Indian Journal of Forensic Medicine and Toxicology
Volume 16 No. 4, October-December 2022

Comparative Efficacy Analysis of Intubation Profile in Airtraq Video Laryngoscope Versus Macintosh Laryngoscope in Simulated Difficult Airway Using Cervical Collar

Sunil Valand[1], Makwana Komal[2], Balaji Ghugare[3], Rathod Niraj[4]

[1]Assistant Professor, SBKS Medical Institute and Research Centre, Waghodiya, Pipariya, [2]Assistant Professor, GMERS Med Col Gotri, Baroda 390021, [3]Associate Professor, GMERS Med Col Gotri Baroda 390021, [4]Assistant professor, SBKS Medical Institute & Research Centre, Waghodiya, Pipariya.

How to cite this article: Sunil Valand, Makwana Komal, Balaji Ghugare et. al. Comparative Efficacy Analysis of Intubation Profile in Airtraq Video Laryngoscope Versus Macintosh Laryngoscope in Simulated Difficult Airway Using Cervical Collar. Indian Journal of Forensic Medicine and Toxicology 2022;16(4).

Abstract

Aim: Comparative efficacy analysis of laryngoscopes -Airtraq vs macintosh - using Intubation Time and Intubation difficulty score in simulated difficult airway using cervical collar.

Methods: Peculiarity is simulated difficult airway by use of cervical collar. A prospective interventional-randomized study conducted on 60 adult ASA grade-I&II patients scheduled for surgery in tertiary care center. Tracheal Intubation 1. Group(AVL) Airtraq videolaryngoscope (n=30) 2. Group(ML) Macintoshlaryngoscope (n=30). Parameters observed: 1) Intubation Time- seconds 2) Intubation Difficulty Score (IDS) comprised Numbers of-1. intubation attempts 2.operators 3.alternative intubation techniques, 4. Glottic exposure. 5. paramatric comparison lifting force required during laryngoscopy, Necessity for external laryngeal pressure, Position of the vocal cords.

Results: With airtraq laryngoscope intubation discoursed outcomes intubation time is irrelevant with difficult airway where it is highly associated in case of macintosh laryngoscope. Intubation time & difficulty score is commentating use of Airtraq laryngoscope.

Conclusions: The enhanced visual interiors expedite in such a way that intubation time in Airtraq is not dependent on IDS like Macintosh but on neuromuscular reflexes of performer, commentating the superiority of Airtraq over Macintosh.

Keywords: airway, intubation, cervical collar, Airtraq, Macnitos, Laryngoscope

Introduction

Successful & faster intubation in first attempt without causing morbidities & mortalities in emergency or planned surgery has been age-old challenge.[1,2,3] Macintosh laryngoscope played pivotal role for decades till the evolution of fiber optic video

Corresponding Author: Rathod Niraj, Assistant professor, SBKS Medical Institute & Research Centre, Waghodiya, Pipariya.

E-mail: drnmrathod@gmail.com

Mobile: 8128652117

graphic laryngoscope.[4] The Airtraq(Prodol Meditec, Vizcaya, Spain) is a intubation device developed to expedite tracheal intubation in patients with normal or difficult airways by enhancing visuals of interior anatomy. Literature commentating advantages of Airtraq over Macintosh laryngoscope in simulated difficult intubation scenarios in the manikin when used, are either inexperienced or novice trying intubate.[5,6,7] This study was aimed to assess the effectiveness of Airtraq for tracheal intubation using cervical collar over Macintosh Laryngoscope comparing different intubation profile variables like intubation time, intubation difficulty score & checking their association etc. cervical collar are mostly used in trauma cases where pathological factors affecting outcome already ,but in this study applied in normal subjects for simulating difficult airway management where tracheal study environment is not affected in advance by inflammatory mediators or secretion due to trauma.

Materials and Method

A prospective interventional randomized control study was carried at tertiary care centre in Western Indian population after taking permission from Scientific Research Committee and Institutional Ethics Committee for Human Research. Sample size was calculated with the help of GraphPad software, considering mean difference of SDs = 14.4, Type I alpha error as 0.05 and Type II beta error as 0.1, confidence level interval 95% and power of the study 90%, that came to be Sixty (60). We included 60 participants of both genders in the age group of 18-60 years, belonging to American Society of Anesthesiologists (ASA) physical status I and II, Mallampati grade I and II that were scheduled for planned surgeries and require endotracheal intubation in the study with duly signed informed consent form in vernacular language. We excluded participants with any systemic diseases like cardiac disease, hepatic disease, renal dysfunction, neurological disorder, lung disease, psychiatric illnesses, endocrine disorders on clinical assessment. We also excluded participants with anticipated difficult intubation, thyromental distance less than 6 cm, Inter- incisor gap less than 3 cm, sternomental distance less than 12 cm, neck circumference more than 42 cm, pregnant and obese patients, and risk of gastric aspiration. Patients were explained in detail about the purpose, procedure of the study and possible side effects. They were also explained about the devices. Operation theatre preparation: Anesthesia machine, AIRTRAQ Size -3/MACINTOSH Size-4 airway devices, routine and emergency anesthesia drugs and equipment, multipara monitor and cardiac defibrillator were checked and kept ready. Multipara monitor was attached and baseline vital parameters were recorded. Premedication: All the patients were premedicated with following medications at the time of induction. 1. Inj. Glycopyrrolate 0.2mg IV 2. Inj. Dexmedetomidine 1 µg/kg IV 3. Inj. Ondansetron 4 mg IV. 4. Inj.Tramadol 1 mg/kg.

Participants were randomly allocated into two groups by envelope method. 1. Group AVL (n=30): patients were intubated using AIRTRAQ video laryngoscope. 2.Group ML (n=30): patients were intubated using MACINTOSH laryngoscope. Induction: Preoxygenation was done with 100% oxygen for 3 min with Bain's circuit. Inj. Propofol 2 mg /kg IV was given till the loss of eyelid reflex followed by Inj. Vecuronium bromide 0.1mg/kg IV. Lungs were ventilated using Bain's circuit for 3 minutes with O2 + N2O (50: 50) and Sevoflurane 2-2.5%. Peculiarity is that cervical collar is used mostly in trauma cases where pathological events interfere with outcome

Laryngoscopy and intubation were done as per the group randomization. For the group AVL: Tracheal intubation was carried out using Airtraq video laryngoscope. Airtraq was loaded with ETT size 7.5mm for female and 8.5mm for male. For the group ML: Tracheal intubation was carried out using Macintosh Laryngoscope. Tracheal intubation was carried out with ETT size 7.5mm for female and 8.5mm for male. Intubation with the Airtraq SP laryngoscope: The head was placed in the neutral position. The standard technique (A) consists of sliding the tip of the Airtraq SP laryngoscope into the mouth along the tongue. The blade of the laryngoscope is kept in contact with the tongue, until the epiglottis comes into view. If passage of the laryngoscope into the oropharynx gave difficulty, crawling movements were used to move the blade over the tongue towards the epiglottis. Once the tip

of the laryngoscope is positioned in the vallecula, the laryngoscope is lifted straight up to expose the glottis. For rotational insertion (B), the Airtraq SP laryngoscope is inserted into the mouth from 90 to 180 degree to the usual direction and then rotated into the usual position. The tracheal intubation was considered failed if attempt time exceeds 120 seconds leading to switching of the type of laryngoscope i.e. Macintosh to Airtraq or vice versa. If the Spo2 dropped below 92% during intubation attempt, facemask ventilation was carried out and laryngoscope to be switched. Maximum 2 attempts were allowed. Maintenance with gas mixture: O2 + N2O 50:50, Sevoflurane given up to 2 to 2.5 %, Inj. Vecuronium bromide was given intermittent dose at 0.02, mg/ kg. Ventilation was carried out with circle absorber system. Parameters observed: (1) Intubation Time: (in seconds) It is the time taken from removal of face mask for intubation to connection of endotracheal tube to anesthesia circuit and sine wave on capnography.[8.] (2) Intubation Difficulty Score: [9] N1Number of intubation attempts >1 (n-1), N2 Number of operators >1 (n-1) N3 Number of alternative intubation techniques used (n), N4 Glottic exposure (Cormack and Lehane grade 1) (n-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. Intubation Difficulty score and Intubation Quality: IDS = O - Easy, 0 < IDS ≤ 5 - Slight difficult, 5 < IDS - Moderate to Major difficult, IDS = ∞ -Impossible intubation. The Cormack and Lehane grade at laryngoscopy[10]: 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.

All procedures adopted guidelines as per world medical declaration of Helsinki for research in human participants. Statistical analysis was performed by descriptive and inferential statistics using the student's unpaired *t*-test, Graph Pad Prism (version 5.0; Graph Pad Software Inc., California, USA). *P*-values less than 0.05 were considered statistically significant.

Results

All data were presented as mean±SD (standard deviation). Demographic data analysis and justification of study population was inferred by student's t test ($p<0.01$) – Statistically highly significant, ($p<0.05$) – Statistically significant, ($p> 0.05$) – Statistically Not Significant (NS).

Table 1: Age & sex demography of subjects

Age (years)	Group-AVL (n=30)			Group-ML (n=30)		
	M	F	Total	M	F	total
21-40	7	8	15	8	7	15
41-60	8	7	15	8	7	15
Total	15	15	30	16	14	30

Table 2: Age, weight & ASA parameters are statistically similar in both groups

Parameters	Group-AVL (n=30)	Group-ML (n=30)	'p'value
Age (years)	34.80±10.91	33.16±11.23	P >0.05
Weight (Kg)	56.12±7.78	55.82±10.09	P > 0.05
ASA gradingI: II	16:14	15:15	P >0.05

(Note: AVL- Airtraq video laryngoscope, ML - Macintosh laryngoscope, M-male, F- female)

Table 3: Airway parameters of study participants in both groups

Parameters	Group AVL(n=30)	Group ML(n=30)	P value
Mouth opening	3.15±0.51	3.20±0.50	P value <0.05
MPG Mallampati grade	1.83±0.79	1.66±0.71	
Inter-incisor gap	4.31±0.99	3.94±0.71	
Thyromental distance	6.21±0.46	6.02±0.76	
Neck circumference	38.71±3.42	38.37±3.33	
Teeth (present/absent)	27:3	28:2	

Table 4: Comparison of Intubation profile- intubation time-IT, intubation difficulty score- IDS) in two groups

Profile	Group AVL(n=30)	Group ML(n=30)	'p' value
Intubation time	23.43±8.70	37.26±12.81	0.0001
intubation difficulty score,IDS: 0 Easy	18 (60%)	12 (40%)	0.034
0<IDS≤5 Slight difficult.	12 (40%)	18 (60%)	0.0420
5<IDS Moderate to major difficult	0	0	NA
IDS =∞ Impossible	0	0	NA
Association by regression analysis intubation time vs IDS- correlation coefficient determination r & two tailed p value	r=0.2801 p=0.1338	r=0.6500 p=0.0001	

Table 5: Intubation Difficulty Score profile of study participants in both groups

IDS Criteria		Group AVL(n=30)	Group ML(n=30)	p-value
N_1 (No of attempts)	1st	25 (83%)	17 (56%)	0.049
	2^{nd}	05 (16%)	13 (43%)	0.04
N_2 (No of operator)	One person	26 (86%)	25 (83%)	0.09
	Two persons	04 (13%)	05 (16%)	0.97
N_3 - No of alternative technique applied		0	0	-
N_4 (Cormack & Lehane grade)	Grade I	20 (66%)	08 (26%)	0.004
	Grade II	07 (23%)	14 (46%)	0.1
	Grade III	03 (10%)	08 (26%)	0.216
	Grade IV	0	0	-
N_5(Lifting force required)	0 (normal)	27 (90%)	17 (56%)	0.007
	1(increased)	03 (10%)	13 (43%)	0.009
N_6(External laryngeal pressure)	NA	0	0	-
	Applied	0	0	-
N_7 (position of vocal cord)	abducted	26	25	0.83
	adducted	04	05	0.66

Discussion

In present study we observed that, mean intubation time is shorter with using Airtraq laryngoscope compared to Macintosh which is in consonance with the study performed by PadmajaDurga et al[11] where mean intubation time was 33.27±13.25 s for ML laryngoscopy while 28.95±18.53s for AVL group. Marwa A Tolon et al[8] observed similar results although mean values were on higher side in both groups. The Intubation Difficulty Scale (IDS) score as observed in our study (table no.5) showed that intubation is much easier with Airtraq laryngoscope considering when total score is 0 but referring to moderate difficult intubation scenarios both laryngoscopes are equally effective. None of the patient had IDS score more than 5 so a comment on superiority of either laryngoscope in severely difficult intubation can't be inferred from our study. There is neither the case of failed tracheal intubation in either group. Our results were in agreement with study by Padmaja Durga et. al.[11] They concluded that for Airtraq group the first attempt success rate for intubation was higher, less no of alternate technique required, achieved Cormack and Lehane grade I in more no of patients and least lifting force was required. In group AVL, 25 patients trachea was intubated at first attempt and in 5 patient's second attempt was required. While in group ML in 17 patient's trachea was intubated at first attempt and in 13 patients second attempt was required. Statistically it was significant (p = 0.045). In current study too we observed similar findings. In Group AVL, 26 patient's trachea was intubated by one operator and in 4 patients' trachea was intubated by two operators, while in Group ML, in 25 patients' trachea was intubated by one operator and in 5 patients' trachea was intubated by two operator, which was statistically not significant (p = 0.7 in one person p = 0.2 in two person respectively). In our study, we have not used any other alternative technique like the use of boogie, stylet, removal of cervical collar and external laryngeal pressure or BURP applied during intubation. Our all-stated outcomes in regard of no. of attempts, operators & technique are in course with results of Padmaja Durga et al,[11] Maharaja et al, M.A. Tolon et. al. [8] where there was no need for any optimizing maneuvers. In group AVL, Cormack and Lehane grade I was seen in 20 patients, grade II in 7 patients and grade III in 3 patients, while it was grade I in 8 patients, grade II in 14 patients and grade III in 8 patients in group ML. So, we observed Cormack & Lehane grade 3 in Group ML become grade 2 in Group AVL and grade II become grade I in Group AVL. There was improved Cormack and Lehane grade from Grade II to Grade I using Airtraq laryngoscope compare to Macintosh which was statistically significant (p = 0.04). These findings were corroborative with Padmaja Durga et al.[11] In group AVL, lifting force during laryngoscopy was not required in 27 patients and only in 3 patients it was required, while in group ML in 17 patients lifting force was not required and in 13 it was required. So increased lifting force was required in ML Group which was statistically significant (p = 0.009). Results were in consonance with Padmaja Durga et. al. [11] External laryngeal pressures was not applied because of the presence of cervical collar around the neck in both the Groups. We observed abducted position of vocal cord in 26 patients in Group AVL, 25 patients in Group ML and 6 in Group AVL and 5 patients in Group ML, which was statistically not significant (p = 0.3). Koh et. al. reported higher success rate of intubation with Airtraq in patients with cervical immobilization with collar. [12] Arslan et. al. evaluated the effectiveness of the Airtraq and C-Trach in lean patients with simulated cervical spine injury after application of a rigid cervical collar. [13] Padmaja Durga et. al. 2012 reported less intubation difficulty score using Airtraq Video laryngoscope using rigid cervical collar.[11]

Unique observation in our study (image1) that intubation time in AVL group is not dependent on intubation difficulty score which is different from previous study[14] the reason might be the enhanced visuals by video laryngoscope. But in Macintosh laryngoscope we observed that intubation time is highly associated with intubation difficulty score (image 2) which is in accordance with previous discoveries[14] so i would like to put new hypothesis for future research that enhanced visual smooths the entire process in such a way that intubation time is now dependent on neuromuscular reflexes of performer

of intubation not on intubation difficulty score.

Conclusions

The Airtraq video laryngoscope reduced the intubation time, had high success rate in first intubation attempts, minimum need for additional maneuvers, and with less intubation difficulty score.

Conflict of interest: Nil

Source of Funding: Self or other source- self

Ethical clearance: Ethical clearance was obtained from institutional human ethical committee SSG Institutional Ethics committee for human research (IECHR) medical college & SSG hospital, Baroda & approval no. ECR/85/INST/GJ/2013

References

1. Caplan R, Posner K, Ward R, Cheney F. Adverse respiratory events in anesthesia: a closed claims analysis. Anesthesiology 1990; 72: 828–33.
2. Cheney F. The American Society of Anesthesiologists Closed Claims Project: What have we learned, how has it affected practice, and how will it affect practice in the future? Anesthesiology 1999; 91: 552–6.
3. Peterson G, Domino K, Caplan R. Management of the difficult airway: a closed claims analysis. Anesthesiology 2005; 103: 33–9.
4. Macintosh R. A new laryngoscope. Lancet 1943; i: 205.
5. Maharaj C, Higgins B, Harte B, Laffey J. Evaluation of ease of intubation with the Airtraq or Macintosh laryngoscope by anaesthetists in easy and simulated difficult laryngoscopy – a manikin study. Anaesthesia 2006; 61: 469–77.
6. Maharaj C, Chonghaile M, Higgins B. Tracheal intubation by inexperienced medical residents using the Airtraq and Macintosh laryngoscope: a manikin study. American Journal of Emergency Medicine 2006; 24: 769-74.
7. Maharaj C, Costello J, Higgins B. Learning and performance of tracheal intubation by novice personnel:a comparison of the Airtraq and Macintosh laryngoscope. Anaesthesia 2006;61:671–7.
8. Marva T, Ola Z. Comparative study between the use of Macintosh Laryngoscope and Airtraq in patients with cervical spine immobilization. Alexandria Journal of Medicine 2012;48:179–185
9. Fredrich A, Stephen W. The Intubation Difficulty Scale (IDS): Proposal and Evaluation of a New Score Characterizing the Complexity of Endotracheal Intubation. Anesthesiology 1997; 87: 1290–1297.
10. Krage R, Van C. Cormack–Lehane. Classification revisited. British Journal of Anesthesia 2010; 105: 220–7.
11. Durga P, Kaur J, Ahmed S, Kaniti G, Ramachandran G. Comparison of tracheal intubation using the Airtraq and Mc Coy laryngoscope in the presence of rigid cervical collar simulating cervical immobilization for traumatic cervical spine injury. Indian Journal of Anaesthesia 2012; 56(6): 529–534.
12. Koh J, Lee J, Lee Y, Chang C. Comparison of the laryngeal view during intubation using Airtraq and Macintosh laryngoscopes in patients with cervical spine immobilization and mouth opening Limitation. Korean J Anesthesiol 2010; 59(5): 314-318.
13. Arslan Z, Yildiz T, Baykara Z, Solak M, Toker K. Tracheal intubation in patients with rigid collar immobilisation of the cervical spine: A comparison of Airtraq and LMA CTrach devices. Anaesthesia 2009; 64:13326.
14. Adnet F. The Intubation Difficulty Scale (IDS) : Proposal and Evaluation of a New Score Characterizing the Complexity of Endotracheal Intubation. Anesthesiology December 1997, Vol. 87, 1290–1297.