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Original Research Article

A Comparative Study of Cardiovascular Responses to Laryngoscopy Using McCoy, Macintosh and Miller Blades

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ABSTRACT

Background: Laryngoscopy is a procedure that is used to obtain a view of the vocal folds and the glottis to facilitate tracheal intubation during general anaesthesia or cardiopulmonary resuscitation or for surgical procedures. Different types of curved and straight blades are used for laryngoscopy which affects the haemodynamic parameters.

Methods: The prospective, comparative study was done in the department of anaesthesia for the period of six months with the aim to compare the haemodynamic response in the form of heart rate and mean arterial pressure after intubation with three different types of blades of laryngoscope (Mc Coy, Macintosh and Miller). The study was conducted on 75 patients of 20-50 years, of both genders, which were randomly selected and divided into three groups with 25 patients in each. During intubation McCoy (MC), Macintosh (MT) and Miller (ML) blades were used for intubation in group A, B and C respectively.

Results: The haemodynamic stress response with the Macintosh laryngoscopy is more than that of McCoy and Miller laryngoscopy. The haemodynamic stress response (increased heart rate and mean arterial pressure) is least with Miller laryngoscopy.

Conclusion: The haemodynamic response (increased heart rate and mean arterial pressure) to laryngoscopy is least with Miller laryngoscope and most with Macintosh laryngoscope.

Keywords: Cardiovascular, Laryngoscopy, Mc Coy, Macintosh, Miller.

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INTRODUCTION

Laryngoscopy is endoscopy of the larynx. It is a procedure that is used to obtain a view of the vocal folds and the glottis. Laryngoscopy may be performed to facilitate tracheal intubation during general anaesthesia or cardiopulmonary resuscitation or for surgical procedures on the larynx or other parts of the upper tracheobronchial tree.[1] Two basic styles of laryngoscope blade are currently available: the curved blade and the straight blade. The Macintosh blade is the most widely used curved laryngoscope blades, while the Miller blade is the most popular style of straight blade. Both Miller and Macintosh laryngoscope blades are available in sizes 0 (neonatal) through 4 (large adult). There are many other styles of curved and straight blades (e.g., Phillips, Robertshaw, Sykes, Wisconsin, Wis-Hipple, etc.) with accessories such as mirrors for enlarging the field of view and even ports for the administration of oxygen. These specialty blades are primarily designed for use by anaesthetists, most commonly in the operating room.[2,3]

Cases of mild or severe injury caused by rough and inexperienced use of laryngoscopes have been reported. These include minor damage to the soft tissues within the throat which causes a sore throat after the operation to major injuries to the larynx and pharynx causing permanent scarring, ulceration and abscesses if left untreated. Additionally, there is a risk of causing tooth damage.[4-6] Hemodynamic is the dynamics of blood flow. The circulatory system is controlled by homeostatic mechanisms, much as hydraulic circuits are controlled by control systems. Hemodynamic response continuously monitors and adjusts to conditions in the body and its environment. Thus hemodynamic explains the physical laws that govern the flow of blood in the blood vessels. The sympathetic haemodynamic stress response of cardiovascular system occurs as increase in the heart rate and the mean arterial pressure.[2,7] Although, this haemodynamic stress response to laryngoscopy is transient, generally of short duration and of little consequence in healthy individuals. It is hazardous to those with systemic hypertension, coronary heart diseases, cerebrovascular diseases and the complications like tachycardia, hypertension, myocardial ischemia, left ventricular failure, cardiac dysrhythmias and cerebral haemorrhage can occur.[8-11]

This study was conducted to compare the effect of laryngoscopy on haemodynamic parameters by three different blades (Mc Coy, Macintosh and Miller).

MATERIALS AND METHODS

This study is the prospective, comparative study done in the department of anaesthesia for the period of six months. The aim of the study was to compare the haemodynamic response in the form of heart rate and mean arterial pressure after intubation with three different types of blades of laryngoscope (Mc Coy, Macintosh and Miller).

This study was conducted on seventy five patients in the age group of 20-50 years, of both genders, which were randomly selected and divided into three groups with twenty five patients in each. During intubation Mc Coy (MC), Macintosh (MT) and Miller (ML) blades were used for intubation in group A, B and C respectively.

Inclusion Criteria

a) Age 20-50 years
b) Posted for elective surgery under general anaesthesia
c) Normal cardiovascular parameters in pre-anaesthetic check-up.

Exclusion Criteria

a) Age <20 and >50 years
b) Restricted mouth opening
c) Cardiovascular disorder
d) Not giving consent for participation in study.

In the operation theatre standard multi-monitor, monitoring the ECG, SpO2, non-invasive automated blood pressure and heart rate was used. Intravenous access was obtained using 18G iv cannula. Patients were pre-oxygenated with 100% O2 for three minutes. Induction was done with Inj. Fentanyl 2 µg/kg, Inj. Thiopentone sodium 5 mg/kg and Inj. Vecuronium 0.08 mg/kg IV. Patients were ventilated by facemask with 100% O2.

After three minutes of vecuronium administration, the heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean blood pressure (MBP) was noted as baseline value (BV). Laryngoscopy was then performed (with either McCoy or Macintosh or Miller laryngoscope blade) enabling a clear view of the vocal cords. The laryngoscope blade was gently introduced and the tip of the blade was placed in the vallecula. By just pressing the lever or lifting the laryngoscope, the epiglottis is raised indirectly exposing the larynx.

The heart rate, systolic blood pressure, diastolic blood pressure and mean blood pressure measured at the end of insertion of laryngoscope (LV_0). Then, the laryngoscope was then removed and the patients were ventilated for 5 minutes with N2O:O2 (66%:33%). Heart rate, systolic blood pressure, diastolic blood pressure and mean blood pressure were recorded at 1st minute (LV_1), 3rd minute (LV_2) and 5th minute (LV_3) after laryngoscopy. Then, the patients were intubated and anaesthesia was continued. In each group, changes in the values of the heart rate and the mean arterial pressure were based on the difference between the baseline value (BV) and the values obtained at LV_0, LV_1, LV_2, LV_3. The values of the three groups were compared and expressed as mean ± SD. Statistical analysis was done by using ANOVA and paired t-test. A p value of <0.05 was considered as statistically significant.

RESULTS

This study was conducted on seventy five patients in the age group of 20-50 years, of both genders which were divided into three groups (25 each) according to the blade of laryngoscope used. The demographic profile of these patients was compared. The difference in parameters of the patients (Age, sex, weight) were found to be statistically insignificant (p>0.05) **[Figure 1-3].**

There was statistically significant difference (p value <0.05) in the LV_1, LV_2, LV_3 values of heart rate among the three groups except in comparison between MT & ML recorded at 3rd minute (LV_2) [Table 1,2]. There was statistically significant difference (p value <0.05) in the LV_1, LV_2, LV_3 values of mean arterial pressure among the three groups except in comparison between MC & MT recorded at 1st (LV_1) and 5th minute (LV_3) and in between MC & ML recorded at 1st minute [Table 3,4].

Figure 1: Age (years) distribution of the patient

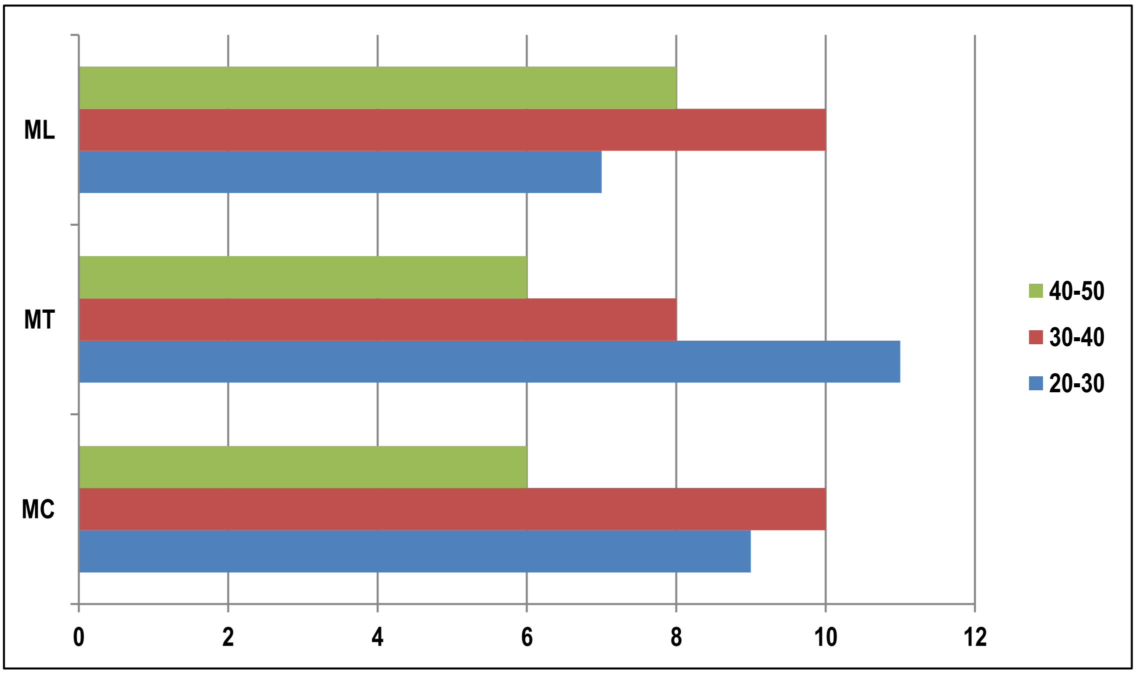

Figure 2: Sex distribution of the patient

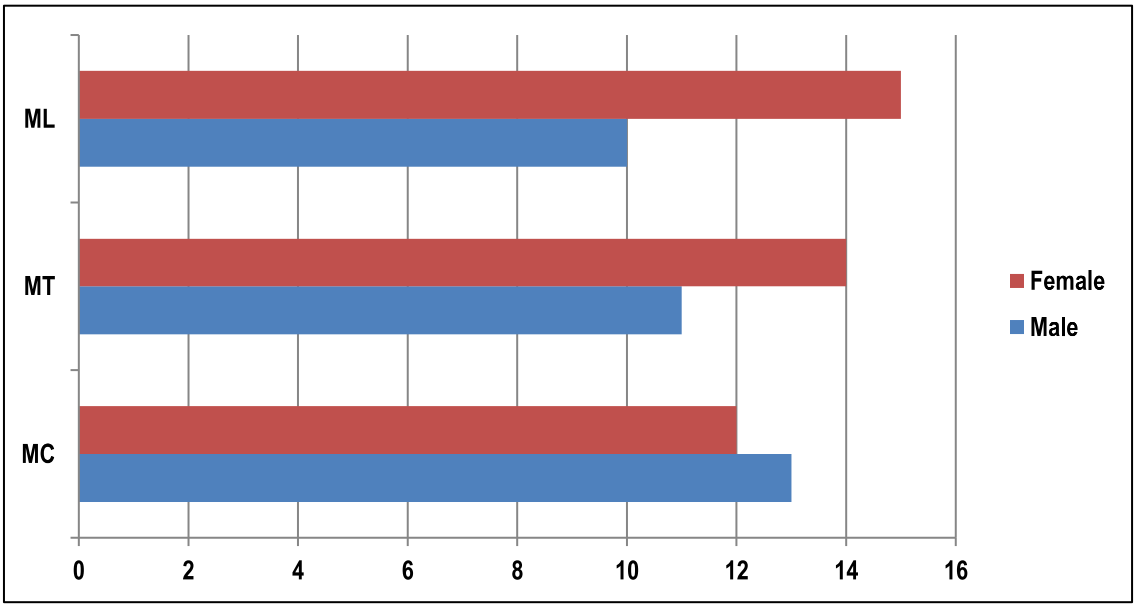

Figure 3: Weight (Kg) distribution of the patients.

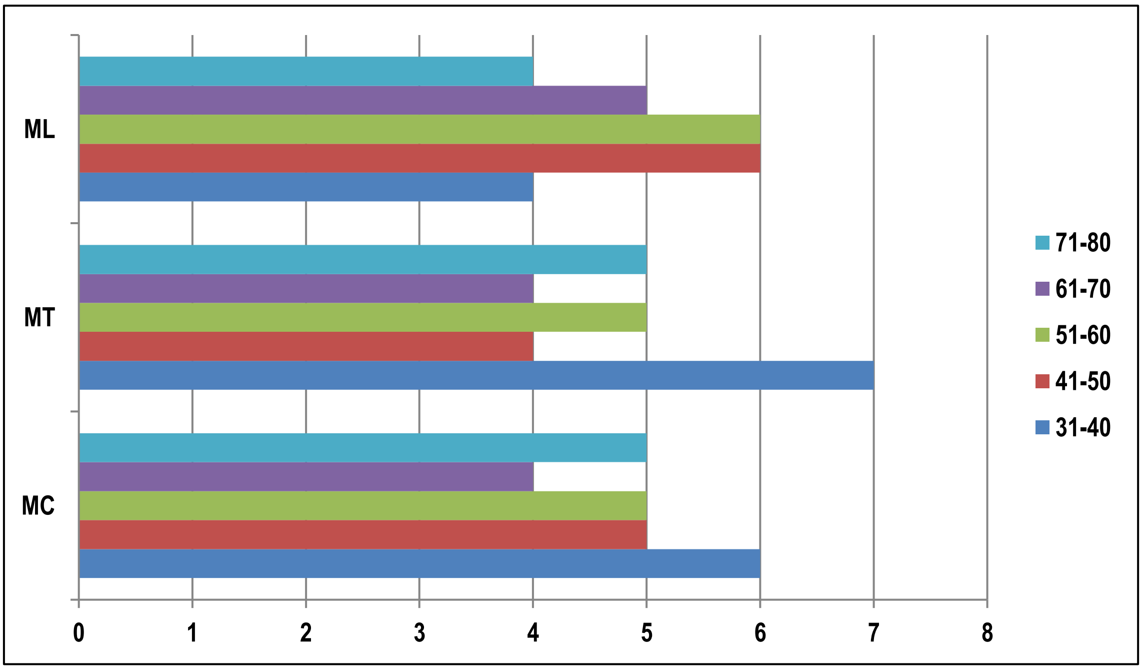

Table 1: Recordings of heart rate before and after laryngoscopy.

Heart rate	MC	MT	ML
BV	78.7 ± 5.2	75.1 ± 4.6	77.3 ± 3.5
LV_0	78.9 ± 5.3	77.3 ± 4.2	78.5 ± 5.8
LV_1	113.6 ± 4.5	98.3 ± 5.1	88.2 ± 5.2
LV_2	109.8 ± 4.1	94.0 ± 4.1	92.4 ± 5.3
LV_3	107.1 ± 3.4	93.9 ± 4.6	82.4 ± 5.5

Table 2: Statistical comparison (p value) of changes in heart rate in three different groups.

Heart rate	MC&MT	MT&ML	MC&ML
LV_1	<0.05*	<0.05*	<0.05*
LV_2	<0.05*	>0.05	<0.05*
LV_3	<0.05*	<0.05*	<0.05*

*p value <0.05 = Significant

Table 3: Recordings of mean arterial pressure (MAP) before and after laryngoscopy.

MAP	MC	MT	ML
BV	92.7 ± 3.1	95.1 ± 4.8	97.3 ± 4.5
LV_0	96.9 ± 9.3	98.3 ± 2.2	99.5 ± 3.8
LV_1	108.6 ± 3.5	110.3 ± 3.1	106.2 ± 8.2
LV_2	111.8 ± 2.8	118.0 ± 4.7	98.4 ± 5.1
LV_3	106.1 ± 1.4	106.9 ± 2.6	92.5 ± 3.8

Table 4: Statistical comparison (p value) of changes in mean arterial pressure.

Mean arterial pressure	MC&MT	MT&ML	MC&ML
LV_1	>0.05	<0.05*	>0.05
LV_2	<0.05*	<0.05*	<0.05*
LV_3	>0.05	<0.05*	<0.05*

*p value <0.05 = Significant

DISCUSSION

Various theories[6,7,12-14] have been recommended by different authors to explain the sympathetic haemodynamic stress response to the laryngoscopy and intubation. The most universally excepted explanation is that the major stimulus to sympathetic haemodynamic stress response during laryngoscopy is the force exerted by the laryngoscope blade upon the structures of oropharynx (tongue, epiglottis). Reduction in the force applied on the structures of oropharynx has attenuated the magnitude of the haemodynamic stress response.

With the McCoy laryngoscopy, the epiglottis is raised indirectly by the tip of the blade by just compressing the lever rather than upward and forward displacement of structure of lower jaw. Hence, the force applied on oropharynx is limited to area of the vallecula and the nearby base of the tongue in contact with distal mobile part of blade. Hence, the degree of haemodynamic stress response (augmented heart rate and mean arterial pressure) is prompted by McCoy.[15]

In Macintosh laryngoscopy, the laryngoscope blade is elevated upward and forward with the force applied on the complete curvature of the spatula of the blade elating the entire lower jaw. The area of oropharynx upon, which the force exercised, is on the total inner part of the lower jaw with the tip of the blade in the vallecula. This leads to more haemodynamic stress response than that of McCoy laryngoscopy. But, as the epiglottis is not moved directly as seen with the use of Miller laryngoscope blade, the haemodynamic stress response is less than that of Miller laryngoscopy.[12,16]

In case of Miller laryngoscope blade, the blade is placed into the oropharynx and the tip of the blade is conceded over the posterior surface of the epiglottis. The epiglottis is involved under the tip of the blade and the blade is raised upward and forward with the force applied on the full inner aspect of lower jaw and compacting the epiglottis on the base of the tongue. The epiglottis is raised directly to sight the larynx. Hence, the haemodynamic stress response with the Miller laryngoscopy is less than that of McCoy and Macintosh laryngoscopy.[17,18]

The haemodynamic stress response with the Macintosh laryngoscopy is more than that of McCoy and Miller laryngoscopy. The haemodynamic stress response (increased heart rate and mean arterial pressure) is least with Miller laryngoscopy.

CONCLUSION

In this study, the haemodynamic response (increased heart rate and mean arterial pressure) to laryngoscopy is compared in between three laryngoscope blades (McCoy, Macintosh and Miller). It is concluded that the haemodynamic response (increased heart rate and mean arterial pressure) to laryngoscopy is least with Miller laryngoscope and most with Macintosh laryngoscope.

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