COMPARATIVE STUDY OF HEMODYNAMIC RESPONSE AND GLOTTIC VIEW TO LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION WITH MACINTOSH, MC COY BLADES AND C-MAC VIDEO LARYNGOSCOPY IN PATIENTS UNDERGOING GENERAL ANAESTHESIA

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ABSTRACT Background: Obtunding, the hemodynamic responses during laryngoscopy and intubation, remains a major concern for the anesthesiologists. The present study was being done to compare the haemodynamic changes and glottic visualization during intubation between C-MAC, McCoy and Macintosh Laryngoscopes. Methods: We conducted the study on 150 patients under ASA I or ASA II scheduled for elective surgery. The patients were randomly assigned to one of the three groups, each containing 50 patients, using a computer-generated random allocation chart. The intubation was performed with Group-A (Macintosh), Group-B (McCoy) and Group-C (C-MAC). Hemodynamic variables such as Heart rate, Systolic blood pressure, diastolic blood pressure, and mean arterial pressure were recorded before, during and till 5 minutes post-intubation, and glottis opening was assessed with Cormack Lehane grading. Observations and Conclusion: There was a statistically significant increase in hemodynamic parameters during laryngoscopy and intubation of patients of all the three study groups but less increase in hemodynamic responses were observed in patients intubated with McCoy laryngoscope when compared with patients intubated with Macintosh and C Mac laryngoscope. In addition, the C Mac laryngoscope shows better visualization of the glottis when compared to that of Macintosh and McCoy.

KEYWORDS Airway, laryngoscopes, hemodynamics

Introduction

Endotracheal intubation is a quick, non-invasive and harmless procedure that attains all the objectives of management of the airway, preserves patency of the airway, shields the lungs from aspiration and protects from trickle free ventilation all through mechanical ventilation and henceforth will be the gold standard practice for airway management.1

The technique of laryngoscope sorts from direct to indirect, from the simple rigid scope with a light bulb to complex fibre optic video scopes to ease the process of laryngoscopy and intubation.2,3 The Powers employed by the laryngoscope blade on the base of the tongue while elating the epiglottis acts as a major stimulus for cardiovascular and airway responses.4 Glottic visualisation is classified by Cormack Lehane grading (CL grading).5

There are two types of curved blades found in the common
practice of laryngoscopy.

- The Macintosh laryngoscope is the most frequently used device for directly visualizing the structures of the larynx and facilitating tracheal intubation. While using the Macintosh blade, the tip of the blade is placed in the vallecula—the space between the base of the tongue and the pharyngeal surface of the epiglottis.6
- The McCoy blade laryngoscope was introduced in 1993 and had an axis on the slant to prevent the elating force in the vallecula in that way depressing the hemodynamic reaction associated with laryngoscopy and tracheal intubation related to the regularly used Macintosh laryngoscopes.7,8

The Video laryngoscope was introduced into clinical practice by Kaplan and Berci in 2002. The C-MAC video laryngoscope is built like a standard Macintosh laryngoscope with a micro video camera and fibre-optic fibres built into the end of the blade.9 The benefits of C-MAC video laryngoscope merging the benefits of direct and video laryngoscopy in one device make it appropriate to help as a standard intubation instrument for difficult airway management and educational purposes for demonstration.

Few studies have compared these three laryngoscopes in the past few years. Hence, this study compared hemodynamic response and glottis view to laryngoscopy and endotracheal intubation, with Macintosh blade and McCoy blades, C-Mac Laryngoscopy in general anaesthesia patients.

Materials and methods

This study was conducted in a prospective and randomized manner at our institute, from September 2019 to August 2021, in 150 adult patients after being approved by the Institutional ethics and scientific committee in Dr. D.Y. Patil Medical College & Research Centre, Dr. D Y Patil Vidyapeeth, Pune. Written informed consent was obtained from all patients.

Study duration

The present study was conducted from September 2019 to August 2021.

Inclusion criteria

1. Age between 18-65 years of either sex.
2. ASA grade I and II
3. Elective surgery under general anaesthesia requiring endotracheal intubation.
4. Patients willing to be part of the study.
5. Haemodynamically stable patients with all routine investigations within normal limits.
6. Availability of written informed consent from concerned patient.

Exclusion criteria

1. Patient refusal
2. NBM status less than 8 hours
3. Haemodynamically, unstable patients
4. Oro pharyngeal surgery
5. Lesion of oropharynx and larynx
6. Known unstable cervical spine injury.
7. Presentation for an emergency surgical procedure.
8. ASA grade > III
9. BMI > 30 kg/m²

Ethical consideration

The institutional human ethics committee approved the study. Informed written consent was obtained from all the study participants and only those participants willing to sign the informed consent were included in the study. The risks and benefits involved in the study and the voluntary nature of participation were explained to the participants before obtaining consent. The confidentiality of the study participants was maintained.

The patients were allocated into the following groups:

- Group A of 50 patients intubated with a Macintosh laryngoscope.
- Group B of 50 patients intubated with McCoy laryngoscope.
- Group C of 50 patients intubated with CMAC video laryngoscope.

Pre-operative evaluation

All patients were thoroughly evaluated pre-operatively. All the relevant and necessary laboratory investigations were carried out.

All patients were kept NBM for a period of at least eight hours prior to surgery to avoid the risk of aspiration and other anaesthesia related complications.

Methodology

Intravenous line was secured using 20G IV cannula, and an infusion of Ringer Lactate (RL) was started. Demographic data such as age, sex, weight, height, MPC grading and ASA physical status of the patient were noted. Patient consent was noted down. Baseline vital monitors were attached, and parameters were noted down: heart rate, SPO2, ECG, and BP.

The patient was pre-oxygenated for 3-5 minutes with 100% oxygen using an appropriate size anatomical face mask. The patients were premedicated with Inj. Glycopyrrolate (0.04mg/kg), Inj. Midazolam (0.02 mg/kg) and Inj. Fentanyl (2 mcg/kg body weight).

Anaesthesia was induced with propofol (2mg/kg). The feasibility of ventilation was checked prior to the depolarising muscle relaxant injection. After ventilation is confirmed, Inj. Succinylcholine (2mg/kg) was administered and the patient was ventilated with 100% O2. Laryngoscopy and intubation was carried out in a classical intubating position by a single anaesthesiologist with either Macintosh, McCoy or video laryngoscopy in either study group.

It was ensured that the portable screen component of the video laryngoscope is properly attached and connected. Correct placement of endotracheal tube was confirmed by vocal cords visualization done by Cormack-Lehane grading. The endotracheal tube was passed through vocal cords under the vision and re-confirmed by auscultation and capnography.

The haemodynamic parameters recorded were Heart Rate (HR), Systolic blood pressure (SBP), Diastolic blood pressure...
were calculated at each interval. (P > 0.05 not significant, P < 0.05 significant). Were measured at the following intervals, Age, Weight, Height, Body Mass Index, Heart rate, Systolic (DBP), and Mean arterial pressure (MAP). The above parameters were measured at the following intervals,

Baseline BL-T0, T1 – Before Induction, T2- After Induction, T3- During Laryngoscopy, T4 – 1min after Intubation, T5- 2min after Intubation, T6-3min after Intubation, T7-5min after Intubation.

1. Modified Cormack Lehane (CL) Grades for visualisation of the glottis:
   Grade 1: Complete glottis visible
   Grade 2 a: Partial view of the glottis
   Grade 2b: Arytenoids or posterior part of the vocal cords only just visible
   Grade 3: Only epiglottis visible but not glottis
   Grade 4: Neither glottis nor epiglottis is visible.

Maintenance of anaesthesia was done with nitrous oxide (60%), oxygen (40%), isoflurane 0.5-1%, and Inj vecuronium. At the completion of surgery, residual neuromuscular blockade was reversed with Inj. Neostigmine 0.05 mg/kg and Inj Glycopyrrolate 0.008 mg/kg intravenously. After extubation, the patients were shifted to the post anaesthesia recovery care unit, where they were monitored for an additional half an hour.

2. Complications/Pressor response during laryngoscopy and endotracheal intubation such as Local injuries, Bleeding, Laryngospasm, Regurgitation, Arrhythmias, if observed, was noted and analysed.

Statistical methods
Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Data was also represented using appropriate diagrams like bar, pie, and box plots.

Statistical analysis was made with IBM SPSS 16.0 software and P value of ≤0.05 was considered significant.

One way ANOVA test is used for Continuous variables like Age, Weight, Height, Body Mass Index, Heart rate, Systolic Blood Pressure, Diastolic Blood Pressure, and Mean Arterial Pressure. Pearson’s Chi-squared test is used for Categorical variables. Data was also represented using appropriate diagrams like bar, pie, and box plots.

Observation and Results
Table 1 shows demographic profile of patients.

The table 2 shows the comparison of the Cormack Lehane grade at Laryngoscopy between three groups.

The Table 3 shows the heart rate recorded during baseline, before induction, after induction, during intubation, 1min, 2min, 3min and 5min after intubation.

The above table 4 shows, SBP recorded during baseline, before induction, after induction, during intubation, 1min, 2min, 3min and 5min after intubation.

In above table 5 shows, the DBP was recorded during baseline, before induction, after induction, during intubation, 1min, 2min, 3min and 5min after intubation.

The table 6 shows, mean arterial blood pressure was recorded during baseline, before induction, after induction, during intubation, 1min, 2min, 3min and 5min after intubation.

Mean and standard deviation of mean arterial blood pressure were calculated at each interval. (P > 0.05 not significant, P <0.05 significant).

Complications
No significant complications noticed during/ following the intubation of patients across all 3 groups.

Discussion
Airway management is the fundamental aspect of anaesthetic practice and emergency & critical medicine—laryngoscope and endotracheal intubation form an important step in administering general anaesthesia. In addition, the process of laryngoscopy is known to be associated with profound cardiovascular effects. Several studies comparing Macintosh and McCoy laryngoscopes and Macintosh and video laryngoscopes have been undertaken successfully in recent years to measure hemodynamic response to laryngoscopy and intubation; however, few research have examined these three laryngoscopes together. As a result, we’re comparing the stress responses and glottis visualization of the Macintosh, McCoy, and C-MAC video laryngoscopes during intubation.

Demographic factors
All three groups were comparable regarding age, gender, height, weight, BMI, MPC grades and ASA grading, and There was no significant difference among the three groups (P-value > 0.05).

Cormack Lehane grading
In the current study, In Group A, 42% of cases had CL grade 1 and 58% of cases in Grade 2. In group B, 56% of cases had CL grade 1, and 44% had grade 2. In group C, 68% of cases had CL grade 1, and 32% had grade 2. There was statistical significance in comparing CL grading among the study groups (P-value 0.033). (Table no-10)

A better CL grading was observed among patients of group C when compared with group B and group A. Erol cavan et al. in 2011(9) it was noticed that in the subgroup of patients that had a suboptimal glottic view with MacIntosh (C/L≥2a; n = 24), the glottic view was improved in the C-MAC group, C/L class improved by three classes in 5 patients, by two classes in 2 patients, by one class in 8 patients, remained unchanged in 8 patients, or decreased by two classes in 1 patient, which shows that CMAC group had a better glottic opening when compared with that of the Macintosh.

Hemodynamic parameters
Heart rate
There was an increase in heart rate during intubation in all the patients in the three study groups. However, there was a statistically significant (P-value <0.05) (Table no: 11) among the study groups was observed that more increase in Macintosh (C-MAC) group when compared with group B and group A.

In recent years to measure hemodynamic response to laryngoscopy and intubation; however, few research have examined these three laryngoscopes together. As a result, we’re comparing the stress responses and glottis visualization of the Macintosh, McCoy, and C-MAC video laryngoscopes during intubation.

Grade 3: Only epiglottis visible but not glottis
Grade 4: Neither glottis nor epiglottis is visible.

Statistical analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Data was also represented using appropriate diagrams like bar, pie, and box plots.

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Mean and standard deviation of mean arterial blood pressure were calculated at each interval. (P > 0.05 not significant, P <0.05 significant).
Table 1

| Parameters       | Group A (n=50) | Group B (n=50) | Group C (n=50) |
|------------------|----------------|----------------|----------------|
| Age (years)      | 32.16 ± 11.37  | 33.6 ± 13.03   | 33.52 ± 11.84  |
| BMI (kg/m²)      | 22.31 ± 1.34   | 21.86 ± 1.41   | 21.81 ± 1.40   |
| Male/Female      | 22/28          | 21/29          | 23/27          |
| ASA I / II       | 32/18          | 30/20          | 21/29          |
| MPC I/II         | 31/19          | 28/22          | 20/30          |

Table 2

| Parameters       | Group A (%) (n=50) | Group B (%) (n=50) | Group C (%) (n=50) | Chi Square | P value |
|------------------|--------------------|--------------------|--------------------|------------|---------|
| I                | 21 (42)            | 28 (56.0)          | 34 (68.0)          | 6.85       | 0.033   |
| II               | 29 (58.0)          | 22 (44.0)          | 16 (32.0)          |            |         |

Table 3 Distribution of mean heart rate of patients among the study groups (n=150).

| Heart rate/min | Group A (n=50) | Group B (n=50) | Group C (n=50) | P value |
|----------------|----------------|----------------|----------------|---------|
| Mean±SD        | Mean±SD        | Mean±SD        |                 |         |
| Baseline       | 83.04±9.21     | 80.54±9.11     | 81.36±11.02     | 0.433   |
| Before induction| 82.92±7.87     | 78.72±9.3      | 80.28±6.75      | 0.033   |
| After induction | 80.8±8.43      | 77.08±6.74     | 78.32±6.87      | 0.040   |
| During intubation | 92.3±8.04     | 87.96±6.53     | 89.3±5.65       | 0.005   |
| 1 min           | 88.6±7.91      | 83.16±6.38     | 86.8±5.77       | 0.0003  |
| 2 min           | 84.96±7.46     | 78.28±6.76     | 83.08±6.04      | <0.0001 |
| 3 min           | 81.6±7.77      | 75.52±7.27     | 78.44±6.58      | 0.0002  |
| 5 min           | 78.96±7.82     | 70.08±8.04     | 73.72±7.15      | <0.0001 |

Table 4 Distribution of mean systolic blood pressure of patients among the study groups (n=150).

| SBP (mm of hg) | Group A (n=50) | Group B (n=50) | Group C (n=50) | P value |
|----------------|----------------|----------------|----------------|---------|
| Mean±SD        | Mean±SD        | Mean±SD        |                 |         |
| Baseline       | 126.7±9.72     | 121.6±11.65    | 122.36±10.80    | 0.732   |
| Before induction| 123.36±11.05   | 120.52±10.96   | 120.4±10.44     | 0.304   |
| After induction | 121.76±6.41    | 116.04±11.15   | 118.96±11.17    | 0.016   |
| During intubation | 136.76±7.25   | 129.92±10.36   | 133.88±10.34    | 0.002   |
| 1 min           | 131.96±6.82    | 125.28±10.6    | 129.08±10.93    | 0.003   |
| 2 min           | 128.8±6.84     | 120.36±11.25   | 124.12±11.86    | 0.000   |
| 3 min           | 125.92±7.31    | 117.72±11.81   | 121.2±12.85     | 0.001   |
| 5 min           | 122.96±8.18    | 115.04±12.49   | 118.04±14.44    | 0.005   |

Table 5 Distribution of mean diastolic blood pressure of patients among the study groups (n=150).

| DBP (mm of hg) | Group A (n=50) | Group B (n=50) | Group C (n=50) | P value |
|----------------|----------------|----------------|----------------|---------|
| Mean±SD        | Mean±SD        | Mean±SD        |                 |         |
| Baseline       | 81.6±10.63     | 81.28±8.17     | 81.92±9.48     | 0.944   |
| Before induction| 82.32±3.82     | 83.24±9.97     | 81.64±9.08     | 0.613   |
| After induction | 81.16±10.51    | 76.96±6.37     | 78.6±6.93      | 0.037   |
| During intubation | 95.76±10.57   | 90.52±6.73     | 93.12±6.69     | 0.007   |
| 1 min           | 90.8±10.19     | 85.76±7.49     | 88.6±6.78      | 0.011   |
| 2 min           | 86.08±10.41    | 80.52±9.15     | 83.86±7.4      | 0.009   |
| 3 min           | 83.56±10.61    | 77.88±10.09    | 81.2±8.08      | 0.014   |
| 5 min           | 80.84±11.08    | 75.36±11.02    | 78.76±8.71     | 0.030   |
was observed that there was more increase in the Macintosh group [136.76 (S.D ± 7.25)] and C-Mac laryngoscope [133.88 (S.D ± 10.34)] when compared with patients of McCoy laryngoscope [125.28 (S.D ± 10.6)] group. Aggarwal et al. 2019\(^\text{[10]}\) showed that there was a significant increase in mean systolic blood pressure among the study groups with less increase in Group B (McCoy)134.64±10.17 when compared with group A(Macintosh)143.16±5.14 and Group C (C-Mac) 144.72±6.24.

**Diastolic blood pressure**

There was an increase in diastolic blood pressure during intubation in all the patients of the three study groups. However, there was statistically significant among the study groups, and it was observed that more increase in Macintosh [95.76 (S.D ± 10.57)] and C-Mac laryngoscope [93.12 (S.D ± 6.69)] when compared with patients of McCoy laryngoscope group [90.52 (S.D ± 6.73)].

Archana et al. in 2019\(^\text{[11]}\) conducted a study titled, ‘C-MAC Video Laryngoscope versus Macintosh Laryngoscope for Intubation in Elective Surgery: A Clinical Trial’ in which they compared the hemodynamic changes in both the groups. DBP was noted immediately after intubation in the C-Mac group at 71.06 + 5.9 & in the Macintosh group at 80.9 + 10.6, which was statistically significant (P<0.05). Aggarwal et al. in 2019\(^\text{[10]}\) showed that there was a significant increase in mean diastolic blood pressure among the study groups with less increase in Group B (McCoy) 86.92±7.92 when compared with group A(Macintosh) 93.52±8.33 and Group C(C-Mac) 94.52±6.98.

**Mean arterial pressure**

There was an increase in mean arterial blood pressure during intubation in all the patients in the three study groups. However, there were statistically significant among the study groups. It was observed that there was more increase in the Macintosh group[109.4 (S.D ± 7.66)] and C-Mac laryngoscope [106.6 (S.D± 5.91)] when compared with patients of McCoy laryngoscope [103.64 (S.D± 6.76)] group. Gaurav et al. in 2016\(^\text{[12]}\) showed that the maximum change in mean arterial pressure was 28.08% in the Macintosh and 15.25% in the McCoy group. This difference between groups was significant (P < 0.0001). Lipika et al. 2016\(^\text{[13]}\) it was concluded that significant increase in mean arterial blood pressure (27%) after laryngoscopy using the Macintosh blade (P < 0.05). The use of the McCoy blade did not result in any significant change in mean arterial blood pressure. It was concluded that the stress response to laryngoscopy is less marked with the use of the McCoy blade.

| MAP (mm of hg) | Group A (n=50) | Group B (n=50) | Group C (n=50) | P value |
|---------------|---------------|---------------|---------------|---------|
|               | Mean±SD       | Mean±SD       | Mean±SD       |         |
| Baseline      | 77.2±2.32     | 76.8±2.14     | 77.18±2.30    | 0.669   |
| Before induction | 80.88±4.82 | 80.16±1.57     | 80.74±1.29   | 0.451   |
| After induction | 79.84±4.41 | 75.48±3.77     | 77.96±4.52   | <0.0001 |
| During intubation | 109.4±7.66 | 103.64±6.76    | 106.6±5.91   | 0.000   |
| 1 min         | 104.46±7.23   | 98.94±7.36    | 102.02±6.37  | 0.0006  |
| 2 min         | 100.42±7.39   | 93.78±8.79    | 97.2±7.27    | 0.002   |
| 3 min         | 97.74±7.76    | 91.12±9.71    | 94.46±8.26   | 0.008   |
| 5 min         | 94.96±8.49    | 88.52±10.68   | 91.78±9.35   | 0.004   |

**Limitation**

- One limitation of our study was that we measured blood pressure non-invasively. However, the patients included in our study were relatively healthy ASA I and ASA II patients, so it was not justified to monitor blood pressure in these patients invasively.
- The muscle relaxation and the degree of relaxation at the time of tracheal intubation, which may affect the response, were not measured.

**Conclusion**

From the present study, it was concluded that:

- There was a statistically significant increase in hemodynamic parameters during laryngoscopy and intubation of patients of all three study groups. However, less increase in hemodynamic responses was observed in patients intubated with McCoy laryngoscope compared with patients intubated with Macintosh and C Mac laryngoscope.
- The C Mac laryngoscope shows better visualization of glottis when compared to that of Macintosh, and McCoy can be used for intubation. Hence it can be used among patients with anticipated intubation difficulty.

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**Conflict of interest**

There are no conflicts of interest to declare by any of the authors of this study.

**References**

1. Dr.Divitia J.V, Dr.Bhownick K: Complications of endotracheal intubation and other airway management procedures. Indian Journal of Anaesthesia, August 2005; 308.
2. Dorsh JA, Dorsh SE.Laryngoscopes. In: Understanding Anesthesia Equipment. 5th ed. Philadelphia: Lippincott Williams and Wilkins; 2008:521.
3. Kaur S, Gupta A, Ranjana Rita- Intubating conditions and stress response to laryngoscopy: Comparison between Macintosh and levering (McCoy’s type) laryngoscopcr. J Anaesth Clin Pharmacol 2009; 25:333-6.
4. Fox EJ, Sklar CS, Hill CH, Villanueva R, King BD. Complication related to the pressor response to endotracheal intubation. Anesthesiology 1977;47:524-5.

5. Isaacs RS, Sykes JM. Anatomy and physiology of the upper airway. Anesthesiol Clin N Am 2002; 20:733-735.

6. Snell RS. Larynx. In: Clinical Anatomy, 5th ed. Philadelphia: Lippincott Williams and Wilkins; 2004:864-875.

7. Fung DM, Devitt JH. The anatomy, physiology and innervations of the larynx. Anesthesiol Clin N Am 1995; 13:259-275.

8. Bishop MJ, Bedford RF, Kil HK. Physiologic and pathophysiologic responses to intubation. Airway management-principles and practise. New York: Mosby.1996:1:102-17.

9. Cavus E, Thee C, Moeller T, Kieckhaefer J, Doerges V, Wagner K. A randomized, controlled crossover comparison of the C-MAC videolaryngoscope with direct laryngoscopy in 150 patients during routine induction of anesthesia. BMC Anesthesiol. 2011;11:6.

10. Hiteshi Aggarwal, Sarvjeet Kaur, Naresh Baghla, Satinderjit Kaur Hemodynamic Response to Orotracheal Intubation: Comparison between Macintosh, McCoy, and C-MAC Video Laryngoscope. Anaesthesia essays and researches, 2019 : 13(2) : 308-312.

11. Chandra A, Singh M, Agarwal M, Duggal R, Gupta D. Evaluation and comparison of haemodynamic response and ease of intubation between Truview PCD TM, McCoy and Macintosh laryngoscope blades. Indian Journal of Clinical Anaesthesia. 2019 Apr;6(2):209-14.

12. Gaurav Arora, Akhilesh Chayya, Rama Upadhyaya Randomized controlled study comparing the hemodynamic response to laryngoscopy and endotracheal intubation with McCoy, Macintosh Natl J Med Res. 2016; 6(3): 271-27

13. Lipika Baliarsing, Mangesh Gore, Prashant Akulwar. Comparison of glottis view and hemodynamic response by using macintosh and MacCoy laryngoscopes for endotracheal intubation in general anaesthesia for elective surgery. International Journal of Contemporary Medical Research 2016;3(8):2186-2188.