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Original Research Article

Comparison of Different Type of Video Laryngoscope with Direct Laryngoscope for Endotracheal Intubation in Adult Patients with Difficult Airway

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Abstract:

Introduction: The essential practice of anaesthesia as well as emergency and critical care medicine is airway management. Endotracheal intubation is the gold standard method for airway management because it is quick, non-surgical, and safe. It also achieves all airway management objectives, preserves airway patency, guards the lungs from aspiration, and allows leak-free breathing during mechanical ventilation.

Methodology: A prospective study at a tertiary care hospital was conducted including 60 participants as per the inclusion and exclusion criteria within the weight group of 40 to 70 and ASA grade II and III. After their Consent, Randomized distribution was conducted to segregate them equally between 3 groups, to compare King Vision and Trueview PCD video laryngoscopes and direct laryngoscopy with Macintosh blade and draw results.

Result: This clinical study involved 60 adult patients. They were divided into three groups using the closed envelope technique. Each group consisted of 20 patients. Group K has patients under Kingvision, Group T having Trueview, Group M having Macintosh laryngoscope.

On average, Group K took 16.5s for intubation; an increase was seen with Group T and M by +7.45s and +3.3s respectively. While 95% of patients in group K were intubated in 1st attempt, the percentage dropped to 80% and 55% in group T and M respectively. External laryngeal manipulation was not required in any patient of group K, but in 33% and 66% in group T and group M respectively.

Conclusion: King vision and TruView PCD video laryngoscope offer a better laryngoscopy view, higher successrate, faster intubations, minimum external maneuvers, less attempts for intubation and less hemodynamic stress response to direct laryngoscopy with Macintosh blade.

Keywords: Video Laryngoscope; Intubation; Hemodynamic stress;

Introduction

Tracheal intubation is the major goal of airway control in general anesthesia patients. The most crucial thing is to maintain enough oxygenation and ventilation [1]. Unexpectedly tough airways are the main challenge because they are not identified in the preoperative assessment. [2] The Mallampati test for airway assessment, which has a stated sensitivity of 50% and specificity of 100%, is a regularly used predictor of a preoperative risk for difficult intubation in general anesthesia techniques. [3]

Despite recent advances in airway management techniques, problems from difficult or unsuccessful intubation still account for the majority of anesthetic morbidity and mortality. As a result, numerous newer types of video laryngoscopes are produced in an effort to lessen the prevalence of this issue. Anaesthesiologists trained in direct laryngoscopy can use them successfully without any further training because of their comparable design to conventional laryngoscopes. [4-8] the creation of a "line-of-sight" between the operator and the laryngeal inlet, precise head alignment, and consistent anatomy are necessary for direct laryngoscopy (DL) using a Macintosh blade to be successful. Video laryngoscopy provides a view of the laryngeal inlet independent of the line of sight, particularly when an angulated instrument is used. [9]

When intubation is challenging, either the larynx cannot be seen with traditional laryngoscopy, or it is seen but the endotracheal tube (ET tube) is difficult to insert into the trachea. Although LMA and I-gel are simple to use, they have several

drawbacks, such as the need for a sufficient mouth opening and the fact that they do not shield the patient from the risk of aspiration. [10] Thus, for general anesthesia, securing the airway with a cuffed ET tube is still the standard procedure. To that end, a variety of video laryngoscope devices, such as the Airtraq, C-Trach, King vision video laryngoscope (KVL), Truview video laryngoscope (TVL), EVO video laryngoscope, Glide Scope, McGrath video laryngoscope has been developed for difficult intubation. Truview PCD video laryngoscope from Israel provides an indirect view of the vocal cord as an alternative to currently utilized conventional laryngoscopes. It is a recently released Truphatek product that is currently waiting adequate clinical testing and positive user reviews. [11] King Vision video laryngoscope is wireless, portable video laryngoscope with high blade angulation that provides the greatest indirect larynx visualization on a compact, portable flat-screen monitor. A tube guiding channel on the disposable blade facilitates tube passage without the need for a tube stylet. [12]

Therefore, the present study was conducted to evaluate and compare laryngeal view and intubation through a direct laryngoscope using a Macintosh blade with, King Vision video laryngoscope and a Truview PCD video laryngoscope in adult patients with difficult airways.

Aims and Objectives

This study was conducted to compare laryngoscopy through a conventional direct laryngoscope using a Macintosh blade with King Vision & TruView PCD video laryngoscopy in terms of various objectives like,

1. Laryngoscope view (the Cormack-Lehane classification)
2. Number of attempts required for intubation
3. Maneuvers necessary to facilitate intubation, such as external laryngeal manipulation, use of stylet or bougie
4. Total time taken for intubation
5. Hemodynamic responses during laryngoscopy and intubation
6. Complications if any

Materials and Methods

A prospective randomized study was carried out at tertiary care institute. An Informed written consent was obtained from each patient and the procedure was explained to the patients.

Total 60 adult patients of either sex, weighing 40 to 70 kg having ASA grade I/II & with predicted difficult airway posted for elective surgery under general anesthesia were included in this study. Patients were randomly divided in three groups using closed envelop technique. Each group included 20 patients.

Group K (n=20): King vision Video laryngoscopy

Group (n=20): Truview PCD Video laryngoscopy

Group M (n=20): Direct laryngoscopy with Macintosh blade

Inclusion criteria:

- ASA grade I/II
- 18-70 years of age
- Elective surgery
- Thyromental distance<6.5cm
- Mallampati grade II/III

Exclusion criteria:

- ASA≥III
- Mallampati grade I/IV
- Emergency surgery
- Patients with difficult mask ventilation
- Full stomach
- Coagulopathy
- Obesity(BMI>30kg/m2)
- Cervical spine injury

Pre-Operative Assessment:

Preoperative assessment was done one day before the surgery. Any significant past, family and personal history were taken. General physical examination was done, vitals (heart rate, blood pressure) and investigations were noted. Detailed airway examination was done. Patients were kept NBM for 6 hours prior to surgery. Written informed consent was taken from each patient.

On the day of surgery, the patients were taken to the operating room, 18 G intravenous cannula inserted, and I.V. fluid started. All preparation for difficult airway was done. Multipara monitor was attached and baseline pulse rate, blood pressure and SpO2 were recorded. All patients were pre-oxygenated for 3min before induction. All patients were premedicated with Inj. Ondansetron, Inj.Glycopyrrolate0.2mgI.V. & Inj. Fentanyl 2µg/kg I.V. All patients were induced with Inj. Thiopentone Sodium 6 mg/kgI.V. & Inj. Succinylcholine 2 mg/kgI.V.

Intubation was done with Endotracheal tubes (ETtubes); Size 7.0–7.5mm tracheal tubes for females and size 8.0–8.5mm in males were used. All patients were checked for mask ventilation before giving succinyl-choline, and those could not be ventilated, were excluded from the study.

Intubation was done according to laryngoscope used in particular group. (Group K, T& M)

The number of attempts required to intubate the patients were noted. Patients who required more than 3 attempts for intubation were excluded from

the study. If the vocal cord was not visualized, then external laryngeal manipulation or use of bougie or stylet was done to make it visible and then tube was inserted After successful intubation, the patients were mechanically ventilated for the surgical procedure and anesthesia was maintained with sevoflurane in a mixture of nitrous oxide and oxygen in a 1:1 ratio with muscle relaxant as per requirement of the surgery.

Laryngeal view was graded as per Cormack-Lehane Grading:

Grade 1: Visualization of entire vocal cords.

Grade 2: Visualization of posterior part of the laryngeal aperture.

Grade 3: Visualization of epiglottis.

Grade 4: No glottis structures seen.

Total time taken for intubation:

During the procedure, time was noted by an assistant from introducing the laryngoscope into the mouth till the appearance of square wave capnography on EtCO2 monitor and bilateral chest movement during manual ventilation, this time was considered as the total b Time taken for intubation

Hemodynamic changes (Pulse rate and blood pressure) and SpO2 were noted and recorded during the procedure (Laryngoscopy and Intubation) at various intervals like Pre-op, Before laryngoscopy and intubation, after laryngoscopy and intubation & 3,5,10, 20 minutes after intubation. Any complications like soft tissue injury, teeth injury, sore throat and hoarseness of voice, if present in any of three groups, were noted.

Statistical analysis was done using IBM SPSS Version 24 Software with one- way Anova test and Post hoc analysis. The data was collected, complied, and analysed statistically using frequencies and percentages for categorial variables, mean and standard deviation for quantitative variables.

All continuous variables are reported as Mean± Standard deviation. P value ≤ 0.05 was considered statistically significant difference for all statistical test.

Results

This clinical study involved 60 adult patients. They were divided into three groups using closed envelope technique. Each group consisted of 20 patients.

Table 1: Demographic Data

Variables	Group K	Group T	Group M
Sex(M: F)	8:12	10:10	12:8
Age(years)	35.15±7.03	33.9±9.21	41.35±12.6
ASA(I:II)	9:11	9:11	2:18
Body Weight(Kg)	51.5±4.58	52.9±4.01	57.8±5.69
Mallampati Grade II:III	17:3	11:9	4:16
Thyromental Distance<6.5Cm	5.17±0.6	5.23±0.6	5.2±0.22

Demographic data regarding sex, age and weight were comparable in all three groups. The predictors of difficult intubation were also comparable in all three groups.

Table 2: Cormack-Lehane Grade

C-L Grade	Group K (n=20)		Group T (n=20)		Group M (n=20)	
	N	%	N	%	N	%
Grade I	6	30	8	40	4	20
Grade II	12	60	8	40	8	40
Grade III	2	10	4	20	8	40
Grade IV	0	0	0	0	0	0

n=number of patients. Cormack Lehane Grade I and II was found in 90% of patients in Group K,80%of patients with Group T while 60% of patients in Group M. The Cormack- Lehane glottis view is better with Truview laryngoscope, and the King view laryngoscope as compared to Macintosh laryngoscope.

Table 3: Total Time Taken For Intubation

	Group K (Mean±SD)	Group T (Mean±SD)	Group M (Mean±SD)	P value
Time (seconds)	16.5 ± 1.63	23.95 ± 2.25	19.8 ± 2.2	K vs T: 0.0001 K vs M: 0.000002 T vs M: 0.0001

Total time taken for intubation was significantly higher with Group T than Group K and Group M.

Table 4: Numbers of Attempts Required for Intubation

No. of attempts	Group K (n=20)		Group T (n = 20)		Group M (n=20)	
	N	%	n	%	N	%
1	19	95	16	80	11	55
2	1	5	4	20	9	45
3	0	0	0	0	0	0

n=number of patients. In Group K, 95% of the patients were intubated with 1st attempts, In Group T, 80% of the patients were intubated with 1st attempt as compared to 55% of the patients in Group M.

Table 5: Maneuvers Required to Facilitate Intubation

Maneuvers	Group K		Group T		Group M	
	N	%	N	%	N	%
External laryngeal Manipulation	-	-	6	30	12	60
Use of stylet	-	-	20	100	6	30
Use of bougie	-	-	-	-	11	55

n=number of patients. As shown in table, ELM is not required in any patient of group K, while it was 30% and 60% in group T and group M respectively.

Mean pulse rate and mean arterial blood pressure at various interval in three groups. Baseline and before laryngoscopy and intubation reading were comparable in all three groups. After intubation and 3 minutes after intubation, pulse rate was significantly increased in Group M, while there was no change in group K and group T. The difference in the pulse rate was statistically significant($P<0.05$) between Group K vs Group M and Group T vs M after intubation, 3 minutes and 5 minutes. After intubation MAP was more increased in Group M (105.50±6.99) as compared to Group K (91.33±5.44) and Group T (96.53±5.66). The increase in MAP was comparable ($P>0.05$) in Group K and T.

After intubation and 3 minutes after intubation, MAP was significantly increased in Group M, while there was no change in group K and group T.

Table 6: Complications

Complications	Group K		Group T		Group M	
	N	%	n	%	N	%
Soft tissue injury	2	10	2	10	5	25
Teeth injury	0	0	1	5	2	10
Sore throat	0	0	0	0	0	0
Hoarseness of voice	0	0	0	0	3	15

n = Number of patients. Number of complications was more with Group M as compared to Group K and group T.

Discussion

Airway Management, an essential skill forms the central pillar of the practice of anesthesiology, resuscitation, critical care and emergency medicine.

Proper view of glottis is essential for successful intubation. It can be done either by direct or indirect laryngoscopy. An ideal laryngoscopy must provide adequate visualization of glottis to allow correct placement of endotracheal tube with minimum effort, less elapsed time and minimal potential for injury to the patient. The laryngoscopy and intubation using Macintosh laryngoscope is the standard technique for anesthesia. [11] But for anticipated difficult intubation, this technique may not be successful all the time and so various other devices have been used for such patients.

Video laryngoscopy (VL) is a relatively recent development that attempts to improve the success of tracheal intubation. High-resolution micro cameras and small portable flat screen monitors are used in an attempt to improve upon the view and success rate of direct laryngoscopy [13]. Considering the wide variety of Video laryngoscopes currently available, we have considered King vision and Review PCD in our study. Present study was conducted with the aim of comparing the laryngoscopy by conventional direct laryngoscope using Macintosh blade and Video laryngoscopy using King Vision and Truview PCD in patients with difficult airway.

Cormack-Lehane grade:

View of Laryngeal inlet as per Cormack-Lehane grade:

Predictors of difficult intubation in our study were similar in all three groups. Mallampati grade II/III were 8/12 patients in Group K, 10/10patients in Group T and 12/8 patients in Group M. Thyromental distance was 5.17± 0.6cms in Group K, 5.23±0.6 cms in Group T and 5.2 ± 0.22cms in

Group M. 90% of patients in group K and 80% of patients in group T were found Cormack-Lehane grade I/II as compared to 60% in group M.

Our findings are comparable with the study of Smita Gulati et al [14] (CL grade I/II 100% in Truview and King vision, 87% in Macintosh) Gurleen Kaur et al [15] (CL grade I/II 100% in Truview, 77.5% in Macintosh, 100% in MacGrath MAC), Ishwar Singh et al [12] (CL grade I/II in100% in Trueview, 54% in Macintosh), A. Jungbauer et al [16] (CLgrade I /II 90% in Berci-Kaplan,64% in Macintosh) and with the study of Sheetal Dalal et al [17] (CL grade I/II in100% in Truview, 28% in Macintosh). In study of M. Barak et al [18], they found 86.25 % of patients having CL grade I with Truview and 45.55% of patients with Macintosh blade. Truview laryngoscope gives a better laryngeal view as compared to direct laryngoscope because it is a modified Macintosh blade with an exaggerated distal curvature and viewing lens. It gives the indirect view of the glottis with a460 anterior refraction without need to align oral, pharyngeal and tracheal axis. [18]

Total Time Taken For Intubation:

Total time taken for intubation was significantly higher for Truview PCD video laryngoscopy among all three groups. Our findings are similar to Smita Gulati et al [14] (28.5±11.1 s King vision Vs 26.2±8.7 s with TruView.35.5±9.7s Macintosh 22.9±7.2Mccoy) Neerja Bharti et al [19] (29.6±11.4 s with Macintosh vs 33.8±8.2s with McCoyvs 36.2±7.5s with Truview).

The prolonged time of intubation in the various studies conducted with Truview has been explained by the indirect method of viewing the larynx through this optical laryngoscope. It is difficult to direct the tracheal tube through the vocal cords while viewing the image on the LCD monitor. The field of vision is narrower and smaller, requiring more time to identify the pharyngeal and laryngeal structures. There is also an angulated view of the larynx, which necessitates the use of stylet to direct the tracheal tube to the glottic opening. Moreover, the experience of the anesthetist with the Truview blade is comparatively less than the Macintosh blade. [20] King vision having anti fogging lens and not require extra port for oxygenation, so intubation time is faster.

No of attempts require for intubation:

In our study, 95% of the patients in Group K, 80% of patients in group T were intubated with 1st attempt as compared to 55% patients in group M. Our findings are comparable with Smita Gulati et al [14] (100%King vision vs 100% Truview vs 10% Mac Intosh vs 2.5% McCoy) and Sheetal Dalal et al [17] (94.2% in Truview EVO2 vs 72.2% in standard Macintosh)

Maneuvers required facilitating intubation:

None of Patients in Group K required External laryngeal manipulation to facilitate the endotracheal intubation while it was 30% in group T and 60% in group M.

In Group K, none of the patient required any type of maneuvers to facilitate the endotracheal intubation. In group T all patients required stylet to facilitate endotracheal intubation, which was a big disadvantage. All patients in Group M required maneuvers like external laryngeal manipulation, bougie and stylet to facilitate endotracheal intubation.

Hemodynamic Parameters:

There is less hemodynamic response to laryngoscopy and intubation with King Vision & Truview PCD video laryngoscope with than Macintosh laryngoscope. Our findings are similar to study of Smita Gulati et al [14], QE Ali et al [20]. This less hemodynamic response with King Vision and Truview may be due to the lesser force applied to the tissues of the supraglottic region during visualization of larynx.

The lifting force is minimal with King Vision and Truview when compared to Macintosh. It is known that the major cause of sympatho-adrenal response is the tissue tension induced by laryngoscope blade in the supraglottic region.

Complication:

Statistical difference were found in complications like soft tissue injury, teeth injuries in group M compare to group K and group T. This is similar to the study done by M. Barak et al [18] they reported significant decrease in incidence of trauma with Truview laryngoscope as compared to Macintosh blade. For optimal visualization of the glottis during direct laryngoscope, the anterior structures of the larynx are elevated.

In a difficult airway scenario this may lead to the application of undue pressure on gums, teeth and periglottic structures for maximal exposure of the vocal cords. The Truview blade is designed to enable indirect laryngoscopy view; therefore, the anaesthesiologist applies less force on the anterior larynx, resulting in fewer patients with bleeding and soft tissue damage. [18]

The limitations of our study were that we did not use both the devices in same patient and did not record the direct view of the glottis during Truview PCD & King vision video laryngoscopy. Further, we did not blind the anaesthesiologist intubating with the device for data collections it was difficult, and so the observer bias may exist.

Conclusion

From present study, we conclude that King vision and TruView PCD video laryngoscope offer a better laryngoscopy view, higher success rate, faster intubations, minimum external maneuvers, less attempts for intubation and less hemodynamic stress response during laryngoscopy and intubation in difficult airway patient as compared to direct laryngoscopy with Macintosh blade. Complications like soft tissue injury, teeth injury, sore throat and hoarseness of voice were higher in direct laryngoscope with Macintosh blade as compared to video laryngoscope.

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