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ORIGINAL ARTICLE

Comparison of hemodynamic changes in patients using conventional laryngoscopy and video laryngoscope in surgery

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Abstract

Introduction: One of the complications of laryngoscopy and endotracheal intubation is sympathetic stimulation with hemodynamic changes that are always tried to be avoided by anesthesiologists. The aim of this study is to review and compare hemodynamic changes caused by both conventional and video laryngoscopy.

Methods: In this clinical trial performed in 2015 in the Birjand-based Imam Reza Hospital, a total of 42 patients were enrolled by census, 21 patients were intubated by direct laryngoscopy and 21 using video laryngoscope. The mean arterial blood pressure, systolic and diastolic blood pressure, pulse rate, and arterial oxygen saturation 2 minutes after induction and after intubation were checked. The data were subsequently analyzed in SPSS software (version 22) using independent T-test and Chi-square. The significant level was set at $P < 0.05$.

Results: According to the findings in this study, the average score of systolic blood pressure after direct intubation was significantly higher than intubation by glidescopy (139.00±22.47 versus 90.00±16.89). The mean arterial blood pressure after intubation by glidescopy was 96.34±13.16 and in direct laryngoscopy, it was 101.60±15.53 with no significant difference between the two. The mean heart rate in the glidescopy group was 104.86±15.79 and in the laryngoscopy group, it was 104.48±16.37, which is not significantly different between the groups.

Conclusions: Compared with video laryngoscopy, the direct laryngoscopy can significantly increase the mean systolic arterial blood pressure in patients, which can lead to fatal complications. Therefore, it is advisable to use glidescopy technique for intubation in high-risk patients.

Key Words: Hemodynamics; Intubation; Laryngoscopy; Surgery

Introduction

The first bronchoscopy was performed in 1879 by Killian, and endotracheal intubation with a direct vision by stiff laryngoscope initiated in 1912 (1).

In 1943, the Macintosh Laryngoscope was introduced, and anesthesiologists noticed simplicity of its application in the process of intubation; thereafter, most tracheal intubations have been performed with the Macintosh laryngoscope (2,3).

In 1964, the Fiber Optic Bronchoscope was made by Ikeda; this bronchoscope is a simple instrument although its application requires special skills (1). This intubation method was very

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limited at the beginning and was used in cases of airway problems, instability, and fracture of the cervical vertebrae. However, application of flexible fibro-optic bronchoscopes as well as other methods of intubation based on direct digital vision has currently become more prevalent as the skills of anesthesiologists have developed (4,2). Meanwhile, the latest intubation method is video laryngoscopy.

The glidescope is a video device for the throat and laryngeal entrance and used for emergency patients with respiratory problems.

Such laryngoscopes are equipped with LCD monitors and CCD cameras that make the intubation and vision of the respiratory tract easier and more successful in the first attempt and increase chances of life preservation (5).

One of the complications in laryngoscopy and intubation is sympathetic activation and hemodynamic changes (HR, BP), which discourage anesthesiologists from using the device as far as possible. Other complications of laryngoscopy and endotracheal intubation are damages to the lips, teeth, tongue, epiglottis, larynx, vocal cords, airway edema, hoarseness and bleeding (7,6). The incidence and severity of these complications depend on the selected technique (2).

Since the introduction of modern intubation techniques that provide direct vision, several studies on the difference between endotracheal intubation by laryngoscope and these procedures have been carried out. The main advantages of modern intubation reside with its application in complicated airway intubation, in fracture and instability of cervical vertebrae, the impossibility of performing laryngoscopy, and prevention from trauma to the patient (9,8).

There are also numerous studies on hemodynamic changes following intubation with new methods. Some believe that hemodynamic changes are significantly less in endotracheal intubation by video laryngoscopy than by direct laryngoscopy (6,8,9).

Other researchers believe that there is no significant difference in hemodynamic changes following these two methods (6,8,12,10).

In some studies, it has been also reported that not only there is no significant difference between these two methods, but because of the faster intubation by laryngoscopy using the Macintosh laryngoscope, it has a preference to modern and visual methods (13,14).

Building on what went above, the aim of this study was to compare the effects of conventional laryngoscopy and video laryngoscopy as one of the newest methods of intubation in anesthesia on the hemodynamic system.

Methods

This study is a double-blind clinical trial (code#IRCT2016102718063N4) where the patients and experts who analyze the collected data were unaware of the study groups and therefore they did not have information about the intubation method. The study was performed in Imam Reza Hospital of Birjand during winter of 2015, after obtaining permission from the Ethics Committee (code#Ir.bums.1394.361).

The statistical population consisted of all patients who were candidate for non-emergency surgery (n=42 patients). Based on the study of DowlatAbadi and Jalali (15) and according to the sample size formula, the sample size for each group was calculated as 21 individuals. Twenty-one individuals were intubated by direct laryngoscopy and 21 patients were intubated by video laryngoscopy

The criteria for entering the study (inclusion criteria) included age 18 to 50 years; patients undergoing non-emergency surgery (elective) and class I and II in terms of the American Anesthetic Association (ASA) classification; absence of a variety of systemic diseases as high blood pressure, diabetes, asthma, and COPD; lack of drug abuse; patients with mallampathi score equal or less than 2; and BMI less than 35. Also, no limitation of neck movements and the absence of other intubation problems were considered as criteria for entering the study.

The criteria for withdrawal from the study were the patient's request at any stage for leaving the study and the duration of the intubation more than 15 seconds.

After considering the inclusion and exclusion conditions, the objectives of the study design and the disadvantages and advantages of the two methods of intubation were fully described to all patients. Thereafter, written informed consents were obtained from the patients to participate in the project. The patients were selected by census and randomized into study groups using two groups of cards (A: Direct laryngoscopy and B: video laryngoscopy).

Individuals in both groups were NPO (nothing by mouth) at least 8 hours before surgery (no food was consumed by mouth). Before anesthesia, 3 ml/kg ringerlactate infusion was given to all patients. Then, 1 mg of midazolam and 3 ml/kg of fentanyl were injected intravenously. Two minutes later, an anesthetic induction with 4 mg/kg thiopental and 0.5 mg/kg atracurium was performed. Three minutes after injection of atracurium, intubation was performed.

For patients in the first group, direct laryngoscopic intubation was performed and for patients in the second group, intubation by video laryngoscopy was performed. Cardiac rhythm with lead II in a standard ECG was monitored, and saturation of arterial oxygenation (SPO2) and NIBP were checked by a pulse oximetry and Saadat monitors and a noninvasive method. Systolic and diastolic blood pressure, mean arterial blood pressure, heart rate (HR) and SPO2 were measured and recorded two minutes after induction of anesthesia and immediately after intubation. Then, in accordance with the routine monitoring during operation, vital signs were monitored every 5 minutes.

All the data were analyzed using SPSS software (version 22) using independent t-test and Chi-square at the significance level of 0.05. Also, all intubations with either a conventional laryngoscopy or video laryngoscopy were performed by the same anesthetist.

Results

In this study, a total of 42 patients were incorporated (21 in the direct laryngoscopy group and 21 in the video laryngoscopy group).

The surgical type for all participants according to the inclusion conditions was elective and the patients who required emergency surgery were excluded. In general, 24 (57.1%) were male and 18 (42.9%) were female. In this study, 33 (78.6%) of the study sample resided in the urban areas and 9 (21.4%) were in the rural areas. The mean age of the participating patients was 35.45 ± 10.70 years with a minimum of 18 and a maximum of 50 years. The average age of glidescopy group was 36.86 ± 9.86, and in the direct laryngoscopy, it was 34.05 ± 11.55 years.

In the glidescopy group, the biggest portion of patients was in the age group of 38 to 42 years (23.8%). As for the direct laryngoscopy group, they were mostly in the age group of 23 to 27 years (28.6%). There was no significant difference between the two sexes, place of residence, and age in the two groups in terms of demographic characteristics (p >0.05) (Table 1.) To analyze the inferential data, the data were normalized using the Smirnov's Kolmogorov test and the data normalization was confirmed. The mean systolic blood pressure of patients two minutes after induction was not significantly different in both methods. However, after intubation, it was significantly higher in the direct laryngoscopy group than the laryngoscopey group (p<0.05) (Table 2).

Also, the mean heart rate and arterial oxygen saturation in both methods were not significantly different two minutes after induction and immediately after intubation (P >0.05). There was no significant difference in the mean time of intubation in both intubations with conventional laryngoscopy and video laryngoscopy (p>0.05)(Table 2).

Table 1: Frequency distribution of demographic indicators in the studied subjects

Variable name		Glidoscopy	Direct laryngoscopy	Total (Percentage)	P
Gender	Male	10 (47.6%)	14 (66.7%)	24 (57.1%)	χ^2=1.55 df=1 P=0.350
	Female	11 (52.4%)	7 (33.3%)	18 (42.9)	
Place of residency	City	16 (76.2%)	17 (81.0%)	33 (78.6%)	χ^2=0.70 Df=1 P=0.140
	Village	5 (23.8%)	4 (19.0%)	9 (21.4%)	
Age	18-27	5(23.8%)	9(42.9%)	14(33.3%)	F=12.33 P=0.950
	28-37	5(23.8%)	4(19.0%)	9(21.4%)	
	38-47	7(33.3%)	4(19.0%)	11(26.2%)	
	48-50	4(19.0%)	4(19.0%)	8(19.0%)	

Table 2: Evaluation of hemodynamic symptoms in both methods in the studied subjects

variables	time	Intubation method	Number	Mean ± standard deviation	P
Mean systolic blood pressure	2 minutes After induction	Glidescopy	21	89±11,39	t=-0.22 df=40 p=0.820
		Conventional laryngoscopy	21	90±16.89	
	After intubation	Glidescopy	21	123.52±13.53	t=-2.70 df=40 p=0.013
		Conventional laryngoscopy	21	139.00±22.47	
Mean diastolic blood pressure	2 minutes After induction	Glidescopy	21	56.10±38.13	t=0.70 df=40 p=0.480
	After intubation	Conventional laryngoscopy	21	53.1376,54	
	2 minutes After induction	Glidescopy	21	82.14±76.23	t=-0.03 df=40 p=0.972
	After intubation	Conventional laryngoscopy	21	82.16±90.55	
Average of arterial blood pressure	2 minutes After induction	Glidescopy	21	67.9±25.42	t=0.39 df=40 p=0.705
	After intubation	Conventional laryngoscopy	21	84.65±13.85	
	2 minutes After induction	Glidescopy	21	96.13±34.16	t=-1.18 df=40 p=0.240
	After intubation	Conventional laryngoscopy	21	101.15±60.53	
Average of heart rate	2 minutes After induction	Glidescopy	21	73.9±12.04	t=-0.66 df=40 p=0.518
	After intubation	Conventional laryngoscopy	21	76.48±13.03	
	2 minutes After induction	Glidescopy	21	104.86±15.79	t=0.07 df=40 p=0.940
	After intubation	Conventional laryngoscopy	21	104.48±16.37	

Discussion

One of the most dangerous stages of anesthesia is laryngoscopy and endotracheal intubation, which results from severe nervous stimulation and severe compressive responses to changes in blood pressure and heart rate (16). Although these changes are tolerable in healthy patients, it is dangerous in patients who suffer from heart failure, coronary artery disease, or increased intracranial pressure [17]. According to the findings of this study, the average of systolic blood pressure was significantly higher after direct laryngoscopy than after intubation by glidescopy, which is consistent with the results of Mortazaviet al (18). Various reports from other parts of the world have shown hemodynamic changes after laryngoscopy and tracheal intubation. In a study comparing two methods of intubation with conventional laryngoscope and combitube,

Wolfgang et al., showed that there is a further increase in blood pressure and pulse in the combitube intubation, which can be dangerous for cardiovascular patients (19). This finding is consistent with the results of this study.

Also, in the above-mentioned studies, hypertension following laryngoscopy and tracheal intubation are similar to our study. However, not much hemodynamic change is reported after tracheal intubation nor any change in the blood pressure and heart rate of patients (20).

Fletcher and his colleagues also performed a study in patients undergoing cardiac surgery under mechanical ventilation of the lungs. They reported that there were no changes in blood pressure and heart rate following intubation through the mouth or nose (21). Our results and those of other similar studies may be due to painful laryngoscopy, intubation, and sympathetic stimulation. In other words, the absence of hemodynamic changes in the tracheal intubation in some studies may be related to the type of medications used before laryngoscopy and intubation, or the characteristics of the patients being studied. Because of the variety of surgical procedures to achieve comprehensive results, the sample size is one of the limitations of our research. More detailed studies should be performed with a larger sample size. Lack of access to complete clinical and paraclinical profile of patients and lack of knowledge of all patient risk factors are the other limitations in this study.

Conclusions

According to the results of this study, intubation performed especially by the direct method can significantly increase systolic blood pressure as compared with the glidescopic intubation. In patients with suspected heart attack, tamponade, shock, and abnormal low blood volume, it can lead to serious problems. Therefore, it is advisable to use a glidoscope for risky patients.

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