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Comparison of Hemodynamic Changes after Intubation with Macintosh and McCoy Laryngoscopes–A Randomised Controlled Trial

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ABSTRACT

Objective: To compare hemodynamic changes (systolic blood pressure and pulse) after intubation with Macintosh and McCoy laryngoscopes.

Study Design: Randomised control trial (Clinicaltrials.gov: NCT05133375)

Place and Duration of Study: Combined Military Hospital, Jhelum Pakistan, from Apr to Oct 2021.

Methodology: A group of 272 patients reporting to the operation theatre were selected and divided into Group-A and B using the lottery method. All patients had ASA class I and II score and Mallampati score of I and II with no comorbid conditions. Macintosh laryngoscope was used in Group-A, and McCoy laryngoscope was used in Group-B. Before intubation, systolic blood pressure and pulse were measured, as well as 30 seconds, 2 minutes, and 3 minutes following intubation. In addition, a comparison of both groups regarding systolic blood pressure and pulse was made.

Results: The patients in the study had a mean age of 34.93±9.66 years. The increase (20%) in heart rate was significantly higher in the Macintosh-Group 23(16.9%), than in the McCoy-Group 8(4.4%), (p=0.001), and the 20% increase in systolic pressure was also found to be significantly higher in the Macintosh-Group as compared to the McCoy-Group, 26(19.1%) versus 8(6.6%), (p=0.002).

Conclusion: According to our research, using the McCoy blade is a safer mode of intubation in terms of the hemodynamic response.

Keywords: Endotracheal intubation, Hemodynamics, Laryngoscopes

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INTRODUCTION

Laryngoscopy and intubation is the basic skill to be mastered by an anaesthetist. Laryngeal mask airway and i-gel have been introduced to avoid intubation.[1] Despite these innovations, intubation remains the safest method of protecting the airway, especially to prevent aspiration during mechanical ventilation.[2]

Different types of laryngoscopes are available. Macintosh and McCoy are the most widely available among these. Macintosh was introduced by Sir Robert Macintosh in 1943, and it became quite popular afterwards due to its easy use. It is the one having a gently curved blade.[3]

McCoy was introduced much later in 1993 by McCoy and Mira Khaur.[4] It is the one having a hinge on the tip. Despite being very easy to use, it still needs to be widely available due to reluctance and a habit of using it only for difficult intubation. No matter what type of laryngoscope is used, it is still associated with stress responses like increased heart rate, blood pressure and sometimes arrhythmias and asystole in patients.[5] These hemodynamic changes occur due to force applied to the epiglottis by the laryngoscope blade.[6]

Hemodynamic responses to laryngoscopy and intubation are related to increased catecholamine levels released by the hypothalamic-pituitary axis.[7] This variation in catecholamines level can depict various signs ranging from tachycardia and increased blood pressure to dysrhythmias and even life-threatening arrhythmias.[8] Different pharmacological agents have been studied widely for attenuating the stress response of laryngoscopy and intubation, especially opioids like fentanyl.[9,10]

In this study, we have tried determining which laryngoscope amongst Macintosh and McCoy causes less hemodynamic variation during and immediately after intubation.

METHODOLOGY

In Combined Military Hospital, Jhelum Pakistan, this randomised control trial was conducted from April to October 2021. Approval was taken from the Ethical Committee (IRB No. 01/21), and the trial was

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registered at Clinicaltrials.gov with the clinical trial number: NCT05133375. Using the World Health Organization calculator, the sample size was calculated.[11]

Inclusion Criteria: Patients aged 17 to 60 years, of either gender, having ASA Class I and II and Mallampati score of I and II, with no known comorbid conditions, were included in the study.

Exclusion Criteria: Pregnant females and those patients having some cervical instability, less than 6 cm thyromental distance and those in which intubation and laryngoscopy took more than 30 seconds were excluded from the study.

Using the lottery method, two hundred seventy-two patients were randomly selected and segregated into two equal groups. In Group-A, a Macintosh laryngoscope was used for intubation, and in Group-B, a McCoy laryngoscope was used. Before reporting in the surgical theatre, a detailed pre-anaesthetic evaluation and assessment were performed on all patients, and all necessary laboratory investigations were collected. On the OT table, pulse and systolic blood pressure were checked by a non-invasive method. 18G cannula was passed, and ECG was attached. A pillow was placed under the head to obtain a classical sniffing position for intubation. All patients were pre-treated with 0.08mg/kg Midazolam injection, 0.1mg/kg Nalbuphine injection, 0.08mg/kg Dexamethasone injection and 0.1mg/kg Metoclopramide injection.

Preoxygenation was done with 100% oxygen for 3-min. Induction was done with Propofol 2mg/kg injection, and muscle relaxation was achieved with Atracurium 0.5mg/kg injection. Laryngoscopy was started 3-min later by a qualified anesthesiologist and intubated within 30-sec. Pulse and systolic blood pressure were recorded with non-invasive measures before laryngoscopy and 30-sec, 2 and 3-min after intubation.

Data were analysed using the Statistical Package for Social Sciences (SPSS) version 21.0. Quantitative variables were measured in terms of mean and standard deviation. In addition, qualitative variables like gender, American Society of Anesthesiologists score, Mallampti, and increase in pulse and systolic blood pressure were measured in terms of frequency and percentages. Chi-square test and Independent sample t-test was applied to find the mean differences among the groups. The *p*-value of ≤0.05 was considered statistically significant.

RESULTS

In our study, 272 patients were divided randomly into two groups. Group-A included patients intubated with Macintosh laryngoscope; in Group-B, McCoy laryngoscope was used for intubation. The mean pulse rate in Group-A (Macintosh-Group) was 83.8±13.23, and in Group-B (McCoy-Group) was 83.83±12.13, while the mean blood pressure in Group-A (Macintosh -Group) was 123.54±12.71 and in Group-B (McCoy-Group) was 126.79±10.89 (Table-I).

Table-I: Descriptive Statistics of Patients' Characteristics (n=272)

Characteristics	Group-A n=136	Group-B n=136	All n=272
	Mean±Standard Deviation		
Age (Years)	34.18±9.30	35.68±9.99	34.93±9.66
Weight (kg)	62.76±11.184	66.10±10.942	64.42±11.16
Height (cm)	162±9	163.2±8.60	162.61±8.808
Pulse Rate	83.8±13.23	83.83±12.13	24.39±3.98
Systolic Blood Pressure (mmHg)	123.54±12.71	126.79±10.89	83.81±12.67

In this study, the increase (20%) in heart rate was significantly higher in the Macintosh-Group 23(16.9%) than in the McCoy-Group 8(4.4%),(*p*=0.001), and the 20% increase in systolic pressure was also found to be significantly higher in the Macintosh-Group as compared to the McCoy-Group 26(19.1%) versus 8(6.6%), (*p*=0.002) as shown in Tables II and III, respectively.

Table-II: Comparison of Increase Pulse Rate between Study Groups (n=272)

20% Increase Pulse Rate from Baseline	Group-A n(%)	Group-B n(%)	*p*-value
Yes	23(16.9%)	8(4.4%)	0.001
No	113(83.1%)	130(95.6%)	

Table-III: Comparison of Increase Systolic Blood Pressure between Study Groups (n=272)

Increase 20% Systolic BP from Baseline	Group-A n(%)	Group-B n(%)	*p*-value
Yes	26(19.1%)	8(6.6%)	0.002
No	110(80.9%)	127(93.4%)	

DISCUSSION

The McCoy laryngoscope has four qualities that differentiate it from Macintosh. It has a hinged tip, a lever at the proximal end, a spring-loaded drum and a connecting shaft. Due to this unique design, lifting the epiglottis is easy. It is a known fact that the amount of force required to lift the epiglottis is directly responsible for stimulating the stretch receptors in the

airway, thus determining the patient's stress response. Different studies have been conducted in this regard.[11]

An old study conducted by McCoy *et al.* found that laryngoscopy with McCoy causes less stress response than Macintosh. Nor were adrenaline levels measured in this study. The limitation of this study was that they did not intubate the patient, and the sample size was small.[12] A study conducted on neurosurgical patients found that when fentanyl is used, there is no difference in hemodynamic parameters with either type of laryngoscope; however, when opioids are not used, Macintosh causes a significant stress response.[13] A study by Buhari *et al.* also concluded that McCoy produces far fewer hemodynamic changes than Macintosh as laryngoscopy with the former required 10.1 N, contrary to 18.1 N required with the latter.[14] A study comparing Macintosh, McCoy, and C-MAC found that hemodynamic changes are far less with McCoy. However, C-MAC gives a better laryngoscopic view.[15] A study conducted by Haidry and Khan found that by using a Macintosh laryngoscope, heart rate increased by 18.7% and by using a McCoy laryngoscope, heart rate increased by 7.7%. Similarly, with the Macintosh laryngoscope, systolic blood pressure increased by 22.9% and with the McCoy laryngoscope, systolic blood pressure increased by 10.3%. The difference was significant, with a *p*-value of less than 0.0001 between these two groups.[16] A 2018 study conducted by Bansal *et al.* also showed similar results. [17] Contrary to the studies mentioned above, a European study conducted found no difference in stress responses between Macintosh and McCoy.[18]

In our study, we have found that McCoy laryngoscope caused fewer hemodynamic changes as compared to Macintosh laryngoscope during laryngoscopy and intubation. Contrary to popular belief of using McCoy only for difficult intubation, we have also used it for easy intubations to compare its hemodynamic effects against Macintosh laryngoscope. We recommend that further studies be done to support our evidence.

STUDY LIMITATIONS

The non-invasive measurement of blood pressure was one of our study's shortcomings. However, utilising invasive techniques in the generally healthy ASA I and II patients needed to be justifiable.

CONCLUSION

Regarding the hemodynamic response, using the McCoy blade has proven to be a safe and reliable intubation technique.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MAQ & SN: Data acquisition, data analysis, drafting the manuscript, critical review, approval of the final version to be published.

FA & TM: Data interpretation, approval of the final version to be published.

MA & SN: Conception, study design, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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