Original Article

Comparison of King Vision video laryngoscope (channeled blade) with Macintosh laryngoscope for tracheal intubation using armored endotracheal tubes

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Abstract

Background and Aims: During direct laryngoscopy (DL), intubation using armored endotracheal tubes (ETTs) requires help of bougies, stylets, or Magill's forceps, which leads to unnecessary prolongation in the intubation times. The channeled blade of King Vision (KV) video laryngoscope is likely to obviate the need of these equipments for a successful intubation using armored tubes.
Material and Methods: After approval from Institutional Ethics Committee and informed consent, 100 patients were randomized to receive endotracheal intubation using armored ETTs either with KV video laryngoscope (VL) channeled blade or with Macintosh laryngoscope. Time to intubation, success rate, time for best glottis view, number of attempts, optimization maneuvers, or complications if any were recorded. Ease of device use was also assessed in terms of insertion, glottis visualization, and intubation. Continuous variables were tested using unpaired *t*-test and categorical variables with Pearson's Chi-square test. $P \leq 0.05$ was considered significant.
Result: First attempt success rate was 92% in group KV and 74% in group DL ($P = 0.017$). Time for successful intubation was less in group KV as compared with group DL ($P < 0.0001$). Optimization maneuvers such as "BURP" was needed in three patients of group KV and 11 patients of group DL ($P = 0.0218$). Bougie was needed in 13 patients of group DL and none from group KV ($P = <0.001$). Ease of device use was similar in the two groups.
Conclusion: KVVL offers faster intubating conditions for tracheal intubation requiring armored ETTs in comparison to DL using Macintosh blade.

Keywords: Armored tubes, direct laryngoscopy, King Vision videolaryngoscope, optimization maneuvers

Introduction

Armored endotracheal tubes (ETTs) are wire-reinforced silicon rubber tubes which are quite flexible in contrast to their PVC counterparts. They are specifically preferred in head, neck surgeries, and in prone patients requiring general anesthesia. But unlike PVC tubes they are less well preformed due to which they are more likely to require a stylet or bougie for successful intubation. Over the last two decades, a number of video laryngoscopes (VLs) have emerged that offer several advantages over direct laryngoscopy (DL), including ease of device use, higher success rate in normal, as well as difficult airway situations and better learning curves in VLs.[1,2] King Vision VL (KVVL) is a comparatively newer VL and we hypothesize that its channeled blade can help achieve faster intubation with armored tubes in comparison to DL, with no or little help of optimization maneuvers.

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The primary aim of this study was to compare the efficacy of DL using the Macintosh blade with the KVVL channeled blade with regard to the duration of intubation in the two groups while using reinforced or armored ETTs.

Material and Methods

After approval from Institutional Ethics Committee and written informed consent, 100 adult American Society of Anesthesiologists (ASA) physical status I and II patients, aged 18–50 years of either sex, undergoing elective surgeries requiring orotracheal intubation as part of anesthesia were enrolled. Patients with ASA grade ≥III, increased risk of pulmonary aspiration, history of difficult intubation, or anticipated airway difficulties, patients with BMI >30 kg/m^2, and patients unwilling to give consent were excluded. They were randomly assigned to two groups based on the device used for laryngoscopy. The group allocation was done according to the numerical order of a computer-generated randomization list. Allocation concealment was ensured with sealed opaque envelopes. Group DL underwent DL using Macintosh blade while in group KV, KVVL channeled blade was used for intubation. A thorough clinical examination was done along with routine laboratory investigations for each patient during preanesthetic check-up.

On arrival to the operating room, patients were connected to the standard monitors, including ECG, noninvasive blood pressure, and pulse oximeter. They were all subjected to the same anesthetic protocol. An 18-gauge intravenous (IV) cannula was placed and preloading was done with 10 ml/kg Ringer's lactate. Fentanyl 2 μg/kg was given intravenously for analgesia. Induction of anesthesia was done with IV propofol 1.5–2 mg/kg. After checking adequate mask ventilation, vecuronium 0.1 mg/kg IV was given for muscle relaxation. Orotracheal intubation was performed after 3 min of mask ventilation using the selected intubation device for each group a cuffed armored ETTs (size 7 and 8, for women and men respectively). In group DL, intubation with reinforced tube was tried without bougie or stylet. If first attempt was unsuccessful bougie was introduced over which ETT was passed. In group KV, ETT was positioned in the channeled blade, and bougie was not used. All intubations were performed by an anesthesiologist with at least 5 years of experience and 50 intubations using KVVL. The glottic view was compared with C-L grading (Cormack-Lehane)[3] and POGO scoring (0–100%, 100 = full view of glottis from anterior commissure to the inter-arytenoid notch, 0 = even inter-arytenoid notch is not seen).[4] The primary outcome was to determine whether there is a difference in intubation time (seconds) for the control group compared to the KV channeled blade. The time to successful intubation was defined as time interval between passing the scope's blade through interdental line to confirmation of correct tube placement by capnography. Secondary outcomes included the time to best glottis view, the number of intubation attempts, the need for optimization maneuvers ("BURP" maneuver or change of blade), need for bougie to facilitate intubation, and complications (dental injury, mucosal trauma or esophageal intubation) if any. Ease of insertion of the device in the mouth, of epiglottis visualization, and of intubation was also documented (1 = very easy, 2 = easy, 3 = moderate, 4 = difficult, and 5 = very difficult).[5] A maximum of three attempts at intubation were permitted after which it was declared as failed attempt; these cases were then managed according to "Difficult Airway Society" guidelines.[6] Patients were monitored continuously for hemodynamic parameters: Heart rate (HR), electrocardiogram (ECG), noninvasive blood pressure (NIBP), and SpO_2 were recorded before induction, before laryngoscopy, immediately after endotracheal intubation, then at every 5 min interval till 20 min after endotracheal intubation.

Based on previous similar studies, we performed a sample size estimation before recruitment, using $\alpha = 0.05$ and $\beta = 0.1$ and found that a minimum of 48 participants were required in each group in order to detect at least a 10 s difference in median standard deviation in intubation times.[7,8] SPSS version 16.0 was used for data analysis. Continuous variables were tested using unpaired *t*-test. Categorical variables were tested using Pearson's Chi-square test. Continuous data are presented as mean (SD) and categorical data are presented as numbers. A value of $P < 0.05$ was taken as statistically significant.

Result

The groups were similar with respect to demographic data and ASA physical status [Table 1]. The C-L grading and POGO scoring [Table 2] were similar in the KV and DL group ($P > 0.05$) [Table 2]. All patients were successfully intubated. First attempt success rate was higher in group KV than in group DL. Second attempt success rate was 100% in both groups. Time to best glottis view was not different in

Table 1: Demographic data and preoperative Mallampatti classification

Parameters	Group DL (*n*=50)	Group KV (*n*=50)
Male:Female	24:26	29:21
ASA I/II	39/11	41/09
AGE (years) mean±SD	31.5±7.2	28.9±8.1
MP classification I/II/III/IV	24/20/06/0	18/27/05/0

the two groups, but time for successful intubation was less in group KV as compared with group DL. Optimization maneuvers like "BURP" was needed in fewer patients of group KV than group DL. Change of blade and bougie were required in more patients of group DL. Bougie was needed in 13 patients of group DL than group KV. Hemodynamic parameters of both groups were comparable throughout the peri-intubation period [Figures 1 and 2].

There was one case of mucosal injury in group KV and one in group DL. Ease of insertion of device in the mouth, epiglottic visualization and ease of intubation was was similar in the two groups [Table 3].

Discussion

This prospective randomized controlled study was done to evaluate utility of KVVL in facilitating intubations requiring armored ETTs. These ETTs lack a well preformed shape and usually need the help of bougies, stylets, or Magill's forceps to guide them into glottis, thereby unnecessarily prolonging the laryngoscopy and intubation times. The channeled blade of KVVL obviates the need of these items for a successful orotracheal intubation.

Previous studies have demonstrated that KVVL improves the laryngeal view and first attempts at successful intubation when compared with the Macintosh laryngoscope in manikins with normal and anticipated difficult airways.[9,10] We found that the CL grade and POGO score were similar in the two groups but less number of optimization maneuvers was required while using KVVL as compared with DL group. In the present study, the time to intubation with the KVVL was less and comparable with Macintosh laryngoscopes.

Ease of device use was similar in our study. Some investigators have found that better glottis visualizations with VL do not necessarily translates into higher first pass intubation rates.[11-13] It may be because of the inappropriate method of insertion of VL or too distal insertion of blade tip leading to discordant alignment between glottis and path of ETT.[14] In our study we followed the recommended procedure of device use and found no difficulty in ETT insertion. The only problem with KVVL is fogging of distal lens affecting the image clarity.

Ali *et al.* noticed that increase in HR and mean arterial pressure (MAP) was less with KVVL as compared with the Macintosh laryngoscope.[15] Elhadi *et al.* also found a significant rise in HR and MAP in the Macintosh group compared with the KVVL group.[16] We did not see any significant difference in hemodynamic parameters between the two groups.

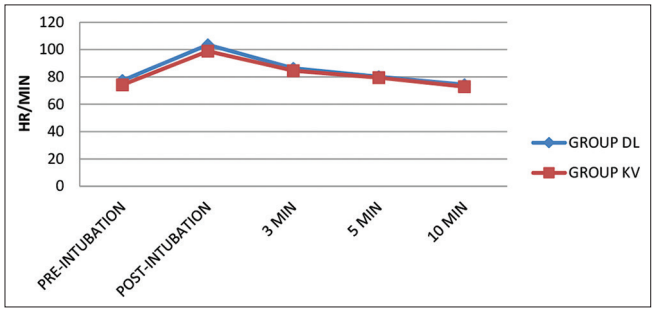

Figure 1: Peri-intubation HR changes

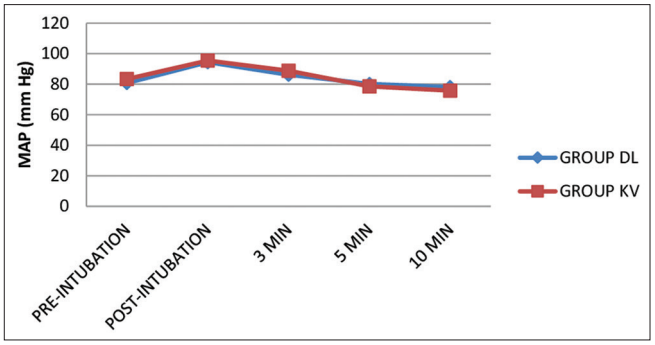

Figure 2: Peri-intubation MAP changes

Table 2: Laryngoscopic and intubation assessment parameters

Parameters assessed	Group DL	Group KV	*P*
Cormack-Lehane (C-L) Score I/II/III/IV	28/13/09/0	31/17/02/0	0.0765
POGO score 100/50-100/0-50	19/27/04	26/22/02	0.322
Time for best glottis view (s)	13.1±4.9	11.5±5.2	0.119
Time for successful intubation (s)	40.3±14.4	28.7±10.6	<0.0001
No. of attempts 1/2/3	37/13/0	46/04/0	0.0165
Success rates % 1st/2nd/3rd attempts	74/100/NA	92/100/NA	0.0170
Mucosal injury	01	01	1.000
Optimization maneuvers			
External laryngeal pressure	11	03	0.0218
Change of blades	05	0	0.0225
Use of Bougie	13	0	0.0001

Table 3: Ease of device use

Parameters	Group DL	Group KV	*P*
Ease of device insertion 1/2/3/4/5	40/04/03/03/0	35/10/02/03/0	0.375
Ease of epiglottic visualization 1/2/3/4/5	38/08/02/02/0	43/04/03/0/0	0.406
Ease of intubation 1/2/3/4/5	37/09/02/02/0	41/07/02/0/0	0.812

First attempt success rate at intubation was significantly greater in this study, 92 vs 74%, which is in agreement with the study by Ali *et al*.; however, Elhadi *et al*. did not find any significant difference.[15,16]

Most of the patients of DL group required one or another optimization maneuver to insert reinforced ETT, while very few patients of group KV needed only BURP for optimum alignment; similar results obtained in other studies too. Bougie was not required in any of KV group patients, and because of this the intubation time was shorter in these patients compared to group DL. Duration of laryngoscopy and intubation is important, especially in ASA grade III and IV patients, cardiac disease, and hypertensive patients where they can cause an exaggerated hemodynamic response, which can worsen their clinical condition. However, it should always be remembered that the "Gold standard" for intubation will always be direct laryngoscopy. It is a necessary life-saving skill which as an anesthetist we must acquire and master, while we keep experimenting with various types of other intubating modalities.

Our study has some limitations. Firstly potential for observer bias exists, as it is impossible to make the observer blind to the device being used. Secondly, we could have employed at least one more video laryngoscope device (e.g., VividTrac®, Airtraq®, Glidescope, Bullard laryngoscope) for a more effective comparison. However, till date we did not find any other study comparing effectiveness of KVVL in intubations using armored ETTs with Macintosh laryngoscope. Further studies are needed comparing the relative efficacies of various other VLs with KVVL in intubations requiring armored ETTs.

Conclusion

KVVL offers faster intubating conditions in intubations requiring armored ETTs in comparison to direct laryngoscopy using Macintosh blade.

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Conflicts of interest
There are no conflicts of interest.

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