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Comparison of Truview® Video Laryngoscopy with Conventional Macintosh Direct Laryngoscopy for Orotracheal Intubation: A Randomized Controlled Trial

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ABSTRACT

Background: Exaggerated hemodynamic response has been linked to laryngoscopy and intubation. This reaction might have negative consequences on the respiratory system, the nervous system, and the heart. It might show up as tachycardia, hypertension, and dysrhythmias. The oral, pharyngeal, and laryngeal axes, all need to be aligned, which is largely responsible for the laryngoscopy reaction. Hence video laryngoscope was developed to overcome this response which does not require the alignment of these three axes. Thus, it can provide this ameliorating effect with less suspension and distension force, which will probably result in less hemodynamic changes during laryngoscopy. Comparing the hemodynamic response during laryngoscopy and intubation using the conventional McIntosh direct laryngoscope and the Truview® video laryngoscope was the primary objective of this study. Intubation time and glottic opening using Cormack Lehane grade were the secondary objectives.

Methods: This randomized controlled trial was conducted in 60 patients who were scheduled to undergo elective surgeries requiring conventional GA. Random allocation into two groups was done. Patients in Group ML (n=30) underwent laryngoscopy and intubation using a conventional McIntosh laryngoscope. Patients in Group VL (n=30) underwent laryngoscopy and intubation using a Truview video laryngoscope. Before and after endotracheal intubation, as well as 2, 5, and 10 minutes later, both groups were monitored for changes in hemodynamic parameters such as heart rate, systolic and diastolic pressure, and mean arterial pressure. Intubation time and glottic view was also assessed using the Cormack Lehane grade.

Results: Heart rate, systolic blood pressure, mean arterial blood pressure, and intubation time were significantly different between the two groups (p=0.00). The diastolic blood pressure did not significantly differ between the two groups (p=0.203). There was no statistically significant correlation between the type of laryngoscopy and the glottic view with Cormack Lehane Grade favouring certain groups (p=1).

Conclusion: We conclude that tracheal intubation with Truview video laryngoscope is advantageous in preventing cardiovascular stress response but with longer intubation time.

Laryngoscopy and intubation are both components of endotracheal intubation. Laryngoscopy and intubation are noxious stimuli that cause significant hemodynamic stress as well as high sympathetic activity characterized by tachycardia and hypertension [1]. The cardiovascular reaction is a reflex

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phenomenon [2]. The rise in blood pressure and pulse rate is typically brief, varied and unpredictable. A normal, healthy person may endure this reaction, but in those who are vulnerable, this momentary sympathetic response might trigger potentially fatal complications [3]. Herein lies the justification for continuing to look for an anaesthetic approach that can dampen the cardiovascular reaction. Over the past 40 years, this has caught the attention of numerous anaesthetists. The hemodynamic reaction to laryngoscopy has been reduced using a variety of pharmacological and non-pharmacological techniques. The cardiovascular response to laryngoscopy and endotracheal intubation has been reduced using non-pharmacological techniques like smooth and gentle intubation with a shorter duration of laryngoscopy, insertion of LMA in place of endotracheal intubation [4] and blocking Glossopharyngeal and superior laryngeal nerves [5]. Since Foregger's invention of the conventional McIntosh direct laryngoscopy in the 1940s, it has been the gold standard tool for direct laryngoscopy and tracheal intubation [6]. Truview video laryngoscope is a newly introduced Truphatek product. It is light weight, portable. It offers clear enlarged view on screen that enhances ease of tracheal intubation. The oxygen flow via a side channel on the handle provides continuous oxygenation which delays desaturation during apneic laryngoscopy. Oxygen flow also improves viewing by preventing fogging of the lens and clearing secretions in its path. The purpose of this research was to assess the hemodynamic response to laryngoscopy and intubation whilst using the Truview video laryngoscope and the conventional McIntosh laryngoscope.

Methods

This prospective randomized study was conducted after obtaining approval from the institutional ethical committee (SKNMC/Ethics/App/2019/564) and written informed consent from all patients. A total number of 60 cases (aged between 18 and 65 years) of either sex, with ASA 1 and 2 status, BMI ≤30 kg/m2, mallampati class 1 and 2 requiring general anaesthesia with adequate tracheal intubation were enrolled.

Patients with ASA>2, anticipated difficult airway (mallampati>2, intraoral lesion, mouth opening less than 3 cm, thyromental distance less than 6 cms), hypertension, diabetes mellitus, treatment known to affect blood pressure or heart rate and obese patients were excluded.

For all patients, the anaesthesia technique was standardised. Pulse oximetry, non-invasive blood pressure, ECG and end tidal carbon dioxide were all monitored. Five minutes after entering the operating room, the patient's baseline systolic, diastolic and mean blood pressures, as well as their heart rate and spo2 readings were recorded. All patients premedicated with Inj.Glycopyrrolate 0.004mg/kg IV, Inj.Midazolam 0.03mg/kg IV, Inj. Ondansetron 0.1mg/kg IV. The patients were preoxygenated for 3 minutes via a face mask, anaesthesia was induced with Inj. Propofol 2mg/kg IV (titrated till loss of verbal response). Endotracheal intubation was facilitated with Inj. Vecuronium 0.1mg/kg IV three minutes prior to laryngoscopy and intubation. Laryngoscopy and oral intubation were performed using appropriately sized McIntosh and Truview blades, bilateral equal air entry checked & endotracheal tube was fixed. Anaesthesia was maintained using 50% nitrous oxide and 50% oxygen with isoflurane/desflurane/sevoflurane, Inj. Vecuronium. No surgical or any other stimulus was applied during 10 minutes of study period.

Patients were randomly divided by computer generated numbers into two groups as Group ML (including patients in whom laryngoscopy and intubation was done using Macintosh laryngoscope) and group VL (including patients in whom laryngoscopy and intubation was done using Truview video laryngoscope) (Figure 1). All intubation procedures were performed by a single anaesthetist who was familiar and well trained (performed at least 20 intubations prior to study with both laryngoscopes). Succeeding hemodynamic measurements were performed at intervals of 0,2,5,10 minutes after intubation.

The time period between the insertion of the designated intubating device into the mouth and the positioning of the tracheal tube between the vocal cords was known as the intubation time. The glottic view was studied using Cormack-Lehane grade where

Grade1: entire vocal cords seen.

Grade2: posterior part of laryngeal aperture seen.

Grade3: only epiglottis visible.

Grade4: no glottic structures seen.

Patients requiring more than one attempt, change of anaesthesiologist or blades were excluded from the study.

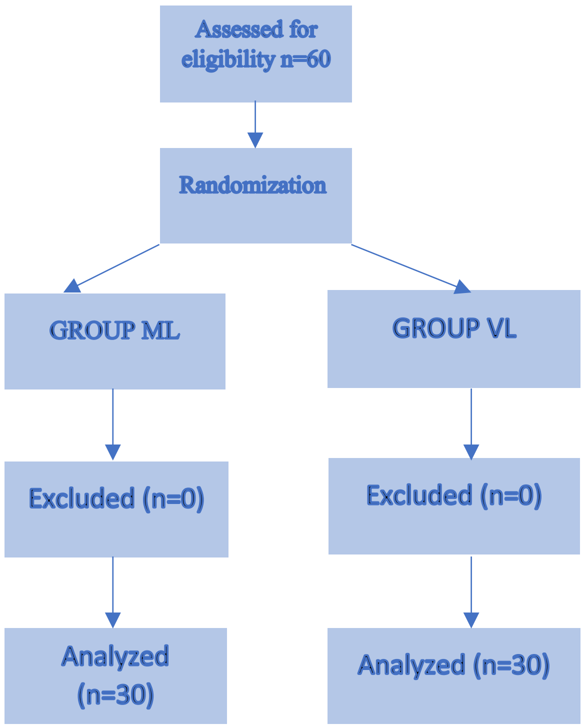
Primary objectives: To study the effect on heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure.

Secondary objective: To study the intubation time and glottic opening using C-L grade.

Statistical Analysis

All data were subjected to descriptive statistics. Version 15.0 of the Statistical Package for Social Sciences (SPSS) was used for the statistical analysis (USA). The appropriate Chi-square test or Fischer's exact test was used to assess the categorical variables within the two groups. An analysis of variance with repeated measures (ANOVA) was used to study the hemodynamic responses to intubation, including heart rate, systolic, diastolic and mean arterial pressures. Statistical significance was defined as a two-tailed probability less than 0.05.

Figure 1- Consort chart



Results

A total of 60 patients were enrolled in the study. The demographic variables were compared in both the groups. There were 30 (50%) females and 30 (50%) males in the study. There was no statistically significant difference between two groups with respect to age, sex, ASA status and weight distribution. Mean age of 60 study sample was 43.72 years (standard deviation 13.25 years), with the highest 63 years and lowest 18 years. Mean weight of 60 study sample was 58.97 kgs (standard deviation 7.93 kgs), with the highest being 78 kgs and the lowest 35 kgs (Table 1).

On application of Repeated measure ANOVA, the heart rate during laryngoscopy showed a significant difference (p=0.00). The difference between the mean heart rates in the Truview video laryngoscopy and direct laryngoscopy groups was statistically significant (p=0.00). The greatest HR increase was noticed during intubation in the ML Group. When compared to that of the ML Group, the consistent drop in HR in the VL Group from the time of intubation to the 10th minute of intubation was statistically significant (p=0.00) (Table 2, Figure 2).

The changes in systolic blood pressure, diastolic blood pressure and mean arterial pressure was assessed at pre-induction and at various time intervals from the onset of laryngoscopy and intubation in McIntosh direct laryngoscopy and Truview video laryngoscopy groups and their comparative statistics are shown in (Table 3).

Application of Repeated measure ANOVA revealed a significant change in systolic blood pressure during laryngoscopy (p=0.00). The mean systolic blood pressure in the direct laryngoscopy group was greater than in the video laryngoscopy group and the difference was statistically significant (p=0.00).

On application of Repeated measure ANOVA, it was found that laryngoscopy significantly changed the diastolic blood pressure (p=0.00). Although the mean diastolic blood pressure in the group undergoing direct laryngoscopy was greater than that of the Truview video laryngoscopy group, the difference was not statistically significant (p=0.203).

The mean arterial blood pressure significantly changed during laryngoscopy according to the Repeated measure ANOVA (p=0.00). In the direct laryngoscopy group, the mean arterial blood pressure was greater than in the Truview video laryngoscopy group and the difference was statistically significant (p=0.00) (Figure 3).

Applying an unpaired t test, it was shown that the Truview video laryngoscopy group required a longer average intubation time than the direct laryngoscopy group and the difference was statistically significant (p=0.00) (Table 4).

There were 15 samples having Cormack Lehane Grade 1 by McIntosh and Truview video laryngoscopy each and 15 samples with Cormack Lehane Grade 2 by McIntosh and Truview video laryngoscopy each. On application of Chi-square test, there was no significant association between the type of laryngoscopy and the Cormack Lehane Grade for glottic view (Chi-square statistic - 0, p=1) (Table5,6).

Table 1- Age and Weight statistics

	Age(Yrs)	Weight(Yrs)
N	60	60
Mean	43.73	58.97
Std. Error of mean	1.711	1.024
Std. Deviation	13.25	7.934
Range	45	43
Minimum	18	35
Maximum	63	78

Table 2- Descriptive Statistics

Heart rate (beats/min)	Laryngoscopy	Mean	Std. deviation
Baseline	ML Group	85.87	9.482
	VL Group	81.97	7.695
Post Induction	ML Group	80.03	9.208
	VL Group	79.00	7.821
0 min	ML Group	89.07	10.079
	VL Group	77.60	7.093
2 min	ML Group	86.33	9.178
	VL Group	75.93	6.000
5 min	ML Group	83.67	8.664
	VL Group	74.30	6.086
10 min	ML Group	81.97	8.552
	VL Group	74.50	5.257

Table 3- Changes in Blood Pressure

		Systolic BP(mmHg)		Diastolic BP(mmHg)		MAP (mmHg)	
	Group	Mean	SD	Mean	SD	Mean	SD
Baseline	ML	121.53	3.371	75.93	8.654	91.00	6.153
	VL	121.13	2.991	80.63	8.696	93.80	6.200
Post induction	ML	117.70	2.667	70.97	6.414	86.10	4.780
	VL	117.07	2.449	74.77	9.302	88.50	6.230
0 min	ML	153.63	6.946	82.70	6.265	105.97	4.909
	VL	119.60	2.444	74.27	7.643	89.23	5.24
2 min	ML	148.13	5.476	80.20	7.631	102.60	5.263
	VL	118.00	2.228	72.47	8.874	87.70	5.966
5 min	ML	141.47	3.812	76.07	7.615	97.50	5.557
	VL	115.77	1.924	72.5	8.419	86.83	5.509
10 min	ML	136.57	3.014	74.57	8.834	94.90	6.288
	VL	112.50	1.614	72.80	7.112	85.80	4.612

Table 4- Group Statistics

Laryngoscopy		N	Mean	Std. Deviation	Std.Error of Mean	P value
Intubation Time (sec)	ML	30	8.10	1.348	0.246	0.00
	VL	30	11.73	1.112	0.203	

Table 5- Cormack Lehane Grade Statistics

		Cormack Lehane Grade		Total
		1	2	
Group	ML	15	15	30
	VL	15	15	30
TOTAL		30	30	60

Table 6- Chi-square result for Cormack Lehane Grade

	Category 1	Category 2	Marginal flow Tools
Group 1	15 (15) (0)	15 (15) (0)	30
Group 2	15 (15) (0)	15 (15) (0)	30
Marginal Column Tools	30	30	60

Figure 2- Line diagram showing mean heart rate among study subjects

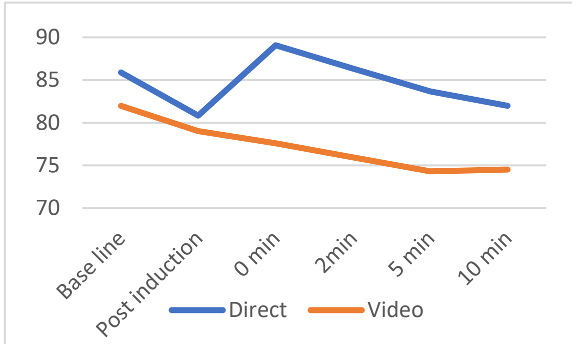
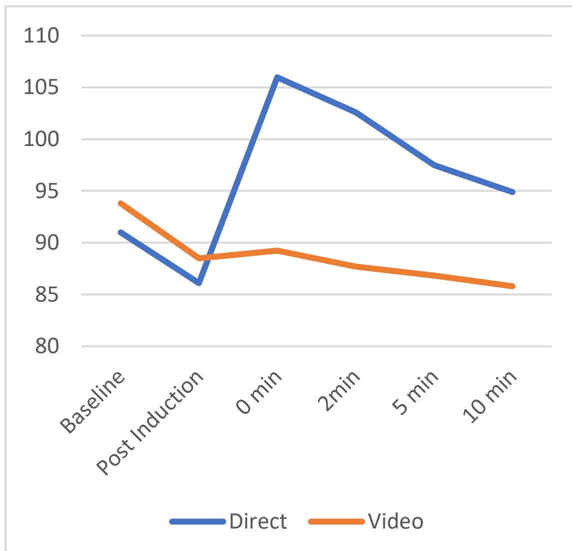


Figure 3- Line diagram showing mean of mean arterial blood pressure among study subjects



Discussion

In this prospective randomized trial, we compared how the conventional McIntosh laryngoscope and the Truview video laryngoscope affected the hemodynamic response during laryngoscopy and intubation. In contrast to the Truview video laryngoscope, the McIntosh laryngoscope significantly increased the hemodynamic response to laryngoscopy and intubation, according to our study. Comparable results were obtained in both groups utilising the Cormack Lehane grade for glottic view. Intubation time using the Truview video laryngoscope was significantly longer as compared to McIntosh group.

The cardiovascular response is a reflex phenomenon. Vagus (X) and glossopharyngeal (IX) cranial nerves play a role in mediating this. The vagus and glossopharyngeal nerves transport the afferent stimulation from the epiglottis and infra glottic area and activate the vasomotor centre to trigger a peripheral sympathetic adrenal response and release adrenaline and noradrenaline [2].

Since Foregger's creation of the conventional McIntosh direct laryngoscope in the 1940s, it has served as the accepted standard for direct laryngoscopy and tracheal intubation [6]. In direct laryngoscopy, a moderately high forward and upward pressure is used to visualize the glottis and align the laryngeal, pharyngeal and oral axes. [7-10].

Truview video laryngoscope is a newly introduced Truphatek product. It is light weight, portable made of stainless steel, applies the optical principle of light refraction. A prism serves as the distal lens on the optical view tube, enabling visualisation of structures 42 degrees anterior. It comes with 5 blade sizes. It offers clear enlarged view on the screen that enhances ease of tracheal intubation [11-13]. The oxygen flow (6-8 liters) via a side channel on the handle provides continuous oxygenation which delays desaturation during apnoeic laryngoscopy. Oxygen flow also improves viewing by preventing fogging of the lens and clearing secretions in its path [14].

It is provided with a stylet for endotracheal tube insertion which must be moulded into a “J” shape.

In a study by Deepak Tempe et al. (2016) [15] looking at the effect of hemodynamic response to laryngoscopy and intubation with Macintosh laryngoscope, McGrath (MG) and Truview (TV) video laryngoscope in patients undergoing coronary artery bypass grafts with normal airways, it was discovered that MG and TV video laryngoscopes do not assist in reducing hemodynamic response in patients. Additionally, they enhance laryngoscopic views while extending the time needed for intubation. The heart rate, SBP, MAP, on the other hand, showed a substantial difference in our study. Our research also showed that the Truview video laryngoscope considerably reduced the hemodynamic response to laryngoscopy and intubation when compared to the McIntosh direct laryngoscope, presumably because less force (5–14 N) is given to the base of the tongue and therefore it is less likely to stimulate stress response.

In a study of patients scheduled for major cardiac surgery, Gamze Sarkilar et al. (2015) [16] compared the hemodynamic responses to endotracheal intubation performed with direct and video laryngoscopy. They found that the time needed for endotracheal intubation was longer in the video laryngoscope group compared to the direct laryngoscope group and also came to the conclusion that video laryngoscopy improves the glottic view. Our study, found similar results.

According to a study by Gurleen Kaur et al. (2020) [13], the duration of laryngoscopy was much shorter in the McGrath MAC group than it was in the Truview group or the Macintosh group, and the duration of intubation was the same in all three study groups. While the Cormack Lehane grading difference between McGrath MAC and Truview was not statistically significant, it was between McGrath MAC and Macintosh as well as Truview and Macintosh. In comparison to the Macintosh group, ease of intubation was better in the McGrath MAC and Truview groups. In an analysis of adult patients with anticipated difficult airways, Upasana Gupta et al. (2020) [14] compared the effectiveness of McIntosh direct laryngoscopy and Truview video laryngoscopy. Her study showed that Truview video laryngoscope enhances the glottic view in patients with anticipated difficult airway but with longer intubation time.

We also found similar results in our study when intubation time was compared. The results of our research showed that Truview video laryngoscope took longer time to intubate as compared to McIntosh direct laryngoscope possibly because of the use of J shaped stylet. But we found comparable results when glottic view was studied using the Cormack Lehane Grade in both the groups. Similar results were also found in studies conducted by Sourav Bag et al (2014) [17] and Demet Altun et al [18], which showed that the hemodynamic response to intubation was markedly reduced when using the Truview video laryngoscope as opposed to the Macintosh laryngoscope. Better visualization with lesser Cormack Lehane grade was found with Truview video laryngoscope but it took longer time for intubation than Macintosh laryngoscope.

Our study has a few constraints. Firstly, the investigator had significantly more experience with the McIntosh laryngoscope than the Truview video laryngoscope, which may have a confounding effect on the results even though only one person performed all the intubations and had sufficient experience using the Truview video laryngoscope (more than 20 times). Second, while this study was done on healthy people, its findings cannot be generalised to hypertensive patients, those who could have an anticipated difficult orotracheal intubation, or people with other concomitant conditions. Third, using invasive blood pressure monitoring by inserting an arterial line would have been ideal because it would have allowed for more frequent BP readings. However, using invasive blood pressure readings in our patient population for research purposes alone was unjustifiable.

Conclusion

We come to the conclusion that tracheal intubation with a Truview video laryngoscope is beneficial in reducing the risk of a cardiovascular stress response but requires a longer intubation period.

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