



EVALUATION OF RELATIVE EFFECTIVENESS OF MACINTOSH, MCCOY, TRUVIEW AND AIRTRAQ LARYNGOSCOPES IN PATIENTS WITH IMMOBILISED CERVICAL SPINE USING RIGID NECK COLLAR: A RANDOMIZED, CONTROLLED CLINICAL TRIAL

Anaesthesiology

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ABSTRACT

Introduction: To evaluate the relative effectiveness of Macintosh, McCoy, Truview and Airtraq laryngoscope in simulated difficult laryngoscopy using rigid neck collar.

Methods: Prospective, randomized clinical trial included 120 patients with ASA I and II, age 18 to 60 years, undergoing general anesthesia, divided into four groups of 40 patients each in which Macintosh, McCoy, Truview and Airtraq were used respectively. The primary outcome measure was Time of Intubation. The secondary outcome measures were number of attempts, ease of intubation, overall success rate, IDS, POGO, hemodynamic parameters and complications.

Results: The time of Intubation was significantly lower with Airtraq (25.52s) as compared to Macintosh(38.10s), McCoy(36.92s) and Truview(38.65s) laryngoscopes.

Conclusion: Airtraq laryngoscope allowed lesser intubation time, better glottic visualization, greater ease of intubation, fewer intubation attempts as compared to Macintosh, McCoy and Truview laryngoscopes.

KEYWORDS

Difficult laryngoscopy, TruView laryngoscope, Airtraq laryngoscope.

INTRODUCTION

The use of cervical collar or manual in-line stabilization of the cervical spine to prevent neck movements may result in poor laryngeal view on conventional laryngoscopy leading to difficulty in intubation.[1,2] Videolaryngoscopes are usually considered as rescue devices. Still, indirect videolaryngoscopy has proven advantageous over direct laryngoscopy using a classic Macintosh blade.[3]

The McCoy laryngoscope (Penlon) is designed to elevate the epiglottis with its hinged tip and requires less neck movement during laryngoscopy.[4] The TruView EVO2 (Truphatek International Ltd, Netanya, Israel) is a modified laryngoscope that expands the angular view of the larynx by an optical system view tube which consists of prisms and lenses, thereby facilitating intubation.[5] The Airtraq optical laryngoscope (Prodol Meditec S.A., Vizcaya, Spain) facilitates tracheal intubation without need for alignment of oral, pharyngeal and laryngeal axis as in neutral neck position maintained by a rigid cervical collar.[6]

The relative efficacies of all these four devices have not been compared in simulated difficult laryngoscopy using rigid neck collar in a single study. Therefore, this study was planned to compare the relative effectiveness of these laryngoscopes, in patients with immobilised cervical spine using rigid neck collar.

MATERIALS AND METHODS

Following the approval of Institutional Ethical Committee and well informed written consent for this prospective, randomized, double blinded study, 160 ASA I and II patients, age 18 to 60 years were enrolled for the study. The exclusion criteria included patients with anticipated difficult airway, obese, risk of pulmonary aspiration of gastric contents, pregnant and airway distortion or trauma. Patients were divided into four groups comprising of 40 patients each in which intubation was done with Macintosh, McCoy, Truview and Airtraq laryngoscopes respectively. Random allocation sequence was generated. An appropriate sized rigid cervical collar was placed as per manufacturer's instructions. Standard monitoring were used.

Patients were premeditated with inj. Dexamethasone 4 mg IV, inj. Fentanyl 2 µg/kg IV and inj. Glycopyrrolate 0.01mg/kg IV following which preoxygenation was done with 100% oxygen for 3 minutes. Anaesthesia was induced with inj. Propofol 2mg/kg IV and relaxation was done with inj. Vecuronium 0.1 mg/kg IV. An anesthesiologist (BD), having experience of more than 75 intubations with Macintosh and McCoy laryngoscope and more than 50 intubations with Truview and Airtraq laryngoscopes applied the laryngoscopy in all patients. If introduction of the intubating device was not possible or there were

more than three attempts for intubation or intubation time will be more than 120sec, it was considered to be a failure. The primary outcome measure was Time of Intubation. The secondary outcome measures were: modified Intubation Difficulty Score, as described by Adnet et al [Annexure 1], number of attempts, success rate, Ease of Intubation, Percentage of Glottic Opening (POGO) score, PR and MAP preinduction, at 1, 3 and 5 minutes post-intubation and complications. Ease of Intubation was assessed on a score of 1 to 3 (Easy: tracheal intubation without maneuver, Satisfactory: tracheal intubation with maneuvers, Difficult: tracheal intubation not even with maneuvers).

Statistical analysis

Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean $\pm$ SD and median. Normality of data was tested by Kolmogorov-Smirnov test. If the normality was rejected then non parametric test was used. Quantitative variables were compared using ANOVA/Kruskal Wallis Test (when the data sets were not normally distributed) between the four groups. Qualitative variables were correlated using Chi-Square test. A p value of <0.05 was considered statistically significant. The data was entered in MS EXCEL spreadsheet and analysis was done using SPSS version 21.0. Previous study observed that mean value of time of intubation in Macintosh group was 41.22 ± 4.72 , in McCoy group was 37.62 ± 3.45 and in Airtraq group was 27.80 ± 3.87 . Taking these values as reference, the minimum required sample size with 90% power of study and 5% level of significance is 28 patients in each study group. To reduce margin of error, total sample size taken was 160 (40 patients per group).

RESULTS

The three groups were comparable in baseline demographic and airway assessment characteristics. [Table 1] The time of intubation was reduced significantly in Airtraq group. [Table 2][Figure 1]. There were two failures in Macintosh and McCoy groups, while no failure was there in Truview and Airtraq groups. There were no differences in complications. The number of successful first intubation attempt was significantly higher in the Airtraq. The Ease of Intubation score was also significant in favour of the Airtraq group. [Table 2]

The median POGO score was also significantly improved in the Airtraq and Truview groups. [Figure 2] The Intubation Difficulty score was significantly reduced in Truview and Airtraq groups. [Figure 3] Pulse rate was significantly lower in Truview and Airtraq groups at 1, 3 and 5 min after intubation [Figure 4]. Mean arterial BP was significantly lower at 1 and 3 min after intubation in Truview and Airtraq group. [Figure 5]

Table 1 : Comparison Of Patient's Baseline Characteristics Between The Macintosh, Mc Coy And Truview Groups.values Are Mean (sd), Number Or Median (interquartile Range).

Parameters	MacIntosh (n=40)	Mc Coy (n=40)	Truview (n=40)	Airtraq (n=40)	P value
Age (years)	39.8±10.96	38.98±10.36	35.48±10.71	35.7±9.8	0.149
Sex (M:F)	20 : 20	22 : 18	20 : 20	18:22	0.940
Weight (kg)	57.65±6.03	58.62±6.46	57.72±5.48	57.62±5.65	0.785
Body mass index (BMI) (Kg/m ²)	22.41±1.00	22.43±1.07	22.09±1.11	22.03±1.13	0.221
ASA physical status (median)	1	1	1	1	
Mallampati Grade	1.63±0.49	1.62±0.50	1.50±0.51	1.48±0.51	0.377
Thyromental distance (cm)	6.19±0.40	6.16±0.40	6.30±0.44	6.28±0.45	0.563

Table 2 : Comparison Of Intubation Attempts, Overall Success Rate (%), Time Of Intubation (sec), Percentage Of Glottic Opening (pogo), Intubation Difficulty Score (ids), Esophageal Intubation And Complications Between Mac Intosh, Mccoy And Truview Groups. Values Are Number (%), Mean (sd) And Median (inter-quartile Range).

Parameters	MacIntosh(n=40)	McCoy(n=40)	Truview(n=40)	Airtraq (n=40)	P value
Intubation attempts (1/2/3)	14/18/6	15/17/6	20/12/8	32/6/2	0.0026
Overall Success rate (%)	95	95	100	100	0.251
Time of Intubation (sec)	38.10±3.5	36.92±2.31	38.65±2.42	25.52±1.22	<0.0001
Ease of Intubation(Score 1/2/3)	18/20/2	22/16/2	24/16/0	32/8/0	0.037
Percentage of Glottic Opening (POGO)	48.71±18.57	55.71±8.59	78.30±3.00	79.70±6.43	<0.0001
Intubation Difficulty Score (IDS)	4.21±1.04	2.95±0.93	1.82±0.68	1.1±0.38	<0.0001
Esophageal Intubation	3	3	1	1	0.551
Complications					
*Blood on laryngoscope	3	4	2	2	0.19
*minor laceration	1	1	5	2	0.402
*dental or other airway trauma	0	0	1	0	0.635

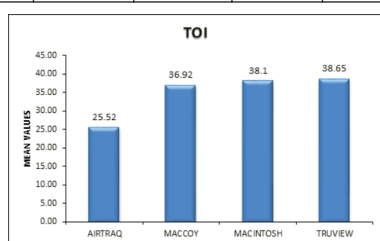


Figure 1 : Comparison Of Time Of Intubation (Toi) Between The Three Groups.values Are In Mean And Standard Deviation. Toi Was Significantly Higher In Truview Group. Statistically Significant, $P \leq 0.05$.

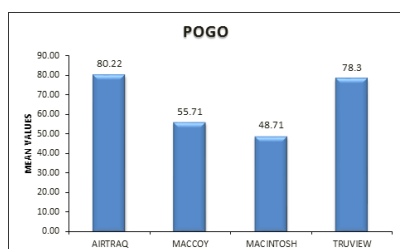


Figure 2 : Comparison Of Percentage Of Glottic Opening (pogo Score) Between The Three Groups.values Are In Mean And Standard Deviation. Pogo Score Was Significantly Higher In Truview Group. Statistically Significant, $P \leq 0.05$. ??

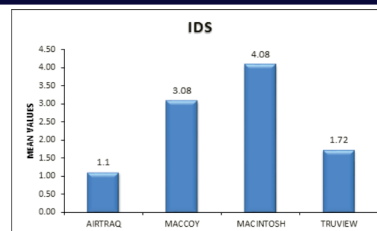


Figure 3 : Comparison Of Intubation Difficulty Score (ids) Between The Three Groups. Values Are In Mean And Standard Deviation. Ids Was Significantly Lower In Truview Group. Statistically Significant, $P \leq 0.05$.

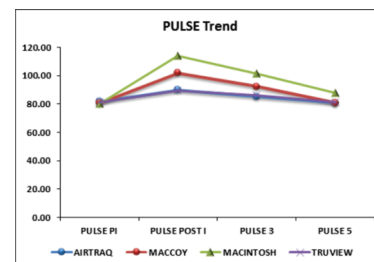


Figure 4 : Comparison Of Pulse Rate Between The Three Groups Up To 5 Minutes After Intubation. Values Are In Mean And Standard Deviation. Statistically Significant, $P \leq 0.05$.

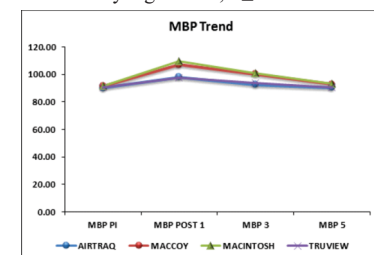


Figure 5 : Comparison Of Mean Arterial Pressure Between The Three Groups Up To 5 Minutes After Intubation.values Are In Mean And Standard Deviation. Statistically Significant, $P \leq 0.05$.

DISCUSSION

Macintosh laryngoscope requires the alignment of various axes which is a difficult skill to learn, acquire [7] and maintain [8]. Although lifting the epiglottis with the McCoy laryngoscope improves glottic exposure, it may require some extension of cervical spine to expose the larynx. Recent alternatives to Macintosh laryngoscope, including Truview and Airtraq videolaryngoscopes, provide magnified or anteriorly refracted view of glottis without need for alignment of axis. The recent guidelines published by the Difficult Airway Society for the management of difficult intubation advocates consideration of alternative video laryngoscopes in the primary intubation plan.[9]

The primary outcome in our study was time of intubation. The mean intubation time was 13,13 and 11 seconds longer in Truview, Macintosh and McCoy groups, respectively than Airtraq group. The duration of intubation was the least for Airtraq group with the duration of intubation being comparable between the other three groups. This finding is different from the findings of the study by Dwivedi et al. [10]. They found that the mean time taken for intubation was significantly longer with Truview (35.3±11.5sec) and comparable between Airtraq (19.2±4.7 sec) and Macintosh (24.4±13.8 sec).

The shorter intubation time with Airtraq may be explained due to two reasons. First, more patients were intubated in the first attempt with Airtraq which reduced the total time. Second, the improved glottic viewing with the Airtraq helped to pass the tracheal tube in shorter time compared to Macintosh and McCoy laryngoscopes. Time to intubation with the TruView laryngoscope was comparable to McCoy and Macintosh laryngoscopes in our study. However, few studies reported an increase in time to intubation with the Truview laryngoscope due to some difficulties experienced during advancement of the tracheal tube toward the glottis.[11,12,13]. The main reason for increased duration of tracheal intubation with TruView is the difficulty experienced in advancing the tube through the lateral side of the patient's mouth, which was also reported by Barak et al [12] and Malik et al .[11]

Another problem with the TruView laryngoscope is fogging on the distal lens which may reduce the image quality. Furthermore, the use of the Truview blade needs good eye-hand co-ordination and practice.

We found that the Airtraq and Truview laryngoscopes reduced the intubation difficulty score and improved the glottis view significantly, compared with Macintosh and McCoy laryngoscopes in patients with immobilized cervical spine, which has also been demonstrated by Malik et al [11]. This is due to better laryngoscopic view, less optimization manoeuvres and lifting force required in comparison to Macintosh.

The overall success rate was high in all four groups but the first attempt success rate was significantly higher with Airtraq laryngoscope. There were two failures in both Macintosh and McCoy groups while no failure was noticed in Truview and Airtraq group. Number of successful 1st attempt was significantly increased in Airtraq in the study of Durga et al [13]. The demonstration that the Airtraq exhibits a rapid learning curve, despite a deliberately brief instruction period probably accounts for its significantly increased first intubation success rate.

Hemodynamic response to laryngoscopy and intubation was least with Airtraq and Truview. The possible explanation might be that the Airtraq and Truview imparts less force to align the oro-pharyngeal-laryngeal axes for intubation, therefore less pain-mediated release of the catecholamines [14]. Esophageal intubations and complications were comparable between the four groups and were not statistically significant.

There are certain limitations to this study. First, the intubating anesthetist was not blind to the randomization of the laryngoscope. Second, we used POGO score to assess the visualization of the vocal cord instead of modified Cormack-Lehane because the POGO score can distinguish patients with large and small degrees of partial glottic visibility; it might provide a better outcome for assessing the difference between various intubation techniques. [15]. Lastly, the laryngoscopes were used by experienced anaesthetists, so results may not be similar for less experienced users.

In conclusion, the Airtraq laryngoscope, as compared to McCoy and McIntosh, significantly reduces the mean time of intubation, offers better laryngeal view, has higher success rate at first intubation attempt, reduces the IDS, has least effect on hemodynamic parameters and causes less airway trauma in simulated difficult laryngoscopy using rigid neck collar. Truview laryngoscope offers similar advantage to the Airtraq Laryngoscope except that the time for intubation was significantly decreased in Airtraq group. Therefore, of all these devices, the Airtraq appears preferable to Macintosh, McCoy and Truview laryngoscopes in simulated difficult laryngoscopy using rigid neck collar.

REFERENCES

- Goutcher CM, Lochhead V. Reduction in mouth opening with semi-rigid cervical collars. *Br J Anaesth* 2005;95:344-8.
- Heath KJ. The effect of laryngoscopy of different cervical spine immobilisation techniques. *Anaesthesia* 1994;49:843-5.
- van Zundert A, Maassen R, Lee R, et al. A Macintosh laryngoscope blade for videolaryngoscopy reduces stylet use in patients with normal airways. *Anaesthesia and Analgesia* 2009; 109: 825-31.
- McCoy EP, Mirakhur RK. The Levering Laryngoscope. *Anaesthesia* 1993;48:516-9.
- Li JB, Xiong YC, Wang XL, Fan XH, Li Y, Xu H, et al. An evaluation of the TruView EVO2 laryngoscope. *Anaesthesia* 2007;62:940-3.
- Arsilan ZI, Yildiz T, Baykara ZN, Solak M, Tokar K (2009) Tracheal intubation in patients with rigid collar immobilisation of the cervical spine: A comparison of Airtraq and LMA CTrach devices. *Anaesthesia* 64:1332-1336.
- Maharaj CH, O'Croinin D, Curley G, Harte BH, Laffey JG (2006) A comparison of tracheal intubation using Airtraq or Macintosh laryngoscope in routine airway management: a randomized controlled clinical trial. *Anaesthesia* 61(11): 1093-1099.
- J. McElwain, J. G. Laffey, Comparison of the C-MAC®, Airtraq®, and Macintosh laryngoscopes in patients undergoing tracheal intubation with cervical spine immobilization, *BJA: British Journal of Anaesthesia*, Volume 107, Issue 2, August 2011, Pages 258-264.
- Apfelbaum JL, Hagberg CA, Caplan RA, Blitt CD, Connis RT, Nickinovich DG, et al. Practice guidelines for management of the difficult airway: An updated report by the American Society of Anesthesiologists task force on management of the difficult airway. *Anesthesiology* 2013;118:251-70.
- Dwivedi Y, Shukla V, Srivastava U, Saxena A, Gupta A, et al. (2015) Comparison of Airtraq and Truview EVO2 with Macintosh Laryngoscope for Endotracheal Intubation by Experienced Anaesthesiologists: A Controlled Clinical Trial. *J Anesth Crit Care Open Access* 3(4): 00105.
- M. A. Malik, C. H. Maharaj, B. H. Harte, J. G. Laffey, Comparison of Macintosh, Truview EVO2®, Glidescope®, and Airwayscope® laryngoscope use in patients with cervical spine immobilization, *BJA: British Journal of Anaesthesia*, Volume 101, Issue 5, November 2008, Pages 723-730.
- Barak M, Philipchuck P, Abecassis P, Katz Y. A comparison of the TruView blade with Macintosh blade in adult patients. *Anaesthesia* 2007;62:827-31.
- Durga P, Kaur J, Ahmed SY, Kaniti G, Ramachandran G (2012) Comparison of tracheal intubation using the Airtraq® and McCoy laryngoscope in the presence of rigid cervical collar simulating cervical immobilisation for traumatic cervical spine injury. *Indian J Anaesth* 56:529-534.
- Trimmel H, Kreutziger J, Fertsak G, Fitzka R, Dittrich M, et al. (2011) Use of the Airtraq laryngoscope for emergency intubation in the prehospital setting: a randomized control trial. *Crit Care Med* 39:489-493.
- Levitan RM, Ochroch EA, Kush S, Shofer FS, Hollander JE (1998) Assessment of airway visualization: validation of the percentage of glottis opening (POGO) scale. *Acad Emerg Med* 5:919-923.