



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

Chhaya Suryawanshi., Khalki Saravan Kumar* and Sonalika Tudimilla

Department of Anaesthesia, Dr. D.Y. Patil Medical College & Research Centre,
Dr. D Y Patil vidyapeeth, Pune

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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, Mc Coy 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 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, 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 statistical 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. The C Mac laryngoscope shows better visualization of glottis when compared to that of Macintosh and McCoy.

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INTRODUCTION

Endotracheal intubation is a quick, non-invasive and harmless procedure that attains all the objectives of management of airway, preserves patency of 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

Technique of laryngoscope sorts from direct to indirect, from simple rigid scope with light bulb to complex fiber 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 elevating 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 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 has a axis on the slant to prevent the elating force in the vallecula in that way depressing the hemodynamic reaction associated to 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 fibreoptic fibers 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 purpose for demonstration.

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

*Corresponding author: **Khalki Saravan Kumar**

Department of Anaesthesia, Dr. D.Y. Patil Medical College & Research Centre, Dr. D Y Patil vidyapeeth, Pune

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 Institutional ethics and scientific committee in Dr. D.Y. Patil Medical College & Research Centre, Dr. D Y Patil vidyapeeth, Pune. A written informed consent was obtained from all patients.

Study duration: The present study was conducted during the period of 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

Study was approved by institutional human ethics committee. 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 voluntary nature of participation were explained to the participants before obtaining consent. Confidentiality of the study participants was maintained.

The patients were allocated into following groups:

Group A of 50 patients intubated with Macintosh laryngoscope.

Group B of 50 patients intubated with Mc Coy 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 was noted. Patients consent was noted down. Baseline vital monitors was attached and parameters- Heart rate, SPO2, ECG, BP was noted down.

Patient was pre-oxygenated for 3-5 minutes with 100% oxygen using an anatomical face mask of appropriate size. 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). Feasibility of ventilation was checked prior to the injection of the depolarizing muscle relaxant. 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 classical intubating position by a single anaesthesiologist with either Macintosh, Mc Coy or video laryngoscopy in either of the 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 was done by Cormack-Lehane grading and endotracheal tube was passed through vocal cords under vision and re-confirmed by auscultation and capnography.

The haemodynamic parameters recorded were Heart Rate (HR), Systolic blood pressure (SBP), Diastolic blood pressure (DBP), 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.

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%) and oxygen (40%) and 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.

1) 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 diagram, pie diagram 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, Mean Arterial Pressure.

Pearson's Chi-squared test is used for Categorical variables like ASA Physical Status, Gender, MPC classification, Cormack-Lehane grading.

OBSERVATION AND RESULTS

Table 1 shows demographic profile of patients.

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/m ²)	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

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

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) Mean±SD	Group B (n=50) Mean±SD	Group C (n=50) Mean±SD	P value
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	92.32±8.04	87.96±6.53	89.32±5.65	0.005
1min	88.64±7.91	83.16±6.38	86.88±5.77	0.0003
2min	84.96±7.46	78.28±6.76	83.08±6.04	<0.0001
3min	81.64±7.77	75.52±7.27	78.44±6.58	0.0002
5min	78.96±7.82	70.08±8.04	73.72±7.15	<0.0001

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

Table 3 Distribution of mean systolic blood pressure of patients among the study groups (n=150)

SBP (mm of hg)	Group A (n=50) Mean±SD	Group B (n=50) Mean±SD	Group C (n=50) Mean±SD	P value
Baseline	126.72±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
1min	131.96±6.82	125.28±10.6	129.08±10.93	0.003
2min	128.88±6.84	120.36±11.25	124.12±11.86	0.000
3min	125.92±7.31	117.72±11.81	121.2±12.85	0.001
5min	122.96±8.18	115.04±12.49	118.04±14.44	0.005

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

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

DBP (mm of hg)	Group A (n=50) Mean±SD	Group B (n=50) Mean±SD	Group C (n=50) Mean±SD	P value
Baseline	81.64±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
1min	90.8±10.19	85.76±7.49	88.6±6.78	0.011
2min	86.08±10.41	80.52±9.15	83.88±7.4	0.009
3min	83.56±10.61	77.88±10.09	81.2±8.08	0.014
5min	80.84±11.08	75.36±11.02	78.76±8.71	0.030

In above table 4 shows, the DBP was recorded during baseline, before induction, after induction, during intubation, 1min, 2min, 3min and 5min after intubation.

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

MAP (mm of hg)	Group A (n=50) Mean±SD	Group B (n=50) Mean±SD	Group C (n=50) Mean±SD	P value
Baseline	77.2±2.32	76.84±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
1min	104.46±7.23	98.94±7.36	102.02±6.37	0.0006
2min	100.42±7.39	93.78±8.79	97.2±7.27	0.002
3min	97.74±7.76	91.12±9.71	94.46±8.26	0.008
5min	94.96±8.49	88.52±10.68	91.78±9.35	0.004

The table 5 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 anesthetic practice and emergency & critical medicine. Laryngoscope and endotracheal intubation forms an important step in administration of general anesthesia. The process of laryngoscopy is known to be associated with profound cardiovascular effects. Several studies comparing Macintosh and McCoy laryngoscopes, as well as 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 with regards to age, gender, height, weight, BMI, MPC grades and ASA grading, There was no significant significant difference among the three groups (P value > 0.05).

Cormack Lehane grading

In 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% of cases had grade 2. There was statistical significance in comparison of 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 *et al* in 2011⁽⁹⁾ it was noticed that in the subgroup of patients that had suboptimal glottic view with Macintosh (C/L \geq 2a; n = 24), 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 C-MAC group had a better glottic opening when compared with that of the Macintosh.

Hemodynamic parameters

Heart rate

There was increase in heart rate during intubation in all the patients of three study groups but there was statistically significant (P value <0.05) (Table no: 11) among the study groups was observed that more increase in Macintosh group 92.32 [(S.D \pm 8.04)] and C-Mac laryngoscope [89.32 (S.D. \pm 5.65)] when compared with patients of McCoy laryngoscope [87.96 (S.D \pm 6.53)] group. Aggarwal *et al* in 2019⁽¹⁰⁾ showed that there was significant increase in mean heart rate Group C (C-Mac) 102.60 \pm 9.74 more than Group A(Macintosh) 101.36 \pm 8.35 more than Group B (McCoy) 92.56 \pm 11.19. (P value <0.05).

Systolic Blood pressure

There was increase in systolic blood pressure during intubation in all the patients of three study groups but there was statistically significant among the study groups and was observed that more increase in Macintosh group [136.76 (S.D \pm 7.25)] and C-Mac laryngoscope [133.88 (S.D \pm 10.34)] when compared with patients of McCoy laryngoscope [125.28 (S.D \pm 10.6)] group. Aggarwal *et al* in 2019⁽¹⁰⁾ showed that there was significant increase in mean systolic blood pressure among the study groups with less increase in Group B(McCoy) 134.64 \pm 10.17 when compared with group A(Macintosh) 143.16 \pm 5.14 and Group C (C-Mac) 144.72 \pm 6.24.

Diastolic blood pressure

There was increase in diastolic blood pressure during intubation in all the patients of three study groups but there was statistically significant among the study groups and was observed that more increase in Macintosh [95.76 (S.D. \pm 10.57)] and C-Mac laryngoscope [93.12 (S.D \pm 6.69)] when compared with patients of McCoy laryngoscope group [90.52 (S.D. \pm 6.73)]. Archana *et al* in 2019⁽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 C-Mac group 77.06 \pm 5.9 & in Macintosh group 80.9 \pm 10.6, which was statistically significant (P<0.05). Aggarwal *et al* in 2019⁽¹⁰⁾ showed that there was significant increase in mean diastolic blood pressure among the study groups with less increase in Group B (McCoy) 86.92 \pm 7.92 when compared with group A(Macintosh) 93.52 \pm 8.33 and Group C(C-Mac) 94.52 \pm 6.98.

Mean arterial pressure

There was increase in mean arterial blood pressure during intubation in all the patients of three study groups but there was statistically significant among the study groups and was

observed that more increase in Macintosh group [109.4 (S.D \pm 7.66)] and C-Mac laryngoscope [106.6 (S.D \pm 5.91)] when compared with patients of McCoy laryngoscope [103.64 (S.D \pm 6.76)] group. Gaurav *et al* in 2016⁽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* in 2016⁽¹³⁾ it was concluded that significant increase in mean arterial blood pressure (27%) after laryngoscopy using the Macintosh blade (P < 0.05). 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 McCoy blade.

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 invasively monitor blood pressure in these patients.
- The muscle relaxation and the degree of relaxation at the time of tracheal intubation which may affect the response was not measured by us.

CONCLUSION

From the present study, it was concluded that:

- There was statistical 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.
- 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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