ORIGINAL ARTICLE

Comparison of the use of McCoy and TruView EVO2 laryngoscopes in patients with cervical spine immobilization

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ABSTRACT

Context: The cervical spine has to be stabilized in patients with suspected cervical spine injury during laryngoscopy and intubation by manual in-line axial stabilization. This has the propensity to increase the difficulty of intubation. An attempt has been made to compare TruView EVO2 and McCoy with cervical spine immobilization, which will aid the clinician in choosing an appropriate device for securing the airway with an endotracheal tube (ETT) in the clinical scenario of trauma. **Aims:** To compare the effectiveness of TruView EVO2 and McCoy laryngoscopes when performing tracheal intubation in patients with neck immobilization using manual in-line axial cervical spine stabilization. **Settings and design:** K. M. C. Hospital, Mangalore, This was a randomized control clinical trial. **Methods:** Sixty adult patients of either sex of ASA physical status 1 and 2 who were scheduled to undergo general anesthesia with endotracheal intubation were studied. Comparison of intubation difficulty score (IDS), hemodynamic response, Cormack and Lehane grade, duration of the tracheal intubation and rate of successful placement of the ETT in the trachea between TruView EVO2 and McCoy laryngoscopes was performed. **Results:** The results demonstrated that TruView has a statistically significant less IDS of 0.33 compared with an IDS of 1.2 for McCoy. TruView also had a better Cormack and Lehane glottic view (CL 1 of 77% versus 40%) and less hemodynamic response. **Conclusions:** The TruView blade is a useful option for tracheal intubation in patients with suspected cervical spine injury.

Key words: *Cervical spine injury, manual in-line axial stabilization, McCoy laryngoscopes, tracheal intubation, TruView EVO2*

INTRODUCTION

The incidence of cervical spine injury is reported to be 1–4% in all major trauma victims, and may be as high as 34% in patients with severe injuries.[1] Orotracheal intubation is the preferred technique for airway management in trauma victims. Failure to adequately immobilize the neck during tracheal intubation in patients with cervical spine injuries can result in devastating neurological outcomes.[2]

Anatomic studies that mimic complete C4-5 ligamentous injury demonstrate that manual in-line axial stabilization (MIAS) reduces segmental angular rotation and distraction.[3] It also results in less subluxation into the spinal canal during Orotracheal intubation than cervical collar immobilization in a cadaver model of cervical spine injury.[4] However, it can be a double-edged sword, in that it has been shown to increase the difficulty level in visualizing the larynx using conventional laryngoscopy.[5] This is because MIAS prevents head extension and neck flexion, which are necessary for optimal alignment of the three airway axes and exposure of the vocal cords using direct laryngoscopic techniques.

Laryngoscopy and endotracheal intubation are known to cause an increase in arterial blood pressure, heart rate and intracranial tension, which can be deleterious in trauma cases with associated head injury.[6] Obtunding this reflex response during laryngoscopy and intubation remains a major concern of the anesthesiologists. Exposure of the glottis during laryngoscopy requires the elevation

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of the epiglottis by a forward and upward lifting of the laryngoscope blade. It has been observed that the amount of forces exerted during laryngoscopy and intubation is the key determinant for mechanical stimulation of stretch receptors present in the respiratory tract. Any laryngoscopy technique requiring lesser lifting force would proportionally reduce the sympathetic discharge, and hence changes in heart rate and blood pressure.

TruView EVO2 (Truphatek International Ltd., Netanya, Israel) is a modified laryngoscope that illuminates and expands the angular view of the larynx and adjacent structures, thereby facilitating endotracheal intubation. It provides a 42° anterior refraction in the line of sight, making difficult cases easier to intubate.[7] TruView EVO2 uses an optical system view tube that consists of prisms and lenses that extend vision beyond the distal end of the blade. It reduces the amount of force needed to successfully intubate a patient by greater than 30%.[7] It is used for endotracheal intubation where there is difficulty in visualizing the laryngeal inlet, especially in cases with limited neck extension.[8,9]

The McCoy laryngoscope (Penlon) was introduced in 1993.[10] It is based on the standard Macintosh blade with a hinged tip that is operated by a lever mechanism on the back of the handle, which allows for elevation of the epiglottis while reducing the amount of force required. It has been designed to facilitate tracheal intubation when the patient's head is in a neutral position. It has also been shown to reduce the stress response to laryngoscopy, probably as a result of the reduction in the required force.

In this study, an attempt has been made to compare the TruView EVO2 and the McCoy with the cervical spine immobilized, with regard to the difference in the ease of intubation and the associated hemodynamic response. Comparison of the intubation difficulty score (IDS), hemodynamic response, Cormack and Lehane grade, duration of tracheal intubation and rate of successful placement of the endotracheal tube (ETT) in the trachea between TruView EVO2 and McCoy laryngoscopes will be reported.

METHODS

The study was conducted on 60 adult patients belonging to ASA physical status 1 and 2, between the ages of 18 and 65 years, who were scheduled for elective surgery under general anesthesia, requiring endotracheal intubation. The approval for the study was obtained from the Institutional Ethics Committee and informed consent was obtained from all patients. Exclusion criteria for the study include patients not fasted for 8 h prior to surgery, rapid sequence intubation, anticipated difficult airway on preoperative assessment with Mallampati class IV, thyromental distance less than 6.5 cm and interincisor distance less than 3.5 cm, pathology of oropharynx, larynx or mass in the neck that is likely to alter the anatomy of the airway, obese patients (body mass index >30), central nervous system disorders, intracranial space-occupying lesion or patients with features of raised intracranial tension or intraocular pressure and allergy to any of the drugs being used in the study. Sixty patients were selected in a random manner and allocated to the TruView (T) group and the McCoy (M) group, each with 30 patients by the "chit in a box" method. Sixty chits, 30 labeled T and 30 labeled M, were put into a box and after mixing, and were picked by the subjects and not replaced in the box. This simple method of randomization ensured equal allocation of cases to both the Truview and the McCoy groups. Use of the airway device and endotracheal intubation was performed by an anesthesiologist who has at least 3 years of experience in anesthesia and has performed at least 20 intubations in the clinical settings with both devices. Two anesthesiologists had performed the laryngoscopy for the study, and they had performed cases in both groups, which were allocated by the "chit in box" method.All patients were kept nil per oral for 8 h prior to the surgery. They were premedicated with lorazepam 0.04 mg/kg orally the night before and 2 h prior to the surgery. In the operating room, preinduction monitoring was performed with a five-lead electrocardiogram, noninvasive blood pressure and a pulse oximeter. Appropriate intravenous access was secured. Premedication with Fentanyl 2 mcg/kg was given. The patients were preoxygenated with 6 L of oxygen for 5 min and general anesthesia was induced with propofol titrated to induce anesthesia in a dose sufficient to produce loss of response to verbal commands. Muscle relaxant vecuronium bromide 0.12 mg/kg was administered after checking adequacy of the mask ventilation. Mask ventilation with oxygen and isoflurane was done for 3 min. At the end of the 3 min, after confirming adequacy of block with a peripheral nerve stimulator, the pillow was removed and the neck was immobilized using MIAS applied by an experienced assistant holding the sides of the neck and the mastoid processes thus preventing flexion/extension or rotational movement of the head and neck.

Direct laryngoscopy was done with either TruView [Figure 1] or McCoy laryngoscopes [Figure 2] in their respective groups. Oxygen was connected to the TruView blade and a flow rate of 5 L/min was kept to prevent fogging. The trachea was intubated with an appropriate size cuffed ETT (7.0 in females and 8.0 in males). After successful tracheal intubation, the lungs were mechanically ventilated for the duration of the procedure and anesthesia was maintained with isoflurane in a mixture of N_2O and O_2.

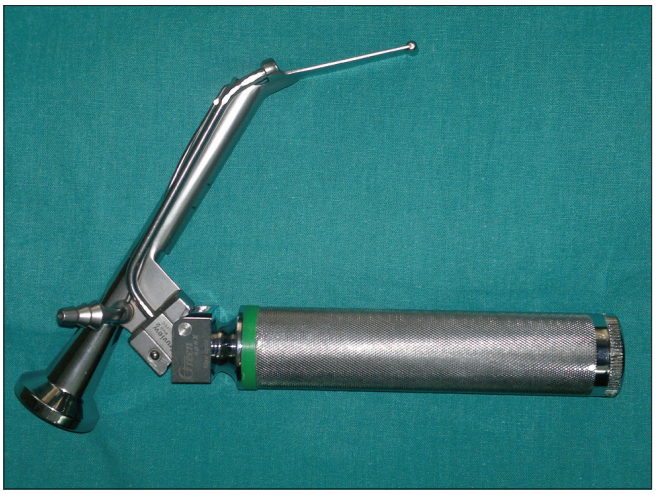

Figure 1: TrueView EVO2

Figure 2: McCoy blade

No other medications were administered or procedures performed during the 5-min data collection period after tracheal intubation. Subsequent management had been left to the discretion of the anesthesiologist providing care for the patient.

The duration of the tracheal intubation procedure was noted. The duration of the intubation attempt is defined as the time taken from insertion of the blade between the teeth until the ETT is placed through the vocal cords, as evidenced by visual confirmation by the anesthesiologists. However, in patients in whom the ETT was not directly visualized as passing through the vocal cords, the intubation attempt was not considered complete until the ETT was connected to the anesthetic circuit and evidence obtained of the presence of CO_2 in the exhaled breath. A failed intubation attempt is defined as an attempt in which the trachea is not intubated or which required more than 60 s to perform. A maximum of two intubation attempts was permitted with the device tested. If the tracheal intubation is unsuccessful with the device tested, MIAS will be discontinued and tracheal intubation performed with the Macintosh laryngoscope. The duration of the first tracheal intubation or of the second, in case the first was unsuccessful, will be recorded.

The number of intubation attempts, the rate of successful placement of the ETT in the trachea, the number of optimization maneuvers required (use of a bougie, cricoid pressure, second assistant) to aid tracheal intubation, the Cormack and Lehane grade at laryngoscopy and hemodynamic response to laryngoscopy were noted. The IDS was calculated. The IDS score, developed by Adnet and colleagues, is a quantitative scale incorporating multiple indices of intubation difficulty that more objectively quantifies the complexity of tracheal intubations.[11]

A pilot study on 12 patients, six in each group, was conducted. The results were analyzed with the aid of a statistician and a sample size of 60 was decided to ensure a level of significance of 5% and a suitable power. Analysis of the statistical data obtained from the study was carried out by a statistical programming software Statistical Package for the Social Sciences (SPSS) version 10. SPSS is a statistical tool used to analyze and correlate social data. The statistical tests applied to the data obtained from the study were Chi-square test, Student's t test, Paired t test and nonparametric Z test. A $P<0.05$ was considered statistically significant.

RESULTS

The study population contains 14 males and 16 females under each group. The Mallampati class and Cormack and Lehane grade observed among the study population in both the groups are as shown in Tables 1 and 2 respectively.

The Chi-square test was applied to determine the statistical significance. Mallampati class was comparable among the two groups, with a *P* value of 0.718. Difference in the laryngoscopic grade is statistically significant, with a *P* value of 0.011 as shown in Figure 3.

The time taken for laryngoscopy and intubation with McCoy was 22.9 s and with TruView was 33.2 s, with a $P<0.001$, which proved to be statistically significant. The IDS with McCoy was 1.2 and with TruView was 0.3 as shown in Figure 4. Student's *t* test was applied and the IDS was found to be statistically significant with a $P<0.001$.

Figure 5 shows the mean heart rate of the patients before induction, before intubation and after intubation at various time intervals (1, 2 and 5 min after intubation). To determine whether the variation in heart rate is statistically

significant, Paired t test was applied. The increase is heart rate is statistically significant in both groups up to 2 min after intubation. But, it does not persist till 5 min. To determine whether there is any statistically significant difference in the increase in heart rate between the two groups, the Unpaired t test was applied. The increase in heart rate was significantly higher in the McCoy group than in the TruView group for 1 min after intubation.

Table 1: Mallampati class observed in the two study groups

Mallampati class	McCoy		TruView	
	Number	Percentage	Number	Percentage
I	9	30	12	40
II	13	43	11	37
III	8	27	7	23
Total	30	100	30	100

Table 2: Cormack and Lehane grade observed in the two study groups

Laryngoscopic grade	McCoy		TruView	
	Number	Percentage	Number	Percentage
I	12	40.0	23	76.7
II	16	53.3	7	23.3
III	2	6.7	0	0
IV	0	0	0	0
Total	30	100	30	100

Figure 6 shows the mean of the systolic, diastolic and mean arterial blood pressure of the patients before induction, before intubation and after intubation at various time intervals (1, 2 and 5 min after intubation). To determine whether the variation in blood pressure is statistically significant, the Paired t test was applied. The increase is systolic and diastolic (and also mean blood pressure) is statistically significant in both groups up to 5 min after intubation. To determine whether there is any statistically significant difference in the increase in blood pressure between the two groups, nonparametric Z test was applied. It shows that the increase in blood pressure is significantly higher in the McCoy group than in the TruView group for 2 min after intubation.

There was no intubation failure in any group. There was no incidence of dental or more severe airway laceration with

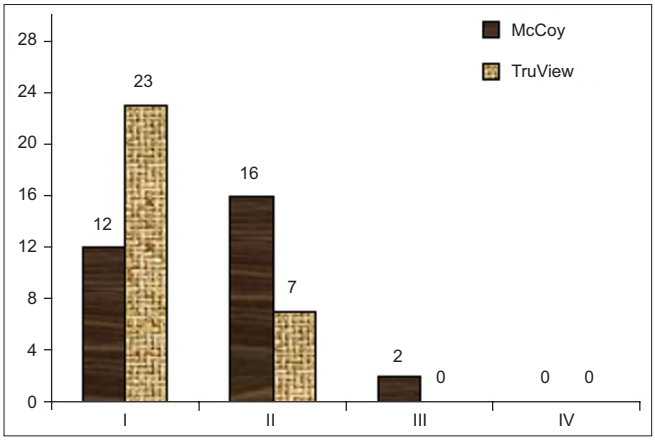

Figure 3: Cormack and Lehane grade

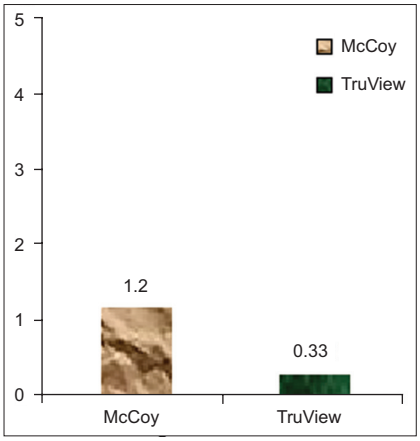

Figure 4: Intubation difficult score

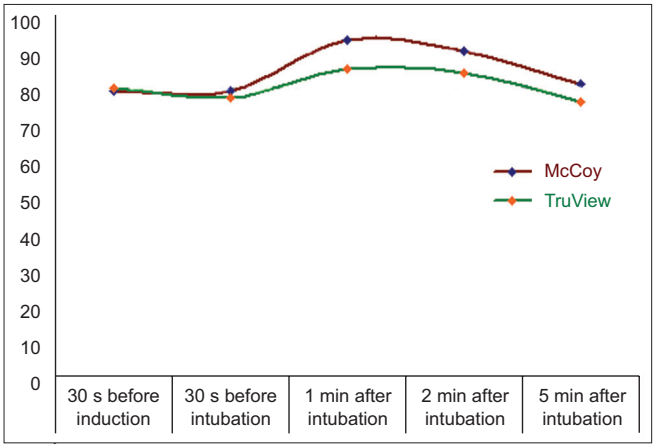

Figure 5: Mean Heart rate graph

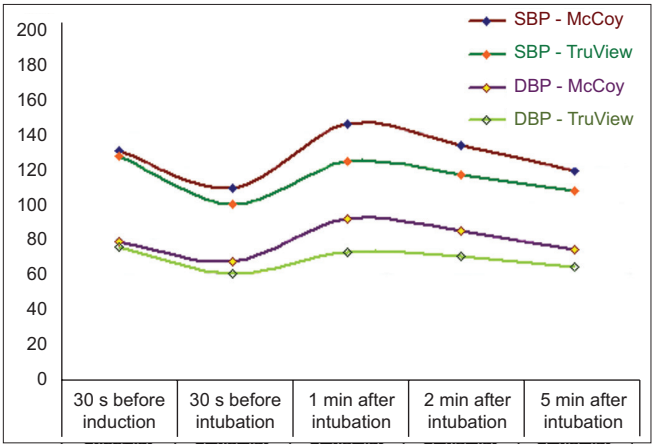

Figure 6: Blood Pressure

any group. Appearance of blood on the laryngoscope blade was seen in one patient each in both groups.

DISCUSSION

In this study, we aimed to evaluate the relative efficacy of TruView and McCoy when used by an experienced anesthetist in the clinical setting of cervical spine immobilization using MIAS. Both TruView and McCoy offer better glottic view and lesser force exerted during intubation when compared with the standard Macintosh laryngoscope.[9,12]

The IDS is a quantitative scale incorporating multiple indices of intubation difficulty that objectively quantifies the complexity of tracheal intubations. IDS score was developed by Adnet and colleagues.[11] In our study, the IDS is significantly low with the TruView laryngoscope (mean of 0.3 with standard deviation of 0.5) than with the McCoy laryngoscope (mean of 1.2 with standard deviation of 1.2), with a *P* value of less than 0.001, which shows that it is very highly significant. In the study conducted by Malik *et al*.,[13] the IDS was significantly low with the TruView laryngoscope when compared with the Macintosh laryngoscope. He evaluated the effectiveness of the Pentax Airway scope, Glidescope and TruView EVO2 in comparison with the Macintosh laryngoscope in 120 patients (30 in each group). IDS were lowest with the Pentax Airway scope.

In this study, the Cormack and Lehane glottic view is significantly better with the TruView laryngoscope than with the McCoy laryngoscope (*P*=0.01). Mallampati classes of the patients studied were comparable in both groups. The studies conducted by Malik *et al*.,[13] Barak *et al*.[8] and Rashid *et al*.[14] showed a significantly better glottic view with the TruView laryngoscope when compared with the Macintosh laryngoscope. The studies conducted by Laurent *et al*.[15] and Gabbot *et al*.[16] showed a significantly better glottic view with the McCoy laryngoscope when compared with the Macintosh laryngoscope.

The cardiovascular response to laryngoscopy and intubation is significantly higher with the McCoy group than with the TruView group. There was a significant increase in heart rate in both groups up to 2 min after intubation, but it did not persist till 5 min. The increase in heart rate is significantly higher in the McCoy group than in the TruView group for 1 min after intubation. In the second minute, there was no significant difference between the two groups. There was significant increase in systolic and diastolic blood pressure in both the groups for 5 min after intubation. And, the increase in blood pressure is significantly higher in the McCoy group than the in TruView group for 2 min after intubation. In the fifth minute, there is no significant difference between the two groups. This less hemodynamic response with TruView may be due to the lesser force applied to the base of the tongue by TruView. The lifting force is very minimal with TruView when compared with McCoy. In the study conducted by Rashid *et al*.,[14] the hemodynamic response to laryngoscopy and intubation was significantly less with the TruView laryngoscope when compared with the Macintosh laryngoscope. The duration of intubation was significantly less with the McCoy laryngoscope (mean of 22.9 s with standard deviation of 8.5) than with the TruView laryngoscope (mean of 33.2 s with standard deviation of 12.3), with a *P* value of less than 0.001, which shows that it is very highly significant. 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 Malik *et al*.[13] and Barak *et al*.[8] Another problem with TruView is fogging, which hinders the visualization of the cords. To overcome this, we have used Oxygen at the flow rate of 6 L/min. There was no intubation failure in any group. There was no incidence of dental or more severe airway laceration with any group. Appearance of blood on the laryngoscope blade was noted in one patient each in both groups.

However, there are a few limitations to this study. The potential for observer bias does exist, as it is extremely difficult to blind the anesthesiologist intubating with the device to data collection. Another limitation is that the study did not focus on which laryngoscope would be appropriate in a case of difficult intubation, as none of the patients had a Cormack and Lehane grade of 4. This arose from the fact that any potential difficult airway was excluded from the study.

In conclusion, while comparing the effectiveness of the TruView EVO2 and the McCoy laryngoscopes, when performing tracheal intubation in patients with neck immobilization using manual in-line axial cervical spine stabilization, we found that the TruView laryngoscope appears to be better than the McCoy laryngoscope in terms of ease of laryngoscopy and intubation, lesser hemodynamic response and better glottic view.

Appendix 1

IDS

N1=No. of intubation attempts >1
N2=No. of operators >1
N3=No. of alternative intubation techniques used
N4=Glottic exposure (Cormack and Lehane grade minus 1)
N5=Lifting force required during laryngoscope (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)

IDS score	Degree of difficulty
0	Easy
0 < IDS ≤ 5	Slight difficulty
5 < IDS	Moderate to major difficulty
IDS=¥	Impossible intubation

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