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ORIGINAL RESEARCH ARTICLE

Evaluation of the Hemodynamic Response during Laryngoscopy and Intubation using McCOY and Macintosh Laryngoscope Blades

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ABSTRACT

Introduction: Basic elements of general anesthesia include unconsciousness, amnesia, analgesia, muscle relaxation, diminished motor response to noxious stimuli, and reversibility. Muscle relaxation necessitates securing ventilation with endotracheal intubation. Laryngoscopy forms an important part of general anaesthesia and endotracheal intubation. Laryngoscopes are used to view the larynx and adjacent structures for inserting an endotracheal tube into the trachea. Laryngoscopy aims to obtain good visualization of the vocal cords to facilitate smooth endotracheal intubation. The direct laryngoscopic view is best seen in sniffing in the morning air position, improving the glottis view. Laryngoscopy triggers major stress responses, one due to sympathetic stimulation releasing catecholamines that leads to tachycardia and hypertension, which increases the myocardial oxygen demand, and the other due to vagal stimulation leading to parasympathetic activation that manifests as bradycardia and hypotension. Both may be catastrophic in patients with a known history of ischemic heart disease.

Materials and Methods: This hospital-based prospective, observational study was carried out in the Department of Anaesthesiology, Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly over 112 patients of ASA physical status I and II, undergoing elective surgery under general anaesthesia during a period of 18 months (February 2021 to June 2022).

Results: In our study, a total of 112 patients were included, 50.0% of cases were managed by Macintosh blade those consisting of group I, and 50.0% of cases were managed by McCoy blade, those consisting of group II. Pre-op Heart rate (HR) was 80.56 ± 11.48 and 76.79 ± 10.90 in group I and II, respectively and it was reduced pre-intubation in both groups and it increased significantly during laryngoscopy ($p < 0.05$). Pre-op systolic blood pressure (SBP) was 116.56 ± 11.55 and 119.48 ± 11.41 in group I and II, respectively and it was reduced at pre-intubation in both groups and it increased significantly during laryngoscopy ($p < 0.05$). Pre-op diastolic blood pressure (DBP) was 73.17 ± 8.54 and 73.61 ± 10.29 in group I and II, respectively and it decreased at pre-intubation and again, it was increased during laryngoscopy ($p < 0.05$). Pre-op mean arterial pressure (MAP) was 87.79 ± 8.64 and 89.28 ± 9.0 in group I and II, respectively and it was decreased at pre-intubation and again, it was increased during laryngoscopy ($p<0.05$). ECG was found normal in both groups at all time duration with tachycardia, but no change in the ST segment was noticed in any group.

Conclusion: Our study concludes that the McCoy blade produces significantly lesser marked hemodynamic changes. The vitals like heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure all rise in both groups following the laryngoscopy and intubation but increases with McCoy were less and insignificant than Macintosh laryngoscopes.

Keywords: Hemodynamic response, Intubation, McCOY, Macintosh, Laryngoscope blades.

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INTRODUCTION

It has been observed that the number of forces exerted during laryngoscopy is the key determinant for mechanical stimulation of the supraglottic region and stretch receptors present in the respiratory tract, while endotracheal intubation and cuff inflation contribute little additional stimulation. Various pharmacological approaches and intubation devices been tried to attenuate hemodynamic response to laryngoscopy and intubation. The force applied by the laryngoscope blade at the vallecula is considered the major stimulus causing the cardiovascular response to laryngoscopy. In difficult situations, force applied during laryngoscopy increases with the degree of difficulty. Thus, the use of different types of laryngoscope blades can help decrease these responses.

The Macintosh laryngoscope is the most frequently used device for direct laryngoscopy and intubation. Its tip fits in the vallecula, and lifts the epiglottis to expose vocal cords. In difficult airway cases, increased force may result in increased stress response and hemodynamic responses with dental and oral trauma.[1] McCoy blade, invented in early 1990s is modification of the Macintosh blade.

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McCoy blade composed of 2 parts, blade with adjunct lever, and handle. It's been designed to ease tracheal intubation when patient's head is in neutral position. When McCoy blade inserted into vallecula, lever lifts epiglottis with the minimal, or no force to expose glottis while decreasing overall movement. Thus, exaggerated reflex haemodynamic response becomes insignificant clinically. Because of the inconclusive and unappreciable results of previous studies, this study was undertaken at our tertiary care center in the north Indian population. An Indian study found that the McCoy blade provides better attenuation of hemodynamic response as compared to intubation using the Macintosh laryngoscope as laryngoscopy and intubation can be performed without the aid of stylets.[2]

Successful endotracheal intubation and maintaining a patent airway carry a pivotal role in providing adequate oxygenation and ventilation. Failure to do so for even a brief period can endanger the life of the patient. Inadequate ventilation, accidental oesophageal intubation, and difficult tracheal intubation are the three main causes of airway/respiratory-related injuries.[3] Therefore, the blades used for laryngoscopy and endotracheal intubation should trigger a minimal stress response and simultaneously facilitate an optimum laryngoscopic view for successful endotracheal intubation.[4,5] In the past few years, different studies have been conducted successfully to compare Macintosh and McCoy laryngoscopes and Macintosh and video laryngoscopes to assess hemodynamic response to laryngoscopy and intubation; but, few studies have compared the above two blades deeply. In this study, we aim to evaluate the McCoy and Macintosh blades for minimal hemodynamic variation during laryngoscopy and intubation.

MATERIALS AND METHODS

This hospital-based prospective, observational study was carried out in the Department of Anaesthesiology, Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly over 112 patients of ASA physical status I and II, undergoing elective surgery under general anesthesia during a period of 18 months (February 2021 to June 2022).

Study Area

Department of Anaesthesiology, Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly

Study Duration

1 February 2021 to 31 July 2022

Study Design

Hospital-based prospective randomized study.

Study Sample

Patients undergoing elective surgery under general anesthesia.

Inclusion Criteria

Age group 20 to 50 years, ASA grades I and II, Mallampati (MP) grade I and II, All laryngoscopy and intubation the done within the shortest span of time < 30 seconds by an expert anesthesiologist.

Exclusion Criteria

Age group <20 and >50 years, patient denies giving informed written consent, patients with hypertension, patients with ischemic heart disease, patients with cerebrovascular disease, anticipated difficult intubation, patients with heart block and heart failure.

The sample was calculated based on the following formula: $N= \{Z^2*p(1-p)\}/d^2$

Where N is required sample size, Z is the statistic corresponding to the level of confidence (1.96), p is expected prevalence (10.0%), d is precision (corresponding to effect size)

Using a 95% confidence level, 5% margin of error & power of 80%, we have calculated a total sample size of 97. So, we decided on the final sample of 112 patients divided into 2 groups (A and B) consisting of 56 patients in each group.

RESULTS

Table 1: Distribution of the studied patients based on the type of management

Groups	*Type of management*	*No of patients (%)*
Group I	Macintosh blade	56 (50.0%)
Group II	McCoy blade	56 (50.0%)

Table 2: Distribution of the studied patients based on age

Age (in years)	*Macintosh blade Group I (n=56)*	*McCoy blade Group II (n=56)*	*p-value*
20–30 years	26 (46.4%)	26 (46.4%)	
31–40 years	18 (32.1%)	17 (30.4%)	0.966
40–50 years	12 (21.5%)	13 (23.2%)	

Table 3: Distribution of the studied patients based on Comparison of HR of both groups at different time

Heart rate (HR)	*Macintosh blade group I (n=56)*	*McCoy blade group II (n=56)*	*p-value*
Pre-op	80.56 ± 11.48	76.79 ± 10.90	0.077
Pre-Laryngoscopy	75.65 ± 11.53	72.54 ± 6.26	0.078
Post-Laryngoscopy	105.31 ± 9.64	78.32 ± 4.90	<0.001

Table 4: Distribution of the studied patients based on comparison of SBP of both groups at different time

Systolic blood pressure (SBP)	*Macintosh blade Group I (n=56)*	*McCoy blade Group II (n=56)*	*p-value*
Pre-op	116.56 ± 11.55	119.48 ± 11.41	0.181
Pre-Laryngoscopy	111.12 ± 11.52	114.01 ± 9.99	0.158
Post-Laryngoscopy	136.52 ± 10.03	124.83 ± 5.73	<0.001

Table 5: Distribution of the studied patients based on comparison of DBP of both groups at different time

Diastolic blood pressure (DBP)	*Macintosh blade Group I (n=56)*	*McCoy blade Group II (n=56)*	*p-value*
Pre-op	73.17 ± 8.54	73.61 ± 10.29	0.806
Pre-laryngoscopy	68.04 ± 7.36	66.75 ± 9.60	0.426
Post-laryngoscopy	88.86 ± 5.31	77.23 ± 6.01	<0.001

Table 6: Distribution of the studied patients based on comparison of MAP of both groups at different time

Mean Arterial pressure (MAP)	*Macintosh blade Group I (n=56)*	*McCoy blade Group II (n=56)*	*p-value*
Pre-op	87.79 ± 8.64	89.28 ± 9.0	0.352
Pre-laryngoscopy	82.43 ± 15.14	82.84 ± 8.24	0.8591
Post-laryngoscopy	104.69 ± 5.72	92.80 ± 4.26	<0.001

Table 7: Distribution of the studied patients based on comparison of ECG of both groups at different time

ECG		*Macintosh blade Group I (n=56)*	*McCoy blade Group II (n=56)*
Pre-op (Normal)		56 (100.0%)	56 (100.0%)
Pre-laryngoscopy (Normal)		56 (100.0%)	56 (100.0%)
Post-laryngoscopy	Normal	21 (37.5%)	40 (71.43%)
	Tachy-cardia	35 (62.5%)	28.57%)

DISCUSSION

In 1940, Reid and Brace[6] first described the hemodynamic response to laryngoscopy and intubation. Laryngoscopy and endotracheal intubation are associated with a rise in blood pressure, heart rate, and cardiac dysrhythmias.[7] These above-mentioned effects may be short-lived but they may have adverse effects in high-risk patients like, those with cardiovascular diseases, increased intracranial pressure, or anomalies of cerebral vessels

In the present study, the heart rate was comparable in both the studied group preoperatively and pre-laryngoscopy but the increase in heart rate was significantly lower for the McCoy blade group than Macintosh post-intubation ($p < 0.05$). increase in systolic blood pressure was significantly lower in the McCoy group than in Macintosh at the post-intubation ($p < 0.05$). increase in diastolic blood pressure was significantly lower for the McCoy group at post-intubation ($p < 0.05$). the rise in mean arterial pressure was significantly lower for the McCoy group post-intubation ($p < 0.05$), there was not much change noticed in ECG.

Our findings were in accordance with the findings of Rajendra N *et al.,* who reported that the increase in mean heart rate after intubation was more with the Macintosh laryngoscope compared to the Airtraq optical laryngoscope and McCoy laryngoscope. The increase in systolic blood pressure after intubation was more with Macintosh laryngoscope compared to Airtraq optical laryngoscope and McCoy laryngoscope. The increase in diastolic blood pressure after intubation was more with Macintosh laryngoscope compared to Airtraq optical laryngoscope and McCoy laryngoscope. The increase in arterial pressure after intubation was more with Macintosh laryngoscope compared to Airtraq optical laryngoscope and McCoy laryngoscope.[8]

McCoy EP *et al.* compared Macintosh and McCoy laryngoscope and concluded that stress response to the laryngoscopy was less marked with use of McCoy blade, and is probably because of reduction in force necessary to obtain clear view of the larynx.[9]

Gabbott D compared the ease of intubation using Macintosh laryngoscope, and McCoy laryngoscope in people with a rigid cervical collar and concluded that the McCoy laryngoscope significantly improves the view at laryngoscopy in the patient whose neck is immobilized in a rigid cervical collar.[10]

CONCLUSION

Our study concludes that the McCoy blade produces significantly lesser marked haemodynamic changes. The vitals like heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure all rise in both groups following the laryngoscopy, and intubation but increases with McCoy were less, and insignificant than Macintosh laryngoscopes.

There was the advantage of the better glottic view and more ease of intubation as compared to the Macintosh blade laryngoscope during laryngoscopy, and tracheal intubation, So we can consider use of McCoy blade laryngoscope along with other pharmacological methods to attenuate pressor response which can be more advantageous, especially in high-risk patients

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