

## Study the efficacy of airtraq video laryngoscope versus Macintosh laryngoscope in general anesthesia

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### Abstract

**Background & Aims:** Video laryngoscopes have become components of difficult airway cart. However, there is a problem with availability at all centres, expertise with the equipment and the price. We compared Airtraq video laryngoscope with conventional Macintosh laryngoscope in ease of intubation based on Intubation difficulty scale, Percent of Glottic Opening (POGO) score.

**Materials & Methods:** A prospective Single blinded, Randomised study with 60 Adult patients, aged 18-60 years, American Society of Anaesthesiologists (ASA) physical status I-II, scheduled for various elective surgeries requiring endotracheal intubation.

We assessed ease of tracheal intubation based on Intubation Difficulty Scale (IDS), Visualisation of glottic opening as per Percent of Glottic Opening (POGO) score and hemodynamic response to endotracheal intubation with Macintosh laryngoscope and Airtraq optical laryngoscope.

**Results:** The mean Intubation Difficulty Scale (IDS) score in Airtraq group is 0.2 as compared to Macintosh group with mean IDS score of 1.93, with p-value <0.0001. There is a difference in POGO grading among the groups with higher scores in Airtraq group, p-value-0.000003. There is a difference in hemodynamic response to intubation among the groups, systolic, diastolic and mean arterial pressure were high in Macintosh group when compared to Airtraq group with  $p < 0.05$ .

**Conclusion:** The optical Airtraq laryngoscope provides a better intubation condition with lower Intubation Difficulty Scale (IDS) score, better glottic view and no marked hemodynamic alterations to laryngoscopy as compared to Macintosh laryngoscope.

**Keywords:** Anaesthesia, endotracheal intubation, MacIntosh laryngoscope, AIRTRAQ video laryngoscope, intubation response

## Introduction



**Fig 1:** MacIntosh Laryngoscope

Airtraq optical laryngoscope is an intubation device that has been developed to facilitate endotracheal intubation in patients with normal and anticipated difficult airway. As a result of the exaggerated curvature of the blade and an internal arrangement of optical components, a high-quality view of the glottis and surrounding structures is provided without sniffing position. It contains a lateral channel for passage of endotracheal tube which has a built-in antifog system and a low temperature light<sup>[1, 2]</sup>.



**Fig 2:** Airtraq video laryngoscope

Laryngoscopy is known to have profound cardiovascular effects. The force exerted by laryngoscope blade on base of tongue cause activation of the autonomic nervous system with the release of stress hormone leading to tachycardia, hypertension, dysrhythmias. Sympathoadrenal response arises from stimulation of supraglottic region along with tracheal tube placement and cuff inflation. These changes are maximum at 1minute after intubation and last for 5-10 minutes<sup>[3]</sup>.

The factors that influence the magnitude of hemodynamic changes are the duration of laryngoscopy and intubation, type of laryngoscope used, anesthetic agent and the depth of anaesthesia<sup>[4]</sup>. Transient tachycardia and hypertension are not significant consequences in

healthy individuals but may be hazardous to those with hypertension, myocardial insufficiency, or cerebrovascular disease. The pressor response following laryngoscopy can lead to complications like myocardial ischemia, cardiac failure, increase in intracranial pressure and intra ocular pressure<sup>[5, 6]</sup>.

Securing an airway is the skill mastered by anesthetists with recent advances in airway equipment lessens the burden. Laryngoscopes must provide good glottic exposure to ease the process of intubation and should trigger a minimal stress response.

The role of Airtraq laryngoscope in clinical practice must be determined. The purpose of this study was to evaluate the usefulness of optical Airtraq laryngoscope over conventional Macintosh laryngoscope.

## Methodology

After Institutional Ethical Committee approval 60 ASA grade I and II patients in the age group of 18-60 years, scheduled for various elective surgeries at our institute, requiring general anesthesia were included.

Sample size was calculated based on the Intubation Difficulty Scale (IDS) score.

At 95% confidence interval and 80% power of the study with proportion of 46.7% in Macintosh laryngoscope Group and 83.4% in Airtraq laryngoscope group with an Equivalence margin of 0.05, the required sample size for each group is twenty-four and we have taken thirty for each group. The sample size was calculated using nMaster 2.0.

We evaluated the Ease of tracheal intubation, Visualization of pharyngeal structures and larynx as per Percent of Glottic Opening (POGO) scoring and hemodynamic response to endotracheal intubation with Airtraq optical laryngoscope, and Macintosh laryngoscope was analysed.

Patients with inter-incisor distance of less than 3 cm, BMI > 30kg/m<sup>2</sup>, Pregnant women, patients recognized as difficult laryngoscopy and intubation during pre-anaesthetic evaluation This is a single-blind Randomized control trial with randomization done using computer generated randomization table into two groups of thirty each (Group M: intubated with MacIntosh Laryngoscope, Group A: intubated with Airtraq laryngoscope). All patients were evaluated at least one day prior to surgery and standard NPO guidelines explained.

After receiving the patient into pre-operative area, they were randomly assigned into either of the groups and shifted into operating room and standard basic monitors attached.

All patients received Inj. Midazolam 0.05 mg/kg IV, Inj Fentanyl 2µg/kg IV as pre-medication. After pre-oxygenation, anesthesia was induced with Inj PROPOFOL 2mg/kg till loss of verbal response, after confirming adequate ventilation, Inj Vecuronium 0.1mg/kg was administered for muscle relaxation and intubation was performed after 3 minutes.

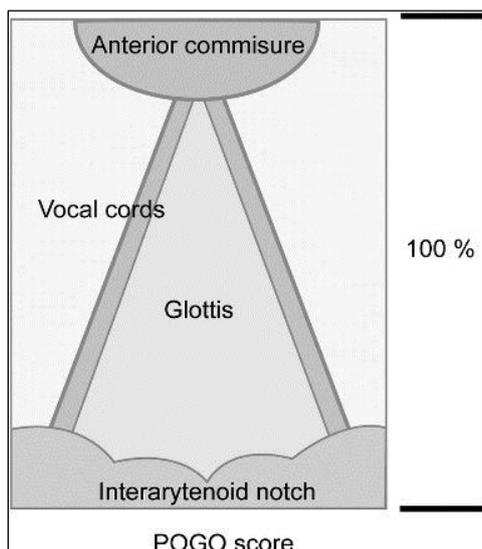
The heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and oxygen saturation (SPO<sub>2</sub>) were noted just prior to laryngoscopy and taken as base line value. Laryngoscopy and intubation were performed by the same anesthetist experienced in using both the laryngoscopes. Anesthesia is maintained with isoflurane in a mixture of 60% N<sub>2</sub>O and 40% O<sub>2</sub> and by intravenous vecuronium bromide 0.02mg/kg as maintenance dose. No other medications were administered, or procedures performed, during the 5-minute data collection period following tracheal intubation. Further management was left to the discretion of anesthesia care provider.

The laryngoscopic view obtained was assessed according to per Percent of Glottic Opening (POGO) grading.

The POGO score represents the linear span extending from the anterior commissure to the inter-arytenoid notch of the vocal cords.

POGO (percentage of glottic opening) was assessed on a score of 1-4.

1. 75-100%
2. 50-75%
3. 25-50%
4. 0-25%



**Fig 3:** POGO grading

The ease of intubation was assessed using Intubation Difficulty Scale (IDS) score, which is the sum of the following seven variables:

**Table 1:** Intubation Difficulty Scale

Variables	Score
Number of Intubation attempts	n-1
Number of Operators	n-1
Number of alternative Intubation techniques used (bougie, Stellate, Different blade/tube)	N
POGO scoring	1/2/3/4
Lifting force required for laryngoscopy	0 = Normal, 1= increased
Necessity of Laryngeal pressure	0 = Not applied, 1= applied
Position of vocal cords at intubation	0 = abduction/not visualized, 1=adduction

**Table 2:** Rules for calculation of IDS

<b>N<sub>1</sub>:</b> Every additional attempt adds one point.
<b>N<sub>2</sub>:</b> Each additional operator adds one point.
<b>N<sub>3</sub>:</b> Each alternative technique adds one point (repositioning of patient, change of materials (blades, ET tubes, need of stylet), change in approach (Naso tracheal, Orotracheal)) or use of another technique, fibre optic scopy or intubation through laryngeal mask.
<b>N<sub>4</sub>:</b> Apply POGO scoring for 1 <sup>st</sup> oral attempt.
<b>N<sub>5</sub>:</b> Sellick's manoeuvre adds no point.
Impossible intubation-IDS takes the value before abandonment of intubation attempts.

**Table 3:** IDS score

IDS	Intubation Quality
0	Easy
$>0 \leq 5$	Slight Difficulty
$>5$	Moderate to Major difficulty
$\infty$	Impossible intubation

Hemodynamic parameters including heart rate, Systolic and Diastolic Blood pressure, mean arterial pressure and oxygen saturation were recorded pre-intubation and post intubation at 1, 3 and 5 minutes.

### Statistical analysis

Sample size was calculated using nMaster 2.0 software. Statistical analysis was done using Data Analysis tool MS-Excel 2016. All values are expressed as mean and standard deviation.  $p < 0.05$  was considered statistically significant.

### Results

We recruited sixty patients who were randomized into two groups of thirty each. Baseline parameters were comparable among the groups. All patients were successfully intubated in both the groups. There were no significant adverse events observed in either of the groups.

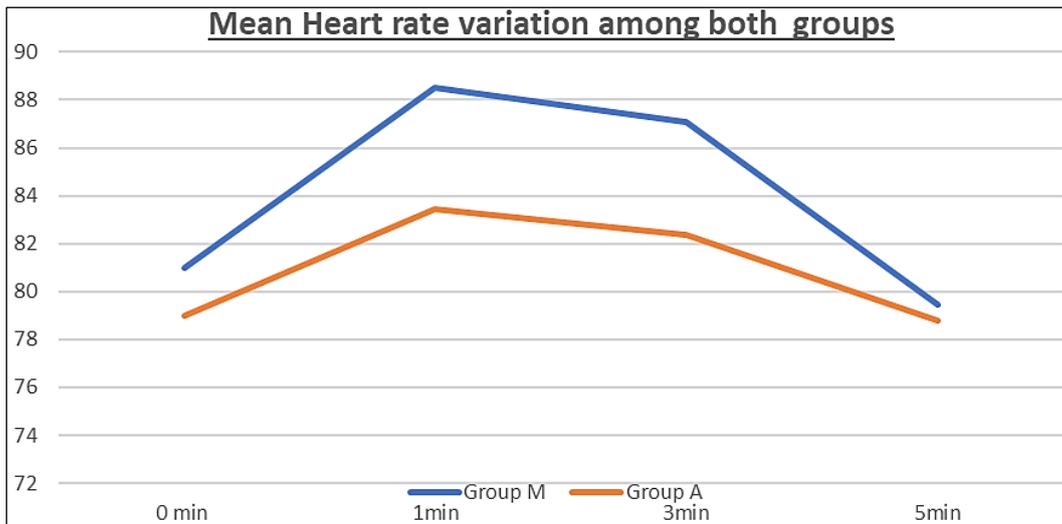
**Table 4:** Demographic data

Gender	Group M		Group A	
	No of patients	%	No of patients	%
Male	9	30	12	40
Female	21	70	18	60
Total	30		30	

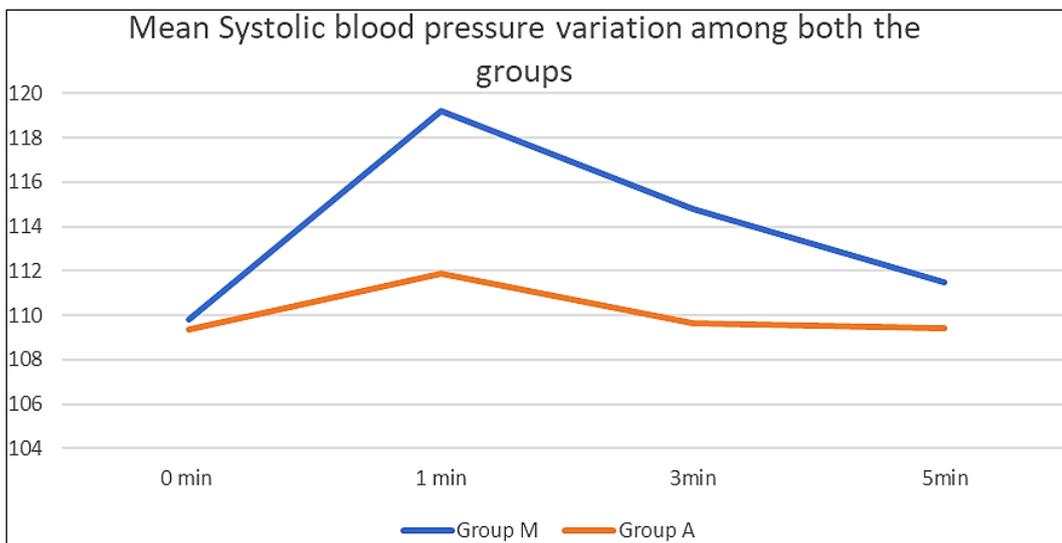
**Table 5:** IDS score of both the groups

	Group M	Group A
Number of patients in whom intubation required more than one attempt	8	3
Number of patients in whom intubation required more than one operator	9	4
Number of patients in whom alternative intubation technique were used (bougie, stylet, different size blade, endotracheal tube)	3	0
Glottic exposure-Percent of Glottic Opening (POGO) scoring 1/2/3/4	7/23/0/0	25/5/0/0
Number of patients in whom increased lifting force required	7	0
Number of patients in whom laryngeal pressure was applied	8	2
Position of vocal cords at intubation	0	0
Total score	<b>1.93</b>	<b>0.2</b>
Mean	1.740657	0.550861

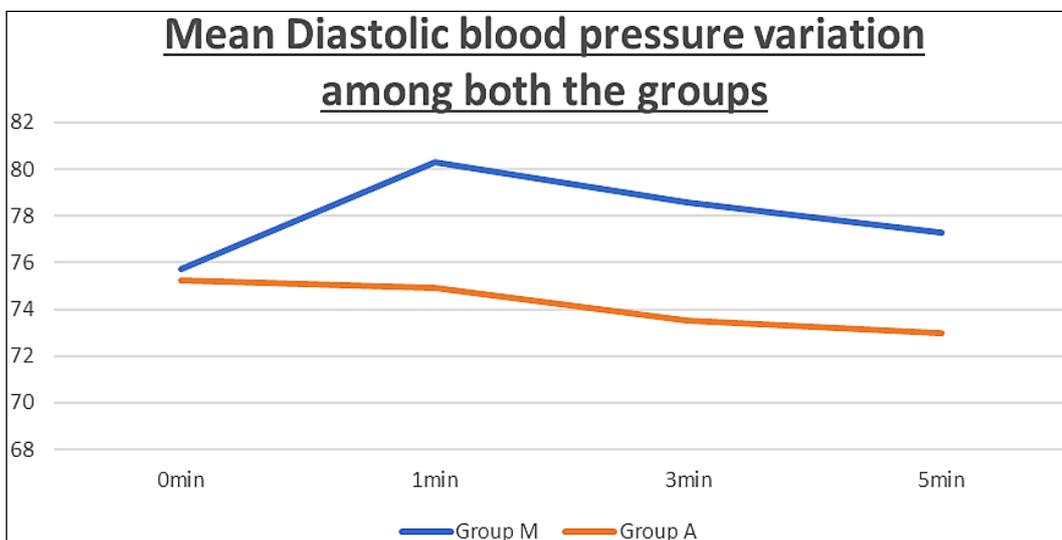
Airraq laryngoscope provided better ease of intubation with lesser mean IDS score of 0.2 as compared to 1.93 with Macintosh laryngoscope which was statistically highly significant ( $p < 0.0001$ ). In Airraq group 77% patients had Cormack-Lehane grade I view of glottis and no patients had grades 3 or 4 view of glottis as compared to 43% with grade 1 view and 10% with grade 3 view in Macintosh group. Thus, Airraq laryngoscope significantly reduced the Cormack-Lehane grade of glottic view with  $p$  value 0.0007.



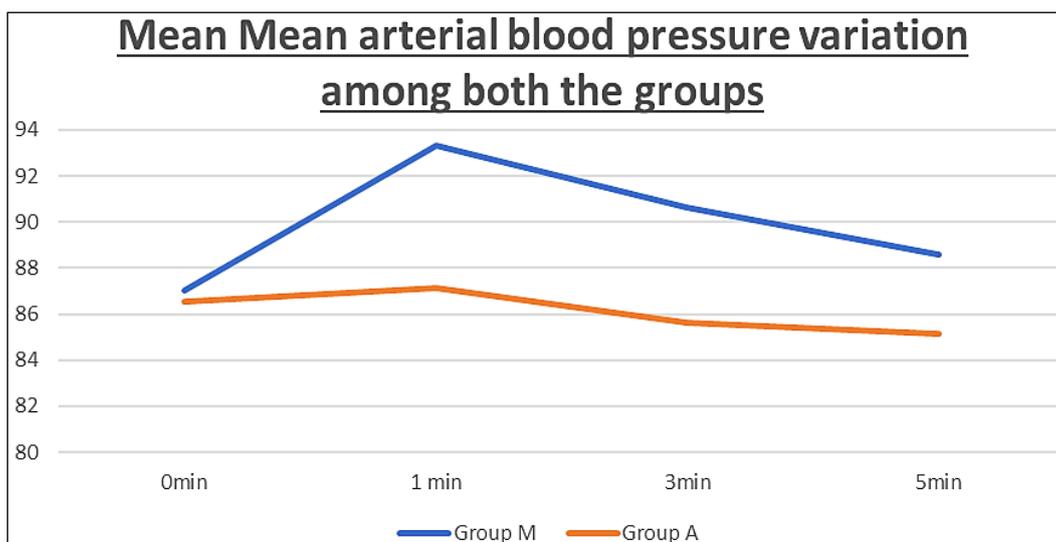
**Graph 1:** Mean Heart rate variation



**Graph 2:** Mean systolic blood pressure variation



**Graph 3:** Mean diastolic blood pressure variation



**Graph 4:** Mean blood pressure variation

In our study Airtraq laryngoscope resulted in less alterations in hemodynamic parameters with reference to baseline values. The hemodynamic findings in our study were comparable to those described by CH Maharaj *et al.* in patients with normal airway <sup>[1]</sup>, anticipated difficult airway <sup>[7]</sup>. This could be due to exaggerated anatomical curvature of the blade of Airtraq laryngoscope which does not require alignment of oral, pharyngeal, and laryngeal axes, less lifting force needed during laryngoscopy and less trauma caused during intubation. A manikin study conducted by Maharaj CH <sup>[8]</sup> *et al.* evaluating Airtraq and Macintosh laryngoscopes in easy and simulated difficult airway scenarios concluded that, Airtraq laryngoscope had rapid acquisition of skills with less time required for intubation and increase in success rate of tracheal intubation.

The recent guidelines <sup>[9]</sup> published by the Difficult Airway Society for the management of difficult intubation advocates consideration of alternative video laryngoscopes in the primary intubation plan.

### Discussion

Airway management is the most important skill for anaesthesiologists. Laryngoscopes play a vital role in securing airways. The current study was aimed at comparing two laryngoscopes, the conventional Macintosh direct laryngoscope with Airtraq video laryngoscope and to note the efficacy among these in terms of ease of intubation, glottic view obtained by POGO scoring and the effect of laryngoscopy on the hemodynamic parameters.

In this single blinded, randomized study conducted at Katuri Medical College and Hospital, 60 ASA grade I and II patients undergoing various elective surgeries under general anesthesia were enrolled and divided randomly into two groups of 30 each, Standard anaesthetic protocols were applied to both groups and intubation with appropriate size endotracheal tube was done using either Macintosh laryngoscope or Airtraq laryngoscope.

There was no significant difference in the demographic profile and airway characteristics of patients in the two groups.

Our study demonstrates the utility of novel optical Airtraq laryngoscope over the conventional Macintosh laryngoscope for endotracheal intubation in patients deemed minimal risk of difficult airway. Airtraq laryngoscope provided better ease of intubation with lesser mean IDS score of 0.2 as compared to 1.93 with Macintosh laryngoscope which was statistically highly significant ( $p < 0.0001$ ).

Intubation difficulty scale as described by Adnet *et al.* <sup>[10]</sup> was used to assess the ease of

intubation in our study as it is based on seven parameters like number of attempts, operators, alternative intubation techniques, glottic view obtained by POGO scoring, requirement of external laryngeal pressure, force required for laryngoscopy and position of vocal cords at intubation, which completely defines the quality of intubation than based on a single parameter.

Hemodynamic parameters including heart rate, Systolic and Diastolic Blood pressure, mean arterial pressure and oxygen saturation were recorded pre-intubation and post intubation at 1, 3 and 5 minutes.

We chose POGO score over Cormack Lehane grading because Cormack Lehane description of the view is not quantitative, alternate systems of description such as percentage of glottic opening (POGO) have been described, that require the viewer to estimate a numerical score; have the advantage of better inter-rater reliability. Accuracy (degree of agreement of score with an expert panel assessment) was higher for POGO (75.5%) and the Fremantle score (73.9%) than for Cormack and Lehane (65.4%;  $p < 0.001$ ). Inter-rater reliability for Fremantle score (0.618) and POGO (0.614) were similar and higher than the inter-rater reliability of Cormack and Lehane 0.464 ( $p < 0.001$ ).

The data of the study is comparable to the study conducted by Maharaj CH <sup>[1]</sup> *et al.* comparing Airtraq and Macintosh laryngoscope in routine airway management.

Sixty ASA grade I and II patients were intubated with either Airtraq or Macintosh laryngoscope, the mean IDS score was 0.2 in Airtraq Group compared to 1.4 in Macintosh group which was statistically significant.

In Airtraq group 83.3% patients had POGO score I view (100%) of glottis, 16.67% had POGO score II and no patients had grades 3 or 4 view of glottis as compared to 23.3% with grade 1 view and 76.67% with grade 2 view in Macintosh group. Thus, Airtraq laryngoscope significantly reduced POGO score of glottic view with p value 0.000003. The current study supports the results of the study conducted by Carlos Ferrando 39 *et al.* comparing the laryngeal view during tracheal intubation using Airtraq and Macintosh laryngoscopes which concluded that Cormack-Lehane grade was lower with the Airtraq device and was statistically significant.

Airtraq laryngoscope has been designed to facilitate intubation in both normal and difficult airways. The internal arrangements of the high-definition optical components including a series of lens, prisms and mirrors with antifogging system transfer the image from low temperature illuminated tip to the proximal view finder, giving a high quality and wide-angle view of glottis, surrounding structures and the tip of the endotracheal tube. Thus, Airtraq laryngoscope improves glottic view and decreases Percent of Glottic Opening (POGO) score. During administration of general anaesthesia, laryngoscopy and tracheal intubation is considered most critical events as they trigger transient but marked sympatho adrenal response which can be detrimental in patients particularly with underlying cardiac diseases.

In this study Airtraq laryngoscope resulted in less alterations in hemodynamic parameters at 1,3,5 minutes after intubation with reference to baseline values.

This could be due to exaggerated anatomical curvature of the blade of Airtraq laryngoscope which does not require alignment of oral, pharyngeal, and laryngeal axes, less lifting force needed during laryngoscopy and less trauma caused during intubation.

The hemodynamic findings in our study were comparable to those described by CH Maharaj *et al.* in patients with normal airway <sup>[1]</sup> anticipated difficult airway <sup>[7]</sup>.

Marwa A Tolon *et al.* 2 in their comparative study between the use of Macintosh laryngoscope and Airtraq in patients with cervical spine immobilization reported statistically significant increase in both heart rate and mean arterial pressure in Macintosh group than Airtraq group. Oxygen saturation showed no significant difference between the groups.

The recent guidelines <sup>[9]</sup> published by the Difficult Airway Society for the management of difficult intubation advocates consideration of alternative video laryngoscopes in the primary

intubation plan. Airtraq laryngoscope has been reported to increase the success rate of intubation in the first attempt.

### Conclusion

The novel optical Airtraq laryngoscope provides a better intubation condition with lower Intubation Difficulty Scale (IDS) score, increased ease of intubation, better glottic view and no marked hemodynamic alterations to laryngoscopy as compared to Macintosh laryngoscope. This demonstrates the utility of novel optical Airtraq laryngoscope over conventional Macintosh laryngoscope in patients at clinically minimal risk of difficult airway.

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