

Comparison between Airtraq Optical Laryngoscope and Conventional Macintosh Laryngoscope for Intubation in Adult Surgical Patients: A Prospective Randomized Controlled Study

S Karthikeyan¹, E Ebenezer Joel Kumar², G Vijay Anand², Heber Anandan³

¹Assistant Professor, Department of Anaesthesiology, Tirunelveli Medical College, Tirunelveli, Tamil Nadu, India, ²Associate Professor, Department of Anaesthesiology, Tirunelveli Medical College, Tirunelveli, Tamil Nadu, India, ³Clinical Epidemiologist, Department of Clinical Research, Dr. Agarwal's Healthcare Limited, Tamil Nadu, India

Abstract

Introduction: Intubating trachea and securing the airway remain a challenge although it is a routine practice for the anesthesiologist. Failure to successfully intubate the trachea remains a leading cause of morbidity and mortality in anesthetic and emergency setting.

Aim: This study aims to compare the intubating conditions in adult surgical patients using Airtraq optical laryngoscope with Macintosh laryngoscope with respect to ease of intubation, the time taken for intubation, airway trauma, and hemodynamic response to laryngoscopy.

Methods: In a single-center, prospective, randomized, parallel group, open-label, interventional study, 40 adult patients posted for surgery under general anesthesia need of endotracheal intubation were recruited and allocated into two groups: Group A ($n = 20$) intubated with Airtraq laryngoscope and Group B ($n = 20$) intubated with conventional Macintosh laryngoscope in standard intravenous induction.

Results: Mean duration of intubation with the Airtraq group was 15.93 s, whereas in the Macintosh group, it was found to be 38.70 s ($P < 0.0001$). The increase in mean heart rate from the pre-induction to post-intubation in Airtraq group was 20.9/min, whereas in Macintosh group was 31.9/min. The increase in mean arterial pressure from pre-intubation to post-intubation in Airtraq group was 12.6 mmHg, whereas in Macintosh group was 30.3 mmHg. Three patients in the Macintosh group and two patients in the Airtraq group experienced trauma to the airways ($P = -0.958$).

Conclusion: A study concluded that endotracheal intubation is easier, less time is taken for intubation, less trauma, and less hemodynamic response when using Airtraq laryngoscope than Macintosh laryngoscope.

Key words: Airtraq, Airway, Equipment, Laryngoscope, Tracheal intubation

INTRODUCTION

Tracheal intubation using a laryngoscope is considered as a gold standard of airway management during the administration of general anesthesia and also in critical

care settings. Failed intubation was the most leading cause for major morbidity and mortality in anesthetic and emergency situation. No single factors determine difficult intubation means that many difficult intubations are not recognized until after induction of anesthesia. Successful conventional direct laryngoscopy and intubation require the alignment of oral, pharyngeal, and laryngeal axes and the intubation and visual confirmation are often complicated by the anatomical abnormalities of the upper airway, comorbid illness, position of the patient, as well as other external factors.^[1-4] Despite of recent development in laryngoscopes, Macintosh laryngoscopes remains them most popular gold standard laryngoscope for intubation

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Corresponding Author: Dr. E. Ebenezer Joel Kumar, Associate Professor of Anaesthesiology, Tirunelveli Medical College, Tirunelveli, Tamil Nadu, India. E-mail: drebenmkm@gmail.com

in inside and outside operation theaters.^[5] In recent decades, video techniques using fiberoptic technology and Airtraq optical laryngoscopes based on reflecting mirrors are being commonly employed. The Airtraq is anatomically shaped and can be used with standard ETTs. The blade of the Airtraq laryngoscope must be inserted in the center of the mouth along the longitudinal axis of the tongue, with the tip positioned in the left vallecula. If necessary, the epiglottis can be lifted by elevating the blade into the vallecula. The ETT does not obstruct the endoscopic view of the vocal cords during tracheal intubation.^[6]

Aim

This study aims to compare the intubating conditions in adult surgical patients using Airtraq optical laryngoscope with Macintosh laryngoscope with respect to ease of intubation, the time is taken for intubation, airway trauma, and hemodynamic response to laryngoscopy.

MATERIALS AND METHODS

It was a single-center, prospective, randomized, parallel group, open-label, interventional controlled study. After obtaining institutional ethical committee approval, 40 adult patients (sample size) are posted for elective surgery requiring general anesthesia (recruitment) with satisfying inclusion criteria. The American Society of Anaesthesiologists (ASA) 1 and 2, Mallampati score 1, 2, and 3, and in the age group of 18–60 years both sexes were enrolled in the study after obtaining informed consent from the patients and relatives. Severe CVS, RS, hepatic, renal disease patients, any valvular, conduction abnormality, ischemic heart disease, hypertensive patients, patients on antihypertensive drugs or beta-blockers, anticipated difficult airway patients, and body mass index (BMI) >40 patients excluded from the study.

The patients were randomly allotted into two groups to each using a closed cover technique. Group A: 20 patients were intubated with Airtraq optical laryngoscope and Group B: 20 patients were intubated with conventional Macintosh laryngoscope.

After assessment, patient shifted to operating room i.v line started and SpO₂, ECG, NIBP, and ETCO₂ (after intubation) monitors connected. Patients were premedicated with 0.2 mg glycopyrrolate and 2 mcg/kg fentanyl iv route 10 min before induction. After preoxygenation, patient was induced with 2.5 mg/kg propofol and 0.1 mg/kg vecuronium. Patient was intubated with Airtraq or Macintosh laryngoscopy according to the group. SpO₂, HR, systolic BP (SBP), diastolic BP (DBP),

and mean arterial pressure (MAP) every 2 min for 10 min were monitored. The following parameters were measured. The primary measures were ease of intubation assessed by intubation difficulty scale (IDS) score. The secondary measures are hemodynamic response, airway trauma, and intubation time.

Intubation difficulty score was used to evaluate the intubating performance of laryngoscopy. IDS scoring was developed by Adnet *et al.*, in 1997. IDS score is a blend of objective and subjective criteria that permit a quantitative and qualitative approach to the progressive nature of the difficulty in intubation. It appears to be the best indicator to date. Seven variables are used such as number of supplementary attempts, number of supplementary operators, number of alternative techniques used, Cormack-Lehane grade, lifting force requirement during laryngoscopy, need for external laryngeal manipulation, and position of vocal cords.

In this scoring, the value of IDS is “0” in full visual view of glottic opening with vocal cords is seen to be nicely abducted. Every variation from this defined “ideal” intubation increases the scoring that indicates the increasing difficulty of intubation. The total IDS score is the sum of all variations from the definition.

Intubation time was measured from the entry of the device into the oral cavity until confirmation of proper placement of the tracheal tube. Heart rate, SBP, DBP, MAP, and SpO₂ were measured every 2 min for 10 min from pre-induction. All complications will be recorded, with special attention to common complications such as upper airway, dental trauma, and blood soiling of Airtraq or Macintosh blade after intubation.

If intubation with Airtraq failed and saturation maintained, Macintosh blade was used for intubation and if the saturation decreased, mask ventilation with 100% oxygen followed by intubation with Macintosh laryngoscope.

RESULTS

Mean age, sex, and BMI of the patients in both the groups were compared and there were no significant differences in between the groups. ASA grading in both groups compared, there was no significant difference in between two groups.

The airways of both the groups of patients were compared with respect to thyromental distance and Mallampati classification, and it was found that there was no statistically significant difference in between the two groups.

Based on thyromental distance, the patients were divided into those with <6.5 cm and ≥6.5 cm, and it is insignificant between groups [Table 1].

Eleven patients in Group A and nine patients in Group B had a Mallampati Class 1. There were eight patients in Group A and nine patients in Group B with Mallampati Class 2. Only one patient in Group A had a Mallampati Class 3 and two patients in Group B had an MPC of 3. No patient selected in either of the group had an MPC of 4 [Table 2].

All the patients in Airtraq group intubated in a single attempt, in Macintosh group, two patients of 20 intubated in the second attempt (N1).

All the patients in both groups are intubated by single operators. None of the patients needed additional operators for assisting intubation (N2). All patients in the Airtraq group intubated without using additional techniques. However, in Macintosh group, four patients of 20 required additional techniques such as changing the blade, using stylet, and using gum elastic bougie (N3). Cormack and Lehane grade 1/2/3/4 found in Airtraq group 17/3/0/0 patients and in Macintosh 10/6/2/2 patients (N4). Lifting force required in 7 of 20 patients in the Macintosh group, only one patient of 20 in the Airtraq group (N5). Laryngeal pressure applied in 10 of 20 patients in the Macintosh group, three of 20 patients in the Airtraq group (N6). In all patients of

both groups, vocal cord mobility was in abduction (N7). Three patients in the Airtraq group had a total IDS of >1, whereas 10 patients in the Macintosh group had a total IDS of 1 or greater. In the Macintosh group, four patients had a total IDS of 5 or greater, indicating moderate-to-severe intubation difficulty, whereas no patient in the Airtraq group had a total IDS of >3. This was computed based on Levene's *t*-test for equality of variances and the result was found to be statistically significant with *P* = 0.001 [Table 3].

Cormack and Lehane grade of both the groups of patients was compared to grade the glottic view. 85% of patients in the Airtraq group had a CL grade of 1, compared to 50% of patients in the Macintosh group. In the Airtraq group, 15% of patients had a CL grade of 2 compared to 30% of patients in the Macintosh group. No patient in the Airtraq group had a CL grade of 3 or 4, whereas in the Macintosh group, 10% of patients had a CL grade of 3 and 10% of patients had a CL grade of 4 [Table 4].

Mean duration of intubation with the Airtraq group was 15.93 s, whereas in the Macintosh group, it was found to be 38.70 s. It was computed using Levene's *t*-test and was found to be statistically significant [Table 5].

The heart rate, blood pressure (BP), and SpO₂ of the patients were measured baseline-before induction (0 min), before intubation (2nd min), post-intubation (4th min), and 6th min, 8th min, and 10th min post-intubation, and the values were computed by Chi-square test and it was found that the tracheal intubation with Macintosh laryngoscope resulted

Table 1: Comparison of thyromental distance in both groups

Parameter assessed	>6.5 cm	<6.5 cm	<i>P</i> value
Airtraq	18	2	0.913
Macintosh	19	1	

Table 2: Comparison of MPC grading in both groups

MPC grade	Group		<i>P</i> value
	A (Airtraq) (%)	B (Macintosh) (%)	
1	11 (55)	9 (45)	0.927
2	8 (40)	9 (45)	0.931
3	1 (5)	2 (10)	0.967
4	0	0	1

Table 3: Comparison of total IDS score in both groups

Group	Total intubation difficulty score								Mean	Standard deviation	<i>P</i> value	
	0	1	2	3	4	5	6	7				8
A	17	0	2	1	0	0	0	0	0	0.35	0.88	0.0011
B	10	0	3	3	0	1	1	0	2	2.05	2.70	

Table 4: Comparison of Cormack and Lehane grading in both groups

Group	CL 1 (%)	CL 2 (%)	CL 3 (%)	CL 4 (%)	<i>P</i> value
Airtraq	17 (85)	3 (15)	0	0	0.0011
Macintosh	10 (50)	6 (30)	2 (10)	2 (10)	

Table 5: Comparison of intubation duration in both groups

Parameter assessed	Group	N	Mean±Standard deviation	<i>P</i> value
Intubation time	Airtraq	20	15.93±2.55	0.0001
	Macintosh	20	38.70±15.81	

Table 6: Comparison of airway trauma in both groups

Group	Airway trauma		<i>P</i> value
	Yes (%)	No (%)	
Airtraq	2 (10)	18 (90)	0.958
Macintosh	3 (15)	17 (85)	

in a significant increase in heart rate, systolic, diastolic, and MAP, compared with pre-intubation values, in contrast to the Airtraq. The differences in heart rate and BP except for DBP in both the groups were statistically significant in the post-intubation (4th min) measurements, statistically significant difference in SBP at 6th min, and not statistically significant difference in the 8th and 10th min post-intubation measurement. The SpO₂ changes in the pre- and post-intubation periods in both groups were not statistically significant. Three patients in the Macintosh group and two patients in the Airtraq group experienced trauma to the airways and all the injuries were to the soft tissues and dental injuries airway trauma [Table 6].

DISCUSSION

Expert airway management is an essential skill for the anesthesiologist. Difficult endotracheal intubation is mostly caused by difficult direct laryngoscopy with an impaired view of vocal cords. Despite all the information currently available, no single factor reliably predicts these difficulties. Unfortunately, many difficult intubations are not be recognized until after induction of anesthesia.

Maharaj *et al.* conducted a study on the comparison of Macintosh and Airtraq laryngoscope intubation in cervical spine immobilization patients. They concluded that 14 of the 20 patients in the Macintosh laryngoscope group had an IDS score of 1 or more, compared with one patient in the Airtraq laryngoscope group. In the Macintosh laryngoscope group, four patients had an IDS score of 5 or more indicating moderate-to-severe intubation difficulty.^[7]

In my study, total IDS score was “0” in 17 of 20 patients, score “2” in two patients, and score “3” in one patient in the Airtraq group. Total IDS score 0 in 10 of 20 patients in the Macintosh group remaining 10 patients had IDS score >1 with a maximum score of 8 in two patients. The findings from my study are comparable to Maharaj *et al.* study. In Maharaj *et al.* study, 19 of 20 patients intubated with Airtraq laryngoscope had Cormack and Lehane grade 1 and one patient had a CL grade 2 when compared to 6/7/7 patients with CL grade of 1/2/3, respectively, in the Macintosh group.^[8]

In my study, Cormack and Lehane score 1/2/3/4 for Airtraq was 17/3/0/0 patients, respectively, and for Macintosh was 10/6/2/2 patients, respectively. The difference was statistically significant (<0.05) when analyzed with the Pearson Chi-square test and paired *t*-test. Cormack and Lehane score 1 was seen in 85% of in the Airtraq group which represents best intubating conditions.

In the study conducted by Maharaj *et al.* in patients, they found that the mean intubation time for Macintosh laryngoscope was 20.3 s and 13.2 s in Airtraq laryngoscope.^[9]

In another study conducted by the same author in manikins, they found that the mean intubation time with Macintosh was 14.2 s and with Airtraq was 9.5 s.^[10]

In the study conducted by Ndoko *et al.* in 106 morbidly obese patients, the mean intubation time with Airtraq was 24 s and with Macintosh was 56 s.^[11]

In my study, the mean intubation duration for Airtraq group was 15.93 s compared with 38.70 s for the Macintosh group which was found to be statistically significant in applying Levene’s test.

In the study conducted by Maharaj *et al.* concluded that an increase in mean heart rate and mean MAP following intubation response was high in the Macintosh group rather than Airtraq group.^[12]

In my study the increase in mean heart rate from the pre induction to post intubation in airtraq group was 20.9 per min whereas in macintosh group was 31.9 per min. The increase in mean MAP from pre intubation to post intubation in airtraq group was 12.6mmHg whereas in macintosh group was 30.3 mm Hg.

In the study conducted by Maharaj *et al.* was noted that intubation attempts with airtraq significantly reduced the incidence of airway trauma in simMan manikin and laerdal airway trainer in easy and stimulated difficult airway scenarios during compared to macintosh laryngoscopy.^[13] In my study minor airway trauma occurred in 2 out of 20 in airtraq group, and 3 out of 20 in macintosh group. Which was to the soft tissues of airway including dental injury, which was not statistically significant

In this study, airtraq has less intubation difficulty score, less Cormack and Lehane score, less intubation duration, less Airway trauma and less hemodynamic response for intubation than Macintosh.

CONCLUSION

Endotracheal intubation with airtraq laryngoscope is easier than Macintosh laryngoscope because of good glottic view. In addition to that, Airtraq has less intubation duration, less hemodynamic response for intubation, and less Airway trauma compared to Macintosh. Airtraq laryngoscope significantly improves the view of the glottic opening and facilitates fast, easy, and reliable intubation. Airtraq reduces the need for more sophisticated and complex

airway instrument like flexible fiberoptic bronchoscope to a particular extent. It can also be useful in routine anesthesia management, in critical care, anticipated and unanticipated airway situations. Due to less hemodynamic response for laryngoscopy for Airtraq may have an advantage in a clinical situation such as coronary artery disease or cardiac arrhythmias and neurosurgery patients.

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