

Evaluation of King's vision videolaryngoscope and glidescope on hemodynamic stress response to laryngoscopy and endotracheal intubation

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Abstract

Background and Aims: We hypothesized that the use of novel airway devices would decrease hemodynamic stress response (HDSR) to laryngoscopy and endotracheal (ET) intubation. The aim of our study was to evaluate the hemodynamic stress response (HDSR) to laryngoscopy and tracheal intubation using the King vision video laryngoscope (KVVL) versus glidescope (GLS).

Material and Methods: A prospective randomized, comparative study that was conducted on 80 patients of both sexes; American Society of Anesthesiologists physical status I and II with no anticipated difficult airway, aged 20–60 years; who were scheduled for elective surgical procedure under general anesthesia. Patients were randomly allocated into two groups (40 each). Group I: laryngoscopy and tracheal intubation were carried out using KVVL, Group II: laryngoscopy and tracheal intubation were carried out using GLS. The two groups were compared for noninvasive hemodynamic data such as heart rate and mean arterial pressure. Time to successful intubation and number of attempts were recorded. Hemodynamic parameters were recorded at the preinduction, after induction, at intubation, 1 min, 3 min, 5 min, 10 min, and 15 min.

Results: There was significant decrease ($P < 0.05$) in HR and MBP in both groups just before intubation. In comparison with the baseline, HR and MBP in group I and group II increased but this difference was not significant at 3 min and 5 min after intubation and returned to the baseline at 10 min after intubation and below the baseline at 15 min after intubation. Also, there were no significant differences in the hemodynamic response between the studied groups.

Conclusion: Novel airway devices either KVVL or GLS are efficient in reducing HDSR to laryngoscopy and ET intubation.

Keywords: Endotracheal intubation, glidescope, hemodynamic stress response, the King Vision video laryngoscope

Introduction


Airway manipulation during endotracheal (ET) intubation results in tracheolaryngeal, epipharyngeal, and parapharyngeal nociceptors stimulation leading to significant increase of catecholamine levels that causes hemodynamic stress response (HDSR) to ET intubation.^[1]

HDSR may be dangerous in susceptible patients having poor cardiac function or with other cardiac diseases, such as those with hypertension, coronary artery disease, cerebrovascular disease and intracranial aneurysm, and may lead to arrhythmias, myocardial infarction, left ventricle failure, or aneurysm rupture. The degree of the HDSR is different and related to the force used during the glottis visualization and the airway manipulation during ET intubation.^[2] Recently,

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there are novel videolaryngoscopes that do not require airway manipulation like upward or forward force to optimize glottis vision during ET intubation. The glidescope was developed in 2001 by John Pacey of Canada.^[3] This video laryngoscope can provide an enlarged video image of airway constructions.^[4]

The King Vision video laryngoscope (KVVV) is an indirect laryngoscope, which produces glottis visualization without vertical alignment axes of the oral, pharyngeal, and tracheal structures.^[5]

The KVVV consists of 2.4 inch reusable display and a disposable rigid blade. Two types of blade are present: one is a channeled one which allows ET tube to be advanced through the glottis, and the other blade is a non-channeled one that just permits glottis visualization, and ET intubation is helped by a metal stylet.^[6]

The objective of this study was to evaluate hemodynamic stress response (HDSR) to ET intubation using the KVVV versus glidescope (GLS). We hypothesised that the use of novel airway devices would decrease hemodynamic stress response (HDSR) to laryngoscopy and ET intubation.

Material and Methods

This is a prospective, randomized, and comparative study conducted at our university hospital and carried out on 80 adult patients of both sexes during the period from December 2017 to May 2018 after approval from the hospital Ethical Committee and written informed consent of the patient were taken. We followed The CONSORT 2010 statement in reporting this clinical trial.

Inclusion criteria were American Society of Anesthesiologists (ASA) physical status I–II with no anticipated difficult airway, age between 20 and 60 years, Mallampati class 1 and 2 and patients scheduled for elective surgical procedure under general anesthesia.

Exclusion criteria were known allergy to the anesthetic agents, history of major psychiatric disorders, cervical spine injury, history of substance abuse and current opioid use, increased intracranial pressure, history of gastroesophageal reflux needing rapid sequence induction, hypertension, ischemic heart diseases, those on drugs with cardiovascular effects and whom intubation attempts lasted longer than 15 s (unanticipated difficult intubation).

Randomization was carried out through a computer-generated, random number schedule. The random number schedule was generated by means of the QuickCalcs (GraphPad Software Inc., La Jolla, CA, USA). The group assignment numbers were

sealed in an opaque envelope and kept by the supervisor of the study. After the written consent was taken, the opaque envelope was unsealed to detect which airway device would be used.

Patients were allocated randomly into two groups (40 each): Group I: ET intubation was carried out using KVVV, Group II: ET intubation was carried out using GLS.

All patients were intubated with ET tube internal diameter 7 mm for adult female and 7.5 mm for adult male and with a low-pressure, high-volume cuff (Kendall Curity tracheal tube, MA, USA).

All patients were fasting for at least 8 h. In the operating room, all patients received antibiotic prophylaxis with ceftriaxone 1 g intravenously within 1 h prior surgical procedure. All patients were premedicated by midazolam 0.02 mg/kg I.V. Baseline parameters, such as heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were recorded by the anesthetist who was blinded about the type of airway device used (most of the data was recorded and printed by an electronic device). All patients were preoxygenated with 100% oxygen for 3 min via gently placed anesthesia face mask. Induction of anesthesia was carried out by IV fentanyl 2 mcg/kg, propofol 2 mg/kg, and rocuronium 0.6 mg/kg to facilitate ET intubation, then rocuronium 0.15 mg/kg IV was given as a maintenance dose. Anesthesia was maintained with sevoflurane two Minimum Alveolar Concentration (MAC) in 100% oxygen. Mechanical ventilation of the lungs was performed and the concentration of end-tidal carbon dioxide was kept between 30 and 40 mmHg. No surgical stimulation or any other type of stimulus was applied throughout the 15 min period of study. Hemodynamic parameters and any adverse effect were recorded at 1 min, 3 min, 5 min, 7 min, 10 min, and 15 min after ET intubation. All the ET intubations were carried out by a well-trained anesthetist with more than 10 years' experience in the field of specialty, also with more than 50 successful ET intubations with both airway devices. Cessation of the attempt was done if SpO₂ decreased below 92% or caused trauma of airway as blood stain over the blade of the airway device. Manual ventilation was carried out in between the trials. Failed ET intubation was considered if two attempts were unsuccessful or if malfunction of airway devices after that algorithm of failed intubation was followed.^[7] Intubation time was measured from the time the airway device blade entered the mouth till the end-tidal CO₂ tracing was observed on the monitor after mechanical ventilation commenced. Laryngoscopy and ET intubation was performed according to the patient's group. Attempts number, external assist maneuvers, and any complications as airway trauma, bronchospasm, esophageal intubation, or desaturation were recorded. The primary outcome was the hemodynamic changes

and the secondary outcome were intubation time, the numbers of intubation attempt, external assist maneuvers, and the incidence of postoperative sore throat.

Statistical analysis

Sample size calculation was carried out by using Epi-Info software statistical package made by World Health organization and Center for Disease Control and Prevention, Atlanta, Georgia, USA version 2002. The following criteria were used for calculation of sample size: 95% confidence and 80% power. Sample size and power of analysis was calculated on the basis of previous study^[5,6] to detect 20% difference in hemodynamic as BP and HR, it was necessary to include 37 patients per group, Therefore, we decided to recruit 40 patients per group to compensate for those dropping out during the study. The Windows version of SPSS 17.0 (SPSS Inc., Chicago, IL) was used for statistical analysis. The Kolmogorov–Smirnov test was used to verify the normal distribution of continuous

variables. Normally distributed continuous variables were compared using unpaired Student’s *t*-test.

All results presented in form of mean ± standard deviation (SD). Descriptive data were analyzed by two-tailed Student’s *t*-test. HR, systolic, diastolic, and mean blood pressures analysis were performed using a repeated-measures analysis of variance. Pearson’ Chi-square test was used to analyze categorical variables. Power of significance (*P* value < 0.05) was considered statistically significant.

Results

Out of the 93 patients who were evaluated for eligibility, 80 adult patients were enrolled in the study, and the results of 80 patients were analyzed. Both groups were comparable in demographic variables with respect to age, gender,

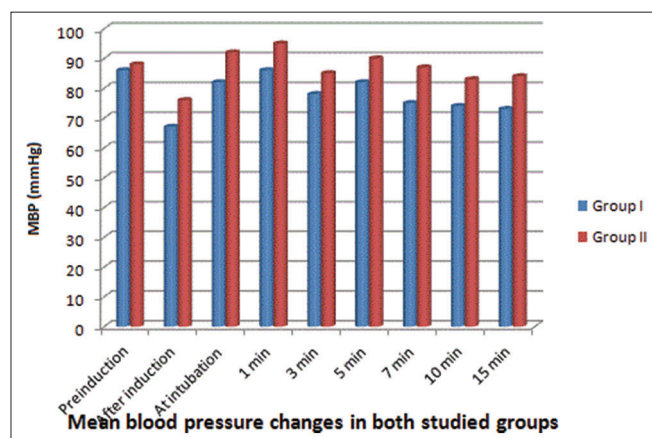


Figure 1: Heart rate changes (beat/min) in both studied groups

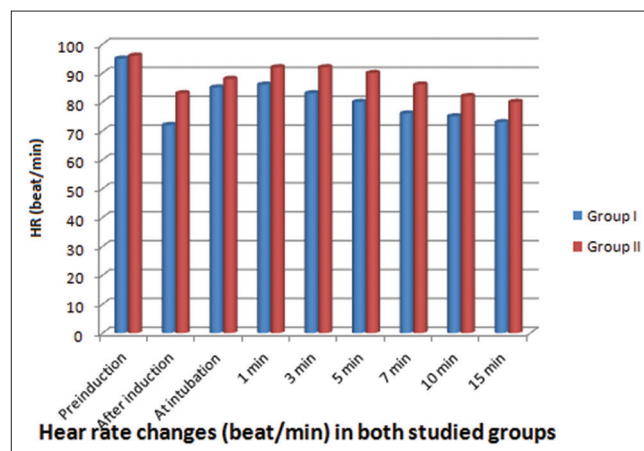


Figure 2: Mean blood pressure changes (mmHg) in both studied groups

Table 1: Demographic variables, airway characteristics, and preinduction hemodynamic variables

Variables	Group I (n=40)	Group II (n=40)	df	95% confidence interval		P
				Lower	Upper	
Age (years)	40.7±7.4	42.6±6.6	77	-5	1.2	0.2
Gender (M:F)	19:21	15:25	1			0.4 ^a
(BMI)	29.6±1.8	29.4±1.0	65	-0.5	0.9	0.5
ASA (I:II)	23:17	21:19	1			0.7 ^a
Mallampati class 1/2/3/4	32/7/1/0	34/5/1/0	1			0.8 ^a
Thyromental distance (mm)	75.8±10.6	77.4±9.9	78	-6.1	3	0.5
ET intubation time (sec)	41.8±10.8	42.7±12.3	77	-6	4.2	0.7
Number of first attempts for intubation	39	38	71	-0.11	0.06	0.6
The lowest SpO ₂ (%) at the time of ET intubation	95.9±2.9	95.1±2.5	76	-0.41	2	0.2
End-tidal CO ₂ at time of ET intubation (mm Hg)	37.1±1.2	37.6±1.7	69	-1.1	0.18	0.2
Need of external neck manipulation	7	9	1			0.6 ^a
Preinduction (HR) b.p.m	94.7±3.2	95.6±3.4	78	-2.4	0.6	0.2
Preinduction (MBP) mm Hg	86.0±2.0	86.7±3.5	78	-1.9	0.6	0.3
Incidence of postoperative sore throat	16	23				0.01

^aDenotes statistically significant *P*<0.05 Body mass index (BMI), Heart rate (HR), Systolic blood pressure (SBP), Diastolic blood pressure (DBP), Mean blood pressure (MBP), n=number of patients in each group, SD=Standard deviation. All values expressed as mean±Standard deviation, b.p.m=beats per minute, SPO₂=Oxygen saturation by pulse oximeter. ^atest was performed by Chi-square test. df: Degree of freedom

body mass index (BMI), ASA physical status, airway characteristics as regards Mallampati class 1/2/3/4 and thyromental distance (mm), preinduction hemodynamic variables as regards preinduction HR, MAP, attempts' number for successful ET intubation, the lowest SpO₂ during ET intubation, end-tidal CO₂ at the time of ET intubation, and other airway parameters [Table 1]. Time taken to intubation was comparable between GLS and KVV [42.7 (12.3) vs. 41 (10.8) min, $P = 0.7$]. Also, there was more need for external neck manipulation with GLS but the differences between groups were statistically insignificant. Patients in group I (KVV group) had statistically significant lower incidence of postoperative sore throat than group II (GLS group) and no failure of intubation was recorded [Table 1].

There was significant decrease ($P < 0.05$) in HR and MBP in both groups just before intubation and it was due to induction of anesthesia [Figures 1 and 2]. In comparison with the baseline HR and MBP in group I and group II increased but this difference was not significant at 3 min and 5 min after intubation and returned to the baseline at 10 min after intubation and below the baseline at 15 min after intubation. Also, there were no significant differences in the hemodynamic response between the studied groups.

Discussion

Laryngoscopy and ET intubation are associated with hemodynamic changes and lead to increase in HR and BP which may cause harmful complications with these HDSR responses.^[8] Video laryngoscope leads to optimum visualization of airway constructions via magnified video image.^[9]

The major findings of the present study were that: In comparison with the baseline values, HR and MBP in group I and group II increased but this difference was not significant at 3 min and 5 min after intubation and returned to the baseline at 10 min after intubation and below the baseline at 15 min after intubation. Also there were no significant differences in the hemodynamic response between the studied groups. Intubation time was slightly longer with GLS as compared to KVV. Moreover, there is more need for external neck manipulation with GLS but the differences between groups were statistically insignificant. Patients in group I (KVV group) had statistically significant lower incidence of postoperative sore throat than group II (GLS group) and no failure of intubation was recorded.

Aqil^[10] assessed hemodynamic response to tracheal intubation performed by GLS and found no statistically significant difference in hemodynamic response to intubation. Another study by Elhadi *et al.*,^[6] compared the Macintosh laryngoscope with the KVV in ET intubation and demonstrated that the KVV was more effective in decreasing hemodynamic stress responses to ET intubation, optimizing the laryngoscopic view with increasing success rate, performing ET intubation, and decreasing the need of external maneuvers throughout ET intubation.

Also in agreement with our results, Lee *et al.*,^[11] compared The Pentax-AWS, Glidescope videolaryngoscope, and KVV for difficult airway intubation and found that time for tracheal intubation was shorter with KVV than Glidescope.

Kanchi *et al.*,^[12] evaluated if the indirect video laryngoscope has any benefits over conventional laryngoscopy and ET intubation in cardiac patients and in contrast to our study, they demonstrated that videolaryngoscope did not provide any advantages in hemodynamic stress response to ET intubation. However, the patient sample was heterogeneous and Pentax-AWS was used.

Also, in contrast to our results, Al-Ghamdi *et al.*,^[13] evaluated the efficacy of different type of videolaryngoscopes on the time to tracheal intubation and concluded that KVL required longer time to tracheal intubation than glidescope and this difference can be explained by the use of videolaryngoscopes by anesthesiologists with limited experience, while in the same study the incidence of postoperative sore throat was in accordance to our results.

No failure of intubation or significant airway complications was recorded in our study. In accordance with our results Ali *et al.*,^[14] observed less airway trauma when using KVL which may be related to the absence of airway maneuver and having a soft blade. However, in contrast to our results, Jagannathan *et al.*,^[15] compared KVL with the Miller laryngoscope and demonstrated that complications were not significantly different between devices. Also, Soliman *et al.*^[16] reported increased incidence of airway trauma and bleeding due to ET intubation with GlideScope than with Macintosh laryngoscope.

Limitation of the study: first, the HDSR was not studied in high-risk subjects as cardiac and hypertensive patients or patients with anticipated or actual difficult intubation. Second, we did not rely on objective method for studying HDSR of ET intubation as plasma catecholamine levels. Third, the potential for bias presents, as it is impossible to blind the anesthetist to the airway device being used. To solve this problem, we chose a reasonably well-experienced anesthetist and the data were

recorded and printed by an electronic device, so, the potential of bias can be reduced.

Conclusion

Novel airway devices either KVV or GLS are efficient in reducing HDSR to laryngoscopy and ET intubation.

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Conflicts of interest

There are no conflicts of interest.

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