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Original Research Article

A Randomized Control Study to Compare Between the Macintosh Laryngoscope and the Video Laryngoscope in Endotracheal Intubation at Tertiary Care Center

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Abstract:

Background and Aim: Laryngoscopy and intubation are noxious stimulus which results in sympathetic response leading to hypertension and tachycardia. This can in turn produce adverse cardiovascular events, especially in patients with cardiac co- morbidities. Present study was carried out to evaluate and compare the laryngeal view, intubation time, stress response by direct laryngoscope using Macintosh blade with video laryngoscope using king vision video laryngoscope in adult patients requiring endo-tracheal intubation.

Material and Methods: This prospective observational study was conducted at our institute with total 132 adult patients aged 18-65 years of either sex and average weighing around 60 kg belonging to ASA grade I/II, patients having Mallampati grade I/II and normal thyro- mental distance were included in this study. All patients were divided into two groups: Group V: patients were intubated using King Vision video laryngoscope and Group M**:** - patients were intubated using direct laryngoscope with Macintosh blade. We studied and compared the laryngeal view, the time taken for intubation, number of attempts and maneuvers required to facilitate intubation and hemodynamic response to the laryngoscopy and intubation in both groups.

Results: Cormack and Lehane grade I/II/III/IV was 59/7/0/0 patients in group V & 30/36/0/0patients patients in group M. The total time taken for intubation in Group V was 18.63 ± 5.04 seconds & 19.26 ± 5.18 seconds for Group M. Hemodynamic response was less during laryngoscopy and intubation with King Vision video-laryngoscope (Group V) as compared to Macintosh laryngoscope (group M).

Conclusion: King vision video laryngoscope offers a better laryngeal view with less hemodynamic response during laryngoscopy and intubation in as compared to direct laryngoscopy with Macintosh blade.

Keywords: Hemodynamic response, Intubation, Laryngoscopy, Macintosh blade.

Introduction

Airway Management, an essential skill forms the central pillar of the practice of anaesthesiology, resuscitation, critical care and emergency medicine. [1] The anaesthesiologist is a person solely responsible for airway management of the patient undergoing a surgical procedure. Airway management and endo-tracheal intubation are fundamental skills for the safe conduct of anaesthesia.

Endo-tracheal intubation is primarily achieved by cannulation of trachea via oro-tracheal route with help of laryngoscope. Intubation isolates the respiratory tract from digestive tract, allows control of breathing, and facilitates administration of oxygen, anaesthetic gases and drugs. Proper view of glottis is essential for successful intubation. It can be done either by direct or indirect laryngoscopy.

An ideal laryngoscopy must provide adequate visualization of glottis to allow correct placement of endo-tracheal tube with the minimum effort with less time and minimal injury to the patient. Macintosh and Miller have developed their own direct laryngoscope; attempts have been made to

improve on these techniques and equipment using technological advances. Nevertheless, these original techniques have withstood the test of time and remain the mainstay of intubation globally. Direct laryngoscopy (DL) relies on the formation of a "line-of- sight" between the operator and the laryngeal inlet, success depends on proper head positioning and consistent anatomy. When the above conditions are not met; for example in poor tissue mobility, restricted mouth opening or large tongue, the failure rate of intubation with conventional direct laryngoscopy increases. Difficulty may be encountered in mask ventilation, laryngoscopy or intubation. Difficult intubation often arises unexpectedly. As even the most of preoperative assessment for the airway will fail to detect some difficult intubations, thus every anaesthesiologist should have a predetermined strategy for dealing with difficult intubation. Incidence of failed intubation from previous reports range between one in two hundred and fifty to one in seven hundred and fifty. [2-5]

Anaesthesia in a patient with a difficult airway can lead to direct airway trauma and morbidity from hypoxia and hypercarbia, [6] Management of the difficult airway sometimes involves the increased application of physical force to the patient's airway than is normal, which can cause direct airway trauma. Much of the morbidity specifically attributable to managing a difficult airway comes from an interruption of gas exchange (hypoxia and hypercapnia), which may cause brain damage and cardiovascular activation or depression. [7-10] directly mediated reflexes laryngovagal and laryngospinal provide the final source of morbidity.

Intubating a patient with an unanticipated difficult airway can be quite challenging when the expertise of experienced senior anaesthesiologists may not be available. Problems in managing "difficult intubation" may also arise in the peripheral hospitals where other aids to intubation in the form of LMA, lighted stylets, Bougie, or fibreoptic bronchoscope may not be available, or the expertise to use these aids may be lacking. Endo-tracheal intubation in the unanticipated difficult airway situation can quickly turn in to a matter of life and death. In this scenario any device, which can aid successful intubation is a boon to the anaesthesiologist. All anesthesiologists should be skilled in at least one alternative devices and technique of tracheal intubation under vision.

They include

- McGrath video laryngoscope
- Truview PCD laryngoscope
- Glidescope laryngoscope video system
- C-Mac video laryngoscope
- C-Mac D-blade video laryngoscope
- Airtraq video laryngoscope
- Pentax-AWS video laryngoscope
- Berci-Kaplan DCI video laryngoscope system
- TelePack endoscope.

Laryngoscopy and intubation are noxious stimulus which results in sympathetic response leading to hypertension and tachycardia. This can in turn produce adverse cardiovascular events, especially in patients with cardiac co- morbidities. The hemodynamic response is due to the oro-pharyngeal stimulation produced by laryngoscopy and laryngo-tracheal stimulation due to tube insertion.

Direct laryngoscopy involved direct line-of-sight to the larynx and most direct laryngoscopy while Video-laryngoscopes do not require the alignment of oral, tracheal and laryngeal axes for glottis visualization and hence may cause less oro-pharyngeal stimulation and airway trauma. Improved laryngeal view provided by VDL increases chances of successful intubation. The laryngeal view on screen of VDL can be seen by others so it also plays an important role as a tool for teaching and training in airway education.

So present study was carried out to evaluate and compare the laryngeal view, intubation time, stress response by direct laryngoscope using Macintosh blade with video laryngoscope using king vision video laryngoscope in adult patients requiring endo-tracheal intubation.

Material and Methods

This prospective study was carried out at tertiary care center. Total 132 adult patients of either sex, weighing 40 to 70 kg having ASA grade I/II posted for elective surgery under general anaesthesia were included in this study. Patients were randomly divided in 2 groups. Each group included 66 patients.

- **Group V (n=66):** Video laryngoscopy
- **Group M (n=66):** Direct laryngoscopy with Macintosh blade

Inclusion Criteria

- Patients posted for general anesthesia
- Inter-incisor distance greater than 5 cm
- Modified Mallampati classes 1 and 2
- Thyro-mental distance of at least 6.5 cm,
- Neck circumference less than 38 cm for menand less than 35 cm for women
- Free neck mobility.
- Age 18-65 years of either sex

Exclusion Criteria

- Emergency intubation
- Inter-incisor distance less than 5 cm
- Modified Mallampati classes 3 & 4
- Thyro-mental distance of less than 6.5cm.

- Neck circumference more than 38 cm for menand 35 cm for women
- Rigid neck
- Age less than 18 or more than 65

Pre-operative assessment was done one day before the surgery. Any significant past, family and personal history were taken. General physical examination was done. Vitals (heart rate, blood pressure) and investigations were noted. Detailed airway examination was done. Patients were kept NBM for 8 hours prior to surgery. Written informed consent was taken from each patient.

OT preparation

- Anaesthesia machine with working laryngoscopes (video laryngoscope & Macintosh blade), Airway, endotracheal tube, stylet, elastic bougie, face masks and Bain's circuit.
- Drugs required for general anaesthesia and resuscitation.
- Suction machine
- Multipara monitor (ECG, Pulse-oximetry, NIBP, Capnography)

On the day of surgery, the patients were taken to the operating room, 18G intravenous cannula inserted and I.V. fluid started. Multipara monitor was attached and baseline pulse rate, blood pressure and SpO2 were recorded. All patients were pre- oxygenated for 3 min before induction.

Premedication:

- Inj. Ondansetron 0.15 mg/kg I.V.
- Inj. Midazolam 0.02 mg/kg I.V.
- Inj. Fentanyl 2μg/kg I.V.

Induction:

- Inj. Propofol 2 mg/kg I.V.
- Inj. Atracurium 0.5 mg/kg I.V.

Procedure was performed by a senior anaesthetist who has experience of more than 5 years. Endotracheal tubes (ET tubes); Size 7.0–7.5 mm tracheal tubes for females and size 8.0–8.5mm inmales were used. All patients were checked for mask ventilation before giving Atracurium, and those could not be ventilated, were excluded from the study.

Group V (n=66): patients were intubated using King Vision Video laryngoscope.

Group M (n=66): patients were intubated using direct laryngoscope with Macintosh blade.

All patients were kept in supine position with head in neutral position in group V and in sniffing position in group M.

In group M, direct laryngoscopy was performed with Macintosh laryngoscope by conventional technique in sniffing position and the maneuvers required to facilitate the intubation like external laryngeal manipulation, use of stylet or bougie were noted.

In group V, after adequate depth of anaesthesia, Patient was positioned with head in neutral position and intubated with King Vision Laryngoscope, using channelled blade with the endotracheal tube preloaded and entering through midline and requires depression of the tongue, not deviation as with Macintosh laryngoscope.

For making glottis opening to be viewed on the LCD screen, minimal rotation or positioning was done. On visualization of the cords, Cormack-Lehane grade (CLG) was noted. The number of attempts required to intubate the patients were noted. Patients who required more than 1 attempt for intubation were excluded from the study.

Patients who required external laryngeal manipulation, use of stylet or bougie were also excluded from the study. After successful intubation, the patients were mechanically ventilated for the surgical procedure and anaesthesia was maintained with sevoflurane in a mixture of nitrous oxide and oxygen in a 1:1 ratio with muscle relaxant as per requirement of the surgery. During the procedure, time was noted by an assistant from introducing the laryngoscope into the mouth till the appearance of square wave capnography on EtCO2 monitor and bilateral chest movement during manual ventilation, this time was considered as the total time taken for intubation. When initial intubation failed, the anaesthetist was instructed to act according to his ⁄ her preference, such as changing blades, patient position, applying external laryngeal pressure or use of bougie.

Laryngeal view was graded as per Cormack-Lehane Grading:-

Monitoring:

- Pulse/min
- Blood pressure in mmHg
- EtCO2
- ECG monitoring
- SPO_2

Hemodynamic changes (Pulse rate and blood pressure) and SpO2 were noted and recorded during the procedure (Laryngoscopy and Intubation) at various intervals.

1. Before Induction
2. Just Before laryngoscopy and intubation
3. After laryngoscopy and intubation
4. 10 minutes after intubation.

Complications like soft tissue injury, teeth injury, sore throat and hoarseness of voice were noted. Statistical analysis was done using single factor

Anova test and unpaired t-test. The data was collected, complied and analyzed statistically. All continuous variables are reported as Mean ± Standard deviation. P value ≤ 0.05 was considered statistically significant difference for all statistical test.

Results

This Randomized control study includes 132 adult patients. They were divided into 2 groups. Each group included 66 patients.

Table 1: Gender of Patients

Sex	Group V	Group M
Male	19 (29%)	17 (26%)
Female	47 (71%)	49 (74%)

In above table, there is a comparison of gender in both groups. There are 19 (29%) males in group V and 17 (26%) males in group M. There are 47 (71%) females in group V and 49 (74%) females in group M.

In above table, age distribution in both groups is explained. Average age in group V is 35 years with standard deviation of 10.47. Average age in group M is 38 years with standard deviation of 11.38. In above table, there is ASA grading of both groups is described. There are 42 (64%) patients in group V and 41 (62%) patients in group M in ASA grade 1 category.

There are 24 (36%) patients in group V and 25 (39%) patients in group M in ASA grade 2 category. In above table, body weight distribution in both groups is explained. Average weight in group V is 60 kgs with standard deviation of 8.49. Average weight in group M is 62 kgs with standard deviation of 6.98.

Table 2: Mallampati Grade

Mallampati Grade	Group V	Group M
Grade 1	29 (44%)	26 (39%)
Grade 2	37 (56%)	40 (61%)
Grade 3	0	0
Grade 4	0	0

In above table, there is Mallampati grading of both groups is described.

There are 29 (44%) patients in group V and 26 (39%) patients in group M in mallampati grade 1 category. There are 37 (56%) patients in group V and 40 (61%) patients in group M in mallampati grade 2 category. In above table, Average Thyromental Distance in both groups is explained.

Average Thyromental Distance in group V is 6.66 cm with standard deviation of 0.11 cm. Average Thyromental Distance in group M is 6.65 cm with standard deviation of 0.10 cm.

Table 3: Cormack-Lehane Grade

Modified Cormack–Lehane Grade	Group V	Group M
Grade I	59 (89%)	30 (45%)
Grade II	7 (11%)	36 (55%)
Grade III	0	0
Grade IV	0	0

The Cormack lehane Grade I was found in 89% of Group V patients, while 45% of Group M patients. The Cormack- Lehane Grade II was found in 11% of Group V patients, while 55% of Group Mpatients.

Table 4: Total Time Taken For Intubation

	Group V (Mean ± SD)	Group M (Mean ± SD)
Time (seconds)	18.63 ± 5.04	19.26 ± 5.18

Mean time for intubation in group V is 18.63 sec with SD of 5.04 sec and in group M is 19.26 sec with SD of 5.18 sec.

Table 5: Mean Pulse Rate (Per Minute)

Time	Group V (Mean ± SD)	Group M (Mean ± SD)	P value
Before Induction (Baseline)	92 ± 13.85	92 ± 15.2	1.000
Before Laryngoscopy	87 ± 12.64	86 ± 9.82	0.61
Immediately After Intubation	102 ± 14.9	110 ± 9.0	0.0003
10 Min After Intubation	82 ± 11.53	85 ± 6.20	0.065

Above table shows the mean pulse rate at various intervals in 2 groups. Baseline, before laryngoscopy, just after laryngoscopy and 10 min after intubation readings were comparable in both groups. Just after intubation pulse rate was significantly increased in Group M compare to group V. The difference in the pulse rate was statistically significant (P<0.05) between Group V v/s Group M.

Table 6: Systolic Blood Pressure (mmHg)

Time	Group V (Mean ± SD)	Group M (Mean ± SD)	P value
Before Induction (Baseline)	133 ± 14.37	133 ± 13.15	1.0000
Before Laryngoscopy	117 ± 14.21	116 ± 9.57	0.6362
Immediately After Intubation	133 ± 11.25	143 ± 12.40	<0.0001
10 Min After Intubation	115 ± 8.97	118 ± 8.93	0.0563

Above table shows changes in systolic arterial blood pressure in both groups. Just after intubation SBP was more increased in Group M (143 ± 12.40) as compared to Group V (133 ± 11.25). Just after intubation SBP was significantly increased in Group M compare to group V. The difference in the SBP was statistically significant (P<0.05) between Group V v/s Group M.

Table 7: Diastolic Blood Pressure (mmHg)

Time	Group V (Mean ± SD)	Group M (Mean ± SD)	P value
Before Induction (Baseline)	83 ± 7.35	84 ± 6.61	0.4127
Before Laryngoscopy	74 ± 8.93	74 ± 6.91	1.0000
Immediately After intubation	84 ± 5.18	88 ± 5.19	<0.0001
10 Min After Intubation	74 ± 6.57	75 ± 5.19	0.3337

Above table shows changes in diastolic arterial blood pressure in both groups. Just after intubation DBP was more increased in Group M (88 ± 5.19) as compared to Group V (84 ± 5.18). Just after intubation DBP was significantly increased in Group M compare to group V. The difference in the DBP was statistically significant (P<0.05) between Group V v/s Group M. Above table shows changes in mean arterial blood pressure in both groups. Just after intubation MAP was more increased in Group M (106 ± 5.97) as compared to Group V (100 ± 6.50). Just after intubation MAP was significantly increased in Group M compare to group V. The difference in the MAP was statistically significant (P<0.05) between Group V v/s Group M.

Table 8: Complications

Complications	Group V	Group M
Damaged Tooth	No	No
Soft Tissue Damage	No	No
Bleeding Gums	No	No
Hoarseness	9 (14%)	11 (17%)
Stridor	No	No
Sore Throat	No	No

In our study, 14% of patients in group V and 17% of patients in group M are having hoarseness after intubation. Patients having other complications are excluded from the study.

Discussion

Macintosh laryngoscopes remain the most widely used laryngoscopes in anesthesiology though various types of video laryngoscopes with different technical specifications and operational characteristics have been developed.

The newer laryngoscopes through the optical apparatus provide improved glottis view and it is also noted that they require more skillful hand and eye coordination during the procedure due to the indirect image.

In the video laryngoscopes, problems occur while guiding the endo-tracheal tube as the tube can be seen only at vocal cord level. Video-laryngoscopes are superior to direct laryngoscopes as they provide superior view of larynx. We conducted a prospective randomized study includes 132 adult patients to compare the Macintosh laryngoscope and King Vision video-laryngoscope for intubation of patients for elective surgical procedure requiring general anaesthesia.

In our study age groups between 18-65 years were included to establish uniformity. The mean age of group V & M is 35 ± 10.47 years and 38 ± 11.38 years. The mean weight of patients in group V & M is 60 ± 8.49 & 62 kgs ± 6.98 kgs. Obese patients were excluded from the study group. We found no significant difference statistically with respect to weight. In this study both the genders were included. There are 19 male & 47 female in group V, while 17 male & 49 female in group M, so that the parameters observed and the result can be projected to the general population. Patients with

ASA 1 and 2 were included in the study. Patients with hypertension, Diabetes, Obesity, Cardiovascular illness, Thyroid disorder were excluded from the study. Thus we concluded in the study there were no strategically significant differences in both the groups with respect to age, sex, and American society of anaesthesiologists' physical status classification. The groups hence were comparable. QE Ali et al [11] and Avula R et al [12] found in their studies that there was no difference between two groups with regard of age, weight, gender, ASA grading respectively.

In our study we also included only the patients with mallampatti classification (MPC) of 1 and 2. Higher grades of MPC were excluded from the study since we cannot compare the intubation parameters for routine airway management in difficult airway patients. They might show a bizarre response and standardization cannot be done. The percentage of patients in group V with MPC 1 and 2 were 44% and 56% respectively and the percentage of patients in group M with MPC 1 and 2 were 39% and 61%. The groups weretherefore comparable. Sherif M. et al [13] also conducted the study with MPC 1 & 2.

In group M, out of 66 patients 30 patients (45%) had CL grade 1 and 36 patients (55%) had CL grade 2. It is observed that there is a statistically significant better glottis view with group V, in which 59 patients (89%) had CL grade 1 and 7 patients (11%) had CL grade 2. Sherif M. et al, [13] Avula R et al [12] and QE Ali et al [11] also found better laryngeal view with video laryngoscope compare to direct laryngoscope. In our study we also found that in Group V, the mean time taken for intubation was 18.63 seconds, comparatively lesser duration as in Group M is it 19.26 seconds but there is no major difference. Sherif M. et al [13] based on the observations from the study, it is noted that there is not a major significance difference in the time taken for intubation.

In our study the heart rate in both groups decreased from basal value after premedication and lowered further after induction with Propofol. It rise immediately after intubation in both groups, and then started declining to reach post induction value at about 10 minutes in both groups. In group M, immediately after intubation the pulse rate is 110 ± 9.0 and before laryngoscopy the pulse rate is 86 ± 9.82, While in group V, immediately after intubation the pulse rate is 102 ± 14.9 and before laryngoscopy the pulse rate is 87 ± 12.There is a statistically significant rise in pulse rate in group M compare to group V, so both groups were comparable. QE Ali et al [11] found in the study that the rise in heart rate after intubation is more in Macintosh & McCoy laryngoscope compare to KVVL. Sherif M. et al [13] found in the study that the rise in heart rate after intubation is more in Macintosh laryngoscope compare to KVVL. Maharaj C. H. et al [14] found the same result in the study by comparing Airtraq video laryngoscope and Macintosh laryngoscope.

In both groups Systolic, diastolic and mean blood pressure (MAP) decreased to lower value from basal value after premedication and lowered further after induction with Propofol. Immediate after intubation they all increased and then started declining. In group M, immediately after intubation the MAP is 106 ± 5.97 and before laryngoscopy the MAP is 88 ± 7.12, while in group V, immediately after intubation the MAP is 100 ± 6.50 and before laryngoscopy the MAP is 88 ± 9.99.There is a statistically significant rise in MAP in group M compare to group V, so both groups were comparable. QE Ali et al11 found in the study that the rise in MAP after intubation is more in Macintosh & McCoy laryngoscope compare to KVVL. Sherif M. et al [13] found in the study that the rise in MAP after intubation is more in Macintosh laryngoscope compare to KVVL. Maharaj C. H. et al [14] also found the rise in the MAP after intubation is more in patients with Macintosh laryngoscopy compare to Airtraq video-laryngoscopy. Complications like hoarseness of voice, soft tissue injury, teeth injury and sore throat were similar in both groups.

Conclusion

From present study, we conclude that King vision video laryngoscope offers a better laryngeal view with less hemodynamic response during laryngoscopy and intubation in as compared to direct laryngoscopy with Macintosh blade.

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