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ORIGINAL ARTICLE

Comparative evaluation of intubating conditions and hemodynamic response to laryngoscopy and intubation with McCoy and Macintosh laryngoscopes; a prospective randomized study

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ABSTRACT

Background: Laryngoscopy and intubation is known to produce an exaggerated stress response. The aim in general anesthesia is to attenuate this stress response.

Method: This was a prospective, randomized, and a single blinded study. Ethical committee approval was obtained and 100 patients, aged 20-50 years, ASA grade I and II of either gender undergoing elective surgery under general anesthesia at a tertiary care center in India between 2015 and 2016 were recruited. We compared the Macintosh and McCoy laryngoscope blades regarding intubation time, laryngoscopic view and hemodynamic variables.

Results: Both groups were comparable regarding age, gender, height and baseline vitals. Patients intubated with McCoy blade showed no or minimal change in heart rate and mean arterial pressure as compared to Macintosh blade. The intubation time was comparable in both groups.

Conclusion: McCoy blade was better in attenuating the stress response to laryngoscopy and tracheal intubation.

Key words: Macintosh blade, Stress Response, Laryngoscopy, McCoy blade, Intubating conditions

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INTRODUCTION

Laryngoscopy and tracheal intubation is associated with a stress response along with an increase in catecholamine concentration.[1] the major cause of the sympathoadrenal response arises from stimulation of the supraglottic region by the laryngoscope blade with little contribution from intubation and cuff inflation. Attenuation of this response remains a major concern for the anesthesiologist. The aim of laryngoscopy is to achieve good visualization of vocal cords to facilitate smooth endotracheal intubation.[2]Transient hypertension and tachycardia may be hazardous to the patients with hypertension, cardiac diseases and cerebrovascular diseases. The hemodynamic response in such individuals may predispose to pulmonary edema, myocardial ischemia and cardiovascular accidents.[3]

Various pharmacological methods and intubation devices had been tried to attenuate the hemodynamic response to laryngoscopy and intubation. The force applied by the laryngoscope blade at the vallecula is considered the major stimulus causing cardiovascular response to laryngoscopy.[4] In difficult situations force applied during laryngoscopy increases with degree of difficulty.

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 the vocal cords.[5] in cases of difficult airway increased force applied possibly results in increased stress response and hemodynamic responses along with dental and oral trauma.[6] The McCoy blade invented in the early 1990s is a modification of the Macintosh blade.[7] The McCoy blade is composed of two parts, a blade with an adjunct lever and handle. It has been designed to facilitate tracheal intubation when patient's head is in neutral position. When McCoy blade is inserted into the vallecula, a lever lifts the epiglottis with minimal or no force to expose the glottis while decreasing the overall movement. Thus the exaggerated reflex hemodynamic response becomes clinically insignificant. Because of the inconclusive and unappreciable results of previous studies this study was undertaken at our tertiary care center in north Indian population.

The primary objectives of our study were; to compare the intubation response and the

intubating conditions with McCoy and Macintosh laryngoscope blades.

METHODOLOGY

A prospective, simple randomized, comparative and single blinded study was carried out after ethical committee approval in 100 patients, aged 20-50 years, ASA grade I and II and either gender undergoing elective surgery under general anesthesia at a tertiary care center in India between 2015 and 2016.

Patients were divided randomly by computer generated numbers to one of the following groups.

Group I (n=50) where patients were intubated using Macintosh blade

Group II (n=50) where patients were intubated using McCoy blade

III Patients with hypertension, ischemic heart disease, cerebrovascular disease, Mallampati grade III and IV, ASA grade III and IV, heart block, heart failure and body mass index $\geq$30 kg/m^2 , previous difficult intubation, severe respiratory distress, patients on beta blockers and vasodilators and patients undergoing ENT surgery were excluded from study. Software NCAA PASS 2000 was used to calculate sample size. To achieve a power of 80% and α error of 0.05, 100 patients were required with 50 patients in each group.

Pre anesthetic check-up was done one day prior to surgery along with airway examination. Mallampati grading was done. Written informed consent was obtained from all the patients. Tab alprazolam 0.5mg was given night before surgery. Tab ranitidine 150 mg was given an hour before surgery with a sip of water. Baseline parameters were recorded. Intravenous line was secured with 20 gauge cannula. Inj. midazolam 2 mg and inj. glycopyrolate 0.2 mg were given 30 min prior to surgery. Patients with $\geq$ 20% rise in heart rate after glycopyrolate were removed from the study.

Anesthesia technique:

After shifting the patient to operation theatre, monitors were attached and baseline parameters (BP, pulse rate and ECG) were recorded using Philips Intellivue mx700™ monitor. Pre oxygenation was done with 100% oxygen for 3 minutes before induction. Patients were induced with inj. thiopentone 5mg/kg, inj nalbuphine 0.1-0.2 mg/kg, inj. vecuronium bromide 0.08-0.1 mg/kg body weight, Oxygen, N2O (50:50) and halothane 2%. IPPV was done for 3 minutes. Laryngoscopy was performed by senior anesthesiologist who had at least 5 years' experience of working in anesthesia with Macintosh blade (Group I) and McCoy

Blade (Group II), to see the glottis and intubation was done with appropriate size of endotracheal tube. The time taken for intubation was recorded by the assistant using a stop watch. Patients who required second attempt for intubation were excluded from the study. All the parameters were recorded in the proforma attached and data was analyzed statistically.

The parameters recorded were Mallampati grading, grade of laryngoscopy using modified Cormack-Lehane classification, time taken for laryngoscopy and intubation, systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), heart rate (HR), SpO2 and end tidal CO2 (EtCO2).

The above parameters were recorded at the following time intervals: Preoperative (Tb), pre induction (T0), post induction (T1), I min (T2) and 3(T3) minute after intubation.

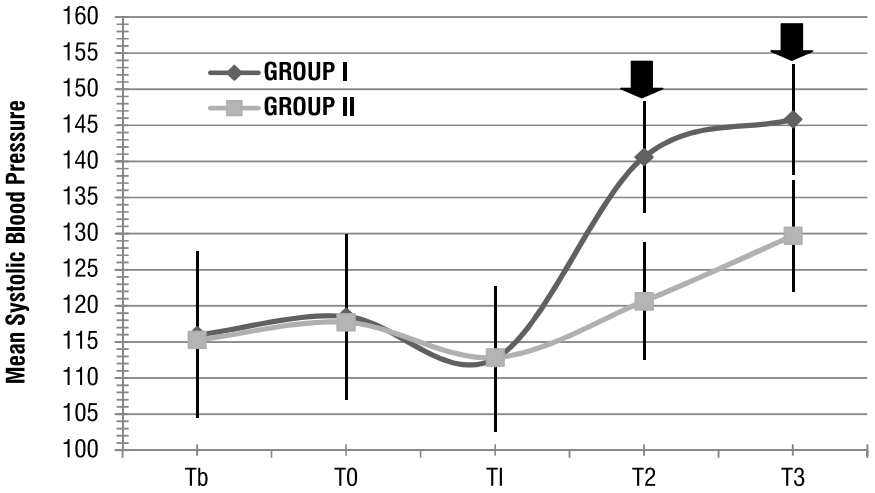

Figure1: Comparison of mean systolic blood pressure
(⬇Indicates significant difference between the groups)

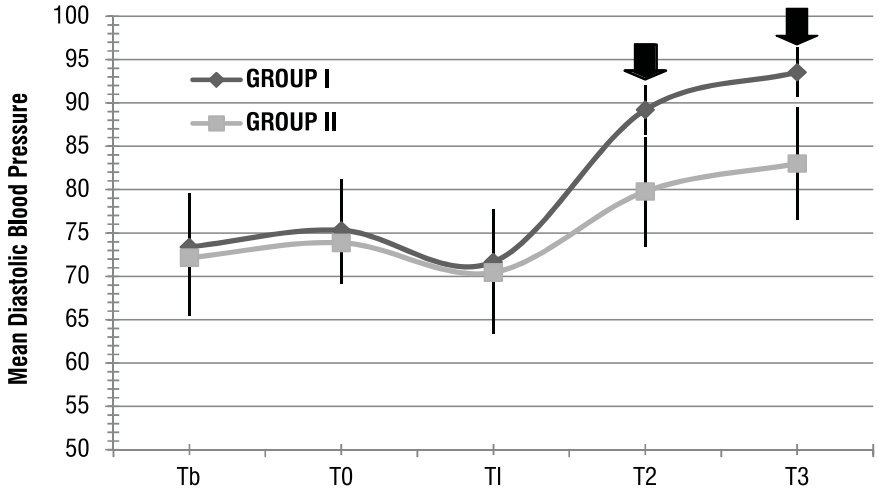

Figure 2: Comparison of mean diastolic blood pressure
(⬇Indicates significant difference between the groups)

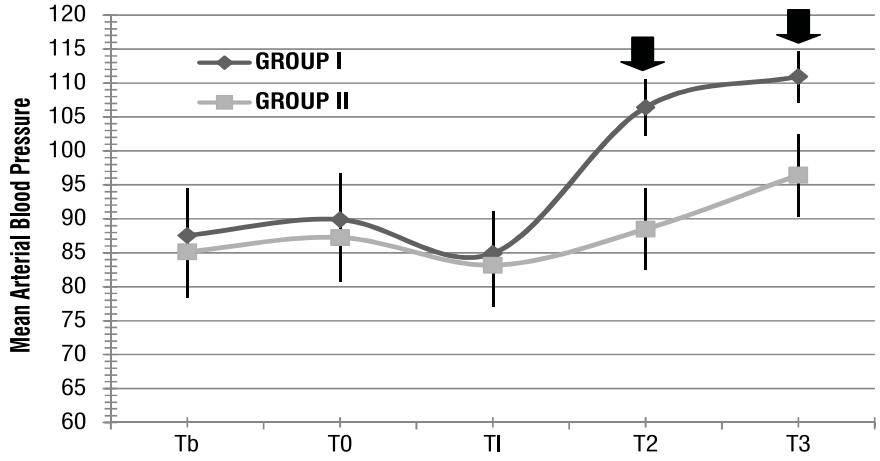

Figure 3: Comparison of mean arterial blood pressure
(⬇Indicates significant difference between the groups)

Data was analyzed using software SPSS 17.00. Categorical data like gender, Mallampati grade, laryngoscopy grade and time taken for laryngoscopy and intubation are presented as numbers and compared using Chi-square test. Heart rate and blood pressure are presented as Mean ± SD and compared using paired t test. P value ≤0.05 was considered significant.

RESULTS

Both the groups were comparable regarding age, gender and height of patients (Table 1). There was no significant difference regarding preoperative vitals in both groups. Patients in Group I and II had comparable Mallampati grading of I and II (p value 0.685) Both groups were also comparable regarding laryngoscopic grade (p value 0.548)

Mean time taken for laryngoscopy and intubation was 16.8 ± 2.19 sec in Group I patients and 16.5 ± 2.13 sec in Group II patients which was comparable (p value 0.859) (Table 2)

Increase in systolic, diastolic and MAP was significantly higher at 1 and 3 minute after laryngoscopy and intubation in Group I as compared to Group II (Figures 1-3). Regarding heart rate, mean heart rate was also significantly higher in Group I patients after laryngoscopy and intubation than in Group

II patients ($p < 0.05$) (Figure 4).

DISCUSSION

Smooth induction without significant hemodynamic response should be achieved for every surgery. But patients with compromised cardiac functions, ocular surgery and intracranial surgery

Table 1: Patient characteristics

Variable	Group I	Group II	p-value
Age	32.04 ± 8.18	34.78 ± 8.28	> 0.05
Gender M/F	24/26	20/30	
Height	155.02 ± 1.00	154.94 ± 1.79	

Table 2: Mallampati, laryngoscopic grade and time taken for laryngoscopy

Variable		Group I	Group II	p-value
Mallampati grade	Grade I	20	22	0.685
	Grade II	30	28	
Laryngoscopy grade	Grade I	23	26	0.548
	Grade II	27	24	
Time taken for laryngoscopy and intubation	I	50	16.8 ± 2.19	0.859
	II	50	16.5 ± 2.13	

requires special drugs and instruments to blunt the stress and hemodynamic response to laryngoscopy and intubation to avoid intraoperative myocardial Zischemia, increase in intraocular and intracranial pressure.

Both laryngoscopy and endotracheal tube placement with cuff inflation play a significant role in altering hemodynamics of which laryngoscopy plays a major role. To prevent this many trials have been done using various pharmacological methods.

The McCoy blade functions through a lever attached at its proximal end and thus decreases the force applied on glosso-epiglottic fold. Its importance also has been studied to prevent increase in intra-ocular pressure during laryngoscopy and intubation secondary to decreased stress response.[8]Another advantage of using McCoy blade is that less of anesthetic drugs are required to prevent hemodynamic response as compared to Macintosh blade.[9] Nishyami et al. [10]also found less stress response using McCoy blade as compared to Miller and Macintosh. In another study by McCoy EP et al.[4] demonstrated increase in catecholamine's concentration with Macintosh blade during laryngoscopy and resulted increase in HR and MAP, but in contrast to our study Han TS et al.[11] found no difference in HR and MAP with both blades which could be because of fentanyl used for induction. Singhal S et al.[12] in their study concluded less hemodynamic response with McCoy blade whereas no significant hemodynamic difference was found by Roman et al.[13] with McCoy and Macintosh laryngoscope blade. In a similar study conducted by Tiwari et al.[9] lesser change in HR and BP with McCoy blade was seen without using fentanyl in neurosurgical patients. In our study increase in MAP & HR was significantly higher in Macintosh group than in McCoy group. A similar study done by Haidry et al.[14] found 18.7% increase in HR using Macintosh blade as compared to 7.7% using McCoy blade.

The magnitude of pressor response is proportional to duration of laryngoscopy and intubation. The hemodynamic stress response also depends upon force of laryngoscopy, which starts at 15 sec with maximum effect at 45 sec. In our study duration of laryngoscopy and intubation was comparable in both the groups, indicating that force applied at epiglottic fold by Macintosh blade to be the main reason for stress response. Significantly longer intubation time with the McCoy group (22.8 ± 4.1 s vs. 16.6 ± 4.0 s) was found by Haidry et al.[14]

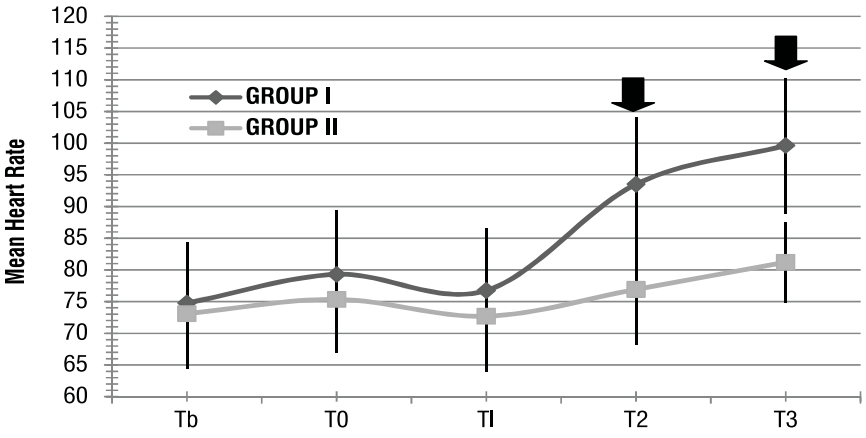

Figure 4: Comparison of mean heart rate between two groups.
(⬇Indicates significant difference between the groups)

Average intubation time with McCoy blade was found to be 30 sec[15]and 34 sec[16] (Bharti et al.).

Gill et al.[17] also described that

intubation time of <30 sec does not evoke stress response.

Another advantage of McCoy blade is improved laryngoscopic view. Cook TM et al.[5] compared Macintosh and McCoy blade and found that McCoy blade performs better when laryngoscopy is difficult with Macintosh blade, but not in neutral position. In our study we found comparable laryngoscopic grades in both groups. Various studies have been done to compare McCoy blade to fiber-optic bronchoscope[18] and Macintosh blade with optimal external laryngeal manipulation (OELM)[19] and found that McCoy blade has an edge over other in view of emergency and difficult intubation along with less stress response. Leon O et al.[20] found significant improvement in intubating conditions in Cormack and Lehane III and IV grade patients with McCoy laryngoscopic blade. Limitation of our study was exclusion of patients with Mallampati grade III and IV, which could be done in future. For future research McCoy blade could be compared with new videolaryngoscopes in difficult airway conditions.

CONCLUSION

We conclude that McCoy laryngoscope blade is better in attenuating the stress response to laryngoscopy and tracheal intubation as compared to Macintosh blade

Conflict of interest: None declared by the authors

Authors' contribution:

SB: Conduct of the study work and manuscript writing

SB + DK: Manuscript editing

J : Conduct of the study work

SS + P: Compilation of data

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