A Randomised Study of Macintosh, Mccoy and Truview Evo2 Laryngoscopes in the Intubation Scenario : Comparison

Nishant Kumar, Kapil Lamba, Manjeet Ratra

ABSTRACT

Background: TThe Truview Evo2 is an angled blade providing an indirect refracted view of 42±2º of the vocal cords anteriorly.

Patients & Methods: We prospectively studied 60 ASA I and II non hypertensive patients for intubation using a Macintosh, McCoy or a Truview Evo2 laryngoscope. The best laryngeal view obtained, time taken to intubate, number of attempts required for intubation and the change in haemodynamic parameters were studied.

Results: We found that the best laryngeal view obtained was better with Truview Evo2 followed by McCoy and Macintosh laryngoscopes. The mean time to intubate was longer with Truview Evo2 compared to Macintosh and McCoy laryngoscopes. The Macintosh and McCoy laryngoscopes did not differ significantly. The number of attempts required for intubation after the best laryngeal visualization and changes in haemodynamics did not differ statistically.

Conclusion: The Truview Evo2 laryngoscope may therefore reduce the incidence of unanticipated difficult intubations on routine use and is a useful tool for anticipated difficult intubations.

KEYWORDS: Laryngoscopy and intubation, Macintosh Laryngoscope, McCoy laryngoscope, Truview Evo 2 laryngoscope, Cormack and Lehane grading, Haemodynamic changes.

One of the most important skills an anaesthesiologist must master is direct visualisation of vocal cords to safely and successfully intubate the trachea. Individuals have claimed superiority of one laryngoscope over another,[1] which has resulted in a deluge of various airway adjuncts and different types of laryngoscopes becoming available at the disposal of the modern day anaesthesiologist. Inspite of myriad of tests available to assess the airway preoperatively, the incidence of unanticipated difficult intubation remains as high as 1.5-13%.[2,3]

The Truview Evo2 blade (Truphatek Holdings Ltd, Netanya, Israel), enables an indirect view of the vocal cords. The Truview Evo2 blade is based on a combination of an optical system with a specially profiled 12.8 mm slim steel blade. The optical apparatus provides a 42° angled deflection view through a 15-mm eyepiece. The Truview Evo2 eyepiece can be connected to an endoscopic camera head with a monitor. In addition, the Truview Evo2 blade has a port that connects to the auxiliary oxygen flow of the anaesthesia machine (flow rate of 4-6 $l.min^{-1}$), which prevents misting and clears secretions from the lens and provides continuous oxygen insufflation during intubation.[4] Both Truview Evo2 and the McCoy blades have been reported to provide a better glottic visualization over the standard Macintosh blade in a difficult airway. However the Truview Evo2 blade has not been compared to the McCoy blade till date. The primary aim of this study was to compare the best laryngeal view obtained by the three laryngoscopes. The secondary outcomes included the ease of intubation as defined by the time and number of attempts taken to successfully intubate the trachea. The haemodynamic changes using the Macintosh blade, the McCoy blade and the Truview Evo2 blade in patients with normal airway characteristics and physical status were also compared.

PATIENTS & METHODS

Following approval of the institutional ethics committee, we conducted a prospective study on 60 patients in the age group of 14-60 years, who were scheduled to undergo elective surgery requiring general anaesthesia and tracheal intubation. Signed informed consent was obtained from each patient (parent/s in the case of minors) who agreed to participate in the study.

Exclusion criteria included: anticipated difficult intubation, Modified Mallampati classification grades (MMT) III and IV, American Society of Anaesthesiologists (ASA

Drs. Nishant Kumar, Senior Resident, Department of Anaesthesiology,Mata Chanan Devi Hospital, New Delhi, (Current Affiliation: Maulana Azad Medical College & Lok Nayak Hospital, New Delhi, India.), Kapil Lamba, Senior Consultant, Manjeet Ratra, Senior Consultant & Head of Deptt., Deptt. of Anaesthesiology, Mata Chanan Devi Hospital, Janakpuri, New Delhi, India.
Correspondence : Dr. Nishant Kumar, E-mail: kumarnishant@yahoo.co.uk

Grade) = 3, a history of hypertension, systolic blood pressure > 140 mmHg or diastolic blood pressure > 85 mmHg, indication for rapid sequence induction of anaesthesia and facial trauma.

The patients were randomly divided into three equal groups of twenty patients each: intubation using a Macintosh (Group 1), McCoy (Group 2) or with a Truview Evo 2 (Group 3) laryngoscope blade by the 'chit in a box' method.

Pre-operative airway evaluation was performed by unbiased anesthesiologists who were unaware of the patient's group allocation. Airway evaluation included: opening of the mouth (=3cm), thyromental distance (= 6.5cm), condition of the teeth, temporomandibular joint mobility, neck movements, Mallampati[5,6] oropharyngeal view according to the revised scoring of Samsoon and Young[7] (Grade I and II).

All patients were kept fasting for a minimum of 8 hours and received tab. Ranitidine 150 mg night prior to surgery. On arrival in the operating room, the patient was monitored using a pulse oximeter, non-invasive blood pressure, electrocardiogram and intravenous access was established. Baseline heart rate, systolic, mean and diastolic blood pressures were recorded.

The lungs of the patients were pre oxygenated for 3 min prior to start of induction. Inj. Fentanyl 0.002mg kg^{-1} was given for analgesia. Anaesthesia was induced with Inj. Propofol 2 mg kg^{-1} (premixed with preservative free Lignocaine). Inj. Vecuronium 0.1 mg kg^{-1} IV was administered to facilitate endotracheal intubation. The lungs of the patient were then ventilated for three minutes with oxygen, nitrous oxide (40:60) and isoflurane (1%). Haemodynamic parameters were again recorded at this time point. The intubations were performed by a single anaesthesiologist who had had an experience of more than two years. A preliminary 20 intubations with the new Truview Evo 2 blade had been performed to get acquainted with the instrument prior to the start of the study.

With the head of the patient in the neutral position, the Truview Evo2 blade was introduced from the centre of the mouth and rested on the tongue. The endotracheal tube had to be mounted on the preformed curved steel stylet provided with the laryngoscope. The tube was introduced from the angle of the mouth with the concavity facing laterally and needed to be advanced blindly until its tip entered the Truview Evo2 visual field. Thereafter, the tube was rotated through 90º and was introduced through the vocal cords (stylet was removed as the tube rested on the vocal cords) while looking through the lens. The Macintosh and the McCoy blade were handled in the standard manner and the lever of the McCoy blade was always depressed. The head of the patient was kept in the neutral position.

During Laryngoscopy, an assistant timed the period from lifting of the laryngoscope to the introduction of tube in the trachea. The anaesthetist observed the best laryngeal view obtained according to the Cormack Lehane classification[8] modified by Yentis and Lee,[9] without the application of external pressure. However the external laryngeal maneuver was applied to facilitate intubation if so required. Haemodynamic parameters were again noted at this point. The number of attempts required to successfully intubate the trachea were also noted. This was defined as withdrawing the tube till the angle of the mouth and reintroducing it.

Data was collected for each patient concerning age, gender, weight, oropharyngeal grading according to modified Mallampati classification, ASA physical status, haemodynamic parameters (baseline, pre laryngoscopy and post intubation) and intubation parameters (modified Cormack and Lehane Grade, Number of attempts taken to intubate and the time taken to intubate) by an independent observer who maintained the coding for the three groups till they were statistically analysed.

Statistical Analysis

A commercial software package (SPSS version 10 LTD, Chicago, IL, U.S.A) was used. Sample size was calculated based on Cormack and Lehane[8] (modified by Yentis and Lee)[9] laryngoscopic views obtained between groups (after a pilot study), using ANOVA with an α error of 0.05 and a β error of 0.1 with an effect size of 0.45 to determine a difference of grade by 1.

The nominal and ordinal categorical data such as sex, ASA, MMT, Cormack and Lehane Grade obtained and number of attempts was analyzed by Kruskal Wallis test. The haemodynamic data obtained from the study was statistically analyzed comparing the mean of SBP, MBP, DBP & HR at various intervals among the three groups using the ANOVA test and Bonferroni/ Tamhane's 2 test for multiple comparisons. The rise in haemodynamic parameters was noted and the mean rise was analyzed using the ANOVA and Bonferroni/ Tamhane's 2 test. A p value of < 0.05 was accepted as statistically significant. Inter Group analysis was done by paired t - test and Mann Whitney U test. The statistical analysis was performed by an individual unaware of the group allocation.

RESULTS

Demographic, physical status & oropharyngeal assessment was as shown in Table 1. There was no significant difference with respect to age, sex, weight, ASA physical status and the MMT grading of the patients in the three groups. The three groups were also similar with respect to

the baseline haemodynamic parameters.

The mean time taken to intubate, the number of attempts required and the best laryngeal view obtained for each laryngoscope is shown in Table 2. The mean time taken was the maximum with Truview Evo2 (28.15 ± 7.18 sec) as compared to Macintosh (18.95 ± 11.74 sec) and McCoy (14.45 ± 5.49) laryngoscopes. The time taken by Truview Evo 2 laryngoscope was significantly more than the other two laryngoscopes (p=0.016 and p=0.000 respectively). The time taken by the Macintosh and McCoy laryngoscopes did not differ significantly.

The number of attempts required for intubation after the best laryngeal visualization did not differ significantly in the three groups (p=0.529).

The laryngeal view obtained as graded by Cormack and Lehane grading (modified by Yentis and Lee) was significantly better with Truview Evo2 (CL I/IIa/IIb/III/IV= 20/0/0/0/0) followed by McCoy (12/8/0/0/0; p=0.03) and Macintosh (10/3/7/0/0; p=0.006) laryngoscopes. Application of external laryngeal maneuver improved the CL IIb grades to CL IIa or CL I in all the patients. The McCoy laryngoscope however did not perform statistically better than the Macintosh laryngoscope (p=0.194).

There was a significant decline in haemodynamic parameter values in all the three groups upon induction of anaesthesia and a significant increase post intubation as compared to the pre laryngoscopy values (Table 3). The three groups however showed no significant difference.

Table 1
Patient Characteristics

	Group 1 Macintosh Blade (n=20)	Group 2 McCoy Blade (n=20)	Group 3 Truview Evo 2 Blade (n=20)	P value
Age ; years	28.6 (9.99)	31.75 (9.62)	30.95 (11.91)	0.620
Sex; F:M	14:6	16:4	18:2	0.293
Weight; Kg	60.65 (13.18)	61.5 (12.95)	61.7 (13.13)	0.964
ASA; I:II	16:4	17:3	14:6	0.509
MMT; 1:2	8:12	7:13	12:8	0.360

DISCUSSION

The majority of tracheal intubations performed daily are easy and effortless. This requires good exposure of the larynx and the glottis. Success can generally be achieved with additional force or external laryngeal manipulation.[9] Adnet et al, through a series of magnetic resonance images showed that the angle between the laryngeal axis and line of vision was 42±12º in the neutral position.[10] Truview Evo2 is an angled indirect laryngoscope that provides an anterior refraction of 42º thus eliminating the need for additional force or eternal laryngeal manipulation. Various reviewers[4,11-18] in the recent years have already established that Truview Evo2 provides a better visualization of the vocal cords as compared to the Macintosh blade. However, a search of the literature failed to reveal any studies comparing the Truview Evo2 blade to the McCoy blade. We achieved Grade I views in 100% of our cases with Truview Evo2 blade. The McCoy blade provided Grade I visualisation in 60% (p=0.03) and Macintosh in only 50% (p=0.006) of the patients. Although the McCoy blade has been reported to perform better than the Macintosh,[19-21] we did not find any difference between the two.

Although Truview Evo2 provides a better view, it requires a longer time as compared to McCoy and Macintosh blades. We took 28.15 ± 7.18 seconds with the Truview Evo2 blade as compared to McCoy (14.45 ± 5.49 sec; p=0.000) and

Table 2
Time taken for intubation, number of attempts required and laryngeal view

		Macintosh	McCoy	Truview Evo 2	Total	p value	Gp 1/ Gp 2	Gp 2/ Gp 3	Gp 3 /Gp 1
Time for Intrubation	Mean	18.95	14.45	28.15	20.52	0.00*	0.346	0.000*	0.016*
	Std. Deviation	11.74	5.49	7.18	10.19				
No. of Attemps	1	17	19	17	53	0.529	-	-	-
	2	3	1	3	7				
Cormack Lehane	I	10	12	20	42	0.001*	0.194	0.030*	0.006*
	IIa	3	8	0	11				
	IIb	7	0	0	7				
	III	0	0	0	0				
	IV	0	0	0	0				

Table 3
Changes in heart rate and blood pressures

	Group 1 Macintosh Blade (n=20)	Group 2 McCoy Blade (n=20)	Group 3 Truview Evo 2 Blade (n=20)	P value
Increase in Haemodynamic Parameters (Post intubation- Pre laryngoscopy)				
Post-Pre HR	2.05 (14.81)	-0.6 (3.95)	1.15 (8.22)	0.699
Post-Pre SBP	21.25 (20.88)	22.6 (14.46)	23 (15.78)	0.945
Post-Pre MBP	15.95 (16.67)	17.7 (13.17)	21.4 (17.7)	0.548
Post-Pre DBP	13.1 (14.71)	14.15 (10.79)	19.3 (13.78)	0.290

Numbers in parentheses denote standard deviation.

HR= Heart Rate (beats/min), SBP= Systolic Blood Pressure (mm Hg), MBP= Mean Blood Pressure (mm Hg), DBP= Diastolic Blood pressure (mm Hg).

Macintosh (18.95 ± 11.74 sec; p=0.016) blades. Various other authors have reported similar time taken for intubation with the Truview Evo2 blade. Gupta et al[15] reported that intubations took 31.6±15.23 seconds while Barak et al[4] reported intubations in 33±12 seconds with Truview Evo2 blade while Li et al[11] took 51 seconds. Maroof et al[18] reported a time of 40.9±23.9 seconds. Khan et al[13] however, intubated in the least time of 12.3±2.0 seconds. All of these studies have compared the Truview Evo2 blade to the Macintosh blade and have reported that the time taken was significantly longer with the former. No studies are available that compare the time taken for intubation by the Truview Evo2 to McCoy and the McCoy to the Macintosh blade.

Performing intubation with Truview EVO2 requires good eye– hand co-ordination and some practice. The mandatory use of stylet and the relative inexperience with the Truview Evo2 blade may be the reasons for the difference in duration of intubation between the groups.

The number of attempts required for intubation after the best laryngeal view did not differ significantly in the three groups, thus indicating the ease of use of the Truview Evo2 blade.

Laryngoscopy is a consistent noxious stimulus which provokes a sympatho-adrenal response. The duration of laryngoscopy is one of the important contributing components of this response.[22] There is little information about the influence of laryngoscopic blade design on the stress response to laryngoscopy. It is believed that the major stimulus to cardiovascular changes during and after laryngoscopy is the force exerted by the laryngoscope blade on the base of the tongue or of the lifting of the epiglottis, and maybe independent of the type of laryngoscope used.[23-25] Song et al[16] and Lieberman et al[26] have previously reported a lesser force requirement with the Truview Evo2 and the Truview blades respectively, as compared to the Macintosh blade. Both the authors have reported a lesser haemodynamic response to laryngoscopy with the former.[17,18]

The McCoy blade was reported to require less force and hence caused lesser[27,28] or similar[29-31] hemodynamic response to laryngoscopy as compared to the conventional Macintosh blade. In our study, we observed no statistical difference in the hemodynamic changes in response to laryngoscopy and intubation from the pre laryngoscopy values with the Macintosh, McCoy or the Truview Evo2 laryngoscopes.

The main limitation of this study was that it was not blinded due to the unfeasibility of blinding the anaesthetist to the laryngoscope type being used. This was overcome to some extent by having an independent observer for recording the observed parameters and also the data analyst was blinded to the group allocation.

To conclude, although Truview Evo 2 provides the best laryngeal view as compared to Macintosh and McCoy blades, this is not translated into rapid intubation times. It took slightly longer time for laryngoscopy and intubation but without comprising the haemodynamics of the patient. Although fiberoptic bronchoscope is the gold standard for managing difficult airway, where its availability and familiarity is a question, Truview Evo2 may have a role to play. It may therefore reduce the incidence of unanticipated difficult intubations on routine use and is a useful tool for anticipated difficult intubations. However, a certain familiarity and practice is required to achieve good eye-hand coordination for indirect laryngoscopy with this blade.

REFERENCES

1. Burkle C, Zepeda F, Bacon D, Rose S: A Historical Perspective on Use of the Laryngoscope as a tool in Anesthesiology: Anesthesiology 2004; 100(4): 1003-6.
2. Crosby ET, Cooper RM, Douglas MJ, et al. The unanticipated difficult airway with recommendations for management. Can J Anaesth 1998; 45: 757–76.
3. Tse JC, Rimm EB, Hussain A. Predicting difficult endotracheal intubation in surgical patients scheduled for general anesthesia: a prospective blind study. Anesth Analg 1995; 81: 254–8.
4. Barak M, Philipchuck P, Abecassis P, Katz Y: A comparison of the Truview blade with the Macintosh blade in adult patients. Anaesthesia 2007; 62: 827–831.
5. Mallampati SR: Clinical sign to predict difficult tracheal intubation (hypothesis). Can Anaesth Soc J 1983; 30: 316-7.

6. Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiberger D, Liu PL: A clinical sign to predict difficult tracheal intubation: a prospective study. Can Anaesth Soc J 1985; 32: 429-34.
7. Samsoon GLT, Young JRB: Difficult tracheal intubation: a retrospective study. Anaesthesia 1987; 42: 487-90.
8. Cormack RS, Lehane J: Difficult tracheal intubation in obstetrics. Anaesthesia 1984; 39: 1105-11.
9. Yentis SM, Lee DJH: Evaluation of an improved scoring system for the grading of direct laryngoscopy. Anaesthesia 1998; 53: 1041-44.
10. Adnet F, Borron SW, Dumas JL, Lapostolle F, Cupa M, Lapandry C: Study of the Sniffing Position" by Magnetic Resonance Imaging. Anesthesiology 2001; 94: 83-6.
11. Li JB, Xiong YC, Wang XL, Fan XH, Li Y, Xu H, Ma Y and Deng XM: An evaluation of the TruView EVO2 laryngoscope. Anaesthesia 2007; 62 (9): 940-943.
12. Goto Y, Goto I, Suzuki A, Takahata O, Iwasaki H: The new VIEWMAX™ improves the laryngeal view optically but aggravates directly. Anesthesiology 2007; 107: A578.
13. Khan Y, Jain S, Khan RM, Khan FR, Maroof MM: Use of Macintosh, Truview and Airtraq Laryngoscopes for Intubation of Immobilized Manikins Head. Anesthesiology 2007; 107: A588.
14. Khan Y, Maroof M, Jain S, Khan FR, Khan RM: Truview Evo-2 Is a Superior Aid to Tracheal Intubation in Patients with Difficult Airway. Anesthesiology 2007; 107: A594.
15. Gupta A, Singh I: Evaluation of Truview evo2 Laryngoscope in Anticipated Difficult Intubation Cases. Anesthesiology 2007; 107: A584.
16. Song D, Hamza MA, White PF: Comparative evaluation of a standard macintosh blade and a modified viewmax blade. Anesth Analg 2004;98:S-101 (ISSN 0003-2999 Volume 98, Number 2S, February 2004 Supplement to Anesthesia & Analgesia).
17. Jain S, Maroof M, Verma V, Alam M, Gogia S, Khan RM: Truview Evo 2 laryngoscopy is superior to Macintosh laryngoscopy in terms of force used, glottic view and haemodynamic changes. Anesth Analg 2007;104:S-119 (ISSN 0003-2999 Volume 104, Number 2S, February 2007 Supplement to Anesthesia & Analgesia).
18. Maroof M, Khan RM, Verma V, Jain S, Khan Y: Intubation with Truview Evo-2 is superior to Macintosh in terms of force used and hemodynamic changes. Anaesthesiology 2006; 105: A1284.
19. Tuckey JP, Cook TM, Render CA: An evaluation of the levering laryngoscope. Anaesthesia 1996; 51: 71–3.
20. Sakai T, Konishi A, Nishiyama T, Higashizawa T, Bito H: A comparison of the grade of laryngeal visualisation–the McCoy compared with the Macintosh and the Miller blade in adults. Masui 1998; 47: 998-1001.
21. Léon O, Benhamou D: Improvement of glottis visualization with a McCoy blade. Ann Fr Anesth Reanim. 1998;17(1): 68-71.
22. Bishop MJ, Harrington RM, Tencer AF: Force applied during tracheal intubation. Anesth Analg 1992;74:411-4.
23. King BD, Harris LC, Greifenstein FE, Elder JD, Dripps RD: Reflex circulatory responses to direct laryngoscopy and tracheal intubation performed during general anesthesia. Anaesthesia 1951; 12: 556-66.
24. Stoelting RK: Circulatory changes during direct laryngoscopy and tracheal intubation: Influence of duration of laryngoscopy with or without prior lidocaine. Anesthesiology 1977; 47: 381-3.
25. McCoy EP, Mirakhur RK, McCloskey BV: A comparison of the stress response to laryngoscopy; The Macintosh versus the McCoy blade. Anaesthesia 1995; 50: 943-6.
26. Lieberman N, Hakim AR, Lemberg L: Truview blade improves laryngeal view and reduces airway trauma in comparison to Macintosh blade-A preliminary report. Anesth Analg 2004;98:S-102 (ISSN 0003-2999 Volume 98, Number 2S, February 2004 Supplement to Anesthesia & Analgesia).
27. McCoy EP, Mirakhur RK, McCloskey BV: A comparison of the stress response to laryngoscopy; The Macintosh versus the McCoy blade. Anaesthesia 1995; 50: 943-6.
28. McCoy EP, Mirakhur RK, Rafferty C, Bunting H, Austin BA: A comparison of the forces exerted at laryngoscopy; the Macintosh versus the McCoy blade. Anaesthesia 1996; 51: 912-5.
29. Han TS, Kim JA, Park NG, Lee SM, Cho HS, Chung IS: A Comparison of the Effects of Different Types of Laryngoscope on Hemodynamics: McCoy Versus the Macintosh Blade. Korean J Anesthesiol. 1999; 37(3): 398-401 (Korean).
30. Joo JS, Lee YS, Jo DH, Kim HK, Chung CK: The Effects of Tracheal Intubation with McCoy or Macintosh Laryngoscope on Blood Pressure, Heart Rate. Korean J Anesthesiol. 1997;33(4):648-652 (Korean).
31. Roman J, Beltran de Heredia B, Garcia-Velasco P, Parramon F, Garcia R, Vilaplana J, Villalonga A: Hemodynamic response to intubation with Macintosh and McCoy blades. Rev Esp Anestesiol Reanim. 1996; 43(5): 177-9.