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Original Research Article

Comparison of king vision video laryngoscope with macintosh laryngoscope for nasotracheal intubation: Randomized control study

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A B S T R A C T

Background and Objectives: Nasotracheal intubation is essential in oro-maxillofacial surgeries to provide a good operational field along with a secured airway. In this study, we aim to compare king vision video laryngoscope with conventional Macintosh laryngoscope for nasotracheal intubation in ear, nose throat and oro-maxillofacial surgeries under general anaesthesia.

Materials and Methods: A total of 102 patients were posted for elective oro-maxillofacial surgeries under general anaesthesia with nasal intubation. Patients were randomized to two different groups. In group K nasotracheal intubation was done with king vision video laryngoscope (KVVL) and in group M with Macintosh laryngoscope. Primary objective was to compare total intubation time and each time intervals (time A: placement of the nasal tube from selected nostril to oropharynx; time B: use of devices to view the glottis, and time C: for nasal tube to be advanced from oropharynx into trachea and removal of the laryngoscope from oral cavity). Secondary objectives were to compare scores of Modified Naso Intubation Difficulty Scale (MNIDS) and haemodynamic responses.

Results: The mean total intubation time, and time C interval were noted in King Vision Video Laryngoscope group (37.29±7.83 s and 15.99±8.9 s) and Macintosh laryngoscope group (46.11±10.05 s and 19.86±9.96 s) respectively. There was significant difference between these two groups in terms of mean total intubation time, and time C interval (total time, p=0.001 and time C, p=0.041). The level of difficulty in intubation noted using MNIDS score which is zero in 52.9% patients in King Vision group and 23.5% in Macintosh group (p=0.011).

Conclusion: As compared to Macintosh laryngoscope, the king vision laryngoscope requires lesser time for nasotracheal intubation. In addition, Intubation is easier with the king vision laryngoscope than with the Macintosh laryngoscope.

1. Introduction

In general anaesthesia, establishment of definitive airway is crucial. Airway management problems constitute about 17%, with difficult intubation being the most common with incidence rate of 5%.[1,2] Failure to intubate or repeated attempts may result in hypoxia, hypercarbia, laryngeal spasm, bronchospasm, bleeding from the upper airway, regurgitation of gastric contents, aspiration of gastric contents, dental damage, various dysrhythmias, brain damage, cardiac arrest, or even fatalities.[3] First-pass success is perhaps even more crucial in critically sick patients because subsequent intubation attempts frequently result in severe hypoxia and other life-threatening consequences.[4]

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Difficult intubation may be anticipated preoperatively even in Mallampatti I and II class airway. Hence, it is necessary to develop tools for advanced airway instrumentation and better visualization of the larynx. A few manufacturers created video chips in response to the digital technology revolution and complementing metal-oxide semiconductors. As a result, video-laryngoscopes (VL) were created to allow for intubation while viewing the glottis.[5]

The Video Assisted Laryngoscopy (VAL) helps in the visualization of the real-time or enlarged video image of airway structures. In addition to providing a clearer view of the glottic opening than a regular Macintosh laryngoscope, VAL intubation requires less force than Macintosh laryngoscopy, lowering the risk of injury to soft tissues and teeth.[6–9] Video laryngoscopes have demonstrated their efficacy for intubating patients with normal, challenging difficult airways and also in nasotracheal intubation.[10–12]

King Vision Video Laryngoscope (KVVL) provides an indirect view of glottis without aligning oral, pharyngeal, and tracheal axis. The KVVL has both channelled and standard (unchanneled) blades. In order achieve definitive airway and good surgical field, nasotracheal intubation is frequently used in patients having maxillofacial surgery. Many previous studies have proved that King vision provides best glottic views in comparison with other conventional laryngoscopes for nasotracheal intubation.[13–16] We did this study because, when KVVL is utilized by skilled anaesthesiologists, it's unclear if these findings will translate into lesser intubation time and higher success rates of intubation.

In this study, we compared KVVL with Macintosh laryngoscope for nasotracheal intubation in patients posted for Ear, Nose, Throat and Oro maxillofacial surgeries under general anaesthesia.

2. Materials and Methods

Before the first patient recruitment, the current trial has been listed with "Clinical Trial Registry of India" (CTRI/2020/05/025196) and the ethical clearance (certificate no 2019-20/A-10/1.2) was obtained from the Institutional Ethical Committee. Participants involved in our study provided their consent. From December 2019 - June 2021, a total of 107 patients were recruited who were admitted to H.S.K. hospital, Bagalkot. The following were the inclusion criteria: patient posted for elective oro-maxillofacial and ENT surgeries under general anaesthesia with nasotracheal intubation, age range of 20-65 years, American Society of Anaesthesiologist physical stats **I** or **II**. Patients with mouth opening < 3 cm, history of documented difficult airway, cervical spine injury, chronic sinusitis, ankylosing spondylitis involving neck, and nasotracheal intubation contraindications were excluded from the study.

Airway evaluation was done in preanesthesia clinic and Mallampati classification was done. Before surgery, all study participants were kept nil per oral 8 hours except for only clear fluids up to 2 hrs of surgery.

The patients participating in this study were randomly grouped into group K (King Vision Video Laryngoscope) and group M (Macintosh laryngoscope). Using computer-generated random number tables, 102 index cards were placed into 102 envelopes and randomly divided into two groups. Each patient chose an envelope which is sealed in the preoperative room, containing the cards with the codes for each airway device marked on them. Participants were blinded to the choice of airway device used for intubation, but intubating anaesthesiologist was not blinded.

After checking the patient's identity and confirming the NBM status, they were shifted inside the operating room. An appropriate intravenous cannula was secured. All participants were attached to monitors to record electrocardiogram (ECG), non-invasive blood pressure (NIBP), heart rate (HR), peripheral oxygen saturation (SpO_2). Mean arterial pressure (MAP) and basal heart rate (HR) were documented prior to the induction of general anaesthesia.

Patients were premedicated with glycopyrrolate 0.01 mg/kg iv, midazolam 0.05 mg/kg iv, fentanyl 2 mcg/kg iv before induction of general anaesthesia. Inj. propofol 1.5-2 mg/kg iv is to induce anaesthesia. Once the mask ventilation was confirmed, i.v. vecuronium 0.1 mg/kg was given. Bag and mask ventilation was done for 3 minutes till we get plane of intubation. After achieving adequate depth of anaesthesia, nasotracheal intubation was performed by an experienced anaesthesiologist using King Vision or Macintosh laryngoscope with flexometallic ET tube with the help of Magill's forceps. End tidal isoflurane at 1.5% of and CO2 at 35 to 40 mmHg was maintained. The following parameters were noted in all patients throughout the study.

The primary outcome was to compare total intubation time and each time intervals (time A: placement of the nasal tube from selected nostril to oropharynx; time B: use of devices to view the glottis, and time C: for nasal tube to be advanced from oropharynx into trachea and removal of the laryngoscope from oral cavity. Secondary outcomes were scores of Modified Naso Intubation Difficulty Scale (MNIDS)[17] and hemodynamic responses i.e. MAP and HR were measured before and after intubation. The Modified Naso Intubation Difficulty Scale (MNIDS) for intubating condition were assessed as follows: N1- Supplementary intubation attempt; N2- number of additional operators, who have not assisted; N3- alternative intubation techniques like change in head position or cuff inflation; N4- glottic view graded as Cormack Lehane minus 1; N5- force for lifting; N6- glottis view with manoeuvres like BURP; N7- position of vocal cards. The MNIDS scores were graded as easy (score 0), Minor difficulty (score 1 to 5), Major difficulty (score >5). The hemodynamic response for intubation was recorded by measuring HR and MAP changes before and after intubation. Efficacy parameters (clinical outcome parameters) were time taken for intubation and MNIDS scores. Safety and tolerability parameters were haemodynamics like HR, MAP at intervals of before pre-medication, before intubation and after intubation.

Sample size was estimated using, Open Epi software version 2.3.1 with 95% confidence level and 80% power of the study according to a previous study by Tseng KY et al.[13] Total time needed for intubation with KVVL (in sec) = 32.9±10.5 and total time needed for intubation with Macintosh laryngoscope (in sec) = 42.7±19.2. Sample size estimated is 40 in each group but we enrolled 51 patients owing to withdraw of patients and attrition. Sample size calculated using the formula: $N= 2(Z\alpha+Z\beta)^2\delta^2/d^2$, Z is critical value for given α and β; α is type 1 error (0.05); β is probability of type 2 error; d is absolute difference of two means. Data entered in Excel spreadsheet & analysed using SPSS version 19 software. Mean & Standard Deviation was calculated for quantitative data. Percentage & Proportion were used for qualitative data. Chi-Square test and Student's t-test were applied for qualitative and quantitative data respectively. Other statistical tests were also applied to the data. The p value < 0.05 was considered statistically significant.

3. Results

The demographics in terms of age, gender, weight, and ASA status in both groups were comparable (Table 1). The Mallampati classification of patients in both the groups were compared in the above table and there is no statistically significant difference (p=0.259) in both groups in the Mallampati classification.

The total intubation time was significantly lesser in group K (37.29 ± 7.83 sec) compared to group M (46.11 ± 10.05 sec) which was statistically significant (p=0.001). The time A was not statistically significant (p=0.225) indicating no much difference in time for placement of the nasal tube from selected nostril to oropharynx. The time B and C are lesser in group K (13.91 ± 6.53 sec and 15.99 ± 8.9 sec) as compared to group M (18.03 ± 9.21 and 19.86 ± 9.96 sec) which was statistically significant p= 0.009, and p= 0.041 respectively.

The MNIDS score is zero in 52.9% of patients in group K which is more, as compared to group M in which the MNIDS score is zero in only 23.5% of the patients. From the above table, it is statistically significant (p=0.011). Indicating intubation was less difficult in King Vision group than the Macintosh group. We also found that 45.1% of patients in group K showed minor difficulty (i.e. MNIDS score 1-5) which is much lower than the 66.7% of patients in group M who showed minor difficulty during intubation. Only 2% of patients in group K had major difficulty during intubation with KVVL (i.e. MNIDS score >5), which is much fewer than the 9.8% of patients in group M who had major difficulty during intubation with a Macintosh laryngoscope. The basal HR and MAP were comparable in King Vision group (p value 0.787) and Macintosh group (p value 0.427). Statistical analysis showed no significant difference in HR and MAP changes between King vision and Macintosh group pre and post intubation.

Table 1: Demographic data and anthropometric variables

Variables	Group KVVL	Group Macintosh	p value
Age (Mean ±SD)	29.55±8.36	31.88±11.08	0.233*
Male	36 (70.6%)	31 (60.8%)	0.698*
Female	15 (29.4%)	20 (39.2%)	
Weight (Mean ±SD)	58.71±6.56	58.25±7.55	0.748*
ASA **I**	31 (60.78%)	32 (67.75%)	0.830*
ASA **II**	20 (39.22%)	19 (37.25%)	

SD: Standard deviation, ASA: American Society of Anaesthesiologists, KVVL: King Vision Video Laryngoscope, *P>0.05 (Not significant)

Table 2: Comparison of airway data

Mallampatti Classification	Group KVVL (n = 51)	Group Macintosh (n = 51)	p value
Class **I**	5 (9.8%)	12 (23.5%)	0.259*
Class II	12 (23.5%)	9 (17.6%)	
Class III	13 (25.5%)	14 (27.5%)	
Class IV	21 (41.2%)	16 (31.4%)	

KVVL: King Vision Video Laryngoscope, *P>0.05 (Not significant)

Table 3: Comparison of nasotracheal intubation time.

Time	Group KVVL	Group Macintosh	P value
Time A	7.36±3.54	8.23±3.18	0.225*
Time B	13.91±6.53	18.03±9.21	0.009^{Ψ}
Time C	15.99±8.9	19.86±9.96	0.041^{Ψ}
Total time	37.29±7.83	46.11±10.05	0.001^{Ψ}

KVVL – King Vision Video Laryngoscope, *P>0.05 (Not significant), $^{\Psi}$p<0.05 (significant)

4. Discussion

In general anaesthesia, the anaesthesiologist's primary concern is protecting the patient's airway. The design of laryngoscopes has developed over time to facilitate intubation. KVVL is a battery-powered portable VL with a reusable monitor and blades. Nasal intubation is commonly used in oro-maxillo-facial procedures to increase surgical mobility and field of view. For nasotracheal intubation, the Macintosh laryngoscope is commonly used.

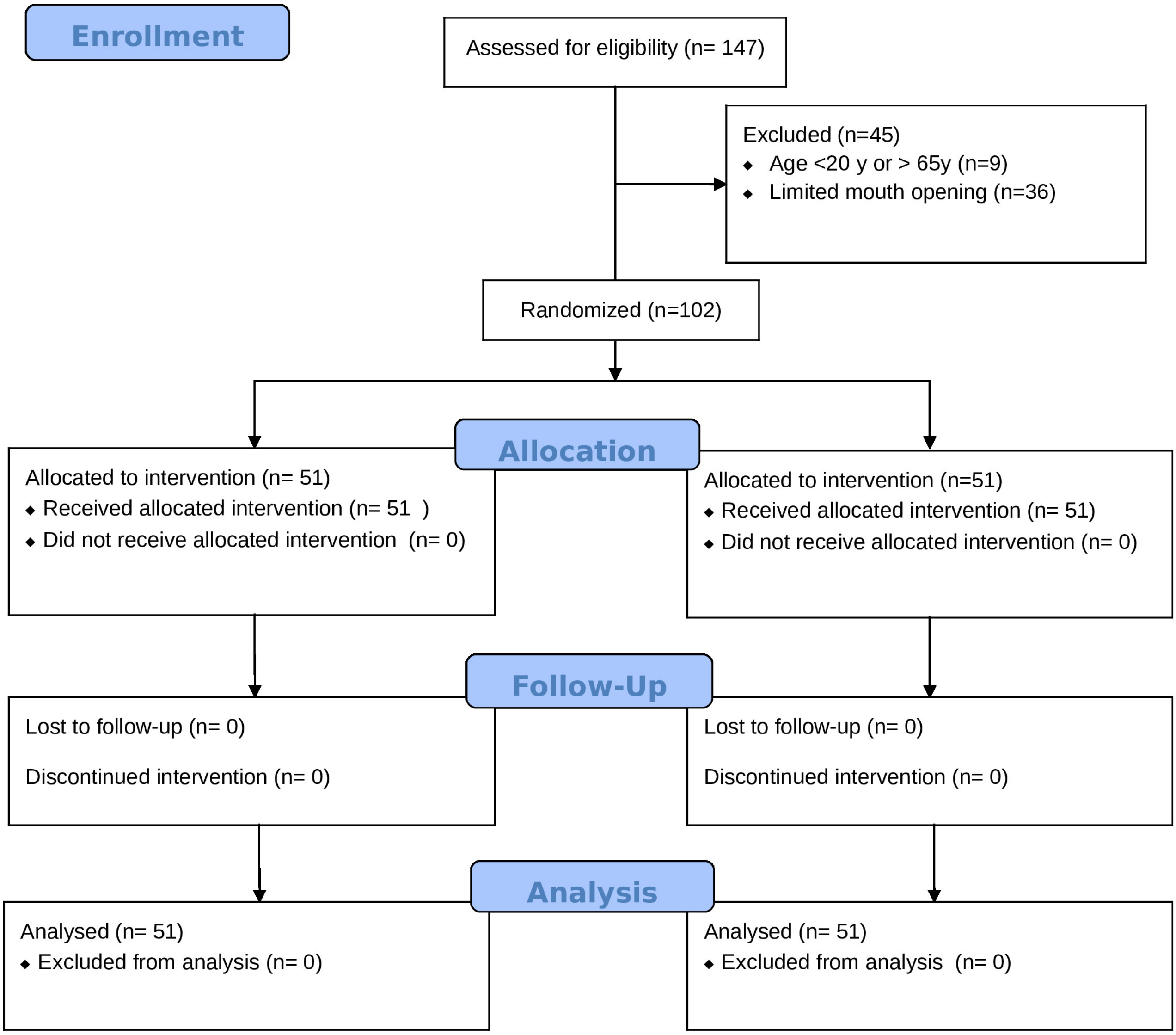

Figure 1: Consort diagram

Table 4: Comparison of scores of modified naso-intubation difficulty scale (MNIDS)

Time	Group KVVL (n =51)	Group Macintosh (n =51)	p value
MNIDS score 0	27 (52.9%)	12(23.5%)	
MNIDS score 1-5	23 (45.1%)	34(66.7%)	0.011$^{\Psi}$
MNIDS score >5	1 (2%)	5(9.8%)	

KVVL: King Vision Video Laryngoscope, $^{\Psi}$p<0.05 (significant)

Table 5: Hemodynamic responses during baseline, pre-intubation and post-intubation periods values are presented as mean ± SD

Hemodynamic parameters	Group K	Group M	t Value	P Value
Baseline				
HR	86.1 ± 14.9	86.75 ± 10.37	0.27	0.787
MAP	92.73 ± 8.3	91.47 ± 7.5	0.798	0.427
Pre-intubation				
HR	86.45 ± 13.5	85.35 ± 9.34	0.479	0.633
MAP	94.42 ± 7.4	92.22 ± 7.4	1.484	0.141
Post-intubation				
HR	90.69 ± 13.38	92.41 ± 10.5	0.724	0.471
MAP	98.15 ± 7.03	96.30 ± 7.0	1.331	0.186

The aim of our research was to compare and contrast the King Vision to Macintosh laryngoscope for nasal intubation in terms of total duration, difficulty and hemodynamic response to intubation. A total of 102 study patients with ASA status 1 and 2, who were undergoing elective surgery under general anaesthesia were enrolled and made into two random groups in this prospective, randomized trial. King Vision videolaryngoscopes were used to intubate patients in group K, while Macintosh laryngoscopes were used to intubate patients in group M. In both groups, the standard anaesthesia protocol was followed and intubation was performed with the appropriate size ET tube.

The demographic profile and airway data of the patients were comparable between the two groups.

4.1. Intubation time

The intubation time was considered accordingly to the study conducted by Tseng KY,[13] the whole intubation time was separated into three parts: time A, B, and C. Time A: placement of the nasal tube from selected nostril to oropharynx; time B: use of devices to view the glottis, and time C: for nasal tube to be advanced from oropharynx into trachea and removal of the laryngoscope from oral cavity.

In our study, group K had a substantially shorter total intubation period (37.29 ± 7.83 sec) than group M (46.11 ± 10.05 sec), which was statistically significant (p=0.001). The difference in time for placing the nasal tube from the selected nasal opening to the oropharynx (time A) was not statistically significant (p=0.225), implying that there was little difference in time. Group K had shorter time B and C (13.91 ± 6.53 sec and 15.99 ± 8.9 sec) than group M (18.03 ± 9.21 sec and 19.86 ± 9.96 sec), which is statistically significant (p= 0.009 and p=0.041, respectively). This indicates that KVVL requires a lesser time to visualize the glottis and reduces the duration of intubation as compared to conventional Macintosh laryngoscope.

In a study conducted by Tseng KY,[13] who compared Glide Scope, Pentax Airway scope and Macintosh laryngoscopes for nasal intubation in 108 patients, the results were similar to our research. Mean total intubation time and time C interval for advancing nasal tube from oropharynx into the trachea and removing the scope from the oral cavity were taken with Glide Scope (33.1 sec and 9.7 sec), Pentax (38.4 sec and 12.9 sec), and Macintosh (42.2 sec and 14.9 sec) respectively (P = 0.03 for total time; P =0.02 for time C).

Roh G U et al.[15] conducted study in 120 patients, using Macintosh laryngoscope, McGrath MAC videoscope, Pentax Airway for nasal intubation. The total intubation duration in the MVL group was considerably less than in the Macintosh direct laryngoscope group (45 sec vs 57 sec, P=0.01).

4.2. Modified naso intubation difficulty scale (MNIDS)

The MNIDS score was adapted from a similar previous study by Tseng KY.[13] The MNIDS score is the sum of N1 to N7 as described in methodology. A score of 0 imply intubation under ideal conditions and easy. The MNIDS score of 1 to 5 imply minor difficulty in intubation and the MNIDS score of > 5 imply major difficulty.

In our study, we discovered that 52.9% of patients in group K have the MNIDS score of zero, which is higher than the 23.5% of patients in group M who have the MNIDS score of zero indicating intubation was easier in group K than in group M.

We also found that 45.1% of patients in group K showed minor difficulty (i.e. MNIDS score 1-5) which is much lower than the 66.7% of patients in group M who showed minor difficulty during intubation. Only 2% of patients in group K had major difficulty intubating with KVVL (i.e. MNIDS score >5), which is much fewer than the 9.8% of patients in group M who had major difficulty intubating with a Macintosh laryngoscope.

Consistent with our results, a study done by Tseng KY[13] who compared Glidescope, Pentax airway and Macintosh laryngoscope. They found that the median scores of MNIDS were significantly lower using Pentax Airway or Glidescope compared to the use of Macintosh in nasotracheal intubation (P= 0.037) and the Glidescope group performed difficult intubations more easily than the

Macintosh group did (p=0.016).

In a study conducted by Erdivanli B et al,[14] there was an improvement in glottic visualization on using KVVL. Based on the Mallampati class in the preoperative clinic, the KVVL improved the glottic view in more patients (220, 56.7%) compared to Macintosh group (180, 46.4%) which is statistically significant outcome (p value < 0.001).

In another similar study conducted by Lili X et al[18] it was concluded that the rate of successful nasotracheal intubation was lower with the Macintosh laryngoscope (70%) compared with the Glidescope (96.7%). In their study cohort, comparison of the two groups was done using following parameters such as number of intubation attempts, duration of intubation, rate of success, optimization manoeuvres count, Cormack and Lehane Score, and POGO scores.

The results were also similar in a study conducted by Reena et al,[19] where the time for successful oral intubation was less in KVVL group (28.7±10.6 sec) as compared with Macintosh laryngoscope group (40.3±14.4 sec) which was statistically significant with p <0.0001.

4.3. Hemodynamic changes

During intubation, stress response is due to laryngoscopy and intubation and the following hemodynamic parameters like HR, SBP, DBP, MAP, and oxygen saturation were recorded in all patients. The above hemodynamic parameters were measured at baseline, before intubation and after intubation. In our study, there was no statistically significant difference between the KVVL group and the Macintosh laryngoscope group concerning HR and MAP. Saturation was at 100% throughout the procedure in both groups.

5. Strength of the Study

A good number of the participants were analyzed in the study. Intubation difficulty scale was compared which includes many parameters like the number of attempts, Cormack Lehane grading, use of alternative methods, lifting force used etc. The hemodynamic response to intubation was compared among the groups.

6. Limitation of the Study

1. Results apply to the normal airway as we excluded difficult airways.
2. There could be observer bias as we could not do double-blinding

7. Conclusion

As compared to Macintosh laryngoscope, the KVVL requires lesser time to visualize the glottis and reduces the duration of intubation as compared to Macintosh laryngoscope during nasotracheal intubation. In addition, Intubation is easier with the KVVL than with the Macintosh laryngoscope.

8. Strength of the Study

A good number of the participants were analyzed in the study. Intubation difficulty scale was compared which includes many parameters like the number of attempts, Cormack Lehane grading, use of alternative methods, lifting force used etc. The hemodynamic response to intubation was compared among the groups.

9. Source of Funding

None.

10. Conflict of Interest

None.

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