The Internet Journal of Anesthesiology
Volume 32 Number 1

A Comparison Of Circulatory Response To Laryngoscopy And Intubation With MacIntosh And McCoy Blade

P Bhosle, S Aphale, M Bansal

Citation

P Bhosle, S Aphale, M Bansal. *A Comparison Of Circulatory Response To Laryngoscopy And Intubation With MacIntosh And McCoy Blade*. The Internet Journal of Anesthesiology. 2013 Volume 32 Number 1.

Abstract

Background: It has been observed that laryngoscopy and intubation leads to profound cardiovascular effects along with an increase in catecholamine concentrations. Multiple studies have been conducted to attenuate the same. McCoy blade has been found to decrease this pressor response as compared to the Macintosh blade used routinely. Therefore, a comparative study of heart rate (HR) and mean arterial pressure (MAP) changes during laryngoscopy and intubation using these two blades was conducted to establish the same.
Methods: The study included 200 patients divided into two groups of 100 each. Laryngoscopy and intubation was performed either with Macintosh or McCoy blade. The HR and MAP were recorded at every 1 minute interval during laryngoscopy and intubation for 5 minutes. Apart from above observations, Mallampatti classification (MPC), Cormack and Lehane classification (C& L) and time required for intubation were noted.
Results: There was no difference in baseline HR and MAP in both the groups i.e. Macintosh (MK) and McCoy (MY) . The percentage rise from baseline HR and MAP in MK group was highly significant during laryngoscopy and intubation and 1 minute after that as compared to MY group. Similarly, comparison of HR and MAP changes between both the groups revealed highly significant decrease in the parameters in MY group, during laryngoscopy and intubation and 1 minute after the procedure. No other complications of laryngoscopy & intubation were observed in our study.

Conclusion: McCoy blade, primarily devised for difficult intubation has additional benefit of alleviating the pressor response to laryngoscopy and intubation. We recommend its use in patients with cardiovascular compromise, raised intracranial tension (ICT), apart from its established indications.

Abbreviations: HR- Heart Rate, MAP- Mean Arterial Pressure, ICT – Intracranial tension

INTRODUCTION

Since the first description of circulatory response to laryngoscopy and intubation , there have been numerous studies concerning both responses and maneuvers by which it may be attenuated. Multiple methods for attenuation have been studied and more work has been carried out with different pharmacological agents such as local anaesthetics, vasodilators, beta adrenoceptor blocking agents, calcium entry blockers, opioids, gabapentin, volatile anaesthetics and neuromuscular blocking agents.[1,2,3,4,5,6,7]
Laryngoscopy is known to have profound cardiovascular effects which include a pressor response and tachycardia along with an increase in catecholamine concentrations.[8,9]
The major part of the sympathoadrenal response is believed to arise from supraglottic region by the laryngoscope blade. Tracheal tube insertion and inflation contributes only little additional stimulation.[10]
During laryngoscopy and intubation , nociceptor signals are generated by elevation of epiglottis with the laryngoscope and by insertion of the tube into trachea. The signals are conducted to the brain through the glossopharyngeal nerve and the vagus. Pressor response to laryngoscopy and intubation is mediated via sympathetic nerves and the efferent pathway is also composed of sympathetic nerves.[10,11,12]
The McCoy laryngoscope blade is a modification of Macintosh blade to facilitate tracheal tube placement in a difficult intubation. It is a ‘hinged tip’ blade controlled by a lever on the handle of laryngoscope, allows elevation of epiglottis with less overall laryngoscopic elevation and resulting in exertion of lesser force. [13, 14] Consequently it is known to impart less stress response as compared to the Macintosh blade. Thus we conducted a study comparing HR

and MAP changes during laryngoscopy and intubation using these two blades.

METHODS

After the approval of institutional ethical committee and written informed consent the study was carried out. It included patients of both sexes belonging to ASA grade I and II and Mallampatti classification(MPC) of I and II between the age group of 18 to 60 years, scheduled for elective surgery requiring general anaesthesia with endotracheal intubation. Patients with acid peptic disease, obesity , anticipated difficult intubation , coronary artery disease (CAD) , hypertension , intestinal obstruction, diagnosed case of pheochromocytoma, and chronic smokers were excluded. The selected patients were randomly divided into 2 groups of 100 each, Macintosh group (MK) and McCoy group (MY) i.e. laryngoscopy and intubation carried out with Macintosh or McCoy laryngoscope. Laryngoscopy was performed by a person with a reasonable expertise to avoid interference in observations and results.

All patients received Tab. Alprazolam 0.5 mg at night prior to the day of surgery and Inj. Glycopyrrolate 0.01 mg/kg intramuscularly, 45 minutes prior to surgery.

In the operating room after intravenous access and application of monitors, baseline readings of HR and MAP were noted. Preinduction - Patients received Inj. Ondansetron 4 mg, Inj. Midazolam 0.03mg/kg and Inj. Fentanyl 1.5mcg/kg intravenously. After 3 minutes of preoxygenation, anaesthesia was induced with Inj. Thiopentone sodium 6-7mg/kg and Inj. Vecuronium 0.1 mg/kg as muscle relaxant .All patients were ventilated with 100% O2 with bag and mask for 3 minutes. The HR and MAP was recorded 1minute prior to laryngoscopy .After adequate relaxation direct laryngoscopy with either Macintosh or McCoy blade was performed enabling the view of larynx and vocal cords [Cormack and Lehane (C&L) Classification grade I and II]. The duration of laryngoscopy and intubation was restricted to less than 15 seconds. The tip of either laryngoscope blade was gently passed towards the glosso-epiglottic fold. The larynx with Macintosh blade was visualized by forward , upward movement of the handle of Macintosh laryngoscope, while with McCoy blade by just pressing the lever tip of the blade to lift the epiglottis. The trachea was then intubated with appropriate sized cuffed endotracheal tube & cuff was inflated.

The HR and MAP were monitored and recorded every 1 minute interval for 5 minutes since the laryngoscopy &intubation. Intraoperative vital parameters were monitored and maintained. No other drug was used for reducing the pressor response. The complications of laryngoscopy & intubations were anoted.The observations were analysed statistically by ‘unpaired, paired and chi-squared t test’. Statistical significance was assumed if $p<0.05$.

OBSERVATIONS AND RESULTS

All patients representing both sexes and age ranging from 18 to 60 years belonging to ASA Grade I and II were included in study. Patients were scheduled to undergo various elective surgical procedures under general anaesthesia and were divided in 2 groups of 100 each :

Group MK : Laryngoscopy and Intubation carried out using Macintosh blade.

Group MY : Laryngoscopy and Intubation carried out using McCoy blade.

All patients had a comparable demographic data with respect to age, sex and weight . Patients from both groups were assessed for Mallampatti classification, Cormack - Lehane grade, time taken for intubation and data was comparable.

Table 1

Comparison of Demographic and Air-way assessment data in Group MK and Group MY

S. No.	Group	Age (Yrs) (Mean ± S.D.)	Weight (Kg) (Mean ± S.D.)	Sex distribution (% of total)		MPC (% of total)		C & L Grade (% of total)		Time taken to intubate (Sec.) (Mean ± S.D.)
				Male	Female	MP I	MP II	Grade I	Grade II	
1.	Group MK	33.60 ± 11.67	57.60 ± 5.86	61%	39%	79 %	21 %	76 %	24 %	13.20 ± 1.22
2.	Group MY	35.94 ± 12.03	57.10 ± 6.49	64 %	36 %	76 %	24 %	79 %	21 %	12.83 ± 1.65
	P value	0.16; NS*	0.61; NS*	0.77 NS**		0.73 NS**		0.73 NS**		0.12 (NS*)

Unpaired t test is applied. NS* - Not significant ; Chi-Squared t test is applied. NS**- Not significant.

HAEMODYNAMIC RESPONSES

Table 2

Comparison of percent change in Heart rate and MAP in Group MK and Group MY

Time points	Group MK		Group MY		Group MK		Group MY	
	Heart Rate (bpm) (Mean±S.D.)	% Change as compared to baseline	Heart Rate (bpm) (Mean±S.D.)	% Change as compared to baseline	MAP (mm of Hg) (Mean ± S.D.)	% Change as compared to baseline	MAP (mm of Hg) (Mean ± S.D.)	% Change as compared to baseline
Pre-induction	80.60 ±7.67	-	82.99 ±10.87	-	90.18 ±9.52	-	91.91 ±8.52	-
Induction	85.07 ±9.34	5.25%	84.63 ±11.46	1.92%	85.12 ±10.40	-5.94%	87.39 ±9.30	-5.1%
Laryngoscopy + Intubation (L+I)	106.92 ± 12.07	**24.62%**	96.84 ± 12.50	**14.29%**	115.13 ± 12.30	**21.47%**	103.21 ±11.17	**10.77%**
1 Min after L+I	97.00 ±11.88	**16.9%**	92.68 ±10.03	**10.4%**	101.88 ± 12.63	**11.48%**	98.04 ±11.35	**6.25%**
2 Min after L+I	89.54 ±11.33	9.98%	89.81 ±9.54	7.38%	94.32 ±11.89	4.38%	92.87 ±9.41	1.03%
3 Min after L+I	86.13 ±9.49	6.42%	86.30 ±9.11	3.82%	89.8 ±10.22	-0.42%	89.33 ±8.59	-2.88%
4 Min after L+I	82.66 ±8.38	2.49%	84.32 ±9.02	1.58%	85.48 ±10.52	-5.4%	85.73 ±9.01	-7.20%
5 Min after L+I	80.51 ±8.17	-0.112%	82.29 ±10.42	-0.863%	83.29 ±10.22	-8.2%	83.49 ±8.72	-10.09%

bpm - Beats Per Minute

Percentage change of heart rate and MAP from baseline was more in Group MK as compared to Group MY during laryngoscopy and intubation and 1 minute following that.

Percentage change of heart rate and MAP from baseline was more in Group MK as compared to Group MY during laryngoscopy and intubation and 1 minute following that.

Table 3

Comparison of Heart Rate changes in Group MK and Group MY

Time points	Group MK Heart Rate (bpm) (Mean ± S.D.)	Group MY Heart Rate (bpm) (Mean ± S.D.)	P Value	Significance
Pre-induction	80.60 ±7.67	82.99 ±10.87	0.07	NS
Induction	85.07 ±9.34	84.63 ±11.46	0.7	NS
Laryngoscopy + Intubation (L+I)	**106.92±12.07**	**96.84±12.50**	**<0.001**	**HS**
1 Min after L+I	**97.00±11.88**	**92.68±10.03**	**<0.01**	**HS**
2 Min after L+I	89.54 ±11.33	89.81 ±9.54	0.86	NS
3 Min after L+I	86.13 ±9.49	86.30 ±9.11	0.90	NS
4 Min after L+I	82.66 ±8.38	84.32 ±9.02	0.18	NS
5 Min after L+I	80.51 ±8.17	82.29 ±10.42	0.18	NS

Unpaired t test is applied. NS – Not significant, HS - Highly significant

In both the groups, heart rate before and after induction was comparable (P > 0.05).

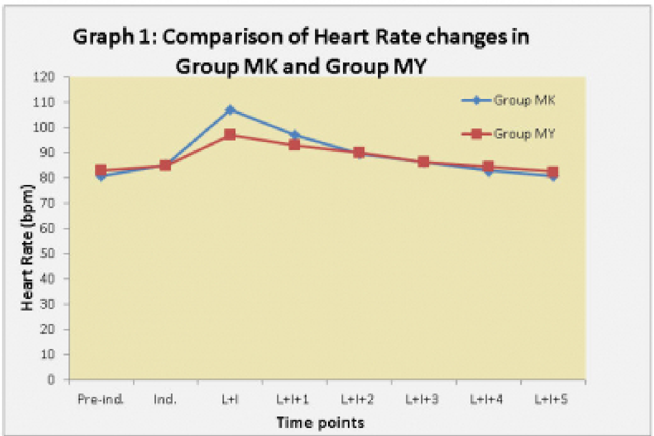
Following laryngoscopy and intubation, the mean rise in heart rate from pre-induction value of 80.60 ± 7.67 to 106.92 ± 12.07 Beats Per Minute (bpm) was noted in group MK, while in group MY the mean rise in heart rate was observed from 82.99 ± 10.87 to 96.84 ± 12.50 bpm. Mean heart rate in both groups at laryngoscopy and intubation was compared and difference was highly significant (P < 0.001).

After 1 minute, the heart rate in group MK was 97.00 ± 11.88 bpm while in group MY it was 92.68 ±10.03 bpm. The difference was statistically significant (P < 0.01).

Following 2 minutes the difference was statistically not significant and return to baseline was observed at the end of 5 minutes.

Figure 1

Comparison of Heart Rate changes in Group MK and Group MY



Key : L + I = Laryngoscopy and Intubation, L + I + n (n = 1,2,3,4,5 minutes)

Table 4

Comparison of Mean Arterial Pressure (MAP) changes in Group MK and Group MY

Time points	Group MK MAP (mm of Hg) (Mean ± S.D.)	Group MY MAP (mm of Hg) (Mean ± S.D.)	P Value	Significance
Pre-induction	90.18 ±9.52	91.91 ±8.52	0.17	NS
Induction	85.12 ±10.40	87.39 ±9.30	0.10	NS
Laryngoscopy + Intubation (L+I)	**115.13±12.30**	**103.21±11.17**	**0.001**	**HS**
1 Min after L+I	**101.88±12.63**	**98.04±11.35**	**0.02**	**S**
2 Min after L+I	94.32 ±11.89	92.87 ±9.41	0.34	NS
3 Min after L+I	89.8 ±10.22	89.33 ±8.59	0.73	NS
4 Min after L+I	85.48 ±10.52	85.73 ±9.01	0.86	NS
5 Min after L+I	83.29 ±10.22	83.49 ±8.72	0.88	NS

Unpaired t test is applied. NS - Not significant, S - Significant, HS - Highly significant

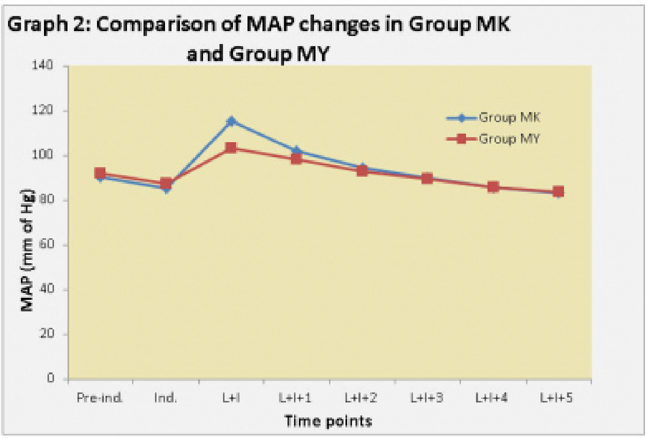
Following laryngoscopy and intubation, the mean rise in MAP from pre-induction value from 90.18 ± 9.52 to 115.13 ± 12.30 mm of Hg was noted in group MK, while in group MY the mean rise in MAP was observed from 91.91 ± 8.52 to 103.21 ± 11.17 mm of Hg. This mean rise in MAP at laryngoscopy and intubation was compared and the difference was highly significant (P < 0.001).

After 1 minute, the MAP in group MK was 101.88 ± 12.63 mm of Hg while in group MY it was 98.04 ± 11.35 mm of Hg. The difference in rise in MAP was statistically significant (P < 0.02).

Return to baseline value was observed at 3 minutes.

Figure 2

Comparison of MAP changes in Group MK and Group MY



Key: L + I = Laryngoscopy andIntubation, L + I + n(n= 1,2,3,4,5 minutes)

DISCUSSION

The pressor response is observed during laryngoscopy and intubation due to sympathetic stimulation of laryngo-pharyngeal region. Efforts of attenuating this response have been concentrated locally and systemically with pharmacological agents. Reduced sympathetic stimulation with the McCoy blade was an accidental finding when used for difficult airway access. Further evaluation of this property and comparison with other blades was studied. The adverse circulatory responses to laryngoscopy and intubation can manifest in the form of increase in heart rate, blood pressure, intracranial tension, intraocular tension, increased catecholamine surge and appearance of arrhythmias and cardiac asystole leading to morbidity or mortality in cardiac compromised patients.

In our study, we investigated if use of McCoy blade is associated with additional benefit of alleviating the pressor response to laryngoscopy and endotracheal intubation by studying two parameters HR and MAP.

The percent rise in HR and MAP from baseline during laryngoscopy and intubation and at 1 minute was observed to be higher in MK group as compared to MY group. We also studied comparison of HR and MAP changes in MK and MY group and the values were compared and statistically analyzed using unpaired t test and observed to be significant during laryngoscopy and intubation and 1 minute following that and return to baseline parameters was observed at 3 to5 minutes.

Similar to our study, E. P. McCoy and R.K. Mirakhur, [15] in 1995 compared the changes in cardiovascular response and catecholamine concentration in 20 patients before and after laryngoscopy with either the Macintosh or the McCoy laryngoscope blade. Significant increase in the HR (33%) and arterial blood pressure (27%) and increase in catecholamine (nor-adrenaline) levels were noted with Macintosh blade as against McCoy blade where no significant change in arterial blood pressure was found. The results of our study are comparable with the study except we have not included the measurements of plasma noradrenaline and adrenaline concentration.

CONCLUSION

The reduced pressor response with the McCoy blade observed in the present study is most probably related to minimal pharyngolaryngeal stimulation due to decrease in overall laryngoscopic movement and the force used. The blade, primarily devised for difficult intubation, alleviated pressor response to laryngoscopy & intubation. Laryngoscopy using McCoy blade, although requires adequate practice, can serve as an additional tool with different pharmacological agents to avoid exaggerated pressor response in indicated high risk patients.

References

1. Abou-Madi , M.N., H. Keszler , and J.M. Yacoub , Cardiovascular reactions to laryngoscopy and tracheal intubation following small and large intravenous doses of lidocaine . Can Anaesth Soc J , 1977. 24 (1): p. 12 - 19.
2.Kautto, U.M. and L. Saarnivaara, Attenuation of the cardiovascular intubation response with N2O, halothane or enflurane. Acta Anaesthesiol Scand, 1983 . 27 (4): p. 289-93.
3.Kautto, U.M. , Attenuation of the circulatory response to laryngoscopy and intubation by fentanyl . Acta Anaesthesiol Scand , 1982 . 26 (3): p. 217 - 21.
4.Lavery, G.G., et al., Does the choice of the neuromuscular blocking agent affect the cardiovascular response to intubation? Acta Anaesthesiol Scand, 1987 . 31 (3): p. 239 - 43.
5. Bijoria, K., et al., Isosorbide dinitrate spray. Attenuation of cardiovascular responses to laryngoscopy and intubation. Anaesthesia, 1992 . 47 (6) : p. 523 - 6.
6.Vucevic, M., G.M. Purdy, and F.R. Ellis, Esmolol hydrochloride for management of the cardiovascular stress responses to laryngoscopy and tracheal intubation. Br J Anaesth , 1992 . 68 (5) : p. 529 - 30.
7.Yaku, H., et al. , Effect of verapamil on the cardiovascular responses to tracheal intubation . Br J Anaesth , 1992. 68 (1) : p . 85 - 9.
8. King, B.D., et al., Reflex circulatory responses to direct laryngoscopy and tracheal intubation performed during general anesthesia. Anesthesiology, 1951. 12 (5) : p. 556 - 66.
9. Forbes, A.M. and F.G. Dally, Acute hypertension during induction of anaesthesia and endotracheal intubation in normotensive man. Br J Anaesth, 1970. 42 (7) : p. 618 – 24
10. Derbyshire, D.R., et al., Plasma catecholamine responses to tracheal intubation . Br J Anaesth, 1983. 55 (9) : p. 855 -

60.
11. Low, J.M., et al., Studies of anaesthesia in relation to hypertension. VII: Adrenergic responses to laryngoscopy. Br J Anaesth, 1986. 58 (5) : p. 471-7.
12. Shribman, A.J., G. Smith, and K.J. Achola, Cardiovascular and catecholamine responses to laryngoscopy with and without tracheal intubation. Br J Anaesth, 1987. 59 (3) : p. 295 - 9.
13. McCoy, E.P. and R.K. Mirakhur, The levering laryngoscopy . Anaesthesia, 1993. 48 (6) : p. 516 - 9.
14. McCoy, E.P., et al., A comparison of the forces exerted during laryngoscopy. The Macintosh versus the McCoy blade. Anaesthesia, 1996. 51 (10) : p. 912 - 5.
15. McCoy, E.P., R.K. Mirakhur, and B.V. McCloskey , A comparison of the stress response to laryngoscopy. The Macintosh versus the McCoy blade. Anaesthesia, 1995. 50(11): p. 943-6.

Author Information

Pooja Bhosle, Dr., Assoc. Professor
Department Of Anaesthesiology, Bharati Vidyapeeth Deemed University Medical College
Pune Maharashtra, India

Shubhada Aphale, Dr., Professor & Head
Department Of Anaesthesiology, Bharati Vidyapeeth Deemed University Medical College
Pune Maharashtra, India

Manuj Bansal, Dr., Chief Resident
Department Of Anaesthesiology, Bharati Vidyapeeth Deemed University Medical College
Pune Maharashtra, India