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Original research article

A CLINICAL STUDY COMPARING TRACHEAL INTUBATION USING TWO DIFFERENT BLADES OF KING VISION VIDEO LARYNGOSCOPE: CHANNELED VS. NON-CHANNELED

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Abstract

Background: Video-laryngoscopes are the latest portable devices for indirect laryngoscopy, routine and difficult endoscopy with cutting-edge technology facilitating easy visualization, easy handling and high success rate of intubation in both routine and difficult endotracheal intubations. The primary study objective was to determine whether there is a difference in total intubation time (seconds) for the King's Vision Video Laryngoscope (KVVL) non-channeled compared to the channeled blade. Secondary outcomes were: first attempt and overall intubation success rates, visualization of the glottis using Cormack & Lehane grade and percentage of glottic opening score in (POGO).

Methods: This study is a prospective randomized study comprising of 66 patients undergoing surgery under general anesthesia divided into two groups of n=33 each; Group C intubated using KVVL channeled blade and Group NC intubated using KVVL non -channeled blade. The difference in the Cormack and Lehane grading of both the groups was statistical insignificant (p value >0.367).

Results: Mean total intubation time for group C was much shorter 9.69±2.41 compared to NC 13.51±3.75s. A significant statistical difference was observed in time to tube placement between two groups (p<0.0001 for both the groups). Time(s) to visualize glottis was more in C group (5.96±1.40s) compared to NC (5.06±1.74s) (p value <0.05).

Conclusion: Our study concluded that although the time for videolaryngoscopic glottis recognition is longer when using a channeled blade, but time to intubation and the total time to secure the airway is shorter.

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Keywords: Video laryngoscope, intubation, KVVL, channeled blades, non-channeled blades

Introduction

Difficulty in airway management has been associated with serious complications, especially when intubation fails. Sometimes there are situations in which the anesthesiologists face a condition where they can neither ventilate with a facemask nor intubate. When using conventional laryngoscope, anesthesiologist have only a narrow view of the airway structure, whereas video laryngoscopes provide high quality video images, that are enlarged on the video monitor for easier visualization and intubation is further easier with a channeled blade [1].

The approach to airway management has undergone a dramatic transformation since the advent of video laryngoscopy (VL). Video laryngoscopes have quickly gained popularity as an intubation device in a variety of clinical scenarios and settings, as well as in the hands of airway experts and non-experts. Their indirect view of upper airway improves glottic visualization, including suspected or encountered difficult intubation [2]. Videolaryngoscopes may therefore provide the possibility of more successful intubation for patients in whom direct laryngoscopy may be difficult. They may also be used following unsuccessful attempts to intubate with direct laryngoscopy [3].

Video laryngoscopy (VL) utilizes video camera technology to visualize airway structures and facilitate endotracheal intubation (ETI). Given the advances in video technology, more reliable, powerful, and less expensive VL are emerging on the market with increasing availability. This emergence has been ushered in by increasing use of VL in patients with difficult airways or as a rescue device in failed intubation attempts. Despite a lack of clear evidence suggesting VL improves overall ETI successively has quickly become a well-established tool in the armamentarium of the anesthesiologist as well as other healthcare providers (e.g., emergency department, intensive care unit, and prehospital settings) involved in airway management.

In contrast to DL, VL utilizes indirect laryngoscopy via its camera; thereby eliminating the need for a direct line of sight to visualize airway structures. In fact, this helps improve glottic visualization. VL requires the application of less force (5-14 N) to the base of the tongue, therefore is less likely to stimulate stress response and induce local tissue injury. Certain VL (Airtraq®, Pentax® AWS have been shown to produce less cervical movement when compared to DL. Furthermore, there is a faster learning curve relative to DL independent of status as a novice or experienced laryngoscopist [2].

The King Vision® video laryngoscope is the newest among other video laryngoscopes. It is a portable device designed for indirect laryngoscopy, difficult endotracheal intubations as well as routine intubations. The King Vision® video laryngoscopes combine the best features of traditional laryngoscopes, Fibreoptic laryngoscopes and new cutting-edge visualization technology to offer clinicians an immediate and clear view of the vocal cords. This results in a more accurate intubation while minimizing soft tissue manipulation. King Vision allow better glottis visualization and Cormack Lehane score (CL) than direct laryngoscopy, a fast learning curve, and it offers a blade that incorporates a tube channel that holds the endotracheal tube (ETT) and guides it towards the glottis [4].

Literature is filled up with various studies comparing different modalities of

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laryngoscopies, their advantages and disadvantages, along with the ease of visualisation of glottis and intubation but very few studies have been conducted with king's vision video laryngoscope comparing the two different types of blade, channeled and non-channeled. Hence, the aim of the study is to analyze the KVVL with a channeled blade compared to non-channeled blade.

Materials and Methods

The present study was conducted as a prospective and randomized study in the Department of Anesthesiology & Critical Care, at a tertiary care centre in Jodhpur, India. After obtaining institutional ethics committee approval and written informed consent, 66 patients scheduled to undergo elective surgery under general anesthesia were enrolled and randomly divided into two groups by computer generated random number.

- **Group C:** This group was intubated using channelled blade of Kings vision video laryngoscope.
- **Group NC:** This group was intubated using non-channelled blade of Kings vision video laryngoscope.

The patients were kept fasting for eight hours for solids and two hours for clear fluid prior to scheduled time of surgery. Patient data like age, gender and BMI were documented. After arrival in the operation theatre routine monitoring e.g. Heart Rate (HR), Electrocardiography (ECG), Pulse Oximetry (SpO_2) and Non-Invasive Blood Pressure (NIBP) was done. Baseline readings of vital parameters were recorded. Intravenous line was sured with 18 G cannula and inj. Ringer Lactate was started. All patients satisfying the inclusion criteria were premedicated with glycopyrrolate 0.2 mg iv and fentanyl 2 µg/kg. The patient was positioned supine with the neck in a neutral position and preoxygenation was done for 3 min using a face mask connected to a closed circuit primed with 100% oxygen at a fresh gas flow of 6 L/min. Intravenous induction of anaesthesia was performed with injection propofol 2-2.5 mg/kg and injection vecuronium 0.1 mg/kg following confirmation of complete muscle paralysis video laryngoscope (channeled blade for group C and non-channeled blade for group NC). The operator was allowed to change the patient's head and neck position in order to achieve optimum laryngeal view. All intubations were performed using either a size 3 curved blade (Group C) or a size 3 curved blade with a tube-guiding channel (Group NC), respectively. The size of the ETT was predefined by the standard operating procedure of the study center. ETT size 7.0 mm internal diameter (ID) was used for female patients and 7.5 mm ID for male patients (Mallinckrodt Medical, Athlone, Ireland). For intubation in the NC group a malleable stylet was inserted in the ETT in a hockey-stick shape (distal end of ETT angulated of 90°). When applying the channeled blade, the ETT was preloaded in the tube-guiding channel before insertion of the channeled blade into the mouth of the patient.

Our primary study objective was to determine whether there is a difference in total intubation time (seconds) for the non-channeled compared to the channeled blade. Additionally, two time points before final tracheal placement were evaluated: Time to visualize glottis and time to tube placement after introducing the device into the oral cavity. Time was measured using the built-in stopwatch of the monitoring system

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Success rate of intubation was also evaluated. Secondary outcomes were: first attempt and overall intubation success rates, visualization of the glottis using Cormack & Lehane grade and percentage of glottic opening score in (POGO). External laryngeal manipulations like the BURP manoeuvre (backwards, upwards and rightwards pressure) was allowed to improve glottis view. After each intubation, the intubating anaesthetist was asked to rate the degree of difficulty of intubation using a 5-point Likert scale (1 = very easy until 5 = very difficult); for each blade.

The sample size of 33 per group was determined by power analysis; due to the preliminary study results. The overall success rate of intubation was better with the channeled (84%), compared to the non-channeled blade 52%, with 80% power and α =0.05, the sample size (*n*) was calculated to be minimum 33 for each group.

Results

The demographic parameters such as age, sex, weight, height, BMI, ASA were comparable between the two groups ($p>0.05$). There were minimal variations in preoperative, intraoperative as well as postoperative mean heart rate, systolic, diastolic, mean arterial blood pressure and oxygen saturation in both the groups, which were statistically insignificant.

However, time(s) to visualize glottis was more in C group (5.96±1.40) compared to NC (5.06±1.74) (p value <0.05). A significant statistical difference was observed in time to tube placement between two groups ($p<0.0001$ for both the groups) with C having shorter time to tube placement compared to NC (Table 1). Mean total intubation time for group C was much shorter 9.69±2.41 compared to NC 13.51±3.75s. All (100%) the intubations performed with group C were successful and only one (3.03%) intubation performed with NC group was not successful.

Although the number of attempts were more in group NC, there was statistical insignificant difference between both groups (p value 0.017). External laryngeal manipulation was required by 1 (3.03%) patient each in both the groups C and NC which was statistically insignificant (p value >1.507). The difference in the Cormack and Lehane grading of both the groups was statistical insignificant (p value >0.367). 32 patients (96.97%) in both the groups had POGO score 100% and 1(3.03%) patient in both the groups had POGO score 50% (Table 2). This difference was not significant statistically (p = 1.507). Degree of difficulty of intubation on Likert scale was comparable between both the groups (p = 0.270).

Table 1:

Parameters	Group C	Group NC	P value
Age (yrs)	43.27±12.70	41.60±12.73	0.596
Weight (kg)	57.42±10.00	58.42±8.70	0.666
Height (cm)	157.78±7.24	159.72±7.60	0.292
BMI (kg/m2)	23.10±4.11	22.89±3.14	0.821
Time to visualize glottis	5.96±1.40	5.06±1.74	0.023

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Time to tube placement	4.57±1.96	7.72±3.28	<0.0001
Total intubation time	9.69±2.41	13.51±3.75	<0.0001

Table 2:

Parameters		Group C	Group NC	P value
Gender (Male/Female)		19/14	22/11	0.446
ASA grade (I/II)		9/24	10/23	0.785
Success rate (Suc/Usuc)		33/0	328/1	1.000
No. of attempts	One	31 (93.94)	22 (66.67)	0.017
	Two	2 (6.06)	8 (24.24)	
	Three	0	3 (9.09)	
External laryngeal manipulation required	Yes	1 (3.03)	1 (3.03)	1.507
	No	32 (96.97)	32 (96.97)	
Cormack & Lehane grade	I	32 (96.97)	32 (96.97)	0.367
	IIa	0	1 (3.03)	
	IIb	1 (3.03)	0	
POGO score	50	1 (3.03)	1 (3.03)	1.507
	100	32 (96.97)	32 (96.97)	

Discussions

Video-laryngoscopy has gained a strong foothold in routine anaesthesia practice and has become a recommended alternative technique in cases of expected difficult airway situations [5]. It facilitates easy visualization of the glottis without a direct line of sight. Ease of handling, high success rate in patients with normal and with difficult airways, high success rate in difficult airway situations and a steep learning curve makes these devices very popular among physicians [6].

The basic blade type, which may be either non-channeled or channeled, represents major practical and methodological differences between VL. This distinction is of clinical relevance, since it requires different handling and may affect the success or failure of its use [5]. Earlier versions of VL were designed in a non-channeled blade configuration. When using these blades, the VL must be held in the left hand and the tracheal tube (TT) has to be steered independently with the right hand. This approach has the advantage for the user that he can freely control the movements and the trajectory of the TT, a circumstance that might be preferable for experienced users. The main disadvantage of the non-channeled blade is the more difficult simultaneous handling of the TT and the VL while maintaining the best glottis view on the screen. In addition, during the first phase of TT insertion there is a “blind” period where the TT’s tip does not yet appear on the screen. This circumstance may lead to exploratory moves of the TT, which may cost time and cause injuries. Additionally, in order to give the TT the necessary curved shape and stability, a malleable stylet has to be inserted and

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bended according the shape of the blade's curvature. Conversely, to facilitate the approach of the TT tip towards the glottis, so-called "channeled" blades have been developed. These are equipped on their right edge with a longitudinal trough (channel), into which the TT is inserted so that its tip becomes permanently visible on the screen. Thus, the TT strictly follows the VL blade. As soon as the glottis opening is in the center of the video image, the TT is advanced forward and should enter the airway without the necessity of being separately steered. After placing the TT into its final position, the user removes the VL by detaching it from the TT. This configuration should enable successful intubation in the hand of less experienced users. The disadvantage of the channeled blade is a bulkier design and the necessity for a larger mouth

The results of our study show that time(s) to visualize glottis was more in C group (5.96±1.40) compared to NC (5.06±1.74) (p value <0.05). Our results were similar to results of a study done by Kreige *et al.* [6] who hypothesised that King Vision video laryngoscope with a channeled blade prolongs time for tracheal intubation in different training levels, compared to non-channeled blade, in which he proved that time to view glottis was significantly shorter (9 s) with non channeled (p<0.001). Schlaepfer *et al.* [7] in a study to compare tracheal intubation with channeled and non-channeled videolaryngoscope blades, also reported that time to glottis visualization was much lower in the NC group (5 s) compared to channeled (11 s) Kumar Gautam *et al.* [8] in a study to compare King vision video laryngoscope with CMAC D-blade in obese patients with anticipated difficult airway reported that time(s) taken to visualize the glottis was more with KVVL channeled blade (12.93±8.58s) compared to CMAC D-blade (10±5.32 s with) (P = 0.12). The results may be explained by bulkier design of channeled blade compared to non-channeled. The King Vision accommodates minimum mouth openings of 13 mm for the standard blade and 18mm for the channeled blade making it easier for the non channeled blade to insert and visualise the glottic aperture. In our study time to tube placement was defined as time from inserting the ETT until the tip of the tube disappeared between the vocal cords. Mean time to tube placement in group C was 4.57±1.96 s and group NC was 7.72±3.28s. A significant statistical difference was observed in time to tube placement between two groups (p<0.0001 for both the groups) with C having shorter time to tube placement compared to NC. Our results were similar to the study conducted by Schlaepfer *et al.* [7] who reported that the time to successful intubation was significantly longer when using the non-channeled compared to the channeled blades; 40 (12-27) s in NC compared to 20 (25-51) s (p<0.001). Similar results were found by Kriege *et al.* [6] who reported that there were no differences between time to place with control 26 s [13-49], compared with channeled 44 s [21-54] (p = 0.21). The overall time needed for first ventilation was shorter with the control 40 s [24-58], compared to the channeled 59 s [40-74] (p =0.03). In non-channeled blade simultaneous handling of the TT and the VL while maintaining the best glottis view on the screen is difficult. In addition, during the first phase of TT insertion there is a "blind" period where the TT's tip does not yet appear on the screen. Channeled blades are equipped on their right edge with a longitudinal trough (channel), into which the TT is inserted so that its tip becomes permanently visible on the screen. Thus, the TT strictly follows the VL blade. This may explain our results

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In our study total intubation time is the time when the blade tip passed the incisors to the point until confirmation of the first wave of CO_2 of the capnometer. Mean total intubation time for group C was much shorter 9.69±2.41 compared to NC 13.51±3.75s. (p<0.0001). Our results were different from the study done by Kriege *et al.* [6], in which the overall time needed for first ventilation was shorter with the NC 40 s [24-58], compared to the channeled 59s [40-74] (p =0.03). Avula *et al.* [9] in a study evaluating the efficacy of King vision video laryngoscope in patients requiring general anaesthesia with endotracheal intubation reported that the mean intubation time was significantly less in the Macintosh group (29.97 s) compared to the King Vision group (42.77s), with p< 0.001. Reena [5] reported that time for successful intubation was less in group KV (channeled) as compared to direct laryngoscopy. Kumar Gautam *et al.* [8] reported that time taken to intubate was 50.04 ± 24.17 s for KVL vs. 46.93 ± 26.59 s for CMAC D-blade (P = 0.64). All (100%) the intubations performed with group C were successful and only one (3.03%) intubation performed with NC group was not successful. There was statistical insignificant difference between both groups (p value 1.000). The results obtained in our study were similar to the study done by Kriege *et al.* [6] and Schlaepfer *et al.* [7], in which all intubation attempts were successful and the difference among success rates was not significant statistically. Although the number of attempts of intubation were more in group NC, there was statistical insignificant difference between both groups (p value 0.017). Kriege *et al.* [6], reported that correct endotracheal placement of the NC blade was successful at the first attempt in 23/23 (100%) patients, compared to 22/23 patients with the channeled blade (96%; p = 0.31), which is in consonance with our study results. Our results are also similar to study done by Schlaepfer *et al.* [7], in which tracheal intubations showed no statistical differences concerning the number of attempts. Reena [5], showed that first attempt success rate at intubation was significantly greater using channeled blade, 92% v/s 74%. External laryngeal manipulation was required by very few patients in both the groups C and NC. Reena [5] also reported that very few patients (6%) of group channeled KVVL needed BURP for optimum alignment.

The Cormark and Lehane view and POGO score obtained were better with C group than NC, however no significant difference was found between them (p value 0.367 and 1.507). Similar results were also obtained by Kriege *et al.* [6] in his study.

Conclusion

Our current study suggests that although the time to videolaryngoscopic glottis recognition is longer when using a channeled blade, but time to intubation and the total time to secure the airway is shorter. With the rest of the parameters like number of intubation attempts, external laryngeal manipulation requirement, Cormack & Lehane grade, POGO score, degree of difficulty of intubation on Likert scale comparable between both the groups, the intended benefits of channeled blades could be confirmed.

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