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# Comparison of stress responses to laryngoscopy between Macintosh and McCoy laryngoscope

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## Abstract

**Introduction:** Laryngoscopy involves opening the mouth, inserting a laryngoscope blade, positioning the blade's tip to visualize the glottis, and applying a controlled lifting force to expose the vocal cords. This enables the insertion of a tracheal tube through the vocal cords into the trachea, ensuring airway patency and facilitating ventilation. This technique is a noxious stimulus triggering adverse response in the cardiovascular, respiratory and other physiological systems. This study aims to compare stress responses to laryngoscopy using the Macintosh and McCoy laryngoscope.

**Method:** In this prospective comparative study, 70 patients were enrolled with 35 in each group i.e. group A (McCoy) and group B (Macintosh), belonging to ASA-PS I and II, 18 to 65 years old, undergoing general anesthesia with endotracheal intubation. The hemodynamic parameters (HR, SBP, DBP and MAP) were observed and compared between two groups.

**Result:** There were significant hemodynamic changes in heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were observed in both the groups following laryngoscopy. The statistically significant changes in heart rate were noted immediately after laryngoscopy (T0) and at 1 minute (T1), 3 minutes (T3), and 5 minutes (T5) post-laryngoscopy. For SBP and DBP, significant differences were observed at T3 and T5, while MAP showed statistical significance at T1, T3, and T5.

**Conclusion:** The McCoy laryngoscope demonstrated a significantly lower hemodynamic stress response compared to the Macintosh laryngoscope, suggesting it may be more advantageous in minimizing cardiovascular fluctuations during laryngoscopy and intubation.

**Keywords:** Hemodynamic Response; Intubation; Laryngoscopy; McCoy Laryngoscope; Macintosh Laryngoscope



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## Introduction

Laryngoscopy involves opening the mouth, inserting and positioning the blade, lifting to expose the glottis, and placing the tracheal tube. The forces exerted by the laryngoscope blade on the base of the tongue while lifting the epiglottis cause cardiovascular changes.[1–9] These pathophysiological effects include raised blood pressure , tachycardia, hypoxia, hypercarbia, laryngospasm, bronchospasm, and raised intracranial pressure, among others.[4,5] The plasma catecholamine levels show a rise in noradrenaline after laryngoscopy, confirming a sympathetic response.[6,7]

Two blades, i.e. Macintosh (curved) and Miller (straight), are commonly used. The McCoy blade is a modification of the Macintosh blade, introduced in 1993. It has a handle and a levering blade that helps lift the epiglottis with minimal or no force, and it has a hinge on the tip to avoid lifting force in the vallecula[10-11], Figure 1. For patients with comorbidities like hypertension, diabetes, coronary artery disease, raised intracranial pressure, etc., laryngoscopy must be quick and smooth; otherwise will lead to increased stress responses.[3,5–8,12]

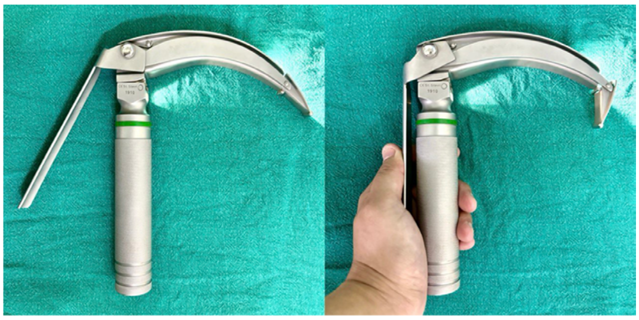

**Figure 1. McCoy laryngoscope where its hinged tip is elevated by a lever in the handle**

Many studies have been conducted to decrease the stress responses related to laryngoscopy and intubation, like the use of different drugs like lidocaine, fentanyl, esmolol, gabapentin, dexmedetomidine, etc.[13-17] These may not be practical for us in every setting, so using laryngoscope blades to reduce stress responses would easier option and affordable.

This study aims to identify which laryngoscopic blade minimizes physiological stress, potentially leading to improved patient outcomes.

## Method

This is a prospective cross-sectional study conducted in Patan Hospital, Lalitpur, Nepal, after the approval of the Institutional Review Committee (IRC), Patan Academy of Health Science (PAHS) (Ref: PMA2304181716). The study was commenced for a total duration of 1 year, i.e., from 2023 Jun to 2024 Jun. With ethical approval, all verbal and informed consent were taken from all the participants.

The sample size was determined based on an Indian reference study, which established a requirement of participants per group.[8] We included 70 participants with American Society of Anesthesiologists-Physical Status (ASA-PS) of grade I and II, aged 18-65 years, Mallampati grading of I and II, posted for elective surgery under general anesthesia under endotracheal intubation. Patients with DM or HTN, coronary artery disease, raised ICP, BMI >40 kg/m2, cervical spine fractures or tumors, restricted cervical spine mobility, laryngeal mass or tumor, pregnant women and those requiring external laryngeal manipulation were all excluded from the study. The participants who required more than one laryngoscopy were also excluded. The participants were randomly allocated into two groups, namely Group A (n=35, laryngoscopy with McCoy) and Group B (n=35, laryngoscopy with Macintosh).

Pre-anesthetic evaluation was done a day before surgery, and written consent was taken. The laryngoscopic blades were assigned randomly using a convenience sampling method; the first case was assigned the McCoy blade, followed by the Macintosh blade, and subsequently on the day of surgery. Enrollment of the participants was done alternatively until the desired sample size was collected. All the procedures were done by anesthesiologists. The cuffed endotracheal tubes of 7.5 mm Internal Diameter (ID) in males and 7 mm ID in females were used. The standard monitors were attached; intravenous access was secured with 18G cannula and Ringer's lactate solution was started slowly. A doughnut-shaped pillow (5 cm) was placed under the head to achieve the sniffing position. Baseline vital parameters such as heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were noted. The patient was preoxygenated with 100% oxygen for 3 minutes and pre-medicated with an injection of midazolam (2 mg) and fentanyl (2 µg/kg) for analgesia. Induction was carried out with a titrated dose of propofol (1-2 mg/kg) till loss of verbal response. After ensuring adequate bag and mask ventilation, rocuronium (0.6 mg/kg) was administered. Laryngoscopy and endotracheal tube insertion were performed 1.5 minutes after the muscle relaxant was given by the anesthesiologists, and intubation with an appropriate sized ET was done. Maintenance of anesthesia was managed with oxygen, isoflurane (1.2 MAC), and intermittent positive pressure ventilation. Hemodynamic parameters, including systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and heart rate (HR), were recorded at baseline (TB), pre-induction in the operating theatre, before laryngoscope insertion then immediately after endotracheal tube insertion (T0), and subsequently at 1 minute (T1), 3 minutes

(T3), and 5 minutes (T5) post-intubation.

The data were managed and analyzed using Epi Info version 7.2.2.2. The descriptive variables were summarized using frequencies and percentages. For categorical comparisons between the McCoy and Macintosh groups, the Chi-square test was employed to analyze variables such as sex, ASA-PS classification, mouth opening, and thyromental distance (TMD). The independent t-test was used to compare continuous variables, including age, Body Mass Index (BMI), Endotracheal Tube (ETT) size, and baseline hemodynamic parameters between the two groups. The level of significance (α) was set at (95% confidence), with a p-value <0.05 considered statistically significant.

## Result

A total of 70 participants were enrolled in this study, with 35 patients each in Group A (McCoy) and Group B (Macintosh). Both groups were comparable with respect to demographic and anatomical characteristics, including sex distribution, ASA physical status classification, mouth opening, thyromental distance (TMD), endotracheal tube (ETT) size, age, and BMI, with no statistically significant differences observed, Table 1.

**Table 1. Comparison of the sex, ASA-PS, mouth opening, TMD, size ET, age and BMI between in both the groups (N=70)**

| Parameters | McCoy | Macintosh | p-value |
|---|---|---|---|
| Female (F) | 19 | 18 | 1 |
| Male (M) | 16 | 17 | |
| ASA-PS I | 22 | 23 | 1 |
| ASA-PS II | 13 | 12 | |
| Mouth opening >3 Fingers | 15 | 20 | 0.1503 |
| Mouth opening = 3 Fingers | 22 | 13 | |
| TMD > 6 cm | 23 | 28 | 0.2823 |
| TMD = 6 cm | 12 | 7 | |
| Size of ETT 7 mm | 19 | 18 | 1 |
| Size of ETT 7.5 mm | 16 | 17 | |
| Age | 35.4±5.2 | 34.2±4.8 | 0.712 |
| BMI | 24.1±3.3 | 22.9 ±2.6 | 0.081 |

The hemodynamic parameters were assessed at various time intervals following laryngoscopy and intubation. The mean heart rate (HR) at T0 was significantly lower in the McCoy group (85.86±8.98) compared to the Macintosh group (93.74±11.51). This trend continued at T1, T3, and T5, with significantly lower HR observed in the McCoy group at each time point, particularly at T3 (77.14±6.50 vs 88.86±8.47) and T5 (76.57±7.79 vs 85.51±8.89), Table 2.

Similarly, systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were consistently lower in the McCoy group at key time points. At T1, the McCoy group had a significantly

**Table 2. Comparison of mean heart rate between two groups (N=70)**

| Parameters | McCoy (Mean±SD) | Macintosh (Mean±SD) | p-value |
|---|---|---|---|
| HR Baseline | 80.83±11.96 | 84.14±14.42 | 0.299 |
| HR Pre-Induction | 83.11±10.71 | 84.49±9.93 | 0.58 |
| HR Before Laryngoscopy | 83.57±12.66 | 84.11±12.54 | 0.857 |
| HR T0 | 85.86±8.98 | 93.74±11.51 | 0.001 |
| HR T1 | 85.00±6.46 | 92.31±9.43 | 0.0003 |
| HR T3 | 77.14±6.50 | 77.14±6.50 | <0.001 |
| HR T5 | 76.57±7.79 | 85.51±8.89 | 0.0003 |

lower SBP (121.97±14.78) compared to the Macintosh group (133.49±15.92; p<0.0004). Significant differences in SBP persisted at T3 and T5, Table 3.

**Table 3. Comparison of mean systolic blood pressure between two groups (N=70)**

| Parameters | McCoy (Mean±SD) | Macintosh (Mean±SD) | p-value |
|---|---|---|---|
| SBP Baseline | 132.40±15.89 | 131.14±16.42 | 0.6416 |
| SBP Pre-Induction | 125.57±15.61 | 128.09±16.27 | 0.2239 |
| SBP Before Laryngoscopy | 128.63±15.53 | 131.09±15.57 | 0.3629 |
| SBP T0 | 132.29±16.31 | 138.29±16.44 | 0.09252 |
| SBP T1 | 121.97±14.78 | 133.49±15.92 | 0.00043 |
| SBP T3 | 114.34±15.10 | 132.71±15.85 | <0.001 |
| SBP T5 | 111.63±15.09 | 128.03±16.41 | <0.001 |

The McCoy group also demonstrated lower DBP at T3 (72.49±8.91 vs 82.94±10.56; p<0.0001) and T5 (65.29±10.62 vs 75.69±11.31; p<0.0001), Table 4.

**Table 4. Comparison of mean diastolic blood pressure between two groups (N=70)**

| Parameters | McCoy (Mean±SD) | Macintosh (Mean±SD) | p-value |
|---|---|---|---|
| DBP Baseline | 84.54±11.11 | 81.23±9.46 | 0.09327 |
| DBP Pre-Induction | 75.26±8.50 | 75.29±8.99 | 0.9825 |
| DBP Before Laryngoscopy | 84.06±9.77 | 82.89±8.92 | 0.5897 |
| DBP T0 | 86.00±12.42 | 88.74±10.95 | 0.4788 |
| DBP T1 | 80.34±10.36 | 76.83±8.50 | 0.2168 |
| DBP T3 | 72.49±8.91 | 82.94±10.56 | <0.001 |
| DBP T5 | 65.29±10.62 | 75.69±11.31 | <0.001 |

The Mean Arterial Pressure (MAP) values were likewise significantly lower in the McCoy group at T1 (90.97±11.54 vs 98.50±11.57; p<0.0005), T3 (86.96±11.23 vs 98.21±12.65; p<0.0001), and T5 (79.78±11.87 vs 92.85±13.24; p<0.0001), Table 5.

**Table 5. Comparison of mean arterial pressure between two groups (N=70)**

| Parameters | McCoy (Mean±SD) | Macintosh (Mean±SD) | p-value |
|---|---|---|---|
| MAP Baseline | 101.51±13.75 | 99.73±12.87 | 0.4699 |
| MAP Pre-Induction | 93.71±12.43 | 95.08±12.01 | 0.6812 |
| MAP Before Laryngoscopy | 99.35±12.20 | 99.38±11.32 | 0.9799 |
| MAP T0 | 100.97±13.28 | 105.14±12.76 | 0.1857 |
| MAP T1 | 90.97±11.54 | 98.50±11.57 | 0.00051 |
| MAP T3 | 86.96±11.23 | 98.21±12.65 | 3.6E-06 |
| MAP T5 | 79.78±11.87 | 92.85±13.24 | 0.00015 |

## Discussion

The key findings of this study indicate that the McCoy laryngoscope blade is associated with significantly lower hemodynamic responses during laryngoscopy and intubation compared to the Macintosh blade. Specifically, patients in the McCoy group exhibited consistently lower mean heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) at multiple time points (T1, T3, and T5) post-intubation. These results suggest that the use of the McCoy blade may attenuate the sympathetic response typically triggered during laryngoscopy and intubation, contributing to better cardiovascular stability.

This study found statistically significant differences in HR at baseline (T0), which were sustained through T1, T3, and T5, with consistently lower HR values in the McCoy group. This contrasts with the findings of similar studies performed in Belfast and Seoul, where no significant hemodynamic differences between the McCoy and Macintosh blades were reported.[19,20] However, their studies excluded intubation and focused solely on laryngoscopy, which may have underestimated the full sympathetic response, and also their limited sample sizes and shorter observation periods may account for the differences in findings.

In the study performed in India, intraocular pressure (IOP) and hemodynamic parameters were measured at different time points, and the McCoy laryngoscope showed a smaller rise in both IOP and hemodynamic values compared to the Macintosh blade.[5] Similarly, another study in Jaipur, India, compared the hemodynamic response of Macintosh, McCoy, and Miller blades and found that the McCoy blade caused the least changes.[21] These findings are consistent with this study.

Likewise, the studies in various places of India have found the potential benefit of using the McCoy blade of having less hemodynamic changes compared to the Macintosh blade.[1,8,22]

While several previous studies reported comparable stress responses between different laryngoscope blades, some did observe variations, with the McCoy blade occasionally associated with reduced hemodynamic changes—though not always reaching statistical significance. This study adds meaningful evidence to this ongoing discussion by demonstrating a clear and consistent reduction in stress responses with the use of the McCoy blade. These findings support the effectiveness of the McCoy laryngoscope in minimizing the sympathetic stimulation associated with laryngoscopy and intubation, particularly in patients where cardiovascular stability is crucial.

There are several limitations to this study. Firstly, it is not able to blind the anesthesiologist to the blade being used, which may introduce bias in technique and assessment. The technique of laryngoscopy and intubation could also vary based on the anesthesiologist's experience, potentially affecting the outcomes. Additionally, the utilization of invasive parameters for measuring hemodynamic data was not carried out, which might have provided more accurate information. Moreover, the duration of laryngoscopy and intubation was not recorded, which could have offered valuable insights into the procedural efficiency and its impact on hemodynamic changes.

## Conclusion

McCoy laryngoscope blade uses during laryngoscopy results in a lesser impact on hemodynamic parameters such as heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure. The McCoy blade proved to be both clinically and statistically more effective in attenuating the stress response associated with laryngoscopy compared to the Macintosh blade. This suggests that the McCoy blade may be preferable for minimizing hemodynamic disturbances during the intubation process.

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## Conflict of Interest

None

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None

## Author Contribution

Concept, design, planning: LB, KMG, MBC, MP; Literature review: LB, MBC, MP; Data collection/analysis; LB, KMG; Draft manuscript: LB, KMG, MBC, MP; Revision of draft: LB, KMG, MBC, MP; Final manuscript: LB, KMG, MBC, MP; Accountability of the work: LB, KMG, MBC, MP.

## References

1. Haidry MA, Khan FA. Comparison of hemodynamic response to tracheal intubation with Macintosh and McCoy laryngoscopes. Journal of Anaesthesiology Clinical Pharmacology. 2013 Apr 1;29(2):196-9. DOI
2. Joshi P, Sigdel S, Bhattarai AS, Pradhan B. Hemodynamic Responses to laryngoscopy and intubation: Comparison between Macintosh and McCoy laryngoscope. Medical Journal of Shree Birendra Hospital. 2022 Jul 7;21(1):74-80. DOI
3. Varsha AV, George G, Pillai R, Sahajanandan R. Comparative evaluation of hemodynamic responses and ease of intubation with airtraq video laryngoscope versus macintosh laryngoscope in patients with ischemic heart disease. Annals of Cardiac Anaesthesia. 2019 Oct 1;22(4):365-71. DOI

4. Takeshima K, Noda K, Higaki M. Cardiovascular response to rapid anaethesiainduction and endotracheal intubation. Anaethesia& Analgesia. 1964 Mar 1;43(2):201-8. PubMed
5. Singhal S, Saharan N, Raghove P. Intraocular pressure changes following laryngoscopy and intubation-McCoy versus Macintosh laryngoscope. Sri Lankan Journal of Anaesthesiology. 2012;20(2):73-7. DOI
6. Prys-Roberts C, Greene LT, Meloche R, Foex P. Studies of anaesthesia in relation to hypertension II: haemodynamic consequences of induction and endotracheal intubation. British Journal of Anaesthesia. 1971 Jun 1;43(6):531-47. DOI
7. Low JM, Harvey JT, Prys-Roberts C, Dagnino J. Studies of anaesthesia in relation to hypertension: VII: Adrenergic responses to laryngoscopy. British Journal of Anaesthesia. 1986 May 1;58(5):471-7. DOI
8. Paul A, Nathroy A. Comparison of hemodynamic changes during laryngoscopy with McCoy and Macintosh laryngoscopes. Journal of Health Research and Reviews (In Developing Countries). 2017 Jan 1;4(1):35-9. DOI
9. Bucx MJ, Scheck PA, Van Geel RT, Den Ouden AH, Niesing R. Measurement of forces during laryngoscopy. Anaesthesia. 1992 Apr;47(4):348-51. DOI
10. Uchida T, Hikawa Y, Saito Y, Yasuda K. The McCoy levering laryngoscope in patients with limited neck extension. Canadian Journal of Anaesthesia. 1997 Jun;44:674-6. DOI
11. McCoy EP, Mirakhur RK. The levering laryngoscope. Anaesthesia. 1993 Jun;48(6):516-9. DOI
12. Tewari P, Gupta D, Kumar A, Singh U. Opioid sparing during endotracheal intubation using McCoy laryngoscope in neurosurgical patients: the comparison of haemodynamic changes with Macintosh blade in a randomized trial. Journal of postgraduate medicine. 2005 Oct 1;51(4):260-4. PubMed
13. Hashemian AM, Doloo HZ, Saadatfar M, Moallem R, Moradifar M, Faramarzi R, et al. Effects of intravenous administration of fentanyl and lidocaine on hemodynamic responses following endotracheal intubation. The American journal of emergency medicine. 2018 Feb 1;36(2):197-201. DOI
14. Teong CY, Huang CC, Sun FJ. The haemodynamic response to endotracheal intubation at different time of fentanyl given during induction: a randomised controlled trial. Scientific reports. 2020 Jun 1;10(1):8829. DOI
15. Figueredo E, Garcia-Fuentes EM. Assessment of the efficacy of esmolol on the haemodynamic changes induced by laryngoscopy and tracheal intubation: a meta-analysis. Acta Anaesthesiologica Scandinavica. 2001 Sep;45(8):1011-22. DOI
16. Bala I, Bharti N, Ramesh NP. Effect of gabapentin pretreatment on the hemodynamic response to laryngoscopy and tracheal intubation in treated hypertensive patients. Acta Anaesthesiologica Taiwanica. 2015 Sep 1;53(3):95-8. DOI
17. De Cassai A, Boscolo A, Geraldini F, Zarantonello F, Pettenuzzo T, et al. Effect of dexmedetomidine on hemodynamic responses to tracheal intubation: A meta-analysis with meta-regression and trial sequential analysis. Journal of clinical anesthesia. 2021 Sep 1;72:110287. DOI
18. Evans A, Vaughan RS, Hall JE, Mecklenburgh J, Wilkes AR. A comparison of the forces exerted during laryngoscopy using disposable and non-disposable laryngoscope blades. Anaesthesia. 2003 Sep;58(9):869-73. DOI
19. McCoy EP, Mirakhur RK, McCloskey BV. A comparison of the stress response to laryngoscopy: The Macintosh versus the McCoy blade. Anaesthesia. 1995 Nov;50(11):943-6. DOI
20. Han TS, Kim J, Park NG, Lee SM, Cho HS, Chung IS. A Comparison of the Effects of Different Types of Laryngoscope on Hemodynamics: McCoy Versus the Macintosh Blade. Korean Journal of Anaethesiology. 1999 Sep 1;37(3):398-401. DOI
21. Dwivedi G, Gupta L. A comparative study of laryngeal view and pressor response by using three different blades-Macintosh, miller and Mccoy laryngoscopes. Indian Journal of Clinical Anaesthesia. 2018 Oct;5(4):569-75. DOI
22. Godbole MR, Saundattikar G. A prospective randomized control trial-Comparison of hemodynamic response to laryngoscopy and intubation–Macintosh versus McCoy blade. Indian Journal of Clinical Anaesthesia. 2018 Jan;5(1):110-3. DOI