology, more dependable, potent, and affordable videolaryngoscopes are becoming available in the market. As VL uses its camera to do indirect laryngoscopy to visualize the anatomy of the airways, it does not require a direct line of sight.[3]

In this study, the Macintosh laryngoscope (ML), a direct visualization tool, is compared to the video laryngoscope, an indirect visualization tool. The VL blade is comparable to the Macintosh blade but has the added benefit of a video camera. An ultra-bright light-emitting diode and a tiny digital camera are built inside the blade's distal end.

The capacity to transmit a video image, reduced stress placed on the airway, assistance in viewing the larynx with less mouth opening, and handling abilities comparable to those of a conventional direct laryngoscope are only a few of the clinical benefits offered by video laryngoscopes.[4]

There have been a variety of reactions to the use of videolaryngoscopes intubation since they were first introduced into clinical practice. There is no doubt that it enhances glottis visibility, but few studies have examined the usefulness of utilizing a videolaryngoscope for intubation, such as the duration of time required and the success rate on the first try. It is yet to be determined whether it can serve as a viable substitute for conventional direct laryngoscopy in routine anaesthetic practice.[5]

The use of video laryngoscopes and advancements in the degree of glottic exposure has greatly boosted the success rate of tracheal intubation in cases of difficult airways.[5-7]

MATERIALS AND METHODS

Study Design and Setting: We conducted a prospective observational study in the major operation theatre, Department of Anaesthesia, Govt Medical College Kozhikode between May 2021-April 2022.

After Institutional Ethics Committee approval and informed written consent, 92 patients (46 in each group) were selected.

Inclusion Criteria

- Patients posted for elective surgery under general anaesthesia.
- American Society of Anaesthesiologists Physical Status (ASA PS) 1&II.
- Age 18-60 years.
- BMI 18-30 Kg/m2.

Exclusion Criteria

- Patients with difficult airway- Mallampati grade 111 and 1V.
- Obese patients (BMI >30).
- Pregnancy.
- Emergency surgery.

Sample Size

Based on a study done by Archana et al, (8)

Sample size calculation done using the formula

$$N = \frac{(Z\alpha + Z\beta)2\ SD2 \times 2}{d2}$$

where $Z\alpha = 1.96$, $Z\beta = 0.84$, d = effect size

As per the observational study by Archana et al,[8]

SD (Standard deviation) = 2.04 d = 1.2, So n=46

So in this study, the sample size calculated using the above formula was 46 in each group.

Data Collection Procedure: 92 adult patients in the age group of 18-60 years undergoing elective surgery under general anaesthesia were enrolled for the study. They were randomized into two groups using consecutive sampling technique Group V (46) – were intubated using Video laryngoscope Group M (46) – were intubated using Macintosh laryngoscope. All patients were assessed by a pre anaesthetic check up with detailed history taking, physical examination and laboratory investigations. An informed written consent was obtained in their native language from all patients for participation in this study. All patients were kept nil per orally before surgery (8 hours for solid foods and 2 hours for clear fluids). Patients were brought to the premedication room on the day of surgery and baseline heart rate, blood pressure, spo2 and respiratory rate were recorded. In the operating room, standard monitors were attached - electrocardiograph, pulse oximeter, non-invasive blood pressure and capnograph. An intravenous access was established with 18G cannula in the forearm after giving local anaesthesia.

All patients were pre-medicated with Injection Midazolam 0.02mg/kg iv and Inj Fentanyl 1mcg/kg iv. Following pre-oxygenation with 100% oxygen for 3 minutes, patients were induced with Injection Propofol 2mg/kg iv and Injection Vecuronium 0.1mg/kg was given for neuromuscular blockade. After face mask ventilation, laryngoscopy and intubation was carried out by an experienced Anaesthesiologist, (who has performed a minimum of 20 successful laryngoscopy and endotracheal

ISSN (O): 2687-5365; ISSN (P): 2753-6556

intubations with both macintosh and video laryngoscope) with Video Laryngoscope (VL) or Macintosh laryngoscope (ML) as per the group patients were allocated into. Trachea was intubated using an appropriate sized endotracheal tube (ETT). Placement of ETT was confirmed by auscultation and capnography and then tube was secured. Haemodynamic variables such as PR, SBP, DBP, and MAP were documented at 1st, 3rd and 5th minute following endotracheal intubation. Further management of the patient was carried out by the concerned Anaesthesiologist as per institutional protocol. At the end of the procedure, patients were reversed from neuromuscular blockade, extubated and shifted to the postoperative ward for further monitoring.

Successful intubation time was defined as the time from when the anaesthesiologist picked up the scope in hand and endotracheal intubation confirmed by capnography. If time taken for successful intubation was more than 2 minutes it was considered as a failure and the patient was excluded from the study. A successful intubation attempt was defined as an attempt in which the ETT was placed in the trachea as confirmed visually by the passage of the ETT through the glottis and the appearance of $EtCO_2$ waveform in the monitor. If more than three attempts were needed for successful intubation, then it was considered as a failure. If more than one attempt was required, the number of attempts taken for successful intubation was also noted.

On laryngoscopy with either of the scopes, if glottic visualization was not adequate, an experienced second assistant was directed to give external laryngeal Manipulation (BURP manoeuvre-backwards, upward, rightward pressure) to bring the glottis in alignment for a proper visualization of the vocal cords and to facilitate endotracheal intubation. In cases where difficulty was faced in negotiating the endotracheal tube through the oropharynx and past the glottis, a malleable stylet was used to facilitate intubation. Number of patients requiring external laryngeal manipulation and use of stylet was mentioned.

The laryngoscopy view obtained was compared according to Cook's modification of Cormack and Lehane grading:

Grade 1: Visualization of entire vocal cords.

Grade 2a: Visualization of posterior part of vocal cord and posterior commissure.

Grade 2b: Visualization of arytenoids only(only posterior commissure visualized).

Grade 3a: Epiglottis visualized and liftable using an introducer or bougie.

Grade 3b: Epiglottis visualized but not liftable.

Grade 4: Epiglottis not seen

In case of video laryngoscope, the integrated LCD monitor and direct visualisation of the glottis in case of Macintosh laryngoscope was used for obtaining the Cook's modification of Cormack Lehane grading.

Hemodynamic responses during and after intubation using both video and macintosh laryngoscopes were measured in terms of pulse rate (PR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial blood pressure (MAP) and was recorded at 1st, 3rd and 5th minute following intubation.

Following laryngoscopy with either of the scopes, trauma or any amount of blood seen on the scope, lips, gums, oropharynx and tongue and breakage or trauma to the teeth were considered as complications.

Statistical Methods: All the relevant patient data was entered in the Microsoft Excel sheet and statistical analysis was done using SPSS version 20.0 (IBM Corp, Armonk, NY, USA). The demographic data was expressed as mean and standard deviation or frequency proportion. The association between the groups were carried out using Chi-square test for categorical variables, in case of continuous variables unpaired t test or Mann whiney U test was performed based on normality. A p-value of <0.05 was considered as statistical significance.

RESULTS

A total of 92 patients with ASA PS I and II undergoing elective surgeries under general anaesthesia were enrolled for this study after obtaining approval from the Institutional Ethics Committee. In Group M (n=46), Macintosh laryngoscope was used, in Group V (n=46), Video laryngoscope was used for endotracheal intubation.

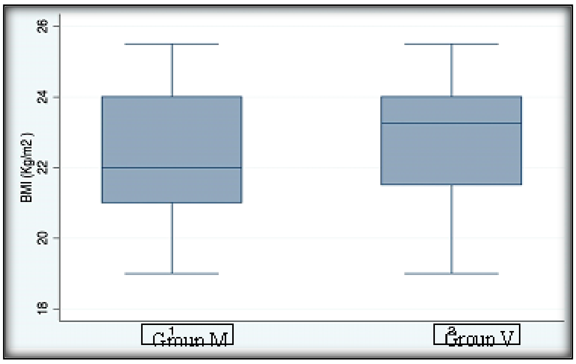

Figure 1: Body Mass Index (BMI)

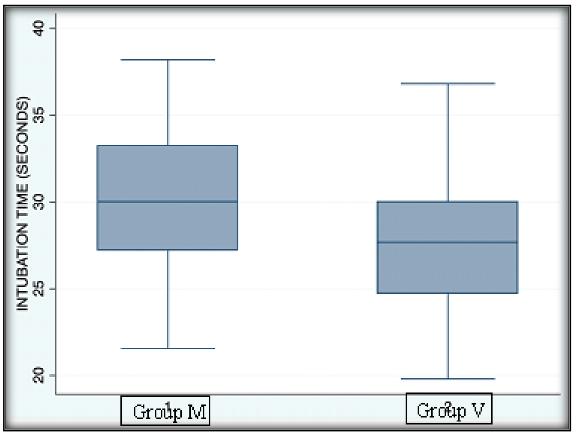

Figure 2: Intubation Time in Seconds

There was no statistically significant difference in age distribution among the two groups (p value - 0.59). [Table 1]
Gender distribution showed no statistically significant difference between the groups (p value - 0.83). [Table 2]

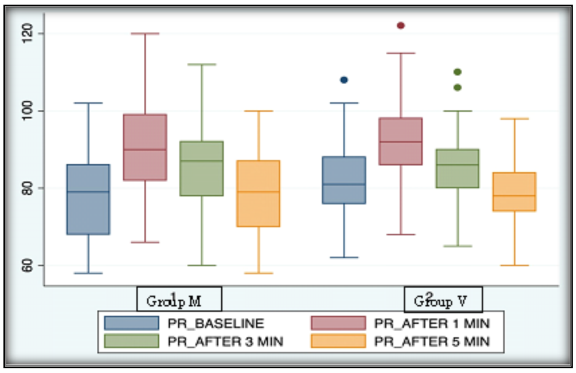

Figure 3: Changes in Pulse Rate

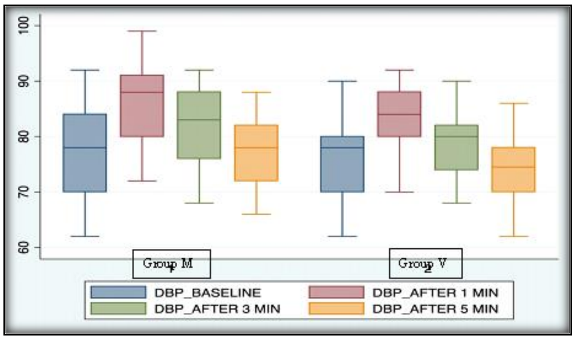

Figure 4: Diastolic Blood Pressure Changes (Baseline and After Intubation)

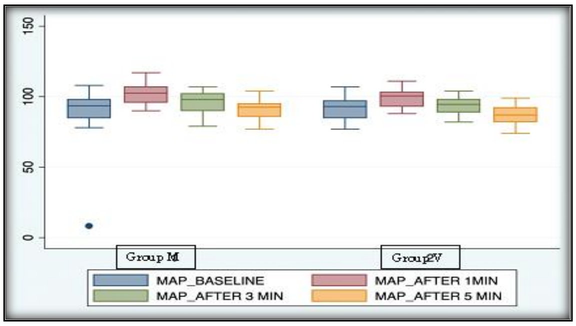

Figure 5: Mean Arterial Blood Pressure Changes (Baseline and After Intubation)

ASA PS showed no statistically significant difference between the groups (p value – 0.36). [Table 3]
Mallampati classification among the groups showed no statistically significant difference (p value- 0.07). [Table 4]

No statistically significant difference of BMI was found between the two groups (p value- 0.36). [Table 5]
The number of attempts needed for successful intubation in Group M were more than those needed in Group V. The number of Intubation attempts was significantly lower in Group V (p value = 0.04). [Table 6]
The average time taken for intubation was 30.07±4.2 seconds in Group M and 27.47±3.6 seconds in Group V. The time taken for endotracheal intubation was lesser in Group V compared to Group M which was statistically significant (p value 0.002). [Table 7]
BURP manoeuvre was needed among Group M and Stylet use was needed more among Group V for endotracheal intubation. We did not observe any statistical difference between manipulation required during intubation amongst the two groups (p value 0.10). [Table 8]
In Group V, 43 patients had CL grade 1 and 3 patients had CL grade 2a, whereas in Group M 34 patients had CL grade 1 and 12 patients had grade 2a (p value - 0.01) which was statistically significant. None of the patients had CL grade 2b, 3a, 3b or 4. Thus, video laryngoscope offered a better laryngoscopic view for intubation compared to Macintosh laryngoscope. [Table 9]
Pulse rate changes during intubation was comparable between the study groups. [Table 10]
The mean baseline systolic blood pressure was comparable between the two groups (p value- 0.40). Systolic blood pressure changes was statistically significant at 5 mins (p value 0.006) after intubation. Group V was found haemodynamically more stable compared to Group M in terms of increase in systolic blood pressure. [Table 11]
The mean baseline diastolic blood pressure was comparable between the two groups (p value 0.38). Diastolic blood pressure changes was statistically significant at 1 min (p value 0.007), at 3 min (p value 0.003) and 5 mins (p value 0.003) after intubation. Group V was found haemodynamically more stable compared to Group M in terms of increase in diastolic blood pressure. [Table 12]
Mean arterial blood pressure changes was statistically significant at 1 min(p value 0.01), 3 mins(p value 0.009) and 5 mins(p value 0.003) after intubation. Group V was found haemodynamically more stable compared to Group M in terms of increase in mean arterial blood pressure. [Table 13]

Table 1: Age Distribution

Age	Group M (ML) (%)	Group V (VL) (%)	p value
<30 years	11 (44.0)	14 (56.0)	0.59
31-45 years	26 (55.3)	21 (44.7)	
>45	9 (45.0)	11 (55.0)	

Table 2: Gender Distribution

Gender	Group M (ML) (%)	Group V (VL) (%)	p value
Male	25 (51.0)	24 (49.0)	0.83
Female	21 (48.8)	22 (51.2)	
Total	46	46	

Table 3: ASA Physical Status (ASA PS)

ASA PS	Group M (ML) (%)	Group V (VL) (%)	p value
I	34 (53.1)	30 (46.9)	0.36
II	12 (42.8)	16 (57.2)	

Table 4: Mallampati Classification

Mallampati	Group M (ML) (%)	Group V (VL) (%)	p value
I	22 (40.0)	33 (60.0)	0.07
II	24 (64.8)	13 (31.2)	

Table 5: Body Mass Index (BMI)

BMI	Group M (ML)	Group V (VL)	p value
Mean ±SD	22.2 ±1.8	22.7 ±1.7	0.36

Table 6: Number of Attempts for Successful Intubation

Number Of Attempts	Group M (ML)	Group V (VL)	p value
Mean ±SD	1.17 ±0.3	1.04 ±0.2	0.04

Table 7: Intubation Time in Seconds

Intubation Time	Group M (ML)	Group V (VL)	P value
Mean ±SD	30.07 ±4.2	27.47 ±3.6	0.002

Table 8: Manipuation

Manipulation	Group M (ML)	Group V (VL)	P value
BURP	4 (100.0)	0 (0.0)	0.10
Stylet	4 (40.0)	6 (60.0)	
None	38 (48.7)	40 (51.3)	

Table 9: Cook's Modification of Cormack and Lehane (Cl) Grading

CL grading	Group M (ML)	Group V (VL)	P value
1	34 (44.0)	43 (56.0)	0.01
2a	12 (80.0)	3 (20.0)	
2b	0	0	
3a	0	0	
3b	0	0	
4	0	0	

Table 10: Changes in Pulse Rate

Pulse Rate	Group M (ML)	Group V (VL)	p value
	Mean±SD	Mean±SD	
Baseline	78.7 ±11.4	81.2 ±10.5	0.29
After 1 min	91.3 ±11.8	91.4 ±10.6	0.95
After 3 min	85.6 ±11.3	85.8 ±9.2	0.93
After 5 min	79.3 ±10.6	78.3 ±8.3	0.60

Table 11: Systolic Blood Pressure Changes (Baseline and After Intubation)

SBP	Group M (ML) (Mean±SD)	Group V (VL) (Mean±SD)	p value
Baseline	122.4 ±9.9	124.1± 9.8	0.40
After 1 min	134.8 ±8.1	131.8 ±8.1	0.08
After 3 min	125.9 ±8.8	122.5 ±7.8	0.05
After 5 min	119.3 ±8.1	114.6 ±8.1	0.006

Table 12: Diastolic Blood Pressure Changes (Baseline and After Intubation)

DBP	Group M (ML) Mean±SD	Group V (VL) Mean±SD	p value
Baseline	77.7 ±7.8	76.3 ±7.1	0.38
After 1 min	86.5 ±6.6	82.8 ±6.0	0.007
After 3 min	82.0 ±6.7	78.1 ±5.5	0.003
After 5 min	77.5 ±6.4	73.7 ±5.7	0.003

Table 13: Mean Arterial Blood Pressure Changes (Baseline and After Intubation)

	Group M (ML) Mean±SD	Group V (VL) Mean±SD	p value
Baseline	90.6 ±14.9	92.0 ±7.7	0.59
After 1 min	102.3 ±6.8	98.8 ±6.4	0.01
After 3 min	96.2 ±7.0	92.6 ±5.9	0.009
After 5 min	91.1 ±6.6	87.1 ±6.2	0.003

DISCUSSION

A prospective observational study was conducted in the Department of Anaesthesia in the Major Operation Theatre to compare the Video Laryngoscope with Macintosh Laryngoscope for intubating conditions in patients undergoing general anaesthesia during May 2021 to April 2022. In this study, we estimated the demographic characteristics including age, sex, BMI of 92 patients who were intubated under general anaesthesia. We compared the ease of Intubation in terms of number of attempts, the time taken for intubation and manipulation required during intubation. We also compared the laryngoscopic view obtained by both laryngoscopes in terms of Cook's modification of Cormack and Lehane grading. we also compared the haemodynamic response during laryngoscopy in terms of variation in pulse rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure at 1st minute, 3rd minute and 5th minute after intubation. The incidence of complications between the groups in terms of any trauma or bleed was also taken into consideration. Existent research on this area is mainly focused in western, and there is a lack of literature from India, specifically from south Indian settings, where the existing literature mainly deals with other clinical outcomes following intubation, and only very few attempts have been made to study the comparison of the Video Laryngoscope with Macintosh Laryngoscope for intubating conditions. Thus considering the advances in this field and the increasing use of these two types of laryngoscopes which show varying results, we decided to take up this study among patients undergoing general anaesthesia.

In this study, 92 patients were grouped into two of 46 each, the Macintosh laryngoscope group (Group M) and the rest 46 into the video laryngoscope group (Group V). We noted that majority of the cases belonged to 31-45 years, and were males by gender. The mean BMI of these study groups were observed to be 22.2 ±1.8 in Macintosh laryngoscope and 22.7 ±1.7 in video laryngoscope group. The two groups were comparable with respect to age, gender, BMI and ASA PS. (pvalue >0.05).

The average time taken for intubation was 30.07±4.2 seconds for Macintosh laryngoscope and 27.47±3.6 seconds for video laryngoscope. The time taken for endotracheal intubation was lesser for videolaryngoscope compared to Macintosh laryngoscope which was statistically significant (p value 0.002). This was observed to be in line with the findings observed by Bhat et al.[9] In their study, it was seen that the time taken for macintosh laryngoscopy was 33.8 ± 9.12 seconds and VL was 24.8 ± 8.5 seconds. In another study by Archana et al, the average intubation time in seconds for ML was 29.7±4.68 and VL was 26.6±3.71 seconds who have also demonstrated that there is a significant difference with respect to the duration of laryngoscopy between the study groups.[8] In a 2011 meta-analysis, individuals scheduled for elective operations were compared with VLs and direct laryngoscopes. It was demonstrated that in patients, the VL required much less time for endotracheal intubation.[10] Similar to that, in this study, the mean intubation time was 30 ±4.2 seconds for the Macintosh group and 27.47 ±3.6 for the Video laryngoscope, indicating a significantly shorter intubation time for VL.

We observed that there was a statistically significant difference with respect to the number of intubation attempts, with video laryngoscope taking fewer attempts for tracheal intubation (p-value 0.04). In a study by Hazarika et al, the number of attempts for successful intubation was significantly less with Videolaryngoscope as compared to Macintosh laryngoscope.[11]

In our study, we did not observe any statistical difference between manipulation required for intubation across the groups, with BURP manoeuvre(backwards, upward, rightward pressure) needed among the Macintosh group and Stylet use more common among the video laryngoscope group (p value 0.10). According to the study by V. Hodgetts et al, there was no significant difference in terms of number of manoeuvres required to facilitate intubation.[4]

Cook's modification of Cormack-Lehane grading was grade 1 in 34 patients and grade 2a in 12 patients in Macintosh laryngoscopy whereas in videolaryngoscopy, there were 43 patients with grade 1 and 3 patients had grade 2a. None of the patients belonged to CL grading 2b, 3 or 4 in both the groups. The difference in CL grading was found to be statistically significant (p value 0.01). From this data, VL offered a better laryngoscopic view for intubation compared to Macintosh laryngoscope similar to a study by Bhat et al where Cormack Lehane grade 1 laryngeal view was 62% in VL group and 36% in the Macintosh laryngoscopy group.[9] In our study, CL grade 1 was 56% in Videolaryngoscopy and 44% in Macintosh laryngoscopy. Chandreshekarriah et al in his study, showed a superior glottic view obtained in all their patients intubated using a videolaryngoscope.[12] Even though a different kind of VL was employed and a different study population

ISSN (O): 2687-5365; ISSN (P): 2753-6556

was included, these findings are comparable to those of the current investigation. This shows that VLs are superior to Macintosh laryngoscopes as alternatives for assuring straightforward intubation and improved glottic visualisation.

Regarding the changes in haemodynamic parameters following intubation – changes in pulse rate between the Macintosh and Video laryngoscope groups, we observed that the pulse rate was comparable between the study groups with no statistically significant p value at 1st, 3rd and 5th min after intubation. In a study by Caparlar et al, the changes in pulse rate at 3 mins (p value 0.135) after intubation were comparable in both groups.[13]

With regard to the changes in systolic, diastolic and mean arterial pressure during intubation between the Macintosh and Video laryngoscope groups, we found that the systolic blood pressure change was statistically significant at 5mins (p value 0.006) after intubation, while the diastolic blood pressure change was statistically significant at 1 min (p value0.007), 3 mins (p value 0.003) and 5 mins (p value 0.003) after intubation. In a study by Archana et al, SBP changes after intubation showed a significant p value at first (p value 0.027) and third (p value 0.021) minute, but not at 5th minute (p value 0.08) after intubation with a lesser increase in SBP noted in VL group. In the same study, DBP variation showed a significant p value at third minute (p value 0.009) after intubation.[8] The mean arterial pressure changes was statistically significant at 1 min (p value 0.01), 3 mins (p value 0.009) and 5 mins (p value 0.003) interval following intubation.

None of the patients in this study sustained any complications in the form of trauma or any amount of blood seen on the scope, lips, gums, oropharynx and tongue and breakage or trauma to the teeth.

CONCLUSION

It is concluded that video laryngoscope provides shorter intubating time, better glottic visualization and fewer attempts for endotracheal intubation in patients undergoing general anaesthesia compared to macintosh laryngoscope. video laryngoscope offered better haemodynamic stability after intubation.

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