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AIRTRAQ VERSUS KINGVISION VIDEOLARYNGOSCOPE: A COMPARATIVE STUDY EVALUATING THE TWO DEVICES AS AN AIDE TO INTUBATION

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ABSTRACT

Background & Aim: Prolonged laryngoscopy is associated with haemodynamic pertubances and can increase morbidity in high-risk patients. Many videolaryngoscopes are now available to the anaesthesiologist. This randomised controlled trial was undertaken to evaluate and compare two chanelled videolaryngoscpes, Airtraq (AQ) and KingVision(KV).

Material & Methods: 60 consecutive ASA physical status I - III patients, who were to undergo surgery requiring general anaesthesia & endotracheal intubation were enrolled & randomly assigned into Airtraq (AQ) & KingVision (KV) groups. Each group had 30 patients. Changes in haemodynamic variables at various intervals were recorded as the primary outcome. Other parameters such as time to view glottic opening, time to intubation, number of attempts to intubate, glottic views, requirement of external manuvers and adverse events were recorded. Results were compared among the study groups with the help of Fisher test, Student 't' test, Mann Whitney U test and Chi-Square test.

Result: The heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) values were comparable between both the groups for the time intervals recorded. There was no difference statistically in the adverse outcomes during laryngoscopy. Parameters like percentage of glottic opening (POGO) score and intubation difficulty score (IDS) were also similar. P <0.05 was considered statistically significant.

Conclusion: Both the video laryngoscopes, KingVision and Airtraq, were found to be comparable with each other in all respects as specified in this study. Personal preference of the clinician managing the airway and cost considerations could govern the choice between the two video laryngoscopes that were evaluated in this study.

KEYWORDS : Videolaryngoscope, Airtraq, KingVision.

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INTRODUCTION

Laryngoscopy and intubation form the core management skills of an anaesthesiologist. Prolonged laryngoscopy is associated with haemodynamic perturbances and can increase morbidity in high - risk patients. The aim of laryngoscopy is to obtain good visualization of the vocal cords to facilitate smooth endotracheal intubation and to minimise the apnoeic period during intubation to avoid undesirable responses. The hemodynamic response to laryngoscopy and intubation is regulated by the hypothalamic-pituitary-adrenocortical and sympathetic adreno-medullary response. As a result of which there is secretion of cortisol, norepinephrine, and epinephrine. The consequence of this neuro–endocrine system may vary from tachycardia, systemic hypertension and occasional dysrhythmias to life threatening problems such as angina, myocardial infarction and stroke. The hemodynamic response to laryngoscopy and intubation was first enunciated by King et al in 1951[1], although endotracheal intubation was being practised since its inception into anaesthesia by Rowbotham and Magill in 1921.[2]

One limitation of the use of the standard laryngoscopes is that they provide only a limited (keyhole) view through the mouth of the patient. A second limitation is that this view is available only to the intubating anaesthesiologist (laryngoscopist). Multiple controlled and prospective observational studies report that video laryngoscopes provide superior views of the glottis compared with direct laryngoscopy (DL) [3] and cause minimal movement of the cervical spine during intubation.[4] However, higher cost of these devices has limited their availability and use in most centres.

Many videolaryngoscopes are nowadays available for use to the clinician. The channelled variety have the potential to decrease the duration of laryngoscopy and intubation and, therefore, the consequent haemodynamic effects by offering the advantage of a "pre-loaded" endotracheal tube and, therefore, reducing the number of manuvers for successful intubation to the least. The Airtraq (Prodol Meditec S.A., Vizcaya, Spain) Optical Laryngoscope is a single - use device that is battery powered and portable. It has an L-shaped design and two channels, one for the optics and one a delivery channel for the introduction of the endotracheal tube. It has carved its niche since its introduction and has gathered enough evidence to be equated to conventinal laryngoscopy and has proven to be superior to it in difficult airway scenarios.[5]

The KingVision Video Laryngoscope is supposedly a less expensive alternative to other video devices. It utilizes disposable J-shaped blades with a video chip and light source at the tip, with a reusable head unit containing a video screen. The blades come either with an ETT channel to guide the ETT into the glottis, or without a channel if greater manoeuvrability is desired.

The present study was undertaken at our tertiary - care teaching hospital to compare the two videolaryngoscopes as an aid to intubation by evaluating the hemodynamic responses that occurred during tracheal intubation, the time taken and number of attempts for intubation, and soft tissue injury sustained.

METHODOLOGY

Institutional ethics committee clearance was obtained prior to proceeding with the study. All participants included in the study gave written informed consent. Sixty consecutive adult patients with American Society of Anaesthesiologists (ASA) Physical Status Grading ranging from I to III listed for surgery under general

anaesthesia with endotracheal intubation at our centre were randomly assigned to either the Airtraq (AQ) or KingVision (KV) videolaryngoscope groups. Patients undergoing emergency surgeries, those classified as ASA Grade IV and higher and those with known lesions involving the upper airway and vocal cords or with trauma to the airway were excluded from this study.

Patients were subjected to preoperative fasting as per existing ASA guidelines[6] and were premedicated with tablet alprazolam 0.25 mg and tablet Ranitidine 150 mg orally at 10:00 PM and 06:00 AM respectively on the night preceding and morning of surgery as per institutional protocol. All antihypertensive medications were continued till the morning of surgery except for angiotensin-converting enzyme inhibitors and angiotensin-receptors blockers. The patients were shifted to the operating room and were subjected to standard monitoring prior to induction of anesthesia as per the American Society of Anaesthesiologists (ASA) Minimum Monitoring Standards. Non-invasive Blood Pressure (NIBP) was measured over the brachial artery using an appropriately sized cuff cycled at 3-minute intervals. A wide - bore intravenous cannula was placed in a peripheral vein of the superior extremity and a balanced salt solution (Ringer`s Lactate) was infused as per fasting deficit and maintenance requirements. The patient was given injection fentanyl, 2mcg/kg, intravenously. General anesthesia was administered according to our institutional regimen. Anesthesia was induced with propofol (1.5 – 2 mg/Kg) in a running drip after 3 minutes of pre-oxygenation (100% oxygen 10l/min). After ensuring successful mask ventilation, vecuronium bromide was given (0.1mg/Kg), intravenously. The patient was ventilated using a bag and mask for three minutes. Endotracheal intubation was performed by using either of the two videolaryngoscopes predetermined by the random number table. The endotracheal tube was lubricated with 2% lignocaine gel prior to placement and was threaded over the intubating device. The parameters were recorded by a research assistant who was blinded to the chosen modality of endotracheal intubation. Heart rate and systemic blood pressure were recorded at pre-induction (baseline), post-induction and post-intubation at pre-defined time intervals. The pre-induction blood pressure and heart rate were recorded three times prior to commencement of the anesthetic sequence. The mean values obtained were taken as baseline. The post-induction heart rate and systemic blood pressure were noted at 1 minute after administration of vecuronium. Post-intubation parameters were obtained 2 minutes after tracheal intubation. The time from cessation of bag and mask ventilation till visualization of the glottic opening on the videolaryngoscope was recorded as 'time to view the glottic opening'. The research assistant started a stopwatch following the removal of mask & the time was counted till the appearance of $EtCO_2$ on the monitor. The percentage of glottic opening (POGO) score was taken as the mean score between the scores called out by the research assistant & the laryngoscopist. The Cormak and Lehane grade was determined by the laryngoscopist in all the patients. The 'number of attempts for intubation' were defined as any realignment or advancement of the tube after the first attempt. 'Failure to intubate' was defined as the failure to intubate the trachea with the preselected technique, removal of videolaryngoscope or change of intubation to alternative technique. 'Sore throat' was defined as per the subjective feeling of throat discomfort by the patient six hours post-operatively. 'Tissue injury' was defined as smearing of tissues at tip of the videolaryngoscope or evidence of bleeding at the tip of the laryngoscope.

The study was designed and conducted as a prospective study. The sample size was calculated (n=26) based on previous studies[14] with confidence limits at 95 percent and power at 80 % with a ratio of sample size being 1/1 for the two groups. The data gathered were statistically analyzed using standard SPSS software. A *'p'* value of less than 0.05 was taken as significant. Details of the various statistical tests are mentioned in the following section.

RESULTS

The physical characteristics of the patients were found to be comparable in both the study groups (Table 1). The age (p=0.847) & BMI (p=0.394) of the patients between the two groups were statistically comparable (Student's 't' test) as were the gender distribution (p=0.791), comorbidities (p=0.998) & Cormack-Lehane (p=0.518) (Fisher's test). The ASA Grading (p=0.719) and Mallampati classification (p=0.518) of the patients between two groups were compared using the Chi-Square test and no significant differences were determined.

Table 1: Demographic characteristics of patients.

Parameter (Mean ± SD)	AQ	KV	*'p' value*
Age	37.87 ± 14.94	38.63 ± 15.56	0.847
Sex – Male	19 (63.3%)	18 (60%)	0.791
Sex – Female	11 (36.7%)	12 (40%)	
BMI (Mean)	21.91 ± 3.41	22.67 ± 3.44	0.394
ASA Grading			
I	21 (70%)	18 (60%)	0.719
II	6 (20%)	8 (26.7%)	
III	3 (10%)	4 (13.3%)	
Mallampati Classification			
I	25 (83.3%)	23 (76.7%)	0.518
II	5 (16.7%)	7 (23.3%)	

AQ, Airtraq; KV, Kingvision.

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The heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) values were a found to be comparable between both the groups (Student t-test) at all specified time intervals (Table 2).

Table 2: Haemodynamic response to intubation following standardised induction.

Parameter (Mean ± SD)	AQ	KV	*'p' value*
Heart Rate (beats/min)			
Baseline	80.57 ± 11.19	81.87 ± 9.17	0.624
Post Induction	71.33 ± 10.63	72.13 ± 8.14	0.745
Post intubation	81.97 ± 8.60	80.93 ± 6.45	0.598
Systolic Blood Pressure (mm of Hg)			
Baseline	118.53 ± 8.67	117.23 ± 8.14	0.552
Post Induction	111.17 ± 7.63	113.87 ± 7.76	0.179
Post intubation	114.27 ± 8.43	112.23 ± 7.44	0.324
Diastolic Blood Pressure (mm of Hg)			
Baseline	79.13 ± 8.32	78.77 ± 7.42	0.860
Post Induction	76.57 ± 7.15	74.93 ± 8.83	0.432
Post intubation	77.80 ± 7.70	79.47 ± 7.64	0.402
Mean Blood Pressure (mm of Hg)			
Baseline	95.57 ± 8.22	98.93 ± 8.41	0.123
Post Induction	93.43 ± 7.81	91.47 ± 7.57	0.328
Post intubation	94.87 ± 7.76	98.57 ± 7.22	0.608

AQ, Airtraq; KV, Kingvision; Student 't' test.

In AQ group, success in the first attempt was noted in 25 (83.3%) patients. The mean percentage of glottic opening and IDSS was 91.23±6.89% and 1.93±1.31 respectively. In KV group, success in first attempt was noted in 27 (90%) patients. The mean percentage of glottic opening and IDSS was 92.77±5.55% and 1.77±1.43 respectively. There was no case of failed intubation in both the groups. There was no significant difference between the groups with respect to these parameters (Mann Whitney U test).

The external manoeuvre applied for intubation in AQ group and KV group was 5 and 3 respectively (Table 3) and the difference between the groups was insignificant as per Fisher's test (p=0.518). The Cormack–Lehane (CL) grade of patients between two groups were comparable and statistically not significant as per Fisher's test (p=0.518).

The mean time to view glottic opening in AQ group was 24.37 ± 4.16 seconds and in KV group was 22.93 ± 4.68 seconds. There was statistically no significant difference between the two groups (Table3) as per Student's t-test (p=0.213). The mean time to intubate in AQ group was 33.27 ± 4.84 secs and in KV group was 32.23 ± 4.52 secs. There was statistically no significant difference between the two groups as per Student's t-test (p=0.393).

The number of attempts to insert the endotracheal tube is statistically not significant (Table3) as there were 5 (16.7%) cases of two attempts in AQ group and 3 (10%) cases of two attempts in KV group (p=0.518).

Table 3: Airway performance

Parameter (Mean ± SD)	AQ	KV	*'p' value*
CL grade			
Grade I	25 (83.3%)	23 (76.7%)	0.518
Grade II	5 (16.7%)	7 (23.3%)	
No of attempts			
1	25 (83.3%)	27 (90%)	0.518
2	5 (16.7%)	3 (10%)	
POGO Scores	91.23 ± 6.89	92.77 ± 5.55	0.459
IDSS	1.93	1.77	0.459
External Manoeuvre Applied	5 (16.7%)	3 (10%)	0.707
Time to View Glottic Opening (secs)	24.37 ± 4.16	22.93 ± 4.68	0.432
Time to intubate (secs)	33.27 ± 4.84	32.23 ± 4.52	0.393

There was no difference in the laryngopharyngeal morbidity (Table 4). In the AQ group, 5 (16.7%) patients had sore throat while 4 (13.3%) patients had bleeding or mucosal injury. In KV group, 3 (10%) patients had sore throat while 2 (6.7%) patients had bleeding or mucosal injury.

Table 4: Airway morbidity

Parameter (Mean ± SD)	AQ	KV	*'p' value*
Sore throat	5 (16.7%)	3 (10%)	0.706
Bleeding or Mucosal injury	4 (13.3%)	2 (6.7%)	0.670

DISCUSSION

It is well known that the stimuli to airway structures are the main causes for circulatory responses to tracheal intubation[7]. Laryngoscopy itself is one of the most invasive stimuli during endotracheal intubation[8,9]. Many anaesthesiologists agree that a skilled anaesthesiologist applies only a small force to the patient's larynx when using a laryngoscope and that reducing the force on the larynx might prevent excessive hyperdynamic responses to endotracheal intubation[10].

The Airtraq & KingVision Videolaryngoscopes have been individually evaluated with direct laryngoscopy with various blades Macintosh, Miller and McCoy blades and in scenarios like patients with immobilized cervical spine**.** [11,12]. Videolaryngoscopes have also been evaluated in high - risk cardiac surgical patients against direct laryngoscopy.[13,14] One large study has been done amongst the videolaryngoscopes in simulation of difficult airway scenario but it mainly focused on intubation characteristics without evaluating the haemodynamic parameters.[15]

Our study helps bridge the gaps in the scientific domain by addressing the paucity of literature comparing the use of the two different types of videolaryngoscopes. It is observed in our study that the heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) values were comparable when either of the two studied devices was used for intubation. Similar observations were noted in the studies of Gavrilovska-Brzanov A et al[14], Barman TK et al[16] and Maharaj CH et al [11]. The changes in heart rate and blood pressure from baseline to post intubation were minimal and, therefore, reflective of the advantage that these videolaryngoscopes may offer in decreasing the haemodynamic response to endotracheal intubation.

This finding probably results from the fact that the Airtraq® & KingVision requires reduced traction to lift the mandible [17,18] and provides a view of the glottis without the need to align the oral, pharyngeal and tracheal axes, and, therefore, requires less force to be applied during laryngoscopy [11]. In addition, the passage of the tracheal tube through the vocal cords is atraumatic due to good glottis visualization and alignment of the tube to the axis of the trachea[17,18].

In the present study the AQ Group had 25 (83.3%) and 5 (16.7%) patients with Cormack–Lehane (CL) Grade I and II respectively while the KV Group 2 had 23 (76.7%) and 7 (23.3%) patients with CL Grade I and II respectively. These differences were not statistically significant. The CL Grade scores did not increase the difficulty in intubation as 25/30 (83.3%) intubations were done in the first attempt in the AQ group whereas 27/30 (90%) were successful in the KV group. These findings were consistent with the studies of Kleine-Brueggeney M et al[15] and Maharaj CH et al[11]. Further, Percentage of Glottic Opening (POGO) scores were identical for the two groups (91.23 % for AQ and 92.77% for KV group). Intubation Difficulty Scoring System Scores (IDSS) were also identical.

External manoeuvre was applied in the AQ & KV groups where intubation was successful in the first instance (5/30 for AQ, 3/30 in KV). There was no case of not been able to intubate any patient in any group. This is similar to the studies of Kleine-Brueggeney M et al [15] and Maharaj CH et al[11].

In our study, the mean time to intubate in AQ group was 33.27 ± 4.84 secs and in KV group was 32.23 ± 4.52 secs, the difference being statistically insignificant. This is in concordance to the studies of Gavrilovska-Brzanov A et al[14], Kleine-Brueggeney M et al[15] and Barman TK et al[16].

It was observed in our study that in the AQ group, 5 (16.7%) patients had sore throat while 4 (13.3%) patients had bleeding or mucosal injury. In KV group, 3 (10%) patients had sore throat while 2 (6.7%) patients had bleeding or mucosal injury. Kleine-Brueggeney M et al[115] noted similar observations in his study.

The authors acknowledge the limitations in this study. The anaesthesiologist performing the videolaryngoscopy could not be blinded to the device being used. Patients with known difficult airways and those with lesions involving the upper airway and vocal cords were excluded from this study .

CONCLUSION

The present study did not elucidate any significant differences in the use of the two different video laryngoscopes in terms of ease of intubation and adverse haemodynamic derangements. The Cormack – Lehane grades, percentage of glottic opening (POGO) scores, intubation difficulty score (IDS), first-pass success, number of attempts, requirement of external laryngeal manoeuvres and time to intubate were similar for both devices. The heart rate, systolic blood pressure, diastolic blood pressure & mean arterial pressure showed comparable changes post - intubation and no significant differences could be determined between patients intubated with either of the two videolaryngoscopes. The incidence of adverse outcomes such as bleeding and mucosal injury during intubation and post - operative sore throat were also found to be similar in this study. Hence, both the video laryngoscopes, KingVision and Airtraq, were found to be comparable with each other in all respects as specified in this study. Therefore, cost considerations and individual preferences may influence the laryngoscopist while choosing between Airtraq and Kingvision videolaryngoscopes.

DECLARATIONS

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