A Prospective controlled comparative study of haemodynamic responses, intubating conditions to laryngoscopy and tracheal intubation by using Macintosh vs. McCoy blade laryngoscope

Sarada Devi V 1, Lakshmi Narasimham M 2*, Manjula VR 3, Saroj P 4, Surender P 5

1, 2 & 3 Assistant professor, 4 Associate Professor, 5 Professor and HOD, Department of Anesthesia, Malla Reddy Medical college for women, Hyderabad

*Corresponding Author:
Dr. Lakshmi Narasimham M
Email: narasimham_dr@yahoo.com

Abstract:

Background: The invention of McCoy blade in the early 1990s is a modification of the Macintosh blade with a hinged tip. The McCoy blade reduces the amount of force applied during laryngoscopy and endotracheal intubation, thus the increased reflex haemodynamic changes in response to tracheal intubation becomes less significant.

Objective: To determine the advantages of McCoy blade laryngoscope in obtunding the pressor response, better glottic visualization and ease of intubation during laryngoscopy and endotracheal intubation as compared to Macintosh blade laryngoscope.

Methods: The present study was done on 60 adult patients of ASA I and II, between the age group of 20 to 50 years. We observed the haemodynamic changes, glottic view and ease of intubation by using either Macintosh or McCoy blade laryngoscope during general anesthesia at laryngoscopy and endotracheal intubation. The changes in HR, SBP, DBP, and MAP were recorded before induction, at laryngoscopy and intubation and at 1 min, 3 min and 5 min after tracheal intubation. Glottic view obtained on laryngoscope was compared as per Cormack and Lehene grading. Tracheal intubation grading was also compared between the groups. Complications during the procedure like arrhythmias, injury, and bleeding were noted.

Results: In our study, a significant haemodynamic changes were observed in both the groups following laryngoscopy and endotracheal intubation. The rise in HR, SBP, DBP, and MAP were more significant with Macintosh blade laryngoscope, whereas better visualization of the glottis, ease of intubation and less haemodynamic changes were noted with McCoy blade laryngoscope.

Conclusion: McCoy blade laryngoscope produces significantly less marked haemodynamic changes, better glottic view and ease of intubation as compared to Macintosh blade laryngoscope during laryngoscopy and tracheal intubation.

Key words: Macintosh blade, McCoy blade, endotracheal intubation, Haemodynamic response, glottic view

Introduction:

General anesthesia requires laryngoscopy and intubation which is an essential part in anesthesia practice. Stress response to laryngoscopy and tracheal intubation is manifested as tachycardia, hypertension and dyssrhythmias and it may have profound respiratory, neurological and cardiovascular effects. There is also a rise in the serum catecholamine levels. 1 Most of the patients tolerate these changes with out any significant consequences but patients with co morbid diseases may not withstand these responses. Forces exerted by the laryngoscope blades on the base of the tongue are assumed to be a major stimulus for Sympatho-adrenal response. This stress response is due to the stimulation of the supra-glottic region by the laryngoscope blade along with the tracheal tube placement and cuff inflation. 2 So during general anesthesia, these effects must be attenuated as much as possible and especially in high risk patients.

Several pharmacological agents (both intravenous and topical) have been using to attenuate these responses but they have some limitations and side effects. Various modified instruments and use of other intubating devices (e.g. LMA) 3, 4, have been tried to attenuate this response to laryngoscopy and endotracheal intubation.

The Macintosh Blade is being used in anesthesia practice since a long time successfully. 5 The invention of McCoy blade with a hinged tip in early 1990s is a modification of Macintosh blade. The insertion of the McCoy blade into the vellocula decreases the amount of force exerted during laryngoscopy and tracheal intubation by elevating the tip acting on the hypo-epiglottic ligament and lifting the epiglottis out of the view for better glottic visualization and decreases the overall movement. 6
Material and Methods:
This prospective study was carried out at MRMCW Hyderabad between Feb 2015 to April 2016 in the dept of anesthesia in 60 ASA physical status I and II adult patients of either gender, age between 20 to 50 years under general anesthesia posted for elective surgeries, after obtaining approval from institutional ethics committee and written informed consent from the patients.

Exclusion Criteria:
1. Pregnant patients
2. Patients with diabetes, HTN and CAD
3. Patients on beta blocker therapy
4. Patients with difficult airway
5. Patients with major liver, kidney and heart diseases
6. Patients with h/o allergy to any of the drugs received in this study.
7. Patients with morbid obesity.

The 60 patients recruited for this study were randomly allocated in to two groups of 30 each by sealed envelop method.

Group A/Study group: 30 patients studied for laryngoscopy and tracheal intubation with the McCoy blade.
Group B/Control group: 30 Patients studied for laryngoscopy and tracheal intubation with the Macintosh blade.

Anesthesia protocol:
Pre anesthesia checkup was done one day prior to the surgery, detailed history of the patient was taking, thorough clinical examination was done, and necessary investigations were sent and reviewed if necessary. Airway assessment was graded by using Modified Mallampati score. Patients were kept nil per oral for 8 hrs prior to the surgery and premedication was given to all patients on the day of surgery. Standard monitoring like ECG, pulse oximeter (SpO2), EtCO2 and non invasive blood pressure were connected. Anesthesia technique was similar for both the groups using propofol, fentanyl, vecuronium, nitrous oxide, oxygen and isoflurane. A 10 cm pillow / head ring was kept under the head to facilitate flexion at the cervical and extension at the atlanto-occipital joint called the sniffing position. Inj glycopyrrolate 0.2 mg, ondansetron 4 mg, midazolam 0.03 mg/kg body weight and fentanyl 1 ug/kg body weight was given as premedication to all patients. All parameters were recorded before induction. General anesthesia was induced after preoxygenation with 100% oxygen for 3 min. with intravenous propofol 2 mg/kg and maintained with 60% N2O, 40% O2 and intravenous vecuronium bromide 0.1 mg/kg as neuromuscular blocking agent. After mask ventilation for 3 minutes, orotracheal intubation was done with McCoy and Macintosh blades in groups A and B respectively. Extent of exposure of the glottis was graded on laryngoscopy according to Cormark and Lehanee’s score and ease of intubation also graded.

The glottis view obtained on laryngoscopy was graded and compared according to Cormark and Lehene grading:
Grade I: glottic view visible fully
Grade II: Only posterior commisure visible
Grade III: Visible only epiglottis
Grade IV: No glottic structure visible

The degree of difficulty with intubation was graded as
Grade I: Intubation easy
Grade II: Intubation requiring an increased anterior lifting force and assistants help to pull the right corner of the mouth to increase the space.
Grade III: Multiple attempts or use of stylet for intubation
Grade IV: Intubation failure with the assigned laryngoscope

The parameters like heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP) and SPO2 were recorded at pre induction, during laryngoscopy & intubation and at 1, 3 and 5 minutes after intubation

Complications during this study like arrhythmias and local injuries, bleeding, regurgitation, laryngospasm and desaturation during laryngoscopy and intubation were noted.

The parameters were recorded and data was entered into Statistical Package for Social Sciences (SPSS 20.0).
Unpaired t test was used for comparing between two groups and paired t test was used for intergroup comparison through graph pad software with quick-calc for statistical analysis.
According to statistical power analysis, to get an 80% power, 24 patients per treatment group were needed to get in detecting a 30% difference between treatment groups with a 5% type 1 error. The study was done on 30 patients in each group and P value less than 0.05 was taken as statistically significant.

Results:

Table 1: Demographic profile of patients

<table>
<thead>
<tr>
<th>Demographic profile</th>
<th>Study group (mean±SD)</th>
<th>Control group (mean±SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>40.7±10.36</td>
<td>38.76</td>
</tr>
<tr>
<td>Male:Female</td>
<td>10:20</td>
<td>13:17</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>65.6±7.32</td>
<td>64.7±7.3</td>
</tr>
<tr>
<td>ASA grade</td>
<td>I/II</td>
<td>I/II</td>
</tr>
<tr>
<td>MP grade</td>
<td>I/II</td>
<td>I/II</td>
</tr>
</tbody>
</table>

In demographic profile both the groups for age, weight, male: female ratio, ASA physical status, Mallampati grades were compared and were not significant statistically.
Both the groups were compared for changes in systolic blood pressure. There was a significant rise in SBP compared to baseline, during laryngoscopy & intubation and at 1 & 3 min after intubation but more rise in group B. There was a 15% rise in DBP compared to baseline in group B and 9.8% rise in group A, which was statistically significant. (p=0.0001). After 5 minutes post intubation, the DBP comparison was statistically insignificant.

**Table 3: Systolic Blood Pressure Comparison**

<table>
<thead>
<tr>
<th>Time interval</th>
<th>Study group (mean±SD)</th>
<th>Control group (mean±SD)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-induction</td>
<td>123.07±7.18</td>
<td>120.73±7.89</td>
<td>0.2177</td>
</tr>
<tr>
<td>During laryngoscopy and intubation</td>
<td>131.07±5.96</td>
<td>138.13±3.67</td>
<td>0.0001</td>
</tr>
<tr>
<td>1 min</td>
<td>131.93±4.88</td>
<td>138±3.67</td>
<td>0.0001</td>
</tr>
<tr>
<td>3 min</td>
<td>128.47±4.83</td>
<td>134.60±4.01</td>
<td>0.0001</td>
</tr>
<tr>
<td>5 min</td>
<td>122.00±4.27</td>
<td>124.00±5.80</td>
<td>0.1337</td>
</tr>
</tbody>
</table>

Both the groups were compared for changes in systolic blood pressure. There was a significant rise in SBP compared to baseline, during laryngoscopy & intubation and at 1 & 3 min after intubation but more rise in group B. There was a 15% rise in DBP compared to baseline in group B and 9.8% rise in group A, which was statistically significant. (p=0.0001). After 5 minutes post intubation, the DBP comparison was statistically insignificant.

**Table 4: Diastolic Blood Pressure Comparison**

<table>
<thead>
<tr>
<th>Time interval</th>
<th>Study group (mean±SD)</th>
<th>Control group (mean±SD)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-induction</td>
<td>71.40±6.06</td>
<td>73.20±4.94</td>
<td>0.2125</td>
</tr>
<tr>
<td>During laryngoscopy and intubation</td>
<td>75.60±5.74</td>
<td>82.40±4.71</td>
<td>0.0001</td>
</tr>
<tr>
<td>1 min</td>
<td>78.13±4.67</td>
<td>84.00±4.46</td>
<td>0.0001</td>
</tr>
<tr>
<td>3 min</td>
<td>75.60±4.12</td>
<td>81.60±4.25</td>
<td>0.0001</td>
</tr>
<tr>
<td>5 min</td>
<td>74.92±4.92</td>
<td>75.93±4.41</td>
<td>0.4105</td>
</tr>
</tbody>
</table>

Both the groups were compared for changes in diastolic blood pressure (DBP). There was a significant rise in DBP compared to baseline, during laryngoscopy & intubation and at 1 & 3 min after intubation but more rise in group B. There was 15% rise in DBP compared to baseline in group B and 9.8% rise in group A, which was statistically significant. (p=0.0001). After 5 minutes post intubation, the DBP comparison was statistically insignificant.

**Table 5: Comparison of Mean Arterial Pressure**

<table>
<thead>
<tr>
<th>Time interval</th>
<th>Study group (mean±SD)</th>
<th>Control group (mean±SD)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-induction</td>
<td>88.63±4.92</td>
<td>89.00±5.32</td>
<td>0.7825</td>
</tr>
<tr>
<td>During laryngoscopy and intubation</td>
<td>94.03±4.69</td>
<td>100.33±4.16</td>
<td>0.0001</td>
</tr>
<tr>
<td>1 min</td>
<td>96.03±3.93</td>
<td>102.07±3.58</td>
<td>0.0001</td>
</tr>
<tr>
<td>3 min</td>
<td>93.27±3.67</td>
<td>99.20±3.71</td>
<td>0.0001</td>
</tr>
<tr>
<td>5 min</td>
<td>90.63±4.21</td>
<td>91.93±4.20</td>
<td>0.2359</td>
</tr>
</tbody>
</table>

Both the groups were compared for changes in mean arterial pressure (MAP). There was a significant rise in MAP compared to baseline during laryngoscopy & intubation and at 1 & 3 min after intubation but more rise in group B. There was 14.6% rise in group B and 9.03% rise in group A. (p=0.0001). After 5 minutes of intubation there were statistically insignificant changes in MAP comparison.

**Table 6: Comparison of Laryngoscopic View**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Laryngoscopic view (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grade I</td>
</tr>
<tr>
<td>Group A</td>
<td>16 (53%)</td>
</tr>
<tr>
<td>Group B</td>
<td>06 (20%)</td>
</tr>
</tbody>
</table>

The glottic view obtained on laryngoscopy was comparable between the two groups. In group A, 53% had grade I and 47% had grade II whereas in group B 20% had grade I, 73% had grade II and 7% had grade III, which is statistically significant. (p value 0.009).

**Table 7: Comparison of Ease of Intubation**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Ease of intubation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
</tr>
<tr>
<td>Group A</td>
<td>23 (77%)</td>
</tr>
<tr>
<td>Group B</td>
<td>11 (37%)</td>
</tr>
</tbody>
</table>

The ease of intubation or degree of difficulty in intubation was comparable between the two groups. In group A, 77% had grade I and 23% had grade II whereas as in group B 37% had grade I and 63% had grade II, which is statistically significant. (P value 0.0018).

Complications during laryngoscopy and intubation like local injury, bleeding, laryngospasm, regurgitation de-saturation and arrhythmias were not seen in either group in our study.
Discussion:
Laryngoscopy and endotracheal intubation during general anesthesia is the most critical event as it may provoke transient and marked sympathetic and sympathoadrenal response and may manifest as tachycardia, hypertension and various dysrhythmias. The principal mechanism for hypertension and tachycardia is the sympathetic response which may be the result of increase in catecholamine activity.

Most of the patients tolerate these changes with out any significant consequences but patients with co morbid diseases may not withstand these responses. Forces exerted by the laryngoscope blades on the base of the tongue are assumed to be a major stimulus for Sympatho-adrenal response. This stress response is due to the stimulation of the supra-glottic region by the laryngoscope blade along with the tracheal tube placement and cuff inflation. So during general anesthesia, these effects must be attenuated as much as possible especially in high risk patients.

Several pharmacological agents have been used both intravenous and topical to attenuate these responses but they have some limitations and side effects. Various modalities like modified instruments and other intubating devices e.g. LMA, also have been tried to attenuate this response to laryngoscopy and endotracheal intubation.

Literature regarding the type of laryngoscope blade and its haemodynamic response to laryngoscopy and intubation are very few. The amount of forces exerted during laryngoscopy and intubation at the base of the tongue is the major mechanical stimulation of stretch receptors present in the respiratory tract. Different types of laryngoscope blades can help in decreasing this response. The McCoy blade with a hinged tip is a modification of Macintosh blade was invented in early 1990 and aimed to attenuate the exaggerated haemodynamic response to laryngoscopy and tracheal intubation.

This study was undertaken to compare the use of McCoy blade laryngoscope with standard Macintosh blade laryngoscope to observe glottic exposure, ease of intubation and hemodynamic changes during laryngoscopy and tracheal intubation. Our study observed better glottic view, ease of intubation and lesser hemodynamic changes with McCoy blade laryngoscope as compared to Macintosh blade laryngoscope. The present study and results were compared with previous studies.

McCoy et al compared HR and BP responses between McCoy and Macintosh blades during laryngoscopy and also measured catecholamine concentrations during the procedure. They observed significant rise in HR and BP in both the groups during laryngoscopy from the baseline but there was no difference in hemodynamic responses between the two groups. This may be because the study included only laryngoscopy but not intubation.

In our study less hemodynamic changes were observed with McCoy blade laryngoscope as compared to Macintosh blade laryngoscope. There was significant rise in HR, SBP, DBP, and MAP in both the groups but observed lesser haemodynamic response with McCoy group. In both the groups the parameters returned to baseline in 5 minutes. These observations were in conjunction with the study of Mukta Jitendra et al. The maximum rise in heart rate compared to baseline seen in our study was 27% in group B as compared to 18% in group A. Both the groups showed a significant rise in Mean arterial pressure compared to baseline during laryngoscopy & intubation, 1 minute, 3 minutes after intubation but more rise in group B. The maximum rise in MAP compared to baseline was 14.6 % in group B as compared to 9.03 % in group A. The parameters returned to baseline in 5 minutes in both the groups. These observations were in concurrence with the study done by Mukta Jitendra et al.

The study done by Mehtab A Haidry observed that hemodynamic changes with the use of McCoy laryngoscope were lesser in magnitude as compared to Macintosh laryngoscope. The rise in the HR was 7.7% in McCoy group whereas 18.7% in Macintosh group. There was a rise in MAP from the baseline of 13.6 % in McCoy group where as 25.7% in Macintosh group. Our study results were in concurrence with the above study.

The glottic view obtained on laryngoscopy in the present study was 53% of grade I and 47% of grade II whereas in group B 20% of grade I, 73% of grade II and 7% of grade III. This was in conjunction with the study done by Zia Arshad et al.

Similarly the results obtained in our study in respect to hemodynamic parameters and glottis view grades were comparable to the study results of Singhal et al.

Conclusion:
Our study concludes that McCoy blade laryngoscope produces significantly lesser marked haemodynamic changes, better glottic view and ease of intubation as compared to Macintosh blade laryngoscope during laryngoscopy and tracheal intubation. So we can consider the use of McCoy blade laryngoscope along with other pharmacological methods to attenuate the pressor response during laryngoscopy and endotracheal intubation more so in high risk patients.

References:


