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Original Research Article

Comparative evaluation of ease of tracheal intubation using Airtraq and intubating laryngeal mask airway with cervical spine immobilization

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ABSTRACT

Background: Tracheal intubation in cervical spine injury patients with application of Manual In Line Stabilization (MILS) of the cervical spine in neutral position is a challenge for the anesthesiologist since it makes visualization of the larynx more difficult using conventional laryngoscopy. Our study was conducted to compare ease of intubation using Airtraq and Intubating laryngeal mask airway (ILMA) in simulated cervical spine injury patient using MILS.

Materials and Methods: 100 ASA I/II patients (without cervical spine injury), aged 18-60 years were randomly allocated in two groups -Group A: Airtraq (n=50), Group I: ILMA (n=50). General anaesthesia was given as per standard protocol in all the patients, after that MILS was applied and patients intubated using Airtraq in group A and ILMA in group I with neck in neutral position. Time taken for intubation, number of attempts for intubation, ease of intubation with Airtraq/ILMA, hemodynamics and complications were compared.

Results: The mean time taken for intubation in the Group A was 12.6 ± 6.6 seconds and in the Group, I was 85.8 ± 36.6 seconds ($p<0.001$). Number of intubations attempts in Group A was significantly less as compared to the Group I ($p= 0.027$).

Conclusion: Airtraq is a safer and faster alternative when compared to ILMA in patients with simulated cervical spine injury using manual in line stabilization.

1. Introduction

Tracheal intubation in patients without adequate neck immobilization in cervical spine injuries can result in a devastating neurological outcome.[1] A widely used approach to neck immobilization during tracheal intubation is Manual In Line Stabilization (MILS).[2] This approach has been demonstrated to reduce cervical spine mobility and additional neurological injuries in cervical spine injured adults (like disc space enlargement and subluxation of the injured segments, which occurred during all basic and advanced airway maneuvers).[3] However, a key concern is that with cervical spine immobilization, it is more difficult to visualise the larynx using conventional laryngoscopy leading to failed intubations.[4] Inability to secure the airway remains a leading cause of morbidity and mortality in the operative and emergency settings.

Uses of specialized supraglottic airway devices and video laryngoscopes are being increasing used in such patients. Among Supraglottic airway devices, intubating laryngeal mask airway (ILMA) (Figure 1) has been the airway device of choice for many anaesthesiologist in patients with cervical immobilization, post burn contracture neck and other difficult airway situations.

The Airtraq (Vygon Ltd, Figure 2) is a newer optical laryngoscope designed to facilitate intubation. It does not require hyperextension and permits intubation with head and neck in neutral position. It has an exaggerated curvature

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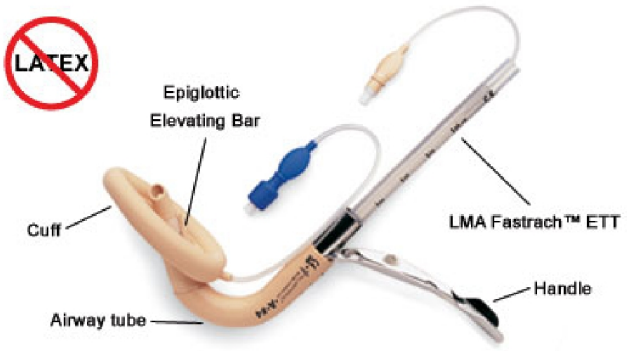


Fig. 1: Intubating laryngeal mask airway

of blade and an internal arrangement of optical components, which provides a high-quality view of glottis without the need for alignment of oral, pharyngeal and laryngeal axis.

Fig. 2: Airtraq

Thus, we planned to undertake this study to compare the ease of intubation using Airtraq and ILMA in clinical settings of cervical immobilization using MILS.

2. Materials and Methods

After the Ethics Committee approval the present study was conducted in 100 adult patients admitted in the tertiary care center at New Delhi. The sample size was calculated using preliminary data i.e. the results obtained from the study conducted by Durga P et al.[5] Taking an alpha error of 0.05 and power of 85%, sample size came out to be 100 (50 in each group). It was a randomized controlled study where patients were allocated in two groups namely Group A: Airtraq (n=50) and Group I: ILMA (n=50) by computer generated random number table.

ASA grade I/II patients, 18 and 60 years of age of either sex, having a Modified Mallampati grade I/II and a BMI<30 kg/cm^2 undergoing elective surgery under general anaesthesia (GA) were included in this study whereas patients with cervical spine or oral pathology, airway distortion (post burn contracture), mouth opening less than 3cm and pregnant patients were excluded from the study. Operator was an anaesthesiologist with experience of having successfully intubated at least 20 patients using each device (Airtraq and ILMA).

Detailed pre-anesthetic checkup (PAC) was done and written informed consent was taken. Patients remained fasting overnight and were pre-medicated with oral Ranitidine and Alprazolam on the night before and morning of surgery. On the day of surgery patients were wheeled into the operating room and ASA standard monitors (Electrocardiogram, oxygen saturation, and non-invasive blood pressure) were attached. Baseline heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and oxygen saturation were recorded. Intravenous access was secured with 18G i.v cannula in all patients and infusion of Ringers lactate was started.[6] Inj midazolam 0.04mg/kg and Inj. fentanyl 2 μg/kg IV was given to all the patients as preanaesthetic medication. After 2mins, anaesthesia was induced with Inj.propofol 2 mg/kg IV. MILS was then applied in all the patients as per standard technique in order to restrict neck movements so as to simulate cervical spine involvement. Subsequently adequacy of ventilation was assessed by bag and mask ventilation and muscle relaxation was achieved with Inj. vecuronium bromide 0.1mg/Kg IV. Patients were ventilated with 100% O2 and isoflurane ≤1% with bag and mask. Thereafter in group A, Airtraq with A-011 Regular (size 3) was used in all patients whereas in group I, ILMA (preselected size 3,4 according to body weight of patient) was inserted and in both groups, trachea was intubated with appropriate size ETT. Endotracheal tube placement was confirmed by square waved capnograph.

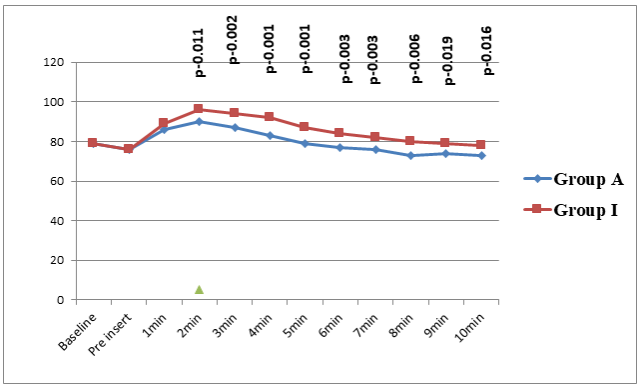
Primary outcome was time taken for intubation (It was defined as time taken from holding the airway device for insertion to the appearance of first square waved capnograph). Secondary outcomes were number of attempts for successful intubation (A total of two attempts at insertion were allowed including change in size & any maneuver required and the respective times were noted as T1 (first attempt) & T2 (second attempt). Effective time was calculated by adding T1 & T2), ease of intubation with the device (Airtraq/ILMA) as graded by Likert scale, hemodynamic variables (HR, MAP) and complications if any (trauma to oropharyngeal structures, blood stains on device/ETT) were compared. If intubation failed, MILS was removed and conventional laryngoscopy and intubation was performed to secure the airway and the case was excluded from statistical analysis.

The data obtained was tabulated and analyzed using Statistical Package for Social Science (SPSS 22.0). For quantitative variable (time taken for intubation and hemodynamic variable), the data was presented as range

(minimum, maximum), mean±sd and median (interquartile range) under each group separately. For categorical variable, the data was presented in terms of frequency (%) under different categories for each group separately. Statistical significance of categorical variables between two groups were determined by Chi-square/Fisher's exact test. For intergroup analysis of hemodynamic parameters over a period of time, Paired't'-test/ non parametric Wilcoxon sign rank test was applied. Level of statistical significance was taken as $p< 0.05$.

3. Results

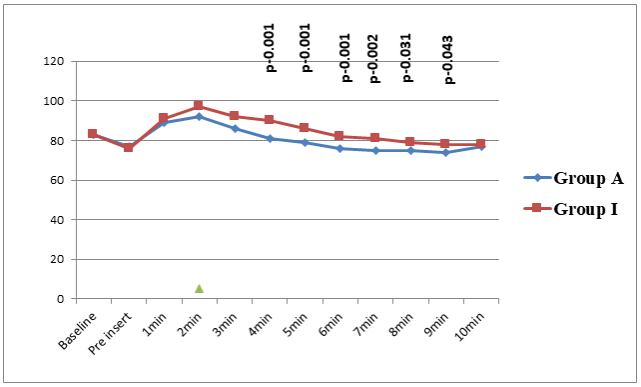
The CONSORT flow diagram mentioned in Figure 3. The demographic profiles and modified Mallampati classification between two groups were comparable (Table 1). In ILMA group, the mean intubation time was 85.8 ± 36.6 seconds in contrast to 12.6 ± 6.6 seconds in Airtraq group ($p<0.001$). In the ILMA group airway was secured in first attempt in 88% of patients while in rest of the patients (12%), a second attempt for intubation was needed (p-0.02). In the Airtraq group, airway of all patients (100%) was successfully secured in the first attempt (p-0.027). Ease of Intubation was determined using Likert scale (Figure 4) in which 79% of operator gave scale of 4(agree) whereas 62% of operator gave scale of 3(neither agree nor disagree) for the Airtraq group and ILMA group respectively (p-0.03). It was also seen that the HR (Graph 1) and MAP (Graph 2) in the Airtraq group was more controlled and stable as compared to the ILMA group. There was no blood staining in the Airtraq group whereas 2 patients had blood staining on ILMA seen on it removal.



Graph 1: Comparison of heart rate at different time points between two groups

4. Discussion

Supraglottic airway devices have been widely compared by investigators in various subsets of patients. In cases of cervical spine injury flexible scopes and ILMA has been widely studied and compared.[7] Among Supraglottic



Graph 2: Comparison of MAP at different time points between two groups

devices, ILMA is most commonly used but frought with failure rates, hemodynamic response and is time consuming. In previous studies Airtraq has been compared with Macintosh laryngoscope in these subsets of patients.[8–11] Hence this study was undertaken to evaluate and compare the efficacy of Airtraq to that of ILMA for endotracheal intubation in simulated cervical spine injury patients using MILS.

In our study, we found that intubation was much faster with the Airtraq (12.6 ± 6.6 seconds) when compared with the ILMA (85.8 ± 36.6 seconds) making Airtraq a better option in simulated cervical spine patients. It may be attributed to the fact that Airtraq significantly improves glottic view and its preformed guide channel with direct visualization made the task of intubation quicker with the Airtraq. The significant time difference with the two devices may be attributed to the fact that after the ILMA was inserted, adequacy of ventilation was confirmed and then intubation was performed through the device which is a longer procedure.

Maharaj CH et al. compared ease of intubation between Macintosh and Airtraq laryngoscopes in patients with cervical spine immobilization. It was observed that Airtraq guided intubation was much faster without using any additional maneuvers (13.2 ± 5.5 vs 20.3 ± 12.2 s). Thus, it demonstrates the Airtraq laryngoscope offers a new approach to tracheal intubation in patients who require cervical spine immobilization.[8] Another study conducted by Bilgin et al., they observed that intubation time was significantly longer in the ILMA group as compared to the C-Trach and McCoy group.[9]

Similarly, in a manikin study conducted by Sherren et al. in 2013, Macintosh, McCoy, Airtraq laryngoscopes and ILMA were compared for time taken for intubation. It was observed that Airtraq was associated with a shorter time for intubation.[10]

In 2016 Saracoglu A et al. performed a study evaluating ease of intubation, time taken for tracheal

Table 1: Demographic profile and time taken for insertion of the airway device

	Group A (Airtraq)		Group I (ILMA)		P value
Age(years) Mean±SD	37.56 ± 14.51		35.80 ± 11.57		0.46
Weight (Kgs) Mean±SD	57.66 ± 5.64		56.24 ± 5.31		0.54
Sex Male / Female	15 (30%)	35 (70%)	10 (20%)	40 (80%)	0.08
ASA Grade I / II	46 (92%)	4 (8%)	45 (90%)	5 (10%)	0.18
Time taken for insertion of the airway device (in seconds) Mean±SD	12.6 ± 6.6		85.8 ± 36.6		0.001

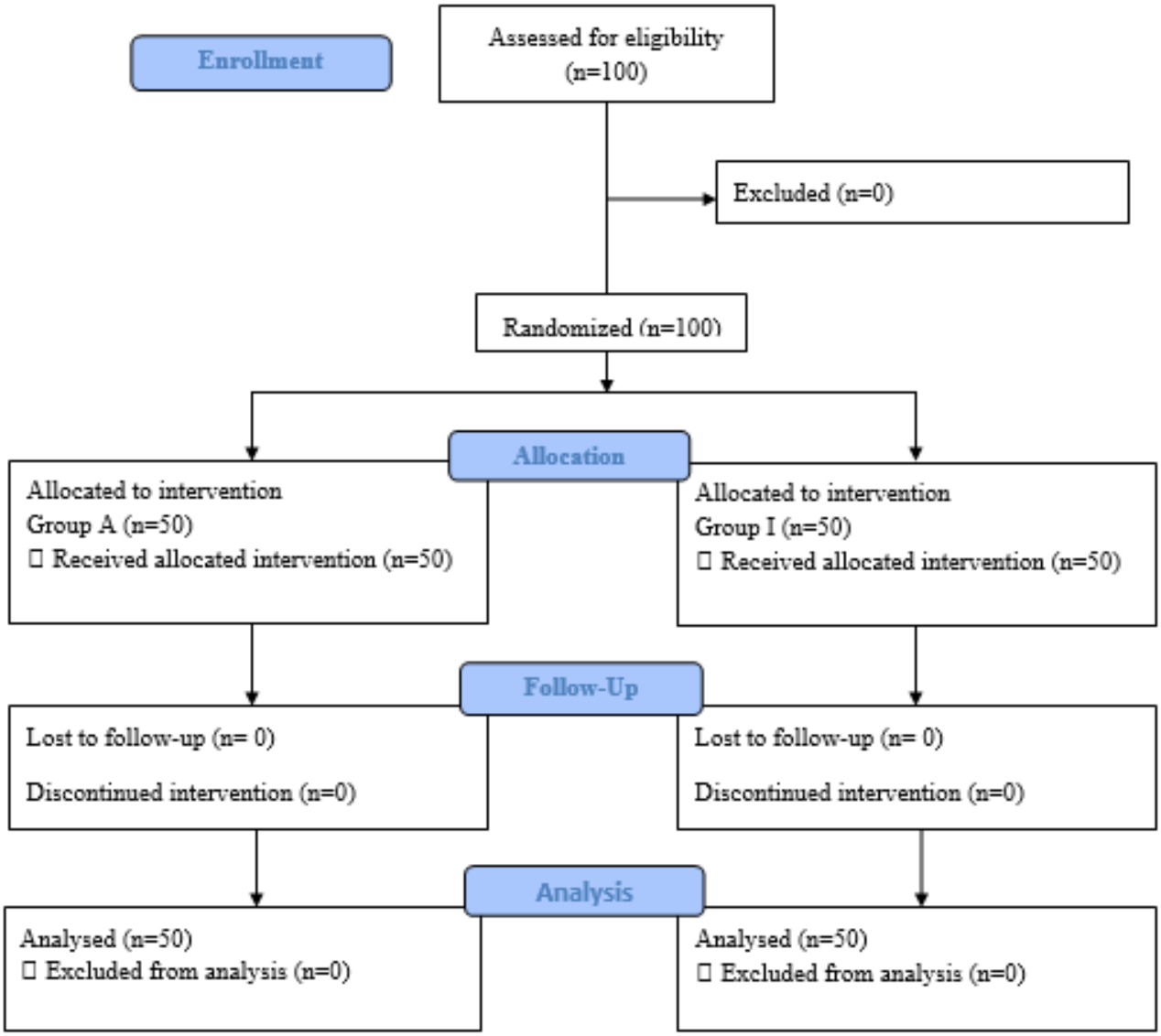


Fig. 3: Consort diagram showing the division of patients at every stage of randomized control trial

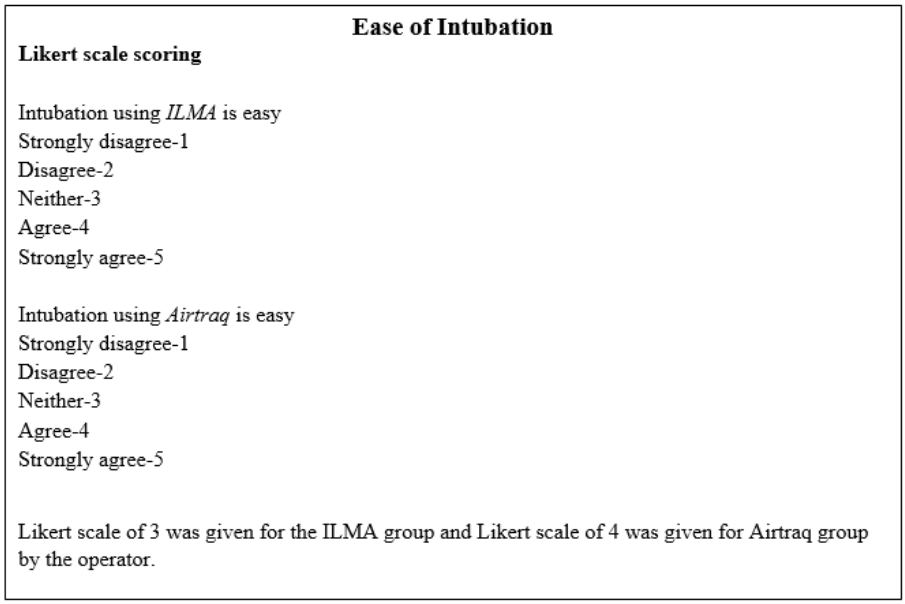


Fig. 4: Likert scale

intubation using Airtraq, LMA C-Trach™ and Macintosh Laryngoscopes. They observed that Airtraq laryngoscope has shorter intubation duration, less additional optimization manoeuvres compared with the LMA CTrach and Macintosh laryngoscopes.[11] This could probably be attributed to the fact that an additional step of check ventilation is done when C-Trach™ is used, before attaching the monitor to the device.

However, another study conducted by the Rao M et al. in 2018 comparing LMA CTrach™ and Airtraq and found that LMA CTrach™ and Airtraq are similar with respect to time taken for obtaining optimal laryngeal view, successful intubation, and total time when used for intubation in patients with simulated limitation of cervical spine movements. This may be attributed to the fact that they had eliminated the time taken for check ventilation during CTrach™ use, since they wanted to compare the devices as conduits for endotracheal intubation. Hence, the two devices were found to be comparable.[12]

In our study, number of attempts required for successful intubation with airway device was analyzed. In the ILMA group it was seen that airway was successfully secured in first attempt in 88% patients and a second attempt was needed in the remaining 12%. In the Airtraq group, airway of all patients (100%) could be successfully secured in first attempt and this difference was found to be statistically significant (p=0.027). We found that in the ILMA group, though the device insertion and ventilation was easy, the tracheal tube could not be negotiated into the glottic opening in 12% patients in the first attempt since repeatedly the tracheal tube was advancing posteriorly towards the oesophageal opening. This may be attributed to the fact that placement of the ILMA may result in a partially obstructed glottic aperture by the down folded epiglottis or an improper placement/size of ILMA. Our study results were consistent with Maharaj CH et al. as they also observed 100% intubation success rate in first attempt using Airtraq in comparison with Macintosh.[8]

Bilgin et al., in their study compared tracheal intubation using ILMA, McCoy or C-Trach laryngoscope in patients with simulated cervical spine injury. But success rates for intubation were higher in the McCoy (100%) and C-Trach (100%) groups than in the ILMA (87%) group.[9] This finding again emphasizes that with increasing number of attempts at intubation, increasing the probability of cervical spine movement.

In our study the operator found intubation using Airtraq easier than intubating with ILMA as has been observed by the Likert scale. Similar observations were made in a previous study conducted by Maharaj CH et al.[8] and Saracoglu A et al.[11] in which Airtraq and Macintosh laryngoscope were compared for ease of intubation. They also observed that Airtraq was easier to insert.

With regards to hemodynamic parameters, it was observed that the heart rate in Airtraq group was more controlled and remained stable as compared to the ILMA group. There was slight rise in hemodynamic variables with insertion of ILMA when compared to Airtraq, probably due to more sympathetic stimulation during manipulation of ILMA but this data was not of statistical relevance.

It was seen by Maharaj CH et al. when they compared Airtraq with Macintosh laryngoscope in forty patients that the Airtraq resulted in less change of heart rate and blood pressure after tracheal intubation in comparison with the

Macintosh laryngoscope. This may be attributed to the fact that the Airtraq provides the glottic view without a need for alignment of the oral, pharyngeal and tracheal axis therefore requires less force to be applied during laryngoscopy.[13]

Another study conducted by Jakhar M et al. in 2020 compared C-MAC video laryngoscope and ILMA for tracheal intubation and found that hemodynamic response to intubation process was comparable between the two groups at all times except heart rate being significantly higher in the ILMA group at 1-and 3-min postintubation and blood pressure (systolic, diastolic and mean) being statistically higher in ILMA group at 1-min postintubation as compared to C-MAC group. This could be due to more manipulation required to obtain adequate ventilation after insertion, a greater number of attempts, and more time taken to secure the airway in ILMA group.[14]

Maharaj CH et al in 2007 comparing Airtraq and Macintosh also showed that tracheal intubation with Airtraq led to fewer alterations in blood pressure and heart rate.[13]

Blood stain on the ILMA after removal was seen in 2 patients as compared to none with the Airtraq. However, the difference was not statistically significant. Previous study by Saracoglu A et al.[11] also found less incidence of dental trauma with Airtraq especially in difficult intubation scenarios.

5. Conclusion

Airtraq has better ease of insertion, faster time for intubation and higher first attempt success rate when compared with ILMA in simulated cervical spine injury patients using manual in line stabilization. Also, it provides better hemodynamic stability so may be a safer airway device in cervical spine injury patients.

6. Source of Funding

None.

7. Conflict of Interest

None.

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