A Comparative Study of Intubation Performance between Channelled vs. Non-Channelled Blade of King Vision Video Laryngoscope in Orotracheal Intubation

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ABSTRACT

BACKGROUND

Video laryngoscope is an important tool for orotracheal intubation in anaesthesia practice particularly in difficult airways. It provides an indirect view of glottis without the need of alignment of oropharyngeal-laryngeal axis. We compared the intubation characteristics of channelled versus non-channelled blades of King Vision™ Video Laryngoscope.

METHODS

In this study 60 patients were randomly allocated to two groups; group C were intubated with channelled and group NC with non-channelled blade of King Vision. We measured time for glottis visualisation and intubation time using both blades. Percentage of glottis opening (POGO), insertion attempts, intubation attempts, and ease of intubation were also assessed.

RESULTS

The time for glottis visualisation was 8.5 ± 3 seconds for group C and 7 ± 2 seconds for group NC. Intubation time was 24 ± 8.5 seconds for group C and 44 ± 5 seconds for NC. There was no statistical difference in POGO, insertion attempts, intubation attempts and ease of intubation between the two groups.

CONCLUSIONS

We concluded that the time for glottis recognition is longer but intubation time is shorter when using King Vision video laryngoscope channelled blade as compared to non-channelled blade.

KEYWORDS

Video Laryngoscope, King Vision, Channelled, Non-Channelled

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BACKGROUND

Direct laryngoscopy (DL) with Macintosh Laryngoscope is most commonly used for orotracheal intubation in anaesthesia practice. In spite of being the gold standard, it has its own limitations. DL is a difficult skill to master[1] and requires alignment of the oropharyngeal-laryngeal axis for optimal glottis visualisation. Delayed intubation and misplaced endotracheal tube can cause disastrous complications like hypoxia, regurgitation and aspiration.[2] Video laryngoscopes (VL) are gaining popularity as an alternative technique of orotracheal intubation in anaesthesia practice and may reduce the number of failed intubations, particularly in patients with difficult airway.[3]

VL provides indirect glottis view without the need of alignment of oropharyngeal-laryngeal axis. Various VL with different designs have been developed such as Macintosh type (C MAC, McGrath), angulated blade type (Glide scope, C-Mac D blade), and tube / guide channel type (Airtraq, King Vision).[4] King Vision ™ Video laryngoscope (KVVL) is a recent portable VL that has a reusable 2.4 inch video display screen and a disposable blade which has an inbuilt camera and light at blade tip. Two types of blades, channeled (C) and non-channeled (NC) are available. Both blades have the same angle and design and have their own advantages and disadvantages. The advantage of NC blade is that it requires less mouth opening (13 mm) and thus helpful in intubating patients with limited mouth opening. It is compact in design so there is more space for maneuvering the endotracheal tube, but it is sometimes challenging to bring the tip of tube to glottis in spite of best glottic view. Thus, it requires more tube manipulation to guide the tip of the tube in glottis which can prolong the intubation time. Additionally, it requires a malleable stylet which is bent according to shape of blade to facilitate intubation which can cause soft tissue injury during intubation. On the other hand, channeled blade has an inbuilt tube guiding channel to facilitate easy tube passage but it is bulky and requires more mouth opening (18 mm) for insertion.

In this study we aimed to compare the time required for glottis visualization, intubation time and ease of intubation using channeled and non-channeled blades of King Vision Video Laryngoscope.

METHODS

This prospective randomised comparative clinical study was conducted at a tertiary care teaching hospital in the Department of Anaesthesia during the period from July 2018 to December 2018. Patients of either sex, between 18 to 60 years of age, belonging to American Society of Anaesthesiologists (ASA) physical status I or II scheduled to undergo elective surgery under general anaesthesia were included. Patients with anticipated difficult airway, risk of aspiration, and ASA III or more were excluded from study. A total of 90 patients were enrolled for the study, of which 30 patients did not meet the inclusion criteria (Figure 1). Sample size was calculated using a previously published study[5] as reference and keeping α value of 0.05 and β value of 0.1, sample size of 40 was calculated i.e. 20 in each group. To compensate for patients dropping out during the study, we included 30 patients in each group. After approval from ethical and scientific committee of hospital, detailed history, clinical examination, informed and written consent from 60 patients was taken. The patients included in the study were randomly divided by computer generated random allocation table and opaque sealed envelope technique into two equal groups named group C who were to be intubated with channelled blade and group NC to be intubated with non-channelled blade of King Vision™ Video Laryngoscope. Both blades have similar angulation and shape, only difference being presence of tube guiding channel in channelled blade. Blade size 3 was used for all patients. All males were intubated with endo tracheal tube (ETT) size 7.5 mm internal diameter (ID) and females with 7.0 mm ID. When using channelled blade ETT was preloaded in the guiding channel. When using non-channelled blade, a malleable stylet was introduced in ETT and bent as per curvature of blade. To avoid bias, all intubations were performed by a single anaesthetist who was well experienced in video laryngoscopy intubation technique.

Standard anaesthesia protocol was followed for all patients. After securing intravenous line and connecting standard monitors, all patients were preoxygenated for 3 min with 100 % oxygen. Patients were induced with Inj. fentanyl 2 $\mu g.kg^{-1}$, Inj. propofol 2 $mg.kg^{-1}$ and Inj. vecuronium 0.1 $mg.kg^{-1}$ was used for neuromuscular blockade. After 3 minutes, intubation was done by KVVL channelled or non-channelled blade as per the allocated group. Intubation technique as recommended by the company was followed. External laryngeal manipulation was allowed to obtain the best view of glottis. If oxygen saturation dropped to 90 %, the intubation attempt was paused and patients were mask ventilated with 100 % oxygen in between the attempts. Failed intubation was considered if total intubation time elapsed was more than 120 sec or maximum 3 intubation attempts could not secure the ETT, then investigator was allowed to secure ETT with different device.

Following parameters were recorded during laryngoscopy and intubation:

- Glottis view: Time from insertion of VL until best glottis view was attained.
- Insertion attempts: Number of VL insertion attempts until best glottis view was achieved.
- POGO: Percentage of glottis opening score was assessed and recorded. A POGO score of 100 % denotes visualization of entire glottis from anterior commissure of the vocal cords to interarytenoid notch. If none of the glottic opening was seen (even the interarytenoid notch) then POGO score would be considered 0 %.[6]
- Intubation time: Time from insertion of VL till the tracheal tube passes into the larynx with black line at level of vocal cords. Tube placement was confirmed by direct visualisation of tube passage beyond vocal cords.
- Intubation attempts: Number of tracheal intubations attempts until tube was successfully placed.
- Ease of intubation – by 5-point Likert scale [7] (0 = very easy, 5 very difficult).

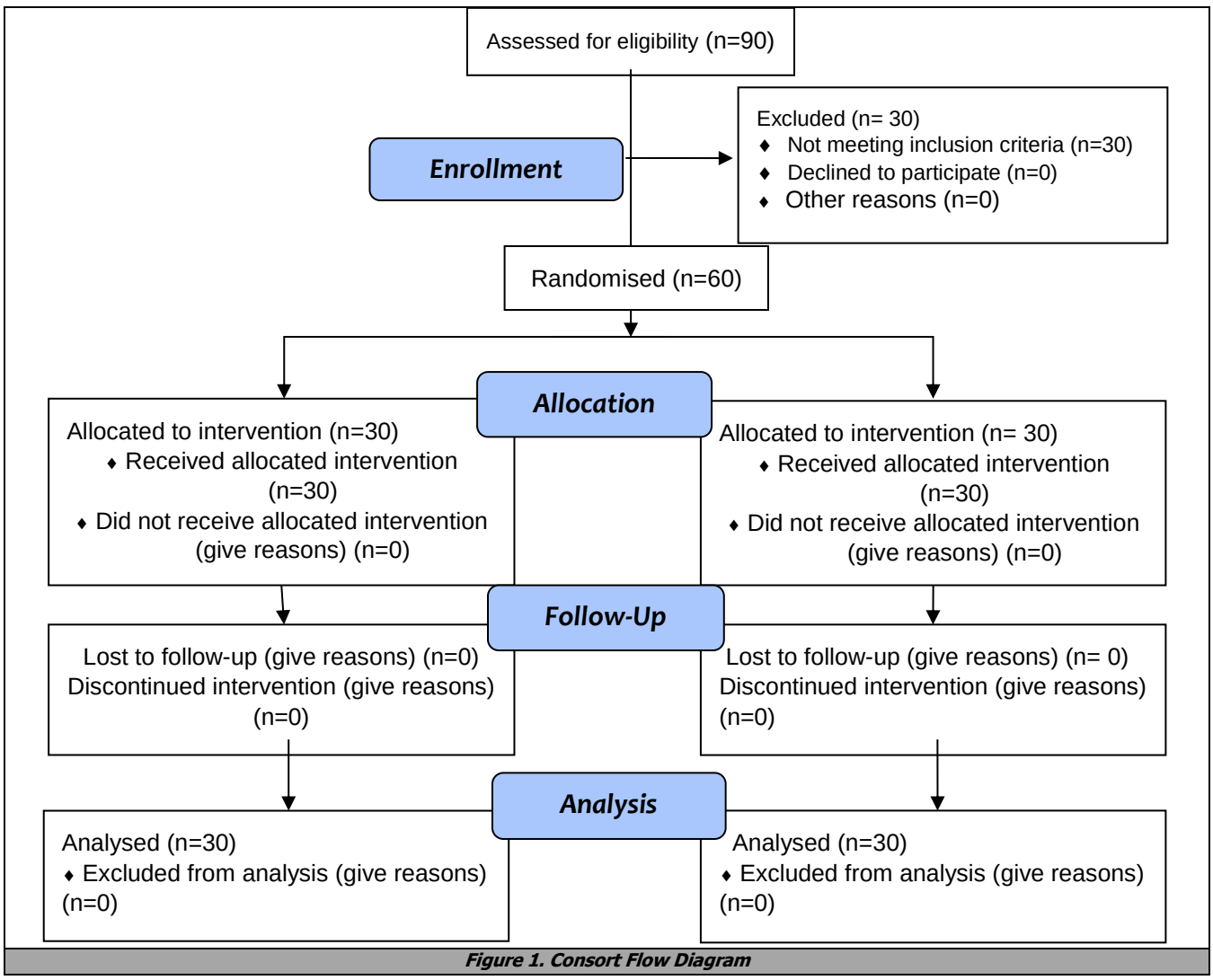

Figure 1. Consort Flow Diagram

After successful intubation, the tracheal tube cuff was inflated and connected to ventilator. Capnography tracing was used for final confirmation of correct placement of the endotracheal tube. Anaesthesia was maintained with 2 % sevoflurane, 66 % nitrous oxide in oxygen and neuromuscular blocker as appropriate. After the tube was secured, rest of anaesthesia management was done as per standard anaesthesia protocol by the anaesthetist managing the case.

Statistical Analysis

Statistical analysis of the data was performed using International Business Machines Statistical Package for the Social Sciences (IBM SPSS Version 26.0, IBM Corporation, New York, USA) software. The results were presented in number, percentage, mean and standard deviation (SD) as appropriate. For gender, American Society of Anaesthesiologists Physical status (ASA), Mallampati (MP) class, intubation and insertion attempts chi-square test was used. Data for age, body mass index (BMI), Likert scale, glottis view time and intubation time were analysed using the unpaired t-test. The P value < 0.05 was taken as significant.

RESULTS

Demographic Data

Both groups were similar demographically and there was no significant difference with respect to age, sex, BMI, ASA and MP grade. (Table 1).

Glottis Visualisation

The time for glottis visualisation was 8.5 ± 3 seconds in Group C, whereas it was 7 ± 2 seconds in Group NC. The difference was statistically significant ($P < 0.05$). Thus, the time to larynx recognition was significantly shorter when using the non-channelled blade as compared to channelled. The number of first time successful VL insertion attempts was higher in NC group suggesting it is easier to insert an NC blade but it was not statistically significant. POGO was 100 % in both the groups. [Table 2]

Intubation Performance

The intubation time was 24 ± 8.5 seconds in group C, whereas it was 44 ± 5 seconds in group NC. The difference was statistically significant (P 0.001). The time to successful intubation was significantly less when using the channelled

blade as compared to the non-channelled blade. The channelled blade thus provides rapid tracheal intubation when compared to the non-channelled blade. There were more first attempt successful intubations in group C as compared to NC, but the value was not statistically significant. Ease of intubation as per Likert scale was similar in both groups. [Table 2]

		Channelled (C) N = 30	Non-Channelled (NC) N = 30	P-Value
Age (Years) Mean ± SD		33.5 ± 11.75	38 ± 9.5	0.11
Gender	Male (%) Female (%)	13 (43.3) 17 (56.7)	15 (50) 15 (50)	0.61
ASA	I (%) II (%)	14 (46.7) 16 (53.3)	19 (63.3) 11 (36.7)	0.19
MP	I (%) II (%)	13 (43.3) 17 (56.7)	16 (53.3) 14 (46.7)	0.44
BMI (kg / m^2)	Mean ± SD	24.2±8.4	25.5 ± 8.7	0.56

Table 1. Demographic Data

P value < 0.05: Significant

	Channelled (C) N = 30	Non-Channelled (NC) N = 30	P-Value
Glottis view (s)	8.5 ± 3	7 ± 2	0.03
POGO %	100	100	1.0
Insertion attempts 1 / 2 / 3	26 / 4 / 0	29 / 1 / 0	0.16
Intubation time (s)	24 ± 8.5	44 ± 5	0.001
Likert scale (1 - 5)	2 ± 0.25	2 ± 1	1.0
Intubation attempts 1 / 2 / 3	29 / 1 / 0	25 / 5 / 0	0.09

Table 2. Laryngoscopy and Intubation Performance

P value < 0.05: Significant

DISCUSSION

Video laryngoscope is a very crucial tool for successful intubation particularly in difficult airway.[3] This study aimed to compare the channelled and non-channelled blade of same VL i.e. King Vision™ video laryngoscope with respect to glottis visualisation time, intubation time and ease of intubation in patients undergoing general anaesthesia. We observed that glottis visualisation time was longer and intubation time was significantly shorter with the channelled blade (P < 0.05). However, insertion, intubation attempts and subjective ease of intubation were comparable between both the groups. The reason behind longer time for glottic view can be contributed to complex design of channelled blade with a guiding channel in situ which makes the blade bulky while non-channelled blade is compact and easier to insert. The same guiding channel is considered advantageous for intubation as it eliminates the need of a stylet which provides rigidity and required shape to ETT but may cause trauma to soft tissues. The guiding channel also obviates the repeated time-consuming manoeuvring of ETT towards glottis, keeping the ETT always in user's view and providing a trajectory thus leading to shorter intubation time. Ease of intubation was almost similar in both blades owing to similar design and angulation.

Various studies compared King Vision with other video laryngoscopes or with traditional Macintosh.[8-11] The intubation time and success rate vary in different studies. In several studies, the participants were novices like paramedics, nurses or junior doctors with no or very less practical video laryngoscopy experience. The study settings in these publications were also different in using manikins as subjects, with difficult airway and done in prehospital settings.[12,13] Akihisa et al. compared intubation performance between King-vision non-channelled blade laryngoscope (KVNC), KVC and Macintosh (MAC) and found that KVNC required significantly longer intubation time (median 60 sec) as compared with MAC (16.9 sec) or KVC (20.5 sec) and the success rate was also significantly inferior (47 % in KVNC as compared to MAC (91%) or KVC (87%).[10] However, this was a simulation study done on manikin by novice personnel and cannot be considered in general population. We speculated that a skilled provider with previous video laryngoscopy experience and controlled anaesthesia environment improves the ease and success of VL intubation.

Very few studies compared channelled and non-channelled blades of the same device with similar shape, curvature and angle.[5,14,15] Shah et al. conducted a similar study and concluded that the channelled blade of King Vision video laryngoscope requires significantly shorter intubation time as compared to non-channelled blade.[5] Their result is in line with our study result, though intubation time was shorter (mean 15 sec) than ours (mean 24 sec). They stated that laryngeal exposure time was longer in channelled blade, although it was not statistically significant. They also observed that anticlockwise rotation of endotracheal tube within the channel slot overcomes impingement at larynx and facilitates intubation with channelled blade while slight withdrawal and redirection towards the centre helps in successful intubation using the non-channelled blade. But this study was a multicentric study involving four experienced anaesthetists which could have led to better intubation time as compared to our study. Biro et al. observed that King Vision video laryngoscope glottis recognition time was longer and the total time to secure the airway was shorter with the channelled blades as compared to non-channeled.[14] They utilised single best expert user approach like us and our results correspond to their study stating the fact that the multiple users of different experience levels might confound the results. However, Kreige et al. conducted similar study and found contrasting results of shorter intubation time with non-channelled blade (median 40 sec; IQR [24–58]), compared to the channelled (59 sec [40–74]; p = 0.03) but there was no difference in glottis visualization between both blades.[15] It is to be noted that they considered intubation time when blade tip passed the incisors to the point until confirmation of first wave of CO2 on capnometer, also they compared both blades for oro tracheal intubation in different training levels which included residents and specialists with different experience while in our study single experienced user performed all intubations to avoid bias. This might have led to a difference in results between both studies. In the frame of reference of above studies, our study also aids to the comparison of both blades of KVVL with regard to duration and ease of intubation.

The power of our study being a single centric, single experienced user which negates the confounding factors of multiple users with varying skills and experiences. However, it also adds to the limitation because being a single

experienced user study, the results cannot be extrapolated for novice and users at different training levels. VL is a very crucial tool in difficult airways but we excluded predicted difficult airways in our study so as to maintain similar conditions for laryngoscopy and intubation, so the results of present study cannot be generalised in difficult airway scenario. Small sample size is another limitation of this study. Hence, results of this study should be confirmed with studies with larger sample size which includes difficult airway to appraise the efficiency of different VL blades.

CONCLUSIONS

The time to glottis visualization is longer but intubation time is shorter when using King Vision video laryngoscope channelled blade as compared to non-channelled blade.

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