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**Research Article**

# Stress response to laryngoscopy and ease of intubation:comparison between macintosh and (levering) mccoys type laryngoscope

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## ABSTRACT

**Background:** Laryngoscopy and intubation is known to cause exaggerated hemodynamic response and increased intracranial pressure. The aim of the study was to compare the hemodynamic response following intubation with mccoys and macintosh blades, to evaluate intubating conditions and to evaluate glottic view during laryngoscopy.
**Methods:** It is a prospective, comparative stody. 100 patients were taken as sample size. Patients undergoing various surgery of age group 20-50 years of both sexes with ASA 1 and ASA 2 were chosen. For odd number patients mccoy laryngoscope blade was used whereas for even number patients macintosh laryngoscope blade for orotracheal intubation. After induction and neuromuscular blockade preintubation pulse and blood pressure was recorded. Orotracheal intubation was attempted at this stage using laryngoscope blade assigned to respective group. Pulse and blood pressure was recorded while the blade was being inserted in vallecula. Similar pulse and blood pressure was taken at 1 minute, 3 minute and 10 minute after laryngoscopy. Ease of intubation was noted by knowing total time required for intubation , need for burp maneuver and occurrence of any complication.
**Results:** Both groups were comparable in terms of age, sex, ASA grade, mallampatti grade. At 3 minutes pulse, systolic and diastolic blood pressures were significantly high with macintosh group as compared to mccoys group. Regarding ease of intubation, it was found that time required for laryngoscopy was significantly longer with the use of macintosh blade as compared to mccoys blade. 34% of patients with macintosh blade required burp manuver as compared to none with mccoys blade. There was no complication with mccoys blade.
**Conclusions:** Less hemodynamic changes was associated with use of mccoys blade. Intubating conditions were better with mccoys blade group as compared with macintosh group.

**Keywords:** Macintosh, Mccoys, Laryncoscopy, Pulse, blood pressure, Ease of intubation

## INTRODUCTION

Sterss response with laryngoscopy is an important concern for anaesthesiologist. Laryngoscopy and intubation is known to cause exaggerated hemodynamic response and increased intracranial pressure. This response manifest as tachycareia, hypertension and dysrhythmias and it may have deleterious respiratory, neurological and cardiovascular effects. Macintosh blade is the most durable and most successful blade in the history of anaesthesia till the date. The curvature of the blade allows tip to fall naturally into position in vallecula and wide flenge assists in holding the tongue safely a side during intubation. The Mccoys blade is based on standard Macintosh blade invented in 1990.[1] It has hinged tip that is operated by the lever mechanism on the back of handle. It act on hypoepiglottis ligament and allows elevation of epiglottis. Keeping above things in mind

present study was undertaken to evaluate the hemodynamic response to laryngoscopy, time for laryngoscopy, need of burp manuver and use of stylet, incidence of complication has been noted and compared between two blades.

***Anatomy of larynx***

The larynx is a cartilaginous skeleton held together by ligaments and muscles. The larynx is composed of nine cartilages, three paired and three unpaired. The three unpaired cartilage are thyroid, crocoid and epiglottis. The paired cartilages are arytenoids, corniculate, and cuneiform. Laryngeal cavity extends from epiglottis to subglottis.

***Skeleton***

*Thyroid cartilage*: It provides anterior attachment of vocal cords and posterior articulation with cricoid cartilage.

*Cricoid cartilage*: It is complete ring and articulates with thyroid and aeytenoids cartilages.

*Epiglottis:* It is a tongue shaped fibrous cartilage. Its mucous membrane reflects as glossoepiglottic fold. Valleculas are there on either side of fold.

***Divisions***

*Supraglottis*: It is covered with respiratory epithelium containing mucous gland.

*Epiglottis:* It is a leaf shaped mucosal covered cartilage.

*Aryepiglottic folds:* Extends from the lateral epiglottis to the arytenoids.

*False vocal cords:* Are mucosal superior to the true glottis, separated from true vocal folds by the ventricle.

*Glottis:* The true vocal folds attach to thyroid cartilage at the anterior commissure. The posterior commissure is mobile, as the vocal folds attach to arytenoids. Motion of arytenoids effects abduction or adduction of larynx.

*Subglottis:* It is the region below the vocal folds, extending to the inferior border of the cricoid cartilage.

***Innervation***

*Superior laryngeal nerve:* It provides sensory supply to glottis and supraglottis. It provides motor fibers to the cricothyroid muscle, which tenses the vocal cords.

*Recurrent laryngeal nerve:* It provides sensation to subglottis motor fibers to intrinsic muscles of larynx.

***Blood supply***

*Superior laryngeal artery*: It is a branch of superior thyroid artery.

*Inferior laryngeal artery:* It is a branch of inferior thyroid artery of thyrocervical trunk, which is a branch of subclavian artery.

***Physiology of laryngeal response***

The pressor response to the laryngoscopy and tracheal intubation is known to be a sympathetic response provoked by stimulation of the epipharynx and larynx. The largest reflex increase in blood pressure was evoked from the epipharyngeal region and the smallest from tracheobronchial tree.

The response is also dependent on the type of blade used and is initiated by the laryngoscope blade pressing on the base of the tongue or by lifting of the epiglottis. The hemodynamic changes in rise in blood pressure are difficult to analyse. The increase in cardiac rate is probably the result of cardio acceleratory action which is more marked with only laryngoscopy. Hence the heart rate does not decrease inspite of increase of blood pressure.

The effect of stimulation at different sites in the respiratory tract on systemic blood pressure was studied in paralysed cat by Tomori et al. They were statistically significant for epipharyngeal and laryngeal stimulation. Russel WJ et al reported that during intubation, blood pressure and noradrenaline levels in the blood were much increased but plasma adrenaline and dopamine levels did not change.

It was concluded by Reid et al that cardiac reflex could originate in the tracheobronchial tree or larynx and effect a response by sudden increase in vagal tone since both afferent and efferent path of reflex were assumed to be vagal in origin. The vagus is sensory nerve to the root of tongue, epiglottis and trachea. It forms the afferent arm of reflex arch.

## METHODS

Prospective, comparative study was done on 100 patients.

***Inclusion criteria***

Patient undergoing various surgeries requiring general anaesthesia. Included age group was 20-50 years. ASA 1 and 2.

***Exclusion criteria***

- Patients with difficult mask ventilation and anticipated difficult intubation.

- Patients with pathology in neck, upper respiratory tract and upper elementary tract.
- Patients with morbid obesity.
- Pregnant and lactating females.
- Patients with ASA 3 or more.
- Patient not willing to partipicate in study.

***Sampling method***

For odd numbered patients mccoy laryngoscope blade was used whereas for even numbered patients macintosh laryngoscope blade was used for orotracheal intubation.

***Methodology***

Hundred consecutive patients undergoing surgical procedure under general anaesthesia meeting the inclusion criteria were enrolled in the study. Peranaesthetic checkup was done by the principal investigator on the day prior to surgery. Detailed history and clinical examination was performed in all patients. Informed vallied and written consent was taken. On the day of surgery once the patient was on the operation table pulse oximeter and electrocardiography leads were attached and automated non-invasive blood pressure moniter was attached. Intravenous line for fluid administration was secured.

Patient premedicated with injection glycopyrrolate 0.2 mg, injection fentnyl citrate 2 mcg/kg and injection midazolam 0.04 mg/kg. Preoxygenated with 100% $O_2$ for 3 minutes. Preinduction pulse and blood pressure were recorded and these formed the baseline pulse and blood pressure. Anaesthesia induced with injection propofol 2mg/kg in graded doses till centralisition of eyeballs. Neuromuscular blockade was achieved with injection vecuronium 0.1 mg/kg. Preintubation pulse and blood pressure were recorded. Orotracheal intubation was attempted at this stage using the laryngoscopy blade assigned to respective group.

Extent of exposure of glottis noted on laryngoscopy was graded accordingly to Cormack and Lehanne score. Grade 1 and 2 were considered as adequate exposure and grade 3 and 4 were considered as indicative of difficult intubation. Pulse and blood pressure was taken while the blade was inserted in vallecula, at 1 minute, 3 minute and 10 minute. Anaesthesia was maintained on $O_2$, $N_2O$, intermittent vecuronium and propofol.

***Parameters to be studied***

Pulse rate, systolic and diastolic blood pressure, cormack-lehanne score, total laryngoscopy time, need for burp manuver, procedure related complications.

***Statistical analysis***

Collected data was entered into SPSS 18.0 software. Data were expressed as Mean±SD. Demographic data and complacations of the two groups were compared using student t-test and chi-square test. Hemodynamic parameters at various time intervals were compared using unpaired t-test. A p-value of less than 0.05 was considered significant.

## RESULTS

Both groups were comparable in terms of demographic data as well as baseline hemodynamic parameters. At 3 minutes, systolic and diastolic blood pressures were significantly higher with macintosh group compared to mccoy group. Regarding the ease of intubation it was found that time required for laryngoscopy for macintosh group was 19.5±70 second and for mccoy group was 16.1±2.61 second respectively while p-value between two groups was 0.00 which was significant. Burp manuver was never required with mccoy blade but with macintosh blade it was required in 34% of patients. No patient developed complication with mccoy blade where as 6% patients developed complication with macintosh blade such as mucosal injury, bleeding, laryngeal injection etc.

**Table 1: Demographic data.**

| Demographic data | Macintosh (N=50) | Mccoy (N=50) |
|---|---|---|
| Median age (years) | 33 | 35 |
| Sex (male:female) | 16:34 | 22:28 |
| Type of surgery emergency:elective | 6:44 | 12:38 |
| ASA grade (1:2) | 44:6 | 49:1 |
| Mallampati grade (2:1) | 10:40 | 5:45 |

**Table 2: Hemodynamic parameters at 3 minutes.**

| 3 minute hemodynamic data | Macintosh N=50 | Mccoys N=50 | P-value |
|---|---|---|---|
| Pulse | 104.8±13.9 | 96.46±12.55 | 0.002 |
| Systolic blood pressure | 140.44±13.33 | 129.6±14.4 | 0 |
| Diastolic blood pressure | 86.96±8.22 | 77.2±8.28 | 0 |

**Table 3: Hemodynamic data at 10 minutes.**

| 10 minute hemodynamic data | Macintosh (N=50) | Mccoy (N=50) | P value |
|---|---|---|---|
| Pulse | 92.5±12.8 | 88.14±11.44 | 0.076 |
| Systolic blood pressure | 131.28±13.50 | 124.56±12.59 | 0.012 |
| Diastolic blood pressure | 80.28±9.38 | 75.16±6.57 | 0.02 |

**Table 4: Ease of intubation between two groups.**

| Ease of Intubation | Macintosh (N=50) | McCoy (N=50) |
|---|---|---|
| Laryngoscopy time | 19.5±3.70 | 16.1±2.61 |
| Burp maneuver | 17/15 | 0/50 |
| Complications | 3/50 | 0/50 |

## DISCUSSION

Laryngoscopy and intubation are major stimuli which evoke a transient but significant sympathetic response leading to increase in heart rate and blood pressure. The nociceptive signals generated during laryngoscopy and tracheal are conducted to the brain via glossopharyngeal and vagus nerve.[2] In general these changes begin immediately after the laryngoscopy and last for 5 minutes.[3] Various anaesthetic techniques has been tried to blunt these deleterious hemodynamic responses like hypertension, tachycardia and arrhythmias in susceptible individuals.[4] Use of mccoys blade instead of macintosh blade for laryngoscopy is one such measure. Theoretically, use of mccoys blade should help since it avoids the lifting force on vallecula and epiglottis during visualization of larynx which might cause a lesser sympathetic response.

In present study, it was observed that the comparison of hemodynamic response (pulse, systolic and diastolic blood pressure) between the two types of blades. It showed

- *Pulse:* The mean pulse recorded 3 minutes after laryngoscopy was 104.8±13.9 for Macintosh blade and 96.46±12.55 for mccoys group. P-value <0.02 the difference was obtained was significant.
- *Systolic blood pressure:* Similarly 3 minutes systolic blood pressure was 140.44±13.33 for macintosh group and 124.6±14.04 for mccoys group. P-value was 0.00. It was again significant.
- *Distolic blood pressure:* The diastolic blood pressure measured was 86.96±8.22 for macintosh and 77.2±8.28 for mccoys blade. P-value was 0.00 there was statistically significant difference.

There was significant increase in heart rate (14%, systolic blood pressure (17%) and diastolic blood pressure (11%) for macintosh group as compared with mccoys group.

In the year 1995, Mccoy EP et al demonstrated hemodynamic changes using macintosh blade.[5,6] There was significant increase in both heart rate (33%) and arterial blood pressure (27%) after laryngoscopy with macintosh blade as compared to mccoy blade. Mehtab et al studied the hemodynamic response to laryngoscopy and tracheal intubation in 60 ASA 1 and 2 patients using either macintosh or mccoys laryngoscope.[7] The maximum change in heart rate was 18.7 % in macintosh and 7.7% in mccoy group. Systolic blood pressure increased in 22.9% in macintosh group and 10.3% in mccoys group. The difference was significant. (P <0.0001). Roman J et al observed that there was not any influence of laryngoscope design on hemodynamic response.[8] Takeshima et al showed a greater effect on heart rate with macintosh blade compared to straight blade. It was concluded that the pressure by the laryngoscope blades on the deep soft tissue adjacent to the epiglottis probably contributed to the ECG findings and hemodynamic response.

As with ease of intubation in present study, it was observed that laryngoscopy time was significantly higher with macintosh group (mean value 19.5±3.70) than mccoy group (16.1±2.61). 17 patients out of 50 (34%) required a burp manuver, stylet for intubation in Macintosh group whereas no aid in mccoys group. There was 6% of complication in macintosh group and no complication in mccoys group. Atul et al had also found that intubation was easier with true view and mccoys blade as compared to macintosh blade.[9] Uchida et al found that Cormack and Lehane grade in the mccoy trial was less than the macintosh trial (p <0.01).[10]

Mccoy blade uses a levering action and flexes the tip like a hinge to elevate the epiglottis which is the main basis of reducing the force of intubation. In present study, 3 cases out of macintosh group did show minor complication as compared to no complication with mccoys group. Recent studies have popularised the use of true view blade, fiber optic laryngoscopy, air traq intubations which are more beneficial than mccoys regarding the ease of intubation.

## CONCLUSION

Mccoys blade is proved to be safe and reliable mode of intubation with regards to hemodynamic response. It produces ease of intubating conditions and useful in difficult intubation. It causes no complication.

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