Original Article

A comparison of King vision video laryngoscope with CMAC D-blade in obese patients with anticipated difficult airway in tertiary hospital in India – Randomized control study

Raj Sahajanandan, Anity Singh Dhanyee, Arun Kumar Gautam

Department of Anaesthesia, Christian Medical College and Hospital, Vellore, Tamil Nadu, India

Abstract

Background and Aims: This randomized control trial was conducted to compare two video laryngoscopes in obese patients with anticipated difficult airway. Video laryngoscopes have shown to be beneficial in many difficult airway scenarios including obesity. Many studies have shown that even though the glottic view is better, it takes longer to negotiate the endotracheal tube. We proposed to compare CMAC D-blade with King vision-channeled blade for intubating obese patients with anticipated airway difficulty. We hypothesized that channeled scope may be superior as once visualized, tube could be easily negotiated. This would be reflected by time taken for the glottis visualization, time taken for intubation, incidence of complications, and hemodynamic stability.

Material and Methods: Sixty-three patients who fulfilled inclusion criteria were enrolled after informed consent. Based on the computer-generated randomization, they were assigned to group 1 (King vision laryngoscope – KVL) and group 2 (CMAC D-blade). All anesthetists who intubated, performed 20 intubations with both video laryngoscopes on manikin before performing the study case. The parameters analyzed were time to visualize the glottis, time to successful intubation, and intubation-related hemodynamic variations and complications.

Results: The mean time taken to visualize the glottis with KVL was 12.93 s compared to 10 s with CMAC D-blade (*P* value 0.12). Time taken to intubate was 50.04 s with KVL compared to CMAC D-blade which took 46.93 s (*P* value 0.64). KVL had a complication rate of 20.7% compared to 3.1% with CMAC D-blade (*P* value 0.04).

Conclusion: There was no statistically significant difference in time to visualize the glottis and intubation between KVL and CMAC D-blade. But there was a high incidence of complications with KVL.

Keywords: CMAC D-blade, difficult airway, King vision laryngoscope

Introduction

Airway management is one of the main implications in anesthetizing a morbidly obese patient. Studies have reported the incidence of difficult intubation in obese with body mass index (BMI) >30 or higher compared to general population.[1,2] The associated difficult mask ventilation, scope maneuverability due to excess soft tissue and hypoxemia were associated with decreased functional residual capacity contribute toward the morbidity and mortality in this population. Multiple trials are underway to assess the superiority of video laryngoscopes over direct laryngoscopy. Few studies have shown that video laryngoscopes are better, few have not.[3–5] Most of them have used non-channeled scope. It was noted that time to visualize is fast while time to intubate is more. We hypothesized that channeled scope may be superior as once visualized tube could be easily negotiated. We compared

Address for correspondence: Dr. Anity Singh Dhanyee, Department of Anaesthesia, Christian Medical College and Hospital, Vellore - 632 004, Tamil Nadu, India.
E-mail: dranity@gmail.com

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King vision laryngoscope (KVL) (channeled – angulated) vs CMAC D-blade (non-channelled – hyperangulated) in obese population with anticipated difficult airway. CMAC (Karl Storz, Tuttlingen, Germany) D-blade[6] is elliptical in shape with a tapered rising distal end, whereas King vision (King Systems, Noblesville, IN, USA)[7] with its channeled slot for preloading endotracheal tube (ET) is designed to minimize manipulation and expedite intubation.

Material and Methods

This study was conducted after getting approval from the institutional ethical committee, over a period of 9 months and patients were recruited after informed consent. Inclusion criteria was the American Society of Anesthesiologists (ASA) [8] 1–2 status, neck circumference/thyromental distance (NC/TMD) >5,[9] age between 18–70 years, and BMI >30. Sixty three patients were enrolled and assigned to group 1 (KVL) and group 2 (CMAC D) based on the computer-generated randomization using opaque envelopes. Anesthesia plan was standardized. All patients were induced after ramping and preoxygenation to end-tidal oxygen of >92%. Induction with fentanyl 2 mcg/kg, propofol 2–3 mg/kg, and rocuronium 1 mg/kg. All anesthetists who performed intubation on study cases, performed 20 intubations with both video laryngoscopes on manikin.

Intubation was done in the sniffing position after ramping and a common problem encountered with usage of CMAC was the inability to introduce ET tube into the glottis in spite of optimum visualization. We used a normal stylet preformed to match the shape of D-blade, which helped in guiding the ET tube into the glottis. For this study, all the patients who were allotted CMAC group were intubated using a similar stylet (Karl Storz stylet for D-blade was not in the market at the time of the study).

After visualization of the glottis if difficulty was encountered due to tube hitching on the anterior tracheal wall, the stylet was withdrawn and tube was rotated 180° to advance it into the trachea. Even though these manipulations were not documented, time taken for intubation and number of attempts served as surrogate markers for difficulty in tube passage.

Data collection and analysis

Data were collected by an independent observer and Cormack–Lehane[10] classification was used for laryngoscopy grading. The "time taken to visualize the glottis" is calculated from the time of introduction of laryngoscope into the patients' mouth to good glottic view." "Time for intubation" is time taken from insertion of blade into the patients' mouth till three end-tidal carbon dioxide ($ETCO_2$) tracings were seen on the monitor. Vitals during and post-intubation were noted at 0, 1, 3, and 5 min. In case of failure to intubate with the study device, patient position was re-optimized and external laryngeal manipulation was used to facilitate intubation. If unsuccessful, a third attempt was made using GlideScope. If further difficulty was encountered, then consultant will manage the case according to the Difficult Airway Society (DAS) failed intubation algorithm.[11]

Sample size and statistics

The sample size was calculated based on the study done by Ng *et al.*;[12] which concluded that time to successful intubation with CMAC video laryngoscope was shorter compared to McGrath video laryngoscope [50 s inter-quartile range (IQR) 38–70 vs 67 s IQR 49–108, $P < 0.001$], despite McGrath video laryngoscope providing significantly more grade 1 glottis views. We assumed that the mean time difference between the two scopes is 10 s. So minimum number of subjects to be studied were calculated to be $n = 29$.

Results and Discussion

Obesity poses significant challenges to anesthesiologist and incidence of difficult airway is higher in obese compared to general population (8.2% vs 5.8%). Video laryngoscopy has been suggested as one of the initial options of intubation in difficult airway (ASA) and has been shown to improve intubating conditions in obesity.[13-15] The rationale behind conducting this study was to compare two video laryngoscopes, channeled vs non-channeled blades in obese patients with anticipated difficult airway. We chose to compare CMAC D non-channeled blade vs KVL-channeled blade. Our hypothesis was that channeled blade option should be as good as non-channeled blade, which would reflect in time taken to intubate, hemodynamic variations, and incidence of complications related to intubation. Sixty five patients were randomized and 31 were assigned to KVL group and 32 to CMAC D group. Baseline demographic characteristics [Table 1] and airway characteristics were comparable between the groups except TMD.[16] The mean TMD in the KVL group was 7.15 cm (SD 0.67 cm) and 6.70 cm (SD 0.89 cm) in CMAC D group. This was found to be statistically significant (P value 0.03). The NC/TMD ratio in KVL group was 5.64 ± 0.54 cm compared to 5.91 ± 0.80 cm in the CMAC D group. NC in the CMAC D group was 38.65 ± 3 cm compared to 40.03 ± 3.68 cm in KVL. Studies[17] have shown that NC >40 cm is associated with difficult airway. Even though the difference is not statistically significant, clinically the patients who received KVL had a broader neck. However, when we looked at the ratio of NC/TMD, both groups had similar ratios and

we assume that our groups are matched in terms of airway characteristics.

Our primary objective was to determine the time taken to visualize the glottis 12.93 ± 8.58 s with KVL vs 10 ± 5.32 s with CMAC D-blade ($P = 0.12$) and time taken to intubate was 50.04 ± 24.17 s for KVL vs 46.93 ± 26.59 s for CMAC D-blade ($P = 0.64$) [Table 2]. About 80.8% of patients in the KVL group had grade 1 laryngoscopy and 19.2% had grade 2 Cormack and Lehane view. About 83.3% of patients in the CMAC D-blade group had grade 1 laryngoscopy while 16.7% were grade 2. The first attempt success rate in obese patient with difficult airway using KVL was 74.1%, while it was 84.3% with CMAC D-blade.

One of the reasons for longer time taken by KVL to visualize was due to difficulty in introducing blade inside patient's mouth. The total length of KVL device is 23 cm (17 cm blade, 6 cm monitor). When attempting to introduce the blade, a common difficulty encountered was that screen would hit the patient's chest not allowing adequate maneuverability. Hence, to overcome this mechanical problem, we decided to detach the screen from handle and introduce the blade first then followed by coupling the monitor onto it. Although this modification facilitated the introduction of scope, it seems to have increased the time to visualize the glottis. Although the glottis view with KVL is optimum in most of the laryngoscopies, introducing ET was difficult. During advancement of the preloaded ET, it would impinge on the right arytenoids. The lateral position of the KVL channel seems to be the cause. This difficulty was overcome by withdrawing the laryngoscope away from the glottis and rotate the tube anticlockwise within the channel or introducing the scope through midline and to the left. This provided adequate space to maneuver the scope and brought the channeled slot in line with the glottis. Another method which resolved this issue was external laryngeal manipulation toward the right.

The common problem encountered with CMAC D-blade was inability to introduce ET into the glottis despite optimum visualization. Using a preformed stylet matching the shape of D-blade was helpful in guiding ET tube into the glottis. For this study, all CMAC D group patients were intubated using a preformed stylet. The other option is to use a Truflex articulating stylet. The CMAC stylet from Karl Storz was not introduced at the time of this study.

The results in our study are comparable to McElwain *et al.*[18] who compared CMAC with non-Macintosh blade video laryngoscopes like Airtraq and GlideScope in difficult and easy laryngoscopy scenarios in manikins. They also found that CMAC was the fastest instrument in intubation during difficult airway scenarios, so did our study. Cierniak M *et al.*[19] compared four video laryngoscopes and their technical parameters and found that thick cross-section of KVL blade may make it difficult to introduce in patients with minimal mouth opening. They also noted that since the LCD screen could not be rotated, one cannot look at the screen during the first phase of intubation. Only after blade passes uvula, the operator can look at the screen. All this would increase the time to visualize the glottis which we also encountered during our study.

Six patients in KVL group and one patient in CMAC D-blade group had failed first attempt intubation [Table 3]. All failed intubations were successfully intubated using the GlideScope by the same anesthetist. The hemodynamic variables were comparable between the two groups [Graphs 1-3]. There were no incidents of trauma like dental damage, laceration of tongue and buccal mucosa, aspiration, or significant desaturation in our study.

It was felt that events like failure to intubate and need for an alternate laryngoscope may be due to lack of familiarity. The CMAC D laryngoscope has been in clinical practice

Table 1: Demographic data of the two study groups

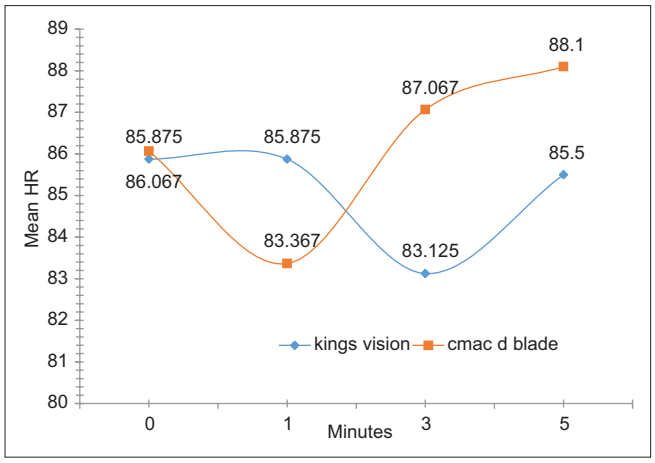
Variables	King vision laryngoscope	CMAC D-blade laryngoscope	Total	*P*
Age (years)				
18-35	9 (64.3%)	5 (35.7%)	14	0.42
36-55	18 (43.9%)	23 (56.1%)	41	
56-75	4 (50.0%)	4 (50.0%)	8	
Gender				
Males	12 (52.2%)	11 (47.8%)	23	0.71
Females	19 (47.5%)	21 (52.5%)	40	
Height (cm)	158	160		
Weight (kg)	83.84	86.0		
Body mass index (kg/m^2)	33.59	33.61	0.95	

Table 2: Association between mean time (s) to view the glottis and the laryngoscope used

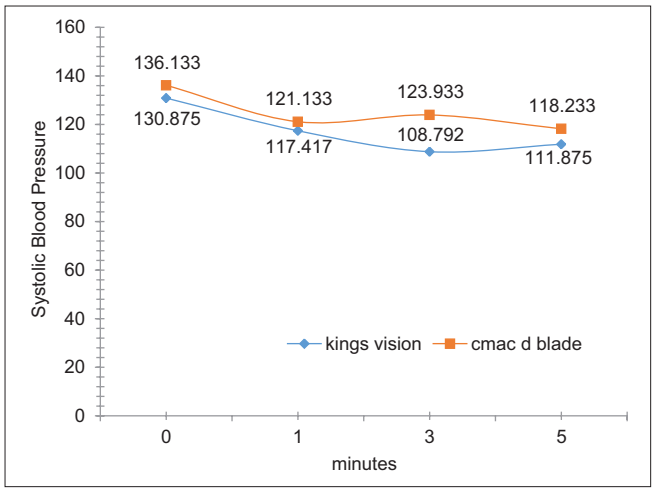
Variables	King vision laryngoscope	CMAC D-blade	*P*
Time to view the glottis (s) mean (SD)	12.93 (8.58)	10.00 (5.32)	0.12
Time to intubate (s) mean (SD)	50.04 (24.17)	46.93 (26.54)	0.64

Table 3: Association between laryngoscope used and complications

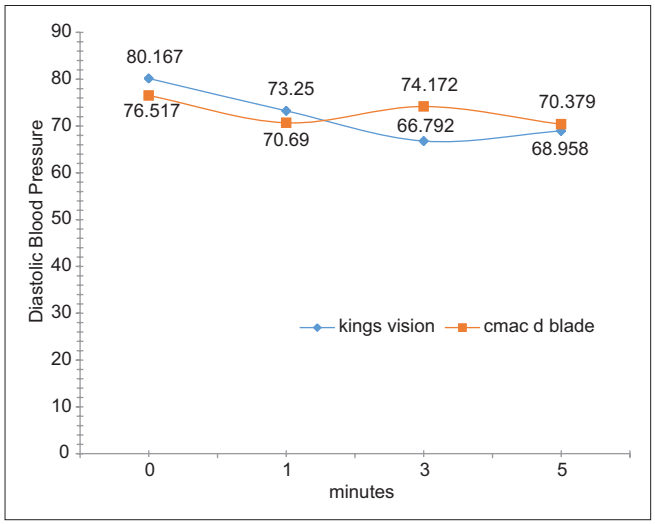
Laryngoscope	Complications		Total	*P*
	Present (%)	Absent (%)		
King vision	6 (19.4)	25 (80.6)	31	0.04
CMAC D-blade	1 (3.1)	31 (96.9)	32	



Graph 1: Heart rate variation during intubation in study groups



Graph 2: Systolic blood pressure variation during intubation in study groups



Graph 3: Diastolic blood pressure variation during intubation in study groups

in our department for a longer period of time compared to King vision. As the learning curve of any new device has a significant impact on success rate achieved, the operators in this study were relatively unfamiliar with usage of KVL, despite mannequin-based training, hence this would have contributed to the outcome.

Limitations

The main limitation of our study was that our power calculation was based on a difference in intubation time of 10 s between scopes. But since our actual time difference is only 4 s we need a larger sample size to conclude that CMAC is superior to KVL.

Conclusion

The use of CMAC D-blade resulted in less time to visualize, less time to intubate, and better first attempt success compared to KVL even though these results were not statistically significant. The use of CMAC D-blade resulted in statistically significant reduction in complications compared to KVL.

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Conflicts of interest

There are no conflicts of interest.

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