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Comparison of the Airtraq laryngoscope versus Macintosh Laryngoscope in Endotracheal Intubation Success.

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ABSTRACT

Background: The curved laryngoscope blade described by Macintosh in 1943 remains the most widely used device to facilitate tracheal intubation. The Airtraq is a new, single use, indirect laryngoscope introduced into clinical practice in 2005. It has wan exaggerated blade curvature with internal arrangement of optical lenses and a mechanism to prevent fogging of the distal lens. A high quality view of the glottis is provided without the need to align the oral, pharyngeal and tracheal axis. We evaluated Airtraq and Macintosh laryngoscopes for success rate of tracheal intubation, overall duration of successful intubation, optimization maneuvers, POGO (percentage of glottic opening) score, and ease of intubation. Difficult or unsuccessful tracheal intubation is one of the important causes for morbidity and mortality in susceptible patients. Almost 30% of the anaesthesia-related deaths are induced by the complications of difficult airway management and more than 85% of all respiratory related complications cause brain injury or death. Nowadays, due to the advances in technology, new video laryngoscopic devices became available. Endotracheal intubation of patients is an effective method for controlling airway and breathing. However, laryngoscopy and Endotracheal Intubation is not easy in every case. This study was carried out to evaluate and compare the efficacy of Airtraq (AL) and Macintosh Laryngoscopes (ML) in intubating patients. **Methods**: This randomized controlled study was carried out in 40 adult ASA I and II patients after written informed consent and approval of the ethical committee, randomly categorized into two equal groups. All patients were subjected to same anaesthetic protocol. Group I patients were intubated using AL and group II patients were intubated using ML. Hemodynamic measurements and oxygen saturation were recorded. Intubation criteria for both groups including (duration of intubation procedure, number of attempts, number of optimization maneuvers, Cormack and Lehane grade at laryngoscopy, Intubation Difficulty Scale score (IDS), rate of successful placement of endotracheal tube, neck mobility during laryngoscopy and intubation complications were recorded. Data statistically analyzed using SPSSR software using (t and v2 tests) and $P < 0.05$ considered significant. **Results:** There was statistically significant increase in both heart rate and mean arterial blood pressure values following intubation in ML group than AL, oxygen saturation showed no significant difference between the two groups. Duration of intubation was statistically significant longer in ML group and needed more optimization maneuvers than the AL group, while for the number of intubation attempts; there was no statistically significant difference between the two groups. Both the Cormack and Lehane grading and IDS score values have shown statistically significant higher values in ML group. **Conclusion**: The Airtraq Laryngoscope offers a new approach for the management of difficult airway like patients with potential cervical spine injury, it is fast, easy to use, gets an easy view of the larynx without moving the cervical spines or causing hemodynamic stimulation.

Keywords: laryngoscope, Airtraq, Endotracheal intubation, Cormack and Lehane grading.

INTRODUCTION

Intubating trachea and securing the airway remains a challenge although it is a routine practice for the anaesthesiologist. Airway management is a major responsibility for the anaesthesiologist.

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Difficulties with tracheal intubation significantly contribute to the morbidity and mortality associated with anaesthesia.[1] The anaesthesiologist should consider strategies to anticipate and manage patients with difficult airways. These include identifying the potential problems, considering different options, and selecting an appropriate plan for the individual patient[2]. Airtraq® laryngoscope is a recently developed video laryngoscope for use in patients with normal or difficult airways. The curvature of the Airtraq blade and the special internal arrangement of the optical components allow visualization of the glottic plane without alignment

of the oral, pharyngeal, and tracheal axis.[3,4] The resultant indirect laryngeal exposure may require less movement of the cervical spine as compared to conventional Macintosh laryngoscopes. The blade of the Airtraq consists of two side channels, one for the insertion of the endotracheal tube (ETT) and the other containing a series of lenses, prisms, and mirrors that transfer the image from the illuminated tip to a proximal viewfinder, giving a high-quality wide-angle view of the glottis and surrounding structures, and the tip of the tracheal tube. 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. This study was conducted to compare the conventional (Macintosh) laryngoscope with newer Airtraq® laryngoscope for duration of successful tracheal intubation and optimization maneuvers needed. But despite recent developments in airway device technologies, the Macintosh Laryngoscope (ML) is still considered the golden standard for endotracheal intubation since it was first used in 1943 until this day.[5,6] Conventional intubation with ML requires a direct view of the structures of the larynx, the line of vision needed for this demands extension of the head and flexion of the cervical spine to align the oral, pharyngeal and tracheal axes. This study was carried out to evaluate and compare the efficacy of both the Airtraq and the Macintosh laryngoscopes in intubating patients. Difficult airway is not recognized until the induction of anesthesia as there is no single factor to predict the existence of a difficult airway.[7]

MATERIALS AND METHODS

This randomized controlled study was carried out on 40 adult ASA I and II patients after taking a written informed consent from each patient and approval of the ethical committee. Patients were randomly categorized into two equal groups (twenty each). Patients with mallampati III and IV, thyromental distance less than 6 cm, risk of gastric aspiration and with cervical injury or instability were excluded from the study. All patients were subjected to the same anaesthetic protocol; using intravenous (IV) midazolam 0.04–0.05 g/kg as premedication, pre oxygenation for at least 3 min, General Anesthesia (GA) using (IV fentanyl 1–1.5 mcg/ kg, IV propofol 2–3 mg/kg and IV atracurium 0.5 mg/kg). All patients were monitored.[8] After the onset of neuromuscular blockade, the neck was immobilized, holding the sides of the neck and the mastoid processes, and thus preventing flexion/extension or rotational movement of the head and the neck. Group I patients were intubated using AL, to use the Airtraq device, the blade must be inserted into the mouth in the midline, over the centre of the tongue, the tip positioned in the vallecula, look through the eyepiece until you see the epiglottis and the vocal cords then advance the ETT until seeing it passing through the vocal cords. After verifying ETT placement, hold it and slide the Airtraq backward and make sure that ETT has not moved.[9] [Figure 1] Group II patients were intubated using ML, the blade of ML was introduced to the right of the tongue, advanced into the hypopharynx, pushing the tongue to the left, and then the laryngoscope was lifted upward and forward, without changing the angle of the blade, to expose the vocal cords. Hemodynamic measurements including (heart rate and mean arterial blood pressure) and oxygen saturation were recorded before induction of GA, before intubation, just after intubation and at 2 min interval for the first 5 min after intubation. Intubation criteria for both groups including (duration of intubation procedure which is the time taken from insertion of the blade of the laryngoscope between the teeth until the endotracheal tube (ETT) is passed through the vocal cords and confirmed by auscultation the chest for bilateral equal air entry, number of intubation attempts, number of optimization maneuvers required and rate of successful placement of the ETT in the trachea) were recorded. The Cormack and Lehane grade at laryngoscopy and intubation difficulty scale score IDS were recorded[10,11] [Tables 1 and 2]. Complications during ETT (lip or tongue bruising and teeth clicking) were also recorded.

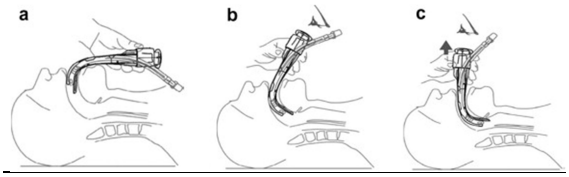


Figure 1: Technique of tracheal intubation with the Airtraq laryngoscope

Table 1: The Cormack and Lehane grade at laryngoscopy [13]

Grade 1	Visualization of the entire laryngeal aperture
Grade 2	Visualization of only posterior commissure of laryngeal aperture
Grade 3	Visualization of only epiglottis
Grade 4	Visualization of just the soft palate

Table 2: The Intubation Difficulty Scale (IDS) score: [14] The IDS score is the sum of the following seven variables

N1	Number of intubation attempts ⩾ 1
N2	Number of operators ⩾ 1
N3	Number of alternative intubation techniques used
N4	Glottic exposure (Cormack and Lehane grade −1)
N5	Lifting force required during laryngoscopy (0 = normal;

	1 = increased)
N6	Necessity for external laryngeal pressure (0 = not applied; 1 = applied)
N7	Position of the vocal cords at intubation (0 = abduction/not visualized; 1 = adduction)

Statistical Analysis:

Data were analyzed by using SPSSR software (Statistical package for social science for personal computers) using (t and v2 tests), data were expressed as mean ± SD and P < 0.05 considered significant.[4]

RESULTS

There were no statistically significant differences between the two studied groups as regards demographic data (age, sex, weight and ASA physical status) [Table 3]. Hemodynamic changes were analyzed in the present study; there was statistically significant increase in both heart rate and mean arterial blood pressure values at all periods following intubation in group II (ML group), while group I (AL group) showed no statistical significant changes. [Figure 2 and 3] As regards the percentage of oxygen saturation, there was no significant difference between the two groups. [Figure 4]. Duration of the intubation procedure was significantly longer in ML group than AL group (34.3 ± 12.27 s in AL group versus 48.75 ± 21.57 s in ML group), while for the number of intubation attempts, although it was less in the AL group, yet there was no statistically significant difference between the two groups. Both devices needed some optimization maneuvers, especially in the ML group which had statistically significant more optimization maneuvers than AL group (0.10 ± 0.031 in AL group versus 0.85 ± 0.081 in ML group) [Table 4].

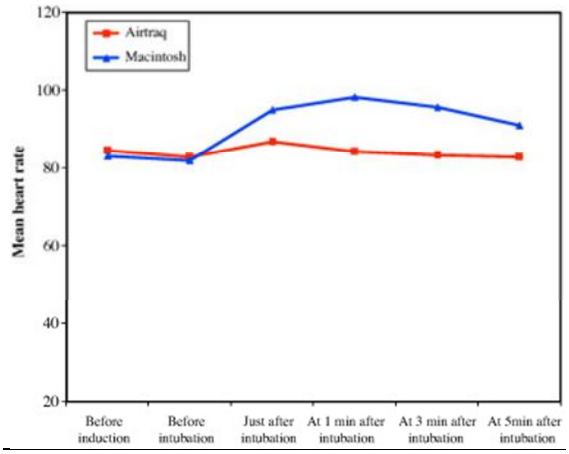


Figure 2: Comparison between different periods of HR in (b/m) in the two groups Airtraq and Macintosh

Both the Cormack and Lehane grading at laryngoscopy and IDS score values have shown statistically significant difference between both groups, where the ML group had statistically significant higher values indicating increased difficulty at intubation (P = 0.021 and 0.022 respectively). [Figure 5 and 6] There were no significant statistical differences between the two groups as regards rate of successful ETT placement [Table 4]. There were no statistical significant differences between the two groups as regards the complications (lip or tongue bruising and teeth clicking) although the ML group showed some complications while the AL group did not show any of them [Table 4].

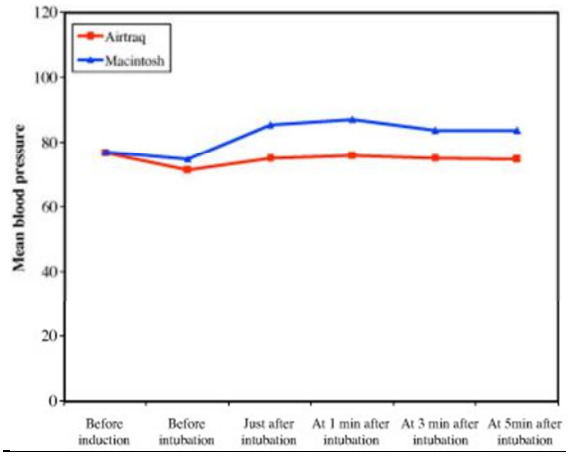


Figure 3: Comparison between different periods of MABP in (mmHg) in the two groups Airtraq and Macintosh

Table 3: Demographic data

Variables	AL	ML	*P* value
Age	29.55 ± 6.72	31.05 ± 6.34	*P* = 0.469[a]
Sex M/F	8/12	11/9	*P* = 0.342[b]
Weight	83.51 ± 21.7	80.12 ± 21.1	*P* = 0.453[a]
ASA I/II	5/15	7/13	*P* = 0.375[b]

a *P* was calculated by using *t*-test.
b *P* was calculated by using χ^2 test

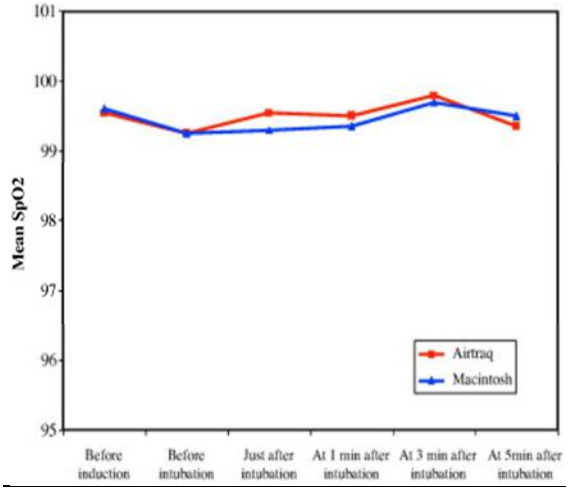


Figure 4: Comparison between different periods of SpO_2 in % in the two groups Airtraq and Macintosh

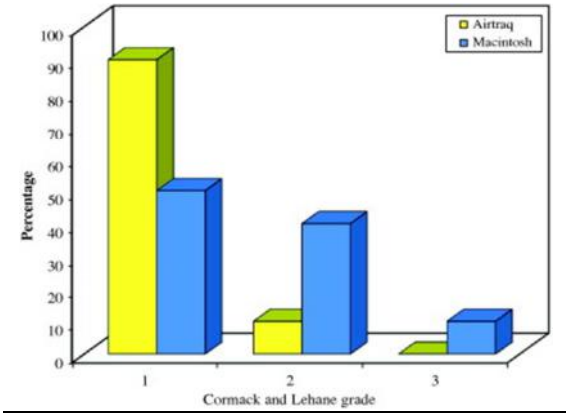


Figure 5: Comparison between Airtraq and Macintosh groups according to Cormack and Lehane grade.

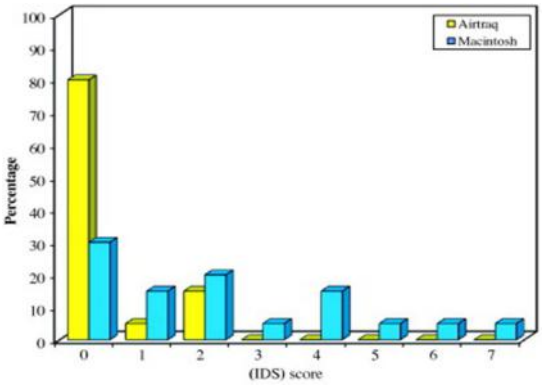
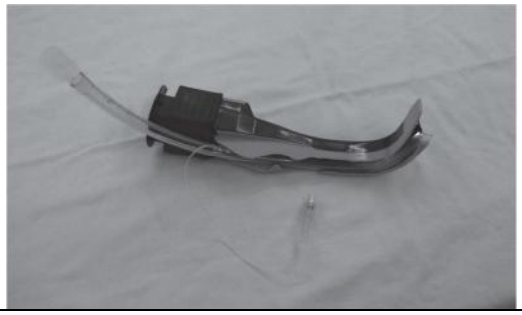


Figure 6: Comparison between Airtraq and Macintosh groups according to Intubation Difficulty Scale (IDS) score.

Table 4: Demographic data

Variables	AL	ML	*P*
Duration (s)	34.3 ± 12.27	48.75 ± 21.57	0.014*
Intubations attempt	1.1 ± 0.31	1.2 ± 0.41	0.382
Optimization maneuvers	0.1 ± 0.031	0.85 ± 0.081	0.001*
Cervical spine immobility	(20) 100%	(20) 100%	–
Rate of successful ET placement	(20) 100%	(20) 100%	–
Complications	–	3(15%)	0.231
Lip bruising	–	1(5%)	1.000
Teeth clicking	–	1(5%)	1.000
Tongue bruising	–	1(5%)	1.000

P was calculated by using *t*-test



Picture of Airtraq

Picture of Mcintosh Blade

DISCUSSION

Airway management remains a vital primary skill for anaesthetist through history, many devices and instruments have been used to ease the burden of this crucial technique. Despite advances in medical technology, emergent orotracheal intubation continues to challenge even the most experienced anaesthetist.[12] The present study was carried out to evaluate and compare the efficacy of both the AL and ML laryngoscopes in intubating patients, in AL group both heart rate and mean arterial blood pressure did not show statistically significant changes during the intubation procedure while in ML group, there was statistically significant increase in heart rate and mean arterial blood pressure at all periods following intubation when compared to the pre-induction values. On comparing the two groups together; the AL resulted in significantly less stimulation of heart rate and blood pressure after tracheal intubation in comparison with the ML. This finding could be attributed to the fact that the AL provides a view of the glottis without a need to align the oral, pharyngeal and tracheal axes, and therefore requires less force to be applied during laryngoscopy, while when using the ML, which did not allow alignment of the three airway axes, more lifting force and more manipulations were exerted to get a glottic view. Similar results were documented by Maharaj et al.[13] when compared AL with the ML for intubating. AL group showed less hemodynamic stimulation and pressor effects than the ML group. These findings were the result of the absence of head/neck manipulations as well as the shorter duration of the intubation trials by the AL. The same results were reported by Costello et al. [14] in their study to evaluate the AL and ML in patients at increased risk for difficult tracheal intubation. In the present study regarding the oxygen saturation during the intubation procedure, in both groups it was preserved above 96% and no desaturation was documented as the intubation attempts were interrupted by mask ventilation. When considering the duration of the intubation procedure, duration of

intubation attempts were significantly shorter with the AL group when compared to the ML group. This can be explained by the fewer maneuvers required in the AL group to improve the glottis exposure compared to the ML group where there was more difficulty to obtain a view of the glottis. Similar results were documented by Maharaj et al.,[13] AL required statically significant shorter time for the intubation procedure with mean value 13.2 ± 5.4 s versus 20.3 ± 12.2 s for the ML. On the other hand, Chalkeidis et al.[15] in their comparative study between the AL and ML for routine airway management have disagreed with the previous results. The results of their study showed that intubation by experienced anaesthetist was performed more quickly with the traditional ML than with the AL. However, the difference between the two groups was 5.9 s only; beside they were working on normal airway. As regards the number of intubation attempts in the present study, there was no statistically significant difference between the two devices as regard the number of intubation trials. In agreement with this study, Maharaj et al.[13] have reported nearly the same results in their study; there was no statistically significant difference between the AL group and the ML group as regards the number of intubation trials. In contrast to this study, Chalkeidis et al.[15] in their comparative study stated that, three patients were unsuccessfully intubated with the AL. Two of these patients, the laryngoscope visual field were blurred; the other patient was initially successfully intubated but was accidentally extubated during the withdrawal of the Airtraq from the mouth. This may be explained by unfamiliarity of the operator with the new device and how to prepare it before use. As regards optimization maneuvers required, both devices needed some optimization maneuvers during insertion and placement of the endotracheal tube, AL had a statistically significant less optimization maneuvers than ML and offered easier intubating conditions. Similar results were documented by Laffey and Black[16] in a similar study showing that all the patients intubated by the use of AL did not require any optimization maneuvers, in comparison to ML group where 25% of the patients required one, 15% of the patients required two and only 60% of the patients did not require any optimization maneuvers. Although Chalkeidis et al.[15] in their comparative study stated that the AL is easier to use yet it does not have any significant advantages compared with the ML for routine airway management. In the present study, Cormack and Lehane grading at laryngoscopy showed that, 90% of the patients intubated with the AL had a grade I Cormack and Lehane glottic view and 10% had grade 2, compared with 50% of the patients in the ML group had grade 1, 35% with grade 2, and 15% with grade 3, which reflects that the Airtraq can be useful in case of difficult airway. Maharaj et al.[13] in their similar study found nearly the same results, where nineteen patients out of the twenty intubated by the AL were grade 1 and one patient was grade 2, while in the ML group only six patients had grade 1, seven patients grade 2 and the other seven had grade 3. On discussing the results of the present study as regards the ID score, mean ID score was reduced in the AL group with none of the patients showing > score 2, in comparison to the ML group which showed increased ID scores. Laffey and Black[16] in their study found that all patients in the ML group had an IDS score of P 1, compared to five in the AL group. In the ML group, 19 patients had an IDS score of 4 or greater, indicating at least a moderate degree of intubation difficulty, compared to none in the AL group. As for the rate of successful placement of the ETT, all patients were successfully intubated by both the AL and the ML, although some required more than one attempt of intubation in both groups. This is attributed to the easiness of use of the Airtraq and its quick learning curve. The same results were conducted by Laffey and Black[16] where all patients in AL group were successfully intubated on the first attempt while in ML group, tracheal intubation was unsuccessful in four patients, and those patients were successfully intubated on the first attempt with the Airtraq. Maharaj et al.[13] also had nearly the same results as regards the overall success rate of intubation in patients, with 100% of the patients intubated in the AL group and 95% in the ML group. Laffey and Black[13] reported that the Airtraq significantly reduced the incidence of minor complications as mucosal bleeding or lip bruising.[6]

CONCLUSION

The Airtraq Laryngoscope offers a new approach for the management of the normal and difficult airway like patients with potential cervical spine injury, it is fast, easy to use, gets an easy view of the larynx without moving the cervical spines or causing hemodynamic stimulation. Both Airtraq and Macintosh laryngoscopes are equally effective in tracheal intubation in normal airways. We found that there was a significant difference in ease of intubation and glottic view with use of both the devices. Airtraq required a shorter duration for successful tracheal intubation with significantly lesser optimization maneuvers.

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