Original Article

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Efficacy of Laryngoscopy and Haemodynamic Response to Endotracheal Intubation: A Comparitive Study between Airtraq Optical Laryngoscope and Macintosh Laryngoscope

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Abstract

Background: Laryngoscopy and endotracheal intubation plays a crucial role in administering general anaesthesia. Laryngoscopes ranging from simple rigid scope with light bulb to complex fiberoptic video devices have been developed to ease the process of laryngoscopy and intubation. *Objective:* This study was conducted to compare the efficacy of laryngoscopy and the haemodynamic response to endotracheal intubation between Airtraq and Macintosh laryngoscopes. *Methodology:* One hundred patients of either sex, in the age group of 20 – 60 years under ASA grade I and II with Mallampati grading I and II posted for elective surgery under general anaesthesia were randomly divided into two groups (n = 50). Induction of anaesthesia was standardized. The efficacy of laryngoscopy was comparared according to Cormack and Lehane grading and haemodynamic response to endotracheal intubation were compared. *Results:* In group A (Airtraq), all 50 (100%) patients had Cormack and Lehane grading I and in group M (Macintosh), 33 (66%) patients had Cormack and Lehane grading I and 17 (36%) patients had Cormack and Lehane grading II (p = 0.000). In Group A, mean heart rate increased from 83.54 ± 10.19 bpm prior to intubation to 90.08 ± 9.98 bpm after intubation and mean arterial pressure increased from 91.06 ± 8.16 mmHg prior to intubation to 95.30 ± 8.40 mmHg after intubation. In Group M, mean heart rate increased from 80.94 ± 6.71 bpm prior to intubation to 103.30 ± 7.86 bpm after intubation and mean arterial pressure increased from 91.80 ± 7.70 mmHg prior to intubation to 114.20 ± 6.69 mmHg after intubation (p = 0.000). *Conclusion:* Airtraq optical laryngoscope provides a better exposure of the glottis when compared to Macintosh laryngoscope while triggering minimum haemodynamic response to endotracheal intubation.

Keywords:
Airtraq Optical Laryngoscope; Macintosh Laryngoscope; GA; Haemodynamic Response.

Introduction

Laryngoscopy and endotracheal intubation plays an important role in general anaesthesia. Direct laryngoscopy is used to facilitate tracheal intubation under direct vision [1]. and its success depends on aligning the axes of oral cavity, pharynx and larynx which is achieved by the 'sniffing position' where there is flexion at lower cervical spine and extension at atlanto occipital joint. Laryngoscopes used to view the larynx and adjacent structures, range from simple rigid scopes with a light bulb to complex fiberoptic video devices [2].

Macintosh laryngoscope, one of the most commonly used rigid direct laryngoscope, consists of three steps of direct laryngoscopy-insertion of the laryngoscope, adjustment of its position and lifting force, and use of other maneuvers to optimize the view of the glottis.

In some patients, conventional direct laryngoscopy fails to provide a complete view of larynx and hence optical devices have been developed for tracheal intubation under vision with technology that transmits the image from a distal lens to the proximal end of the device which will ease visualization of the larynx without the need for head

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extension or distortion of the tissues.

The Airtraq optical laryngoscope is a rigid indirect laryngoscope which is an optical prism device. It is anatomically shaped and contains a lateral channel for passage of endotracheal tube; a built in anti-fog system and a low temperature light [3]. This allows visualization of vocal cords without the alignment of oral, pharyngeal and laryngeal axes [4].

The process of laryngoscopy is known to have major cardiovascular effect which includes pressor response and tachycardia along with an increase in catecholamine concentration. The major cause of this sympathetic response is believed to arise from stimulation of supraglottic region by laryngoscopic blade with tracheal tube placement and cuff inflation contributing to little additional stimulation [5,6].

Transient hypertension and tachycardia may not have consequence in healthy individuals, but either or both may be hazardous to those with hypertension, myocardial insufficiency or cerebrovascular diseases. Complications of pressor response following laryngoscopy include myocardial ischemia, cardiac failure, intracranial haemorrhage and increase in intracranial pressure [7,8].

Objectives of the Study

- To compare the efficacy of laryngoscopy between Airtraq® and Macintosh laryngoscopes.
- To study the haemodynamic response to endotracheal intubation between Airtraq® and Macintosh laryngoscopes.

Source of Data

100 patients undergoing elective surgeries under general anaesthesia(GA) in Adichunchanagiri institute of medical sciences, Bellur, Mandya, Karnataka, satisfying the inclusion criteria were randomized into two groups based on block randomization during the study period from October 2015 to March 2016.

Materials and Methods

After Institutional Ethical Committee approval and written informed consent, one hundred (100) ASA I or II patients aged between 20 to 65 years with mallampatti classification of I or II scheduled for different elective surgeries under general anaesthesia were randomly allocated to one of the two groups of 50 patients each group.

Group A: Patients intubated with Airtraq optical laryngoscope (n-50).

Group M: Patients intubated with Macintosh laryngoscope (n-50).

Airtraq optical laryngoscope size 3 and Macintosh size 3 blade were used for all patients in the study.

The patients excluded from the study were the ones with ASA grade III or IV, Mallampatti class III or IV, posted for emergency surgeries, with risk of aspiration, with upper gastrointestinal pathology and known cases of hypertension and diabetes mellitus

All patients were examined a day prior to surgery. A thorough systemic examination was done to rule out any of the above mentioned exclusion criteria. The hemodynamic variables, heart rate, systolic blood pressure and diastolic blood pressure and mean arterial pressure are recorded preoperatively. Airway assessment was done and movements of neck, rule of 1-2-3, teeth and Samsoon and Young's modification of Mallampati grading were assessed in each patient. Haematological and biochemical investigations like Hb%, platelet count, random blood sugars, blood urea, serum creatinine, chest X-ray, ECG were done.

On arrival of the patient in the operation theater, intravenous line (IV) was secured and IV fluids were started. Pulse oximeter, non invasive blood pressure, ECG and $ETCO_2$ monitors were connected and the pre-induction parameters: Heart rate(HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure(MAP), oxygen saturation (SPO2) and ECG were noted. Patients were premedicated with Inj. ondansetrone 0.1mg kg^{-1}, Inj. glycopyrrolate 0.01mg kg^{-1} and Inj. fentanyl 1mg kg^{-1} and preoxygenation with 100% oxygen was done for 3 minutes using Bain's system. Anaesthesia was induced with Inj. thiopentone sodium (2.5%) 4mg kg^{-1} and Inj. succinyl choline 1 mg kg^{-1} was used for facilitation of intubation. Patients were mask ventilated for 1min after injection of succinyl choline, with Bain's system. HR, SBP, DBP, MAP, SPO_2 and ECG were recorded prior to laryngoscopy.

Patients in group M were put into "sniffing position" and intubated using Macintosh laryngoscope using cuffed endotracheal tube of appropriate size.

Patients in group A were put in neutral position. Light was turned on in the airtraq, and time was given for activation of the antifogging system. Tip of the Airtraq was placed in the vallecula and lifted up to expose the glottis. The glottis was aligned in the center of the visual field by gently moving the tip of the

Airtraq as needed. The ETT was gently advanced in the lateral channel until it was visualized passing through the vocal cords. The cuff of ETT was inflated and checked for proper positioning. The ETT was separated from the Airtraq by pulling it laterally from the ETT, while holding the ETT in position.

Patients requiring more than one attempt of laryngoscopy were excluded from the study.

The laryngoscopy view obtained was compared according to Cormack and Lehane grading as follows.

Grade 1: most of the glottis is visible.

Grade 2: only posterior extremity of glottis visible.

Grade 3: no part of glottis visible only epiglottis visible. 3a:epiglottis can be lifted from the posterior pharyngeal wall. 3b: epiglottis cannot be lifted.

Grade 4: not even epiglottis visible.

The endotracheal tube was connected to Bain's circuit. Position of the tube was confirmed by $EtCO_2$ and auscultation. The endotracheal tube was secured and controlled ventilation was instituted.

Anaesthesia was maintained using O_2 in N_2O (33%:67%) at 14-15 breaths per minute. For muscle relaxation Inj. vecuronium bromide 0.1 mg kg^{-1} was given as loading dose and one fourth of loading dose was used for maintenance. HR, SBP, DBP, MAP, SPO_2 and capnogram were noted one minute after intubation.

Neuromuscular blockade was reversed with Inj. neostigmine 0.05 mg kg^{-1} and Inj. Glycopyrrolate 0.01mg kg^{-1} both IV after ensuring adequate recovery from neuromuscular blockade.

Statistical analysis was done by students 'T' test; ANOVA and Chi square test were performed for nonparametric values and corresponding '*P*' was computed. '*P*' value <0.05 was considered statistically significant.

Observation and Results

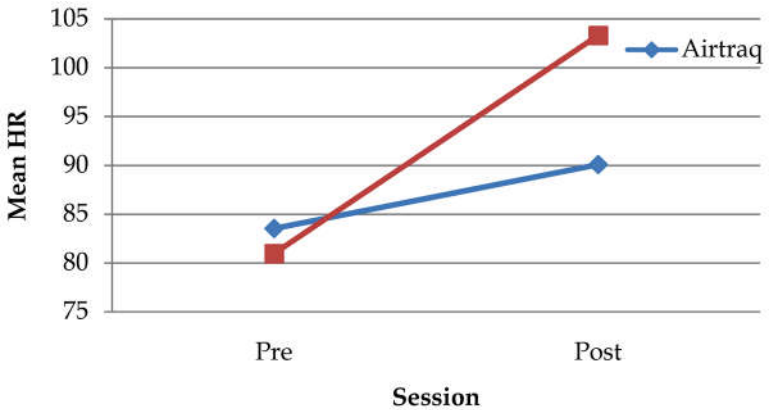
Preoperative vital parameters were compared between the two groups of patients and no significant difference was found. The differences in the Mallampatti grading between the two groups were statistically insignificant. The differences in the

Table 1: Cormack and Lehane grading by groups

Cormack and Lehane grade		Group A	Group M	Total
I	Count	50	33	83
	% of group	100.0%	66.0%	83.0%
II	Count	0	17	17
	% of group	0.0%	36.0%	17.0%
Total	Count	50	50	100
	% of group	100.0%	100.0%	100.0%

Table 2: Mean heart rate (bmp) prior to intubation and after intubation

Time	Group A	Group M
Prior to intubation	83.54 ± 10.19	80.94 ± 6.71
After intubation	90.08 ± 9.98	103.30 ± 7.86



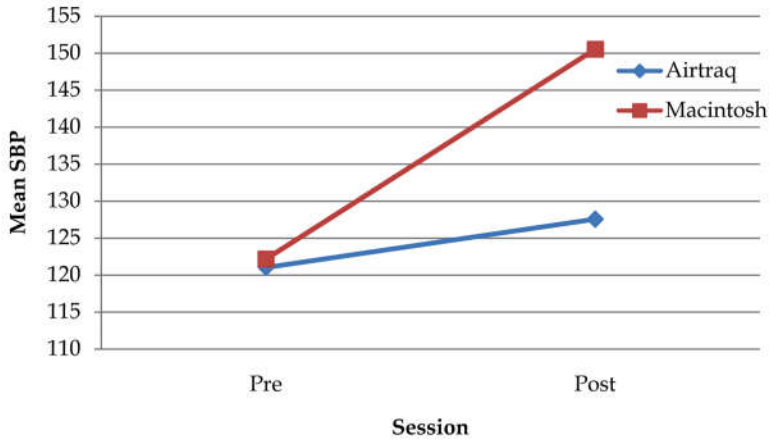
Graph 1: Mean heart rate (bmp) prior to intubation and after intubation

Cormack and Lehane grading between the two groups were statistically highly significant (p = 0.000).

In group A, all 50 (100%) patients had Cormack and Lehane grading I and none of the patients had Cormack and Lehane grading II. In group M, 33 (66%) patients had Cormack and Lehane grading I and 17 (36%) patients had Cormack and Lehane grading II. Hence, the efficacy of laryngoscopy was better with Airtraq optical laryngoscope compared to Macintosh laryngoscope.

Table 3: Mean systolic blood pressure (mmHg) prior to intubation and after intubation

Time	Group A	Group M
Prior to intubation	121.02 ± 9.72	122.18 ± 9.73
After intubation	127.54 ± 9.94	150.52 ± 9.11



Graph 2: Mean systolic blood pressure (mmHg) prior to intubation and after intubation

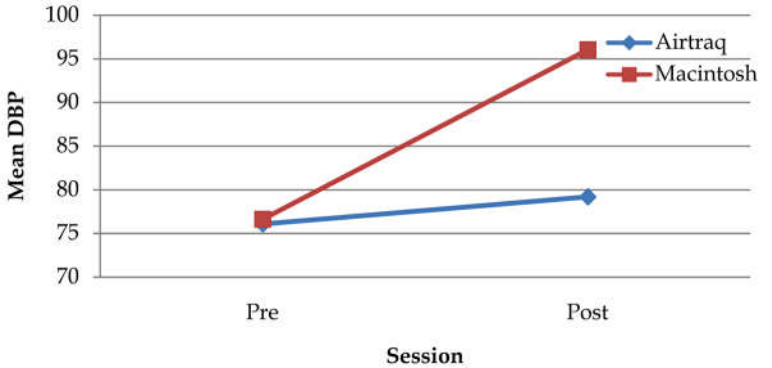
The increase in systolic blood pressure after intubation between the two groups was statistically highly significant (p = 0.000).

In Group A, mean SBP increased from 121.02 ± 9.72 mmHg prior to intubation to 127.54 ± 9.94 mmHg after intubation.

In Group M, mean SBP increased from 122.18 ± 9.73 mmHg prior to intubation to 150.52 ± 9.11 mmHg after intubation. The increase in SBP after intubation was more with Macintosh laryngoscope compared to Airtraq optical laryngoscope.

Table 4: Mean diastolic blood pressure (mmHg) prior to intubation and after intubation

Time	Group A	Group M
Prior to intubation	76.08 ± 7.93	76.62 ± 7.76
After intubation	79.18 ± 8.21	96.04 ± 6.64



Graph 3: Mean diastolic blood pressure (mmHg) prior to intubation and after intubation

The increase in DBP after intubation between the two groups was statistically highly significant (p=0.000).

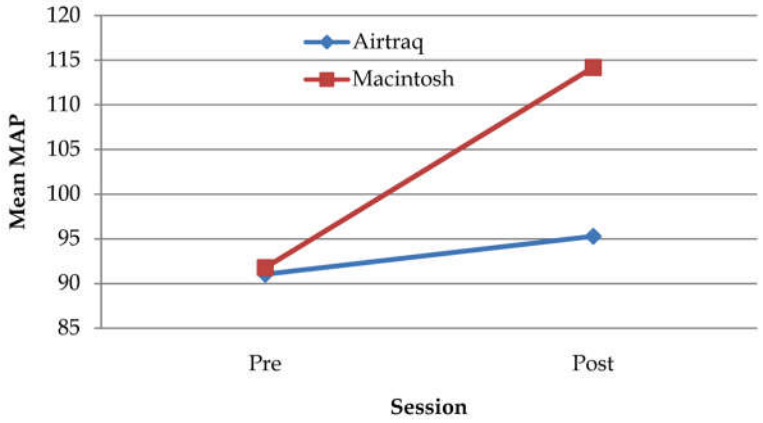
In Group A, mean DBP increased from 76.08 ± 7.93 mmHg prior to intubation to 79.18 ± 8.21 mmHg after intubation. In Group M, mean DBP increased from 76.62 ± 7.76 mmHg prior to intubation to 96.04 ± 6.64 mmHg after intubation. The increase in DBP after intubation was more with Macintosh laryngoscope compared to Airtraq optical laryngoscope.

The increase in MAP after intubation between the two groups was statistically highly significant (p=0.000).

In Group A, MAP increased from 91.06 ± 8.16 mmHg prior to intubation to 95.30 ± 8.40 mmHg after intubation. In Group M, MAP increased from 91.80 ± 7.70 mmHg prior to intubation to 114.20 ± 6.69 mmHg after intubation. The increase in MAP after intubation was more with Macintosh laryngoscope compared to Airtraq optical laryngoscope.

Table 5: Mean arterial pressure (mmHg) prior to intubation and after intubation

Time	Group A	Group M
Prior to intubation	91.06 ± 8.16	91.80 ± 7.70
After intubation	95.30 ± 8.40	114.20 ± 6.69



Graph 4: Mean arterial pressure (mmHg) prior to intubation and after intubation

Discussion

Securing the airway is a vital step in administrating GA which is done through endotracheal intubation. Direct laryngoscopy is used to facilitate tracheal intubation under vision. To aid the process of intubation laryngoscopes ranging from simple rigid laryngoscope to complex fiberoptic video devices have been developed and studied.

Direct laryngoscopy and intubation are noxious stimuli that can aggravate adverse responses in the cardiovascular system like tachycardia and hypertension. The magnitude of the response is greater with increasing force and duration of laryngoscopy. Transient hypertension and tachycardia are probably of no consequences in healthy individuals but both may be hazardous to those with hypertension, myocardial insufficiency and cerebrovascular disease. Thus the laryngoscopes should facilitate good laryngoscopic view of the vocal cords to ease the process of intubation while triggering minimal stress response. The Macintosh blade is one of the most popular blades and the Airtraq is a new intubation device that has been developed to facilitate tracheal intubation in patients with normal or difficult airways. As a result of the exaggerated curvature of the blade and an internal arrangement of optical components, a view of the glottis is provided without alignment of the oral, pharyngeal and tracheal axes.

In this study, the efficacy of laryngoscopy on Cormack Lehane grade and haemodynamic response to endotracheal intubation between Airtraq optical laryngoscope and Macintosh laryngoscope were studied.

One hundred patients of either sex, in the age group of 20–65 years under ASA grade I and II with Mallampati grading I and II posted for elective surgery under GA were randomly divided into two groups (n = 50). The patients in both the groups were comparable with respect to age, sex, weight, height, BMI and Mallampatti grading. The laryngoscopic view was compared according to Cormack and Lehane grading. In Group A all the 50 (100%) patients had grade I. In Group M 33 (66%) patients

had grade I and 17 (34%) patients had grade II. Thus in the present study the visualization of larynx according to Cormack and Lehane grading was better with Airtraq optical laryngoscope as compared with Macintosh laryngoscope which was statistically highly significant. Maharaj et al compared the Airtraq with the Macintosh laryngoscope in patients deemed at low risk for difficult intubation in a randomised, controlled clinical trial and found that Airtraq laryngoscope provided a better laryngoscopic view when compared to Macintosh laryngoscope [9].

Ranieri D et al compared intubation conditions produced by the Macintosh and Airtraq laryngoscopes when used in obese patients in the ramped position and concluded that the Airtraq laryngoscope provided an improved vocal cord view as assessed by the Cormack and Lehane score when compared with the Macintosh laryngoscope [10]. Lopez-Negrete et al compared the AirTraq and Macintosh views and assessed whether predictor of intubation difficulty are useful when the AirTraq laryngoscope is used and found that Airtraq laryngoscope provided a better laryngeal view when compared to Macintosh laryngoscope [11]. These results are similar and comparable to the present study.

Mean heart rate increased from 83.54 ± 10.19 bpm prior to intubation to 90.08 ± 9.98 bpm after intubation in Group A whereas in Group M, mean heart rate increased from 80.94 ± 6.71 bpm prior to intubation to 103.30±7.86 bpm after intubation. Mean SBP increased from 121.02± 9.72 mmHg prior to intubation to 127.54 ± 9.94 mmHg after intubation in Group A whereas in Group M, mean SBP increased from 122.18 ± 9.73 mmHg prior to intubation to 150.52±9.11 mmHg after intubation. Mean DBP increased from 76.08 ± 7.93 mmHg prior to intubation to 79.18 ± 8.21 mmHg after intubation in group A whereas in Group M, mean DBP increased from 76.62 ± 7.76 mmHg prior to intubation to 96.04 ± 6.64 mmHg after intubation. MAP increased from 91.06 ± 8.16 mmHg prior to intubation to 95.30 ± 8.40 mmHg after intubation in Group A whereas in Group M, MAP increased from 91.80 ± 7.70 mmHg prior to intubation to 114.20 ± 6.69 mmHg after intubation. The increase in HR, SBP, DBP and MAP after intubation between the two groups was statistically highly significant (p=0.000) and was more with Macintosh laryngoscope compared to Airtraq laryngoscope.

Maharaj et al compared the Airtraq with the Macintosh laryngoscope in patients deemed at low risk for difficult intubation in a randomised, controlled clinical trial and found that Airtraq resulted in less alterations in heart rate [9].

Maharaj et al compared the ease of intubation using the Airtraq with the Macintosh laryngoscope, in patients at increased risk for difficult tracheal intubation, in a randomized controlled clinical trial and found that Airtraq reduced the degree of haemodynamic stimulation when compared to the Macintosh laryngoscope [12].

These results are similar to the present study where Airtraq optical laryngoscope resulted in lesser variations in the heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure when compared to Macintosh laryngoscope.

Conclusion

From the present study, it is concluded that

1. Airtraq optical laryngoscope provides a better glottic exposure when compared to Macintosh laryngoscope.
2. Airtraq optical laryngoscope triggers minimal haemodynamic response to laryngoscopy and intubation when compared to Macintosh laryngoscope and this can be attributed to the reduction in the lifting force necessary to obtain a clear view of the glottis.

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