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## Comparison of Macintosh Laryngoscope and King Vision Video Laryngoscope for Endotracheal Intubation in Adult Patients

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### Abstract

**Background:** Development of video laryngoscope has made management of airway easier. Our study was aimed to compare the efficacy of Macintosh laryngoscope and King Vision video laryngoscope for endotracheal intubation in adult patients under general anesthesia.

**Objectives:** The primary objective of the study was to compare the glottic view obtained, the need for external manipulation, endotracheal tube insertion time and attempts taken for successful intubation with Macintosh laryngoscope and King Vision video laryngoscope. The secondary objective was to estimate the changes in hemodynamic parameters and to evaluate the occurrence of complications during intubation.

**Materials and Methods:** The study included 136 patients posted for surgery under general anesthesia. Patients were randomly allocated in group C (N = 68) and group V (N = 68). Endotracheal intubation was done in group C by Macintosh and in group V by King Vision video laryngoscope. Laryngoscopy was assessed by Cormack – Lehane grading and the need for any manipulation. The intubation time was calculated with each blade. Hemodynamic parameters were recorded and any complication during laryngoscopy and intubation were noted. The observations were analysed statistically by SPSS Program for windows version 28.

**Results:** In group C, 61.8% of patients had Cormack and Lehane score I while in group V 76.5% of patients had score I. Mean time of successful intubation was  $34.90 \pm 8.35$  sec in group C while in group V it was  $32.82 \pm 5.20$  second. There was no statistical difference in distribution of patients according to number of attempts of intubation. In group C, 64.7% of patients needed external laryngeal pressure while in group V 97.1% patients were intubated without external laryngeal pressure. Both the groups were comparable in relation to changes in hemodynamic parameters and any complications associated with laryngoscopy and intubation.

**Conclusion:** We conclude that glottic view is better obtained with King Vision Video laryngoscope whereas optimisation of position and external laryngeal manipulation is often required with Macintosh laryngoscope to get similar glottic view. Introduction of King Vision video laryngoscope into the oral cavity takes time but intubation is easier with it. Hemodynamic variables and complications during the procedure are equally distributed between the two devices.

**Keywords:** Endotracheal intubation, patients. Video endotracheal intubation, heavy airway

## Introduction

Airway management in patients undergoing surgery is the most necessary skill that every anesthesiologist should possess. In the last two decades, with the development of different types of video laryngoscopes, the management of airway has become easier<sup>1</sup>. King vision video laryngoscope consist of 2.4 inch reusable OLED-Display (organic light emitting diode) and a rigid blade that also includes a CMOS (complimentary metal-oxide semiconductor) video camera (Fig. 1). It has two types of blades: a non channelled blade and a channelled blade(with an integrated endotracheal tube guiding channel). Our study was designed to compare the efficacy of direct laryngoscopy using conventional Macintosh blade and indirect laryngoscopy using the tube guiding channelled King Vision video laryngoscope (KVVL) for endotracheal intubation.



Figure 1. King Vision video laryngoscope with channelled blade

## Material and Methods

After obtaining approval from institutional ethical committee the present study was conducted at a tertiary care centre. Patients between 18–60 years of age of either sex belonging to ASA physical status I or II with modified Mallampati classification I–II posted for elective surgery under general anesthesia were included in the study. Patients with inadequate mouth opening were excluded from the study. The study was conducted on 136

patients by taking 68 patients in each group randomly allocated, group C and group V.

Group C — patients in which Macintosh laryngoscope was used for endotracheal intubation.

Group V — patients in which King Vision video laryngoscope was used for endotracheal intubation.

## Anaesthesia Technique

Preanesthetic checkup was done in all patients posted for surgery. All the patients were instructed to fast for 6 hrs prior to surgery. Premedication was given with tablet alprazolam 0.25 mg on the night and in the morning of surgery. Patients were shifted to operation theatre. Monitors for baseline monitoring was attached for monitoring electrocardiography, heart rate, blood pressure and oxygen saturation. Intravenous canulation was done with 18 G canula. All patients were preoxygenated with 100 % oxygen for three minutes. Induction of anesthesia was done with injection fentanyl 2 µg/kg and injection propofol 2 mg/kg intravenously. After checking mask ventilation, intubating dose of muscle relaxant with vecuronium 0.1mg/kg was done. Endotracheal intubation was performed with selected intubating device after three minutes of bag and mask ventilation and adequate paralysis.

Macintosh laryngoscope was used for patients in group C and tube channelled King Vision video laryngoscope was for patients in group V. Endotracheal tube of adequate size was preloaded before intubation (Fig. 2).



Figure 2. King vision video laryngoscope with endotracheal tube insitu

## Measurement of Outcome:

### Primary outcome:

1. The glottic view during laryngoscopy was assessed with Cormack – Lehane grading system and it was noted whether external laryngeal pressure was given for better view of larynx (Fig. 3).
2. The intubation time (seconds) was calculated with each blade. Confirmation of correct tube placement was done by capnography. The number of intubation attempts were recorded.



Figure 3. Glottic view with King Vision videolaryngoscope

### Secondary outcome:

1. The change in hemodynamic parameters such as heart rate (HR) and mean arterial pressure (MAP) were assessed by monitoring the vitals before induction, before laryngoscopy and immediately after endotracheal intubation at a time interval of 1 minute, 3 minute and 5 minutes.
2. The complications such as dental injury, mucosal trauma, esophageal intubation, oxygen desaturation (oxygen saturation < 90%) and arrhythmias were noted.

## Statistical Analysis

Statistical analysis was performed by the SPSS program for Windows, version 28.0. Continuous variables were presented as mean  $\pm$  SD for normally distributed data

and Median (IQR) for non-normally distributed data and categorical variables were presented as absolute numbers and percentage.

Normally distributed continuous variables were compared using the unpaired t test, whereas the Mann – Whitney U test was used for those variables that were not normally distributed.

Categorical variables were analysed using either the chi square test or Fisher’s exact test. For all statistical test,  $P < 0.05$  was considered statistically significant.

## Results and Observations

Patients in both the groups were comparable statistically in relation to age, sex, weight, ASA physical status, modified Mallampati score and type of surgical procedure. Patients were compared according to various laryngoscope and intubation assessment parameters such as Cormack – Lehane score, time of successful intubation, number of attempts and optimization manoeuvre (external laryngeal pressure).

According to Cormack – Lehane score between the two groups, it was observed that under both the groups maximum percentage of patients had score I. Score I in Group C patients was obtained with the help of external laryngeal pressure and optimization of head position in majority of case whereas in group V, score I glottis view was obtained with the passing of laryngoscope (Fig. 4).

Patients were also compared on the basis of mean time of successful intubation between two groups. It was observed that under group C, mean time of successful intubation was higher  $34.90 \pm 8.35$  seconds as com-



Figure 4. Endotracheal tube visualisation during intubation

pared to group V where mean time of successful intubation was  $32.82 \pm 5.20$  seconds.

Patients in the two groups were also compared on the basis of number of intubation attempts. It was observed that 98.5% of patients under group C and 100% patients under group V had successful intubation in first attempt.

Intubation was successful in second attempt in 17.65% of patients in group C. No significant difference was observed according to number of attempts between two groups (p value 1.000).

Patients in two groups were also compared for requirement of optimization manoeuvres (external laryngeal pressure). It was observed that 64.7% of the patients in group C required optimization manoeuvre for intubation, while only 2.9% of patients required optimization manoeuvre in group V. Significant difference was seen (p value < 0.001) when the two groups were compared.

Both the groups were compared for change in hemodynamic parameters such as heart rate and mean arterial pressure. It was observed that mean heart rate was almost comparable between the two groups before induction, before intubation during intubation and after intubation. There was no significant difference in mean heart rate before induction (p value 0.549), before intubation (p value 0.526), during intubation (p value 0.721), after intubation at 1 minute (p value 0.403), 3 minute (p value 0.308) and at 5 minute (p value 0.672).

Variation in mean arterial pressure was found to be comparable in both the groups. No significant difference was observed before induction (p value 0.853), before intubation (p value 0.816) during intubation (p value 0.51) after intubation at 1 minute (p value 0.542), at 3 minute (p value 0.795) and at 5 minute (p value 0.970).

Both the groups were compared for complications during intubation such as dental injury, mucosal trauma, esophageal intubation and arrhythmia. No significant difference was observed in any of the two groups.

## Discussion

The Macintosh laryngoscope is most frequently used for endotracheal intubation. Alignment of oral, pharyngeal and laryngeal axis is required for intubation by Macintosh laryngoscope.<sup>3</sup> In direct laryngoscopy optimizing head position and manipulation of larynx is required for successful intubation.<sup>4</sup> Intubation with Macintosh laryngoscope is associated with mucosal injury, dental injury, difficult intubation and adverse events in patients with poorly controlled hemodynamics.<sup>5</sup>

Development of videolaryngoscope (VL) has improved the glottic view during intubation.

Videolaryngoscope has a small video camera that allows to indirectly view the glottis. VL attaches an imaging device to the laryngoscope blades distal end.<sup>1, 2, 3, 4</sup>

King vision videolaryngoscope has a preformed angulated blade that incorporates the tip of the blade into the glottis without sniffing position and head extension. The tube guiding channel holds the endotracheal tube in position. It removes the need for stylet and additional manipulation to pass the tube.<sup>6, 7</sup>

Cormack and Lehane score I in group C was obtained with the help of external laryngeal pressure and optimization of head position whereas in group V, score I glottis view was obtained with the passing of laryngoscope.

Mean time of successful intubation was comparable in both the groups. It was observed that tube guiding channelled videolaryngoscope takes time for inserting the bulky blade along the curvature of tongue. Though a clear glottis view is obtained after insertion of blade, it requires more skill to pass the endotracheal tube without direct vision of glottis. It was observed that 64.7% of the patients in group C were intubated with the help of optimization manoeuvre. Intubation with Macintosh laryngoscope requires alignment of oral, pharyngeal and laryngeal axis for better glottic view. A suboptimal view of glottis can be improved with a backward, upward and rightward pressure on thyroid cartilage. In contrast only 2.9% patients in videolaryngoscopy group required optimization manoeuvre. Due to the pre-designed angulation in videolaryngoscope, the tip of the laryngoscope blade reaches the glottis on insertion through oral cavity and the glottis view is obtained through minimal manipulations. Hemodynamic parameters were comparable in both the groups. No significant complications were seen in any group.

In a study by Elhadi et al, it was found that KVVL gave better laryngeal view as compared to Macintosh laryngoscope. KVVL was also found to be more effective in reducing hemodynamic response to laryngoscopy and intubation, high success rate, easier procedure of laryngoscopy and intubation and least use of assisting manoeuvres during endotracheal intubation.<sup>8</sup> Similar observation was found in our study also.

In a study by Erdivanli et al, it was stated that KVVL led to a significantly longer average time to glottic view and time to intubation (p value < 0.001) The study was done by experienced anesthesiologists and it was found that with both the laryngoscope skilled anesthesiologist

may achieve comparable success rate for first pass intubation. King vision does not add to desaturation but took longer time to view the glottis and intubate the trachea<sup>10</sup>. In our study, laryngoscopy and intubation was done by postgraduate student who was learning intubation by both Macintosh laryngoscope and King vision video laryngoscope. The student found it easier to intubate with videolaryngoscope though insertion of blade was difficult.

Reena et al compared the efficacy of direct laryngoscopy using Macintosh blade with KVVV channelled blade for intubation with reinforced or armoured endotracheal tube. The success rate on first attempt was greater in group KVVV than in the DL group. Time to the best glottis view was comparable in both groups, however KVVV group took significantly less time to complete a successful intubation than DL group. In our study we used PVC endotracheal tube in all the cases.<sup>10</sup>

Kaur et al also observed that Cormack and Lehane score I was found in maximum percentage of patients followed by score II and III. Finding was similar to our study.<sup>13</sup>

Mean time of successful intubation was higher in group C because Macintosh laryngoscope needed external laryngeal pressure. Tube guiding channelled king vision video laryngoscope takes time for inserting the bulky blade along curvature of tongue. Though a clear glottis view was obtained after insertion of blade more skill was required to pass the endotracheal tube. Hence no significant difference was observed for mean time of successful intubation when compared between the two groups.

Significant difference was seen when the two groups were compared for the requirement of optimization of external manouvre. During direct laryngoscopy, alignment of oral, pharyngeal and laryngeal axis is required for successful intubation. While during intubation with king vision video laryngoscope, the tip of laryngoscope blade reaches the glottis due to pre-designed angulations and glottis view was obtained with minimal manipulations.

## Conclusion

On the basis of the study conducted for comparing the efficacy of conventional Macintosh laryngoscope and tube guided channelled king vision videolaryngoscope we conclude that glottis view is better with king vision videolaryngoscope without help of an assistant where as optimization of position and external laryngeal pressure

manipulation is often required with macintosh laryngoscope to get similar glottis view. This gives an added advantage to king vision video laryngoscope in difficult airway. Both Macintosh laryngoscope and channelled king vision video laryngoscope were equally efficient when time for successful intubation was compared.

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### Порівняння ларингоскопа Macintosh та відеоларингоскопа King Vision для інтубації трахеї у дорослих пацієнтів

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#### Анотація

**Передумови:** Розробка відеоларингоскопа полегшила роботу з дихальними шляхами. Наше дослідження мало на меті порівняти ефективність ларингоскопа Macintosh та відеоларингоскопа King Vision для інтубації трахеї у дорослих пацієнтів під загальною анестезією.

**Мета:** Основною метою дослідження було порівняти отриманий огляд глотки, необхідність зовнішніх маніпуляцій, час введення ендотрахеальної трубки і кількість спроб, необхідних для успішної інтубації за допомогою ларингоскопа Macintosh та відеоларингоскопа King Vision. Вторинною метою була оцінка змін гемодинамічних параметрів та оцінка виникнення ускладнень під час інтубації.

**Матеріали та методи:** Дослідження включало 136 пацієнтів, направлених на операцію під загальною анестезією. Пацієнти були випадковим чином розподілені у групу С (N = 68) та групу V (N = 68). У групі С інтубація трахеї проводилася за допомогою ларингоскопа Macintosh, а в групі V — за допомогою відеоларингоскопа King Vision. Ларингоскопію оцінювали за шкалою Cormack – Lehane та потребою у будь-яких маніпуляціях. Час інтубації розраховували для кожного леза. Було зафіксовано гемодинамічні параметри, а також будь-які ускладнення під час ларингоскопії та інтубації. Спостереження було проаналізовано статистично за допомогою програми SPSS для Windows версії 28.

**Результати:** У групі С 61,8 % пацієнтів мали оцінку I за шкалою Cormack – Lehane, тоді як у групі V оцінку I мали 76,5 % пацієнтів. Середній час успішної інтубації становив  $34,90 \pm 8,35$  сек. у групі С, тоді як у групі V він становив  $32,82 \pm 5,20$  сек. Статистичної різниці в розподілі пацієнтів за кількістю спроб інтубації не було. У групі С 64,7 % пацієнтів потребували зовнішнього тиску на гортань, тоді як у групі V 97,1 % пацієнтів були інтубовані без зовнішнього тиску на гортань. Обидві групи порівняли за змінами гемодинамічних параметрів і будь-якими ускладненнями, пов'язаними з ларингоскопією та інтубацією.

**Висновок:** Ми дійшли висновку, що кращий огляд глотки отримується за допомогою відеоларингоскопа King Vision, тоді як для ларингоскопа Macintosh часто потрібна оптимізація положення та зовнішня маніпуляція гортанню, щоб отримати подібний огляд глотки. Введення відеоларингоскопа King Vision у ротову порожнину потребує певного часу, але інтубація з ним є простішою. Гемодинамічні зміни та ускладнення під час процедури рівномірно розподіляються між двома пристроями.

**Ключові слова:** Інтубація трахеї, пацієнти. Відеоінтубація трахеї, важки дихальні шляхи