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Prospective Randomized Study To Compare Hemodynamic Changes During Mccoy Versus Macintosh Laryngoscopy

KEYWORDS: Pressor response, Hemodynamic response, laryngoscopy and intubation, Macintosh laryngoscope, McCoy laryngoscope

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ABSTRACT ***Background:*** *McCoy laryngoscope incorporates a modification of the standard Macintosh blade for better viewing of larynx requiring less force and thus decreasing the pressor response associated with laryngoscopy. The available literature on the subject is limited and controversial.*
Materials and Methods: *We studied the hemodynamic response to laryngoscopy and tracheal intubation in 80 ASA I and II patients aged between 20-50 years using either McCoy (Group A; n=40) or Macintosh (Group B; n= 40) laryngoscopes. Heart rate, systolic and diastolic blood pressure and mean arterial pressure was observed before induction, after induction, during intubation (0 minute) and every minute for the first five minutes and at 10 minutes post intubation. Any episode of arrhythmia or desaturation (SpO2 < 90%) were noted.*
Results: *Following laryngoscopy there was statistically significant rise in HR, SBP, DBP and MAP in both the groups. Increase in hemodynamic variables was more with Macintosh laryngoscope as compared to McCoy which was statistically significant (P <0.001). Arrhythmias or desaturation was not observed in either group.*
Conclusion: *Hemodynamic changes with use of McCoy laryngoscope was lesser as compared to Macintosh laryngoscope.*

I. INTRODUCTION

Airway management is an essential task of an anaesthsiologist. Laryngoscopy and endotracheal intubation is the gold standard for securing a definitive airway during general anaesthesia to maintain adequate oxygenation and ventilation. Laryngoscopy and endotracheal intubation triggers pressor responses like tachycardia and hypertension[1] that are well recognized.

Anaesthesia literature has focused more on the pharmacological methods than on non-pharmacological methods such as laryngoscopy blade design for attenuation of the pressor response.

The Macintosh blade is the standard laryngoscope blade designed by Sir Robert Macintosh in 1943[2]. In 1993, McCoy and Mirakhur introduced the flexitip McCoy laryngoscope, which incorporates a modification of the standard Macintosh blade for better viewing of larynx especially in anticipated difficult airway[3] and requires less force[4, 5] and thus decreasing the pressor response associated with laryngoscopy.

Hence, we conducted a prospective randomized observational study to compare the hemodynamic response to laryngoscopy with McCoy and Macintosh laryngoscope blades.

II. METHODOLOGY

After ethical committee approval and informed consent, 80 patients belonging to "American society of Anesthesiology " (ASA) physical status I and II of either sex , aged between 20 to 50 years, scheduled for elective surgery requiring general anaesthesia with endotracheal intubation were enrolled. The patients were randomly allocated through lottery, to one of two groups of 40 each: Group A with patients undergoing laryngoscopy with McCoy blade and Group B with patients undergoing laryngoscopy with Macintosh blade. Patients belonging to ASA grade 3 and 4, those with anticipated difficult airway, coronary heart disease, pregnant patients, patients requiring more than one attempt to tracheal intubation, coughing or bucking on intubation and those requiring external laryngeal manipulation for intubation were excluded from the study.

Thorough pre-anaesthetic evaluation and routine investigations were carried out before taking up the patient for surgery.

After obtaining written informed consent, the patients were fasted overnight and premedicated with tablet Ranitidine 150mg and tablet lorazepam 1mg orally at bedtime and two hours prior to surgery. Before induction of anaesthesia, the patients were randomly assigned to either of the following groups.

On arrival to operation room, peripheral intravenous cannula was secured, an intravenous infusion of ringer lactate started and basic monitors like Noninvasive blood pressure, electrocardiogram, pulse-oximeter and end tidal carbon dioxide connected. Baseline vital readings were recorded.

A 10 cm pillow was kept under the head to maintain flexion at the cervical and extension at the atlanto-occipital joint called the sniffing position. After preoxygenation for three minutes, anaesthesia was induced with intravenous fentanyl 2mcg/ kg and propofol (2 mg/kg). Vecuronium 0.1 mg/kg was given to facilitate tracheal intubation. The lungs were ventilated with oxygen (33%), nitrous oxide (66%), and 1% isoflurane. Laryngoscopy and intubation was followed 3 minutes later. An assistant timed the laryngoscopy period using a stop watch so as to limit the time to less than 30 seconds. Size 7.0 or 7.5 mm ID endotracheal tube was inserted in females and size 8.0 or 8.5 mm ID in males.

All patients were assessed for changes in hemodynamic parameters of heart rate, systolic blood pressure, diastolic

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blood pressure and mean arterial pressure before induction (Baseline), after induction of anaesthesia (Pre-Laryngoscopy and Intubation), during intubation (0 minute) and every minute for the first five minutes after intubation and at ten minutes post intubation.

ECG lead II and SpO2 was monitored continuously throughout the study period and any episode of arrhythmia or desaturation (SpO2 < 90%) were noted. At the end of operation residual neuromuscular blockade was reversed.

III. RESULTS

Sample size calculation was done using software G* Power. It was estimated that with a power of 80% at 5% significance, 39 patients in each group would be required. We included 40 patients in each group for our study. The chi-square test was used to compare categorical variables and unpaired t-test was used to compare the means between the two groups. *P* value < 0.05 was considered as significant. The analysis was carried out by using the software SPSS 20.0 version. Age, Sex and weight were comparable in both the groups.

Graph: 1 Age and Weight Distribution

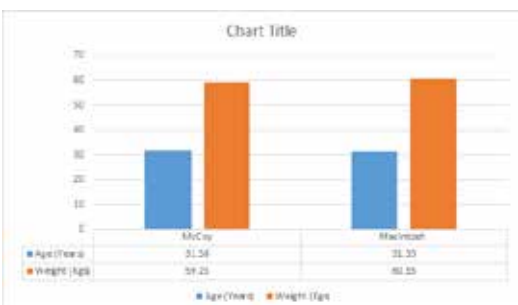
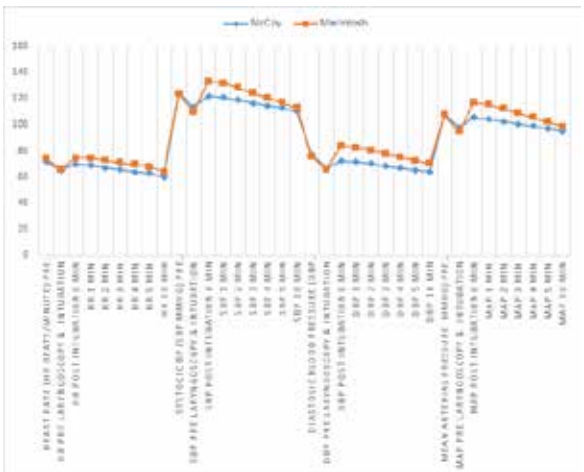


Table: 1 Gender Distribution

McCoy - A Macintosh - B			GROUP		Total
			Group A	Group B	
GENDER	FEMALE	Count	19	19	38
		% within GROUP	47.5%	47.5%	47.5%
	MALE	Count	21	21	42
		% within GROUP	52.5%	52.5%	52.5%
Total		Count	40	40	80
		% within GROUP	100.0%	100.0%	100.0%

Graph: 2 Comparison of HR, SBP, DBP and MAP in two groups of patients studied.



- Basal heart rate was comparable in both groups. Heart rate was statistically and clinically lower in group A post intubation at 0, 1, 2, 3, 4, 5 and 10 minutes compared to Group B.
- Both the groups were comparable with respect to basal systolic blood pressure values. Systolic blood pressure values were statistically and clinically significantly lower in Group A post intubation at 0, 1, 2, 3 and 4 minutes compared to Group B.
- Basal diastolic blood pressure values in both the groups were comparable. Diastolic blood pressure values were statistically and clinically significantly lower in group A post intubation at 0, 1, 2, 3, 4, 5 and 10 minutes compared to Group B.
- Mean arterial pressure values in both the groups were comparable at baseline. Values were statistically and clinically significantly lower in group A post intubation at 0, 1, 2, 3, 4 and 5 minutes compared to Group B.

Table: 2 Comparison of HR, SBP, DBP and MAP in two groups of patients studied.

	GROUP	Pre I (Baseline)	After I	POST INTUBATION						
				0 Min	1 min	2 min	3 min	4 min	5 min	10 min
HR (bpm)	A	71.95	65.53	69.93	69.08	67.5	65.58	63.93	63.08	59.95
	B	74.3	66.13	74.63	74.53	73.1	71.05	69.65	67.9	64.2
	***P* Value**	0.097	0.625	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
SBP (mmHg)	A	124.33	113.8	122.13	120.9	119.05	116.75	114.75	113.03	110.43
	B	123.58	109.8	133.43	132.05	128.35	124.35	120.58	117.05	112.98
	***P* Value**	0.737	0.099	<0.001*	<0.001*	<0.001*	0.002*	0.019*	0.105	0.307
DBP (mmHg)	A	77.38	66.78	72.45	71.6	70.25	68.35	67.13	65.53	63.95
	B	76.18	65.85	84.05	82.65	80.53	77.93	75.45	72.65	70.3
	***P* Value**	0.524	0.609	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
MAP (mmHg)	A	108.675	98.125	105.5667	104.4667	102.7833	100.6167	98.875	97.19167	94.93333
	B	107.775	95.15	116.9667	115.5833	112.4083	108.875	105.5333	102.25	98.75
	***P* Value**	0.656	0.159	<0.001*	<0.001*	<0.001*	<0.001*	0.002*	0.017*	0.066

*** denotes P Value of <0.05 which is statistically significant**

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Group A- McCoy laryngoscope; Group B- Macintosh laryngoscope

HR- Heart Rate; SBP- Systolic blood pressure; DBP- diastolic Blood Pressure; MAP- Mean arterial pressure; Pre I– Pre Induction; After I- After Induction; bpm- beats per minute; mmHg- millimeter of mercury

IV. DISCUSSION

Hemodynamic response during airway management is generally due to the stimulation of the oropharyngeal structures during laryngoscopy or laryngeal stimulation during the passage of endotracheal tube through the glottic opening. The stimulation of mechanoreceptors in larynx via the IX and X cranial nerves to the medulla causes reflex activation of the vasomotor centre resulting in sympathetic neural output to the adrenal medulla. Stimulation of the efferent sympathetic pathway causes release of catecholamines from the adrenal medulla into the circulation and thus results in the pressor response: tachycardia and hypertension[6].

McCoy laryngoscope has been reported to cause less hemodynamic changes compared to the Macintosh laryngoscope[4, 5]. The McCoy blade offers the unique advantage of a hinged blade tip, controlled by a lever on the handle of the laryngoscope which allows elevation of the epiglottis via the hyo-epiglottic ligament from a much deeper point within the larynx while decreasing the overall laryngoscopic elevation or levering movement required. This decreases the forces exerted on the base of tongue so that the pressor response to laryngoscopy and intubation is minimized[5].

We found striking difference in the rise in heart rate and blood pressure between Group A and Group B in our study. The heart rate, systolic and diastolic blood pressure and mean arterial pressure was clinically and statistically lower in Group A (McCoy) than compared to Group B (Macintosh) at various time intervals.

Literature on this subject shows controversial results. Our study is in accordance to Haidry *et al.* and Singhal *et al.* who observed that hemodynamic responses to laryngoscopy with McCoy blade was clinically and statistically lower as compared to macintosh blade[7, 8].

Similarly, Tewari *et al.* compared the two blades in 160 neurosurgical patients and showed that use of McCoy laryngoscope resulted in lesser change in HR and BP, compared to Macintosh blade when fentanyl was not used in obtundation of response. However, when fentanyl was given as an analgesic, no difference was observed between the groups[9].

On the contrary, some studies did not observe any difference in the hemodynamic response between the two blades. Although, McCoy *et al.* found that HR and BP showed significantly greater increase in the Macintosh group compared to the baseline values, they observed no significant difference between the two blades[4].

V. CONCLUSION

In conclusion, the pressor response to laryngoscopy with McCoy blade was significantly less than with Macintosh laryngoscope blade. The McCoy laryngoscope can be utilized as an additional tool along with pharmacological interventions for obtunding hemodynamic response to laryngoscopy. The use of McCoy laryngoscope in patients with cardiac dysfuction may provide better hemodynamic stability although it necessitates further studies.

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