

ORIGINAL RESEARCH

AIRWAY MANAGEMENT

Airtraq-AirView[®] vs. King Vision[®] video laryngoscope: A randomized comparative study to evaluate the intubation dynamics in adult patients for general anesthesia

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Abstract

Background: Airtraq[®]-Airview (AA) and King Vision[®] (KV) video laryngoscopes are two new video laryngoscopes (VLS). Many studies have been carried out to compare the both regarding efficacy, ease of use etc., but the matter remains undecided.

We compared AA to KV(channeled) primarily for total intubation time and *secondarily for success rate*, number of attempts, optimization maneuvers, percentage of glottis opening (POGO) score, Cormack-Lehane (CL) score, degree of difficulty of intubation (Likert scale) and adverse effects.

Methodology: After obtaining institutional ethical committee approval and written informed consent from study subjects, this randomized control study was conducted in the Department of Anesthesiology & Critical Care, Mathura Das Mathur Hospital, Jodhpur from January 2019 to September 2019. Seventy ASA- I and II patients of age 20-60 y, weighing 40-70 kg, irrespective of their Mallampati class, posted for elective surgery under general anesthesia, were included in the study. Patients were randomly divided into two groups, Group AA (n = 35) intubated using AA and Group KC (n = 35) intubated using KV (channeled). Pregnant patients, patients with mouth opening less than 18 mm and any oral pathology, neck deformities and refusal to consent were excluded. Statistical analyses were performed using SPSS 22.0 software package (SPSS Inc., Chicago, IL, USA). Chi square test, Fisher's exact test and Fisher-Freeman-Halton test were used. All data were summarized as mean \pm SD for continuous variables, numbers and percentages for categorical variables. P < 0.05 was accepted as significant.

Results: Total intubation time was significantly longer in group AA. Demographic and hemodynamic data of patients and intubation attempts, CL score, POGO score, degree of difficult intubation on Likert scale and adverse effects such as airway trauma in both the groups were comparable.

Conclusions: Although both video laryngoscopes are similar in intubating conditions, intubation with King's Vision[®] video laryngoscope was faster; hence might be preferable for intubation.

Key words: Airway management; glottis; Humans; Intubation, Intratracheal / instrumentation; Intubation, Intratracheal / methods; Laryngoscopy / instrumentation; Laryngoscopy / methods; Trachea; Video laryngoscopy

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1. Introduction

Video laryngoscopy (VLS) is one of the most significant development in airway management and VLSs are now included in the American Society of Anesthesiologists (ASA) Difficult Airway Algorithm.¹ The Airtraq® Airview (AA) (ProdolMeditec, S.A., Vizcaya, Spain) is a single-use channeled video laryngoscope (VLS) for endotracheal intubation, that projects images of glottis from the distal tip of its blade to a proximal eyepiece. Alternatively any mobile phone may be attached to its handle and used with Airview app (iPhone-app by Mobilemeds®arl, Switzerland) for visualization.^{2,3} King Vision® (KV) VLS (King Systems Noblesville, IN, USA) consists of two parts, a reusable monitor, and a disposable blade which may be 'channeled' (conduit for the endotracheal tube) or 'non-channeled'.⁴ Several studies have reported that both AA and KV allowed faster learning curve, better glottis visualization and Cormack Lehane (CL) score than that of obtained by direct laryngoscopy.^{5,6,7,8} They both offer a blade that incorporates a tube channel that holds the endotracheal tube (ETT) and guides it towards the glottis with visualization on display monitor.⁹ There are various studies comparing direct laryngoscopy and newer intubating devices but very few studies have been conducted comparing efficacy of intubation among different VLSs.^{10,11,12}

We compared the intubation efficacy and dynamics of AA with KV (channeled). The primary objective was to compare total intubation time among the two devices. Secondary objectives included comparison of success rate, total number of attempts, need of optimization maneuvers (external laryngeal manipulation), percentage of glottis opening (POGO score), CL score, degree of difficulty of intubation (Likert scale) and adverse effects.

2. Methodology

Sample size was calculated on the basis of a previous study by Ali et al.¹³ Minimum of 35 patients were required in each group to study the difference between tracheal intubation time in both the techniques, at a power of 80% and confidence interval of 95%. We enrolled 35 patients in each group in accordance with central limit theorem (assuming α -error = 0.05 and β -error = 0.2 or power = $(1-\beta) = 0.8$). All data were summarized as mean \pm standard deviation (SD) for continuous variables, numbers and percentages for categorical variables. $P < 0.05$ was accepted as statistically significant.

This randomized control study was conducted in the Department of Anesthesiology & Critical Care, Mathura Das Mathur Hospital, Jodhpur from January 2019 to September 2019 after obtaining institutional ethical

committee approval and written informed consent from the study subjects.

A total of seventy patients, ASA-I and II, posted for elective surgery under general anesthesia with were included. Patients in the age group 20-60 y, weighing 40-70 kg, irrespective of their Mallampati grades, were enrolled, while pregnant patients, patients with mouth opening less than 18 mm and patients with any oral pathology, neck flexion deformities and non-consenting patients were excluded. The subjects were divided into two groups, Group-AA (n = 35) was intubated using AA and Group-KC (n = 35) was intubated using KV (channeled).

After arrival of the patient in operation theatre, baseline reading of heart rate (HR), electrocardiography (ECG), pulse oximetry (SpO₂) and non-invasive blood pressure (NIBP) were recorded. Intravenous line was secured and patients were premedicated with midazolam 0.05 mg/kg IV, lignocaine 1 mg/kg IV and glycopyrrolate 0.005 mg/kg IV. After pre-oxygenation, anesthesia was induced with fentanyl 2 μ g/kg and propofol 2-3 mg/kg IV. After confirmation of adequate bag-mask ventilation, vecuronium 0.1 mg/kg was used for neuromuscular blockade. Bag and mask ventilation was done for 3 min.

The group allocation was done using the numerical order of a computer-generated randomization list. Allocation concealment was ensured with sealed envelopes. All intubations were performed using either Airtraq-Airview® (Group AA) or KV (channeled) (Group KC), according to the group allocated. One experienced anesthesiologist intubated and another one recorded the time taken for intubation with a stopwatch. Minimum 25 insertions with AA and KV each were done by the intubating anesthesiologist before starting the study. Endotracheal tube (ETT) size 7.0 mm internal diameter (ID) was used for female and 7.5 mm ID for male patients. The selected ETT was lubricated with lignocaine jelly and preloaded into the guide channel of the allocated device. patient's head was keeping in the neutral position and the laryngoscope was inserted in the midline from center of the tongue towards vallecula. ETT was advanced into the trachea with continue monitoring of glottis view in the monitor. the laryngoscope was separated from the ETT and removed from the mouth after intubation. ETT was connected to mechanical ventilator and carbon dioxide sample line. Three intubation attempts were allowed and in case of failed intubation, classic laryngeal mask airway would be used and the patient excluded from the study. Airway trauma was assumed if the blade was stained with blood. Anesthesia was maintained by vecuronium and sevoflurane, and reversed by neostigmine-glycopyrrolate. Total intubation time was defined as the time when the blade tip passed the incisors to the point until confirmation of the first wave of carbon dioxide on

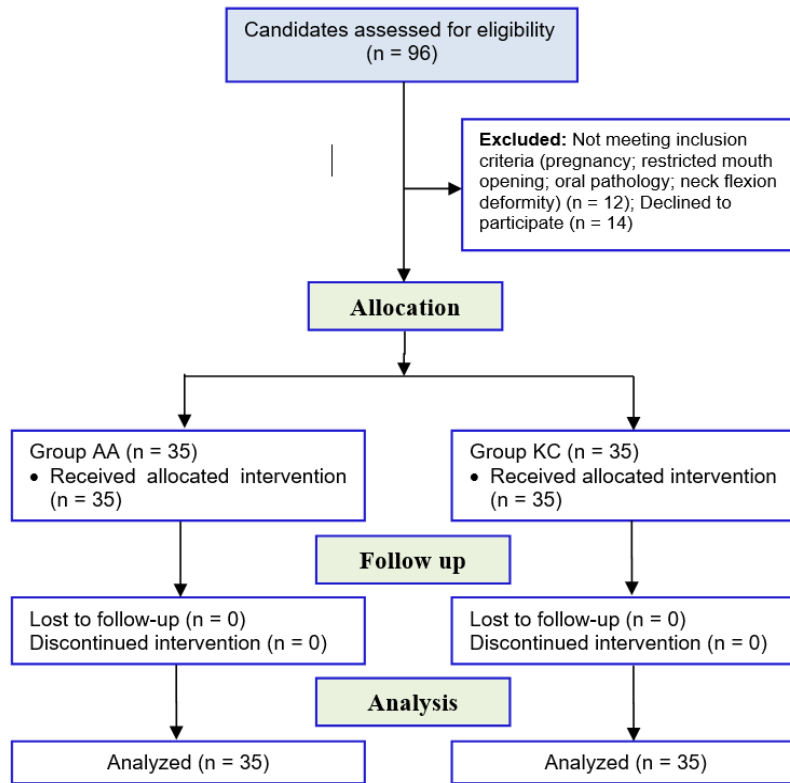


Figure 1: CONSORT flow diagram

the capnometer. Intubation was termed as failed if total intubation time exceeded 120 sec, or three intubation attempts failed. POGO score was the percentage of glottic opening seen, defined by the linear span from the anterior commissure to the inter-arytenoid notch, ranging from 100% when entire glottic aperture was visualized, to 0% when no glottic structure could be visualized.¹⁴ On the basis of views of the structures seen on laryngoscopy, CL grade was Grade-1, when a full view of glottis was visible; Grade-2, if only the posterior extremity of the glottis was visible; Grade-3, if no glottis was visible, but epiglottis was seen; and Grade-4, if neither glottis nor epiglottis could be seen.¹⁵

Five-point Likert scale was used to rate the degree of difficulty of intubation ranging from one to five; very easy = 1, followed by easy = 2, neutral = 3, difficult = 4 and very difficult = 5.¹⁶ Need for external laryngeal manipulations like BURP maneuver (backwards, upwards and rightwards pressure) to improve glottis view if required was noted as an optimization maneuver.¹⁷ Adverse effects such as airway trauma, esophageal intubation, bronchospasm and throat pain were also noted.

Statistical analysis

All statistical analyses were performed by using SPSS (Statistical package for the social sciences) 22.0 software

package (SPSS Inc., Chicago, IL, USA). Yates continuity correction test (Chi square test), Fisher's exact test and Fisher-Freeman-Halton test were used for comparison of qualitative data.

3. Results

Out of 96 patients who were evaluated for eligibility, 70 patients were analyzed in the study (Figure 1). All the patients were statistically comparable regarding demographic parameters, e.g., age, weight, sex, MPG, ASA (Table 1 and 2) ($P > 0.05$); and hemodynamic parameters, e.g., HR, NIBP, and SpO₂, in pre-induction, postinduction and post-intubation periods ($P > 0.05$). However, total intubation time was longer in Group-AA (23.34 ± 3.98 sec) than Group-KV (20.42 ± 2.90 sec). There was statistically significant difference in total intubation time ($P = 0.0008$) (Table 3). All the intubation attempts in both the groups were successful. Total number of laryngoscope insertion attempts were less in Group-KV than

Group-AA but the difference was statistically not significant ($P = 0.460$). Need for optimization maneuver such as external laryngeal manipulation was more in Group-AA (three patients) as compared to Group-KV (two patients) but difference was statistically not significant ($P = 1.000$). The CL score and mean POGO score were better in Group-KV than Group-AA but the difference was not significant statistically ($P > 0.05$). Thirty patients of Group-AA and thirty-two patients of Group-KV had CL grade-I, whereas five patients in Group-AA and only three patients of Group-KV had grade-IIa. The mean POGO score was also high in Group-KV (97.42 ± 6.10) as compared to Group-AA (95.71 ± 1.92), the difference was statistically significant ($P = 0.420$). Degree of difficult intubation (Likert scale) was found more in Group-AA than Group-KV however, there was no statistically significant difference ($P = 0.861$). The difference in the incidence of adverse effects such as airway trauma was statistically insignificant between the groups ($P = 1.000$). Other adverse effects such as esophageal intubation, bronchospasm and throat pain were not observed in any of the patient in both of the groups (Table 3).

Table 1: Demographic data of patients in both the groups

Parameter	Group AA	Group KV	P-value
Age (y)	41.88 ± 13.66	37.71 ± 13.09	0.196
Gender (Male %)	68.57	65.71	0.799
Weight (kg)	58.88 ± 10.57	60.4 ± 11.19	0.562
Height (cm)	157.6 ± 12.17	160.42 ± 10.86	0.308
BMI (kg/m ²)	23.20 ± 3.64	23.54 ± 4.41	0.725
ASA (I/II)	16/19	22/13	0.150
MPG (I/II/III/IV)	17/15/2/1	22/10/2/1	0.650

Table 2: Comparison of MPG in both the groups. Data presented as n (%)

MPG	Group AA	Group KV	P-value
I	17 (48.57)	22 (62.86)	0.228
II	15 (42.86)	10 (28.57)	0.212
III	2 (5.71)	2 (5.71)	1.386
IV	1 (2.86)	1 (2.86)	1.507
Total	35 (100)	35 (100)	-

Table 3: Total Intubation time of both the groups

Total intubation time(s)	Group AA	Group KV	P-value
17-20	8 (22.86)	22 (62.86)	0.0008
21-25	20 (57.14)	10 (28.57)	
26-30	5 (14.29)	3 (8.57)	
31-35	2 (5.71)	0 (0)	
Median	22	20	
Range	18-35	17-30	
Mean ± SD	23.34 ± 3.98	20.42 ± 2.90	
t value	3.4970		

Table 4: Observations

Variable	Group AA	Group KV	P-value
Total intubation time (seconds)	23.34 ± 3.98	20.42 ± 2.90	0.0008
Success rate	100%	100%	1.000
Need of optimization maneuver	8.57%	5.71%	1.000
Cormack & Lehane grade (I/IIa/IIb)	30/5/0	32/3/0	0.709
POGO score (%)	95.71 ± 1.92	97.42 ± 6.10	0.420
Difficulty of intubation on Likert scale (1/2/3/4/5)	25/5/5/0/0	27/4/4/0/0	0.861
No. of attempts of intubation (1/2/3)	28/6/1	31/4/0	0.460
Adverse effects (%) (Airway trauma)	5.71	2.86	1.000

4. Discussion

Very limited studies have been conducted on patients comparing AA and KV. In our study we compared the intubation efficacy of AA with that of KV(Channeled)

on adult patients undergoing elective surgeries under general anesthesia. Our main aim was to compare total intubation time (in sec). We also assessed success rate, number of attempts, need of optimization maneuvers, POGO-score, CL-score, degree of difficulty of intubation (Likert scale) and adverse effects. In our study, the mean total intubation time for Group-AA was more than Group-KV and was statistically significant. In a similar study comparing Airtraq (but without Airview) with KV, the results were similar.¹³ The time to secure airway was significantly longer when using Airtraq (38 ± 18 sec) compared to KV (26 ± 11 sec). However, Airview feature was not used in the study and the anesthetist had to look through an eyepiece to visualize the glottis in Airtraq group. This might explain prolongation of mean intubation time in that study in group-A (Airtraq), when compared to intubation time by Airtraq-Airview in our study. In a study done on mannequins comparing intubating conditions and ease of intubation between AA and KV, the results were contrasting to our study.¹⁸ They observed that the time necessary to identify glottis to insert the tube and inflate its cuff, and to ventilate the lungs was significantly shorter with the Group-AA than Group-KVC. The difference in the result of the above study may be explained by the fact that their study was done on mannequins who do not replicate normal human anatomy completely. Our study had 100% success

rate in both the groups while in a similar study all intubations performed with King Vision group were successful and only one intubation performed with Airtraq group was not successful (P > 0.05).¹³ The CL-view and POGO score obtained were reported better with the Group-KV in our study, however no significant

difference was found between the two groups ($P > 0.05$). Another study which included paramedics and compared Airtraq with KV in a tactical setting, CL views between different VLSs were comparable; although they used the Airtraq with its eyepiece, external viewing of the intubation process was not possible.¹⁹ Another study on mannequins, the pre-intubation CL was statistically better with KV although during intubation, CL were similar in the two groups.¹⁸ In our study successful single attempt intubations were more in Group-KV, and Group-AA had higher number of second and third attempts, but the difference was statistically insignificant ($P > 0.05$). The number of attempts was statistically lower with KV when it was compared to Airtraq without Airview.¹⁷ VLS facilitates easy visualization of the glottis without a direct line of sight reducing the need of optimizing maneuvers. Optimization maneuver requirement was less in Group-KV. Many authors have documented reduced need of optimization maneuvers in VLS groups compared to conventional laryngoscope group.^{7,20} Although one study did not report any difference in Likert scale,¹⁸ our study found higher difficulty in Group-AA although statistically the difference was insignificant, which might be explained by the fact that KV had the better indirect laryngoscopic view than AA. Some authors reported more airway trauma more in Airtraq group, which was not significant as reported in our study.¹⁷

5. Conclusion

Considering the results of statistical analysis of our study, it can be concluded that both Airtraq[®] Airview and King Vision[®] provide satisfactory intubation conditions, but use of King Vision[®] might be preferable for endotracheal intubation in adult patients undergoing elective surgery as it has shorter total intubation time, other parameters being similar to Airtraq[®] Airview.

6. Limitations of the study

1. The protocol did not allow blinding as it was impossible to conceal the airway device during insertion which was a possible source of bias.
2. This study was conducted in a single center. Results cannot be generalized to the population of other parts of the country or other countries.
3. Single user reflects only an individual skill level, which therefore, might not be representative for a larger population.

7. Strength of the study

Single user approach is the strength of the study as it reduces inter-individual skill differences and reduces bias.

8. Data availability

The numerical data generated during this research is available with the authors.

9. Conflict of interest

No external or industry funding was involved in the study.

10. Authors' contribution

MG: Concept and design of the study, acquisition, analysis and interpretation of data, drafting the paper, Final approval of the version

SS: Concept, revising the manuscript for intellectual content, final approval

DC: Interpretation of data, manuscript editing, final approval

CK: Analysis and interpretation of data, manuscript editing, final approval of the version

RK: Concept and design, revising it critically for intellectual content, final approval

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