

Comparative Evaluation of Intubation performances of Novice Residents of Anaesthesiology with Airtraq and Macintosh Laryngoscope

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Abstract

Aim and Objectives: To evaluate and compare intubation performances of novice junior residents of anesthesiology using Airtraq and Macintosh laryngoscope in non-difficult airway situations.

Method: This prospective, randomized study evaluated total 20 junior residents (JR-I) of Anesthesia Department of two consecutive years who had not performed intubation in past. Each student intubated total 20 patients, 10 with Airtraq (Group A) and 10 with Macintosh laryngoscope (Group M) alternatively. Device of intubation was selected as per stratified randomization. For this, consenting 400 patients of ASA I, II of Mallampati grade I, II were included in present study. Patient allocation to student was done as per allocation by chance.

Results: For trainee anesthetist, success rate for intubation was 76.5% in group A and 64.5% in group

M (P= 0.0085) with 95% confidence interval. When overall success rate of trainee anesthetists was analyzed as per chronological order of case with each device, we observed that even in initial cases, success rate for endotracheal intubation was satisfactory in group A with higher ease of intubation (P=0.0025) and lesser complications. Also, trainee students could obtain grade I Cormack Lehane glottic view in higher number of cases in Airtraq group than in Macintosh group (p value=0.0006).

Conclusion: Rapid acquisition of intubation skill with better ease of intubation was observed in Airtraq group. Thus, Airtraq can be used effectively as a teaching gadget for a skill of endotracheal intubation especially in novice medical personnel.

Keywords: Laryngoscopy, Intubation, Anesthetist, Mallampati grade

Introduction

Laryngoscopy and tracheal intubation are foundational and elementary skills that anesthesiologist pursues to learn, practice and excel once they enter the fraternity. [1] Indian medical graduate is expected to learn skill of endotracheal intubation during internship but many of them failed to do so. These students when join the department of anesthesiology apart from other routine work like documentation, trolley preparation, they are expected to attend the emergency calls at casualty and wards where endotracheal intubation may be required for resuscitation purpose and for patient care. Medical and paramedical personnel are also keen to learn the skill of laryngoscopy and intubation as it is a lifesaving process. The curved laryngoscope blade described by Macintosh in 1943 remains the most widely used device to facilitate tracheal intubation [2] but learning curve for endotracheal intubation with conventional laryngoscopes is quite long as it is a complex psychomotor skill.[3]

Airtraq, is novel optical laryngoscope with an exaggerated blade curvature which provides glottis display without any deviation of oral, pharyngeal or tracheal axes. It allows intubation with minimal manipulation of neck and also, tracheal tube does not obstruct the view during intubation [4]. Airtraq is being widely studied and compared with Macintosh laryngoscope and various other video laryngoscopes. During these researches, it was observed that Airtraq was useful in both normal and difficult airway scenario in experienced hands and may be good for novice trainee anesthetist for learning the skill.

Our institute being teaching institute, receives students every year and these students usually are novice to the skill of laryngoscopy and intubation. Hence, keeping in

mind the usefulness of Airtraq in providing faster learning of intubation skill, we carried out the present study to evaluate and compare intubation performances of trainee anesthetists (Junior residents of first year (JR-I)) while using Airtraq and Macintosh laryngoscope to acquire utmost important skill of endotracheal intubation.

Figure 1: Showing airtraq videolaryngoscope with slot for endotracheal intubation



Methods

After obtaining approval from the Institutional Ethical Committee, this prospective randomized and single blinded study was conducted in the Department of Anesthesiology over period of two years from December 2016 to November 2018. Written informed consent to participate in study was obtained from JR-Is and patients both.

We included total 20 novice trainee anesthetists i.e. newly joined residents of Anesthesiology Department who had not performed intubation in past. We excluded students who were not willing to participate in the study and those who were already experienced in intubation. From each batch, out of 14 freshmen, 10 JR-Is selected by simple random sampling technique. All students were given training for laryngoscopy and endotracheal intubation on manikin with both Airtraq and Macintosh laryngoscope. These randomly selected

residents were posted in different surgical OT complexes and were given chance to perform intubation. The device of intubation was selected by stratified sampling technique i.e. if by chit method first device was Airtraq then the next device for intubation used by that resident on next patient was Macintosh laryngoscope and so on. From 3rd to 6th month of residency each student was given a chance to intubate 20 patients (10-Airtraq,10- Macintosh laryngoscope alternatively). The primary outcome of present study was overall success rate of intubation and mean intubation time for individual trainee anesthetist with each device. The secondary outcomes included total number of laryngoscopy and intubation attempts, Cormack–Lehane(C–L) grade on laryngoscopy, ease of intubation and also haemodynamic variations during intubation and any adverse events.

Total 400 adult patients of either gender, ASA grade I and II aged between 18-60 years, BMI<25 kg/m², MPG I and II with adequate mouth opening and who were posted for elective surgery under general anesthesia were included in the present study. However, patients with ASA Grade III or IV, anticipated difficult airway were excluded. Day before surgery, patients underwent thorough preanaesthetic checkup and airway assessment.

On the day of surgery, in operation theatre, standard monitoring for all the patients included electrocardiogram (ECG), non-invasive blood pressure (NIBP), oxygen saturation (SpO₂) and measurement of end-tidal carbon dioxide (ETCO₂) with anesthetic gas monitoring. After premedication and preoxygenation, induction of general anesthesia was done with intravenous Propofol (2mg/kg) and Rocuronium (0.8mg/kg). Tracheal intubation was performed by trainee

anesthetist either by Airtraq (Group A) or Macintosh laryngoscope (Group M) as per the allotment. Intubation was performed in sniffing position in group M and in neutral position in group A. If intubation was not successful after three attempts or time taken for intubation was more than 180 seconds, whichever was earlier, patient was taken over by senior anesthesiologist for further airway management.

The laryngoscopic view of glottis was graded according to Cormack and Lehane (C-L) grading. Visualization of C-L grade I or II is termed as successful laryngoscopy. Intubation time was defined as time from introduction of laryngoscope blade into the patient's mouth until confirmation of intubation by auscultation and ETCO₂ tracings. Ease of intubation was graded by trainee anaesthetist on the basis of numerical rating scale (NRS) which was graded from 1 to 10, 1 being the easiest and 10 being the most difficult. Optimal external laryngeal manipulation (OELM) for Macintosh Laryngoscope and twist and turn maneuver for Airtraq were considered as optimization maneuver required while performing tracheal intubation which was assessed with a score 0- no optimization maneuver required,1- optimization maneuver required.

Haemodynamic parameters were noted upto 10 minutes of intubation. Rate pressure product (RPP) was calculated as the product of heart rate and systolic blood pressure. Complications in the form of bruising to lips, dental trauma, bronchospasm, desaturation (SpO₂ <90%) were noted and treated immediately.

Statistical analysis

For sample size determination, from prior study, parameter of intubation time was taken into consideration. [2] Standard deviation of intubation time with Airtraq and Macintosh Laryngoscope were

10.7seconds and 5.53 seconds respectively. Difference between mean intubation times of both devices was 12. With power of 80%, level of significance 5%, required sample size for students per group was 8. So, total 16 students were calculated. To overcome, the dropouts in the study, we took 20 students.

Data was collected, compiled and analyzed using EPI info (version 7.2). Qualitative variables were expressed in the terms of percentile. Quantitative variables were both categorized and expressed in terms of percentage or in terms of mean and standard deviations. Difference between 2 proportions was analyzed using Chi square or Fisher exact test. Difference between 2 means was tested using student t test. All analysis was 2 tailed and significance level was set at 0.05.

Results

The maximum number of patients were in the age group of 20-40 years (Group A = 77% and Group M = 85.5%) with male predominance in each group as shown in table 1.

Table 1: Demographic profile of the patients

Parameters	Group A (n=200)	Group M (n=200)	P value
Mean Age	33.08±10.32	32.31±8.20	0.4063
Mean BMI	22.17±1.86	22.9±1.78	0.5232
Gender	Male	105 (52.50%)	0.5472
	Female	89 (44.50%)	
ASA Grade	I	177 (88.50%)	1.000
	II	23 (11.50%)	

With confidence interval of 95% (CI-95%), rate of successful intubations by Trainee Anesthetists was more in group A i.e.76.5% (CI- 70.0-82.2%) as compared to 64.5%(CI – 57.4% -71.1%) in group M. Difference in success rate of two groups was statistically significant {(CI 3.1% -20.9%) (p=0.0085)}.

Mean intubation time required by trainee anesthetists in each group for successful intubation was less in group A (44.98 secs) as compared to group M (67.01secs), (p value<0.001).

Although total numbers of laryngoscopy and intubation attempts while using Airtraq were less than with Macintosh laryngoscope, successful laryngoscopy and intubation attempts were higher in group A than in group M and the difference in both groups was statistically significant (Table 2).Because of unsuccessful laryngoscopy, intubation was not attempted in all patients in both groups by trainee anesthetists.

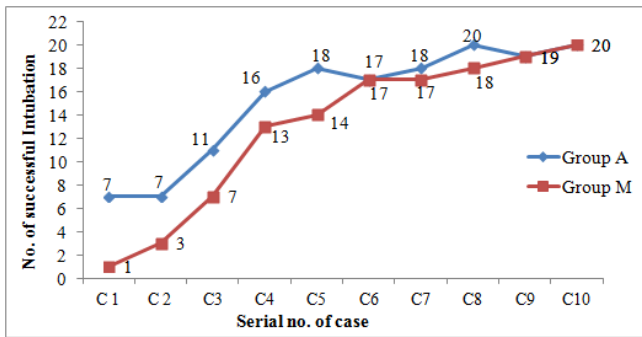
Table 2: Total Laryngoscopy Attempts Required by Trainee Anesthetists

Variables	Group A	Group M	P value
Total No. of Laryngoscopy Attempts	311	344	-
Total No. of Successful Laryngoscopy Attempts	190	166	0.0081
Total No. Intubation Attempts	167	189	-
Total No. of Successful Intubation Attempts	153	129	0.0085

Grade I Cormack Lehane glottic view (Complete Visualization of Glottis) was obtained in 60% of cases in Airtraq group and 44% cases in Macintosh group, (p value=0.0006).

Figure 2 shows that in first study case with Airtraq, 7 trainee anesthetists while with Macintosh laryngoscope only one trainee anesthetist could do successful intubation. As the study progressed, the number of successful intubations by trainee anesthetists in both groups was observed to be increased but this increase in success rate was faster and prominent in group A with each subsequent case especially while doing initial cases.

Figure 2: Distribution of successful intubations by trainee anesthetists as per chronological order



Cut off point for grading intubation as easy or difficult was decided by median of NRS score (25th percentile median of NRS score -5). Distribution of study cases as difficult or easy intubation graded by students in both groups is shown in table no.3.

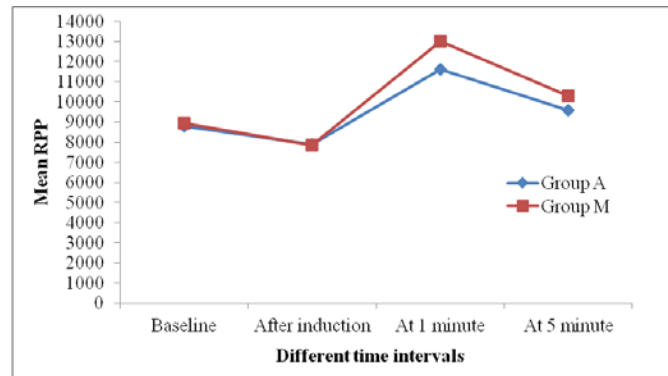
Table 3: Ease of intubation as per NRS score

Groups	Number of Intubations	
	Easy Intubations NRS score (1-5)	Difficult Intubations NRS score (6-10)
Group A	123	77
Group B	60	140
	P=0.0025	

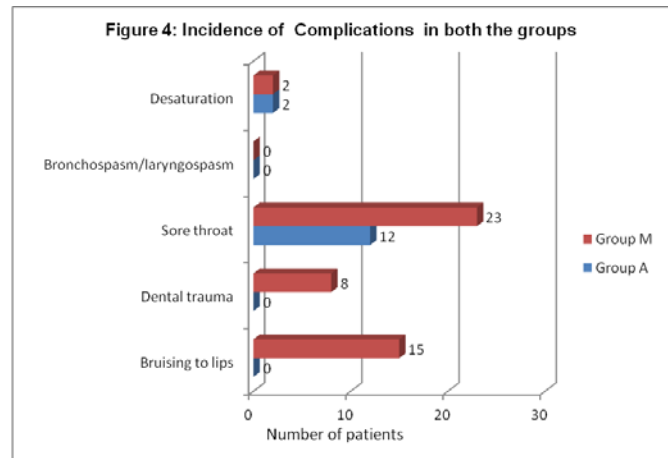
Optimization maneuvers augment glottic visualization. Hence, it was also considered as one of the important parameter for comparing ease of intubation. Trainee anesthetist required lesser optimization maneuver in group A (26%) than in group M (56%), (P < 0.001).

Figure 3 shows hemodynamic changes in terms of RPP which was statistically significant in group M at 1 min (p value <0.001) and 5 min interval (<0.001).

Figure 3: Rate Pressure Product (RPP) Changes at Different Time Intervals



Bruising to lips, dental trauma was observed only in Macintosh group. In one case of group M breakage of upper incisor tooth was noted. The incidence of complications is shown in figure 4.



Discussion

Insertion of Airtraq in oral cavity is easier as it is inserted in oral cavity in midline and passed over centre of tongue while Macintosh needs to be inserted into oral cavity laterally with tongue pushed aside and hence its insertion becomes difficult for trainee students. [5]

Cormack Lehane (CL) grading at laryngoscopy provided a useful comparison of laryngoscopic view of glottis in this study. Although modification of the original Cormack Lehane classification has better specificity and positive predictive value but for trainee anesthetists we used Cormack Lehane grading for their convenience similar to Di Marco et al. [6] The view obtained on laryngoscopy is a major factor in

determining degree of ease of intubation and success rate. A unique combination of an extremely curved blade and an inbuilt optical system enables Airtraq to provide a view of glottis without aligning the axes. [4, 7-9]. This resulted in higher success rate of laryngoscopy and intubation of trainee anesthetists while using Airtraq as intubating device. [2]

Bhandari et al [2] and Di Marco et al [6] observed that no optimization maneuver was required in 98% of patient in Airtraq group in both the studies as compared to 35% and 67% of patients in Macintosh group respectively. Riad et al [10] also found that no optimization maneuver was required at all with Airtraq when he studied pediatric patients.

Airtraq, being a device of combination of simultaneous laryngoscopy and intubation, time required for intubating the trachea was less but similar to Shrivishnu et al, trainee students of our study experienced that inspite of good visualization the glottis with Airtraq, passing the endotracheal tube took more time, as the direction of movement of the tube was fixed by a slot in the device which can be partially overcome by repositioning Airtraq with adequately lubricated endotracheal tube [1,2,4,7,11,12]. Still overall mean intubation time with Airtraq was statistically lower than Macintosh laryngoscope. This was similar to White et al [12] when he studied Airtraq on infants and children.

While using Airtraq, trainee anesthetists could intubate more number of patients successfully in first case and in first attempt as similar to Abdelgalelet al. [13] When learning curve of both groups were studied, we found rapid learning curve and acquisition of intubation skill with Airtraq. Since, endotracheal intubation is a cumulative skill, with the time; trainee anesthetists

could acquire skill of intubation even with Macintosh laryngoscope although the learning curve was slow. This finding was comparable with the study done by Di Marco et al. [6]

RPP is better indicator of myocardial oxygen demand during stress. [14] Hence to study stress response to laryngoscopy and intubation, RPP is used in our study similar to Yallapragada et al. [1] Reason for least hemodynamic response during laryngoscopy with Airtraq even in hands of trainee anesthetists may due to exaggerated anatomical curvature of the blade of which renders good laryngoscopic view with less lifting force and hence less hemodynamic response. This was similar to the study done by Hosalli et al [9], Abdelgalelet al. [13] On the contrary, Yallapragada et al [1] noticed that rise in RPP was statistically significant when Airtraq was used by second year residents of anesthesia as longer duration of intubation with Airtraq as compared to Macintosh laryngoscopy in their study.

Complications like sore throat, trauma to teeth were observed to be more with Macintosh laryngoscope and no or minimal while using Airtraq (p value <0.05), as observed in previous studies done by Dwivedi et al [4], Maharaj et al [7], Hosalli et al [9], Ahmed et al [15], McElwain et al [8].

Limitations of present study: It could not be a blinded study and always there are individual variations in learning skills.

Conclusion

Change is a doctrine of evolution and introducing novel techniques of teaching airway securement to trainee students may bring rewarding results. Considering the above results, Airtraq can be used for training novice medical personnel in this lifesaving skill.

Simultaneously, experience with such devices in normal airway and ASA I, II patients will prepare the future anesthesiologists to tackle difficult airway situation.

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