GlideScope Video Laryngoscope for Difficult Intubation in Emergency Patients: a Quasi-Randomized Controlled Trial

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Abstract- Macintosh direct laryngoscope has been the most widely used device for tracheal intubation. GlideScope video laryngoscope (GVL) has been recently introduced as an alternative device for performing intubation; however, its validity in emergency settings has not been thoroughly evaluated. The aim of this study was to compare Macintosh direct laryngoscope versus GVL for emergency endotracheal intubation. This quasi-randomized clinical trial was performed on 97 patients referred to Imam Reza Hospital whom all needed emergency intubation in 2011. Patients were divided into two groups of the easy airway and difficult airway; intubation was performed for patients with direct laryngoscopy or GVL. Then, the patients were evaluated in terms of demographic characteristics, successful intubation rate and intubation time. Data was analyzed by SPSS software 16. There was no significant difference in demographic characteristics of the patients in both easy airway and difficult airway groups who intubated with direct laryngoscopy and GVL methods ($P>0.05$). In difficult airway group, a significant difference was found in successful intubation at the first attempt (60.9% *vs.* 87.5%; $P=0.036$), overall intubation time (32.7 ± 14.58 *vs.* 22.5±7.88; $P<0.001$) and first attempt intubation time (28.43 ± 12.51 *vs.* 21.48±7.8; $P=0.001$) between direct laryngoscopy and GVL. These variables were not significantly different between two methods in easy airway group. According to the results, GVL can be a useful alternative to direct laryngoscopy in emergency situations and especially in cases with a difficult airway.

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Keywords: Video laryngoscope; Direct laryngoscope; Difficult airway; Tracheal intubation

Introduction

The airway management is the first step in the resuscitation of the patients in emergency situations. Without adequate oxygenation and ventilation, other actions are not successful in the rehabilitation of patients. Endotracheal intubation is the most common way of emergency airway management, and direct laryngoscopy has been the main modality for intubation from 1940 with the invention of Miller and Macintosh laryngoscope (1). However, some conditions such as head and neck mobility, Mallampati classification, ability/inability of prognathism, mouth opening, and the thyromental distance may cause difficulty in intubation of the patients in emergency situations (2). The incidence of difficult airway intubation has been reported between 5 to 30% in different studies (3). In addition, direct laryngoscopy for emergency intubation requires sufficient skill and experience. Recently, video laryngoscopes have been commonly used as simple, reliable, safe and effective intubation equipment (4). GlideScope video laryngoscope (GVL) provide a view of the glottis from a video-camera or video-chip positioned close to the tip of the laryngoscope blade; among various video laryngoscopes each has its own advantages and disadvantages (5-7).

In a randomized crossover trial using a mannequin in 2011, Shin *et al*., showed that video laryngoscope significantly reduced the time of intubation when compared to direct laryngoscopy (8). Also, there are

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some other studies comparing video laryngoscope with standard direct laryngoscopy which reported that video laryngoscopes are an alternative option for difficult airways management, but the results of these studies are conflicting (9,10).

The available studies have used video laryngoscope for elective intubation in the operating room (11), and some of these studies were conducted on a manikin and simulated model of the airway (12). Also, there is no available clinical trial comparing video laryngoscope with direct laryngoscopy in an emergency situation, and few randomized clinical trial has been performed in the operation room. Therefore, we aimed to conduct this clinical trial to compare Macintosh laryngoscope versus GVL video laryngoscope in emergency endotracheal intubation.

Materials and Methods

This quasi-randomized clinical trial was performed on patients referred to the emergency department of one of teaching Hospitals of Mashhad University of Medical Sciences who required an emergency intubation in 2011. The sample size was calculated according to the study of Nouruzi-Sedeh *et al*., with 90% power and 5% alpha error (13); 50 cases was considered for video laryngoscope group and 50 cases for direct laryngoscope group. The method of sampling was alternate randomized with Macintosh Laryngoscope and GlideScope Video Laryngoscope. The study was approved by the Ethics Committee of Mashhad University of Medical Sciences. Since this study was performed in an emergency situation, there was no possibility to randomly divide the patients into two groups of video laryngoscopy and direct laryngoscope; therefore the patients were divided as non-randomized.

The inclusion criteria were the need for emergency intubation, and exclusion criteria were the patients with apnea and cardiopulmonary arrest, failure to accurately record the intubation time, and the patients who were intubated by first-year emergency medicine resident or other individuals. Among 100 patients, 3 cases were excluded, and 97 were recruited in the study.

The patients were divided into groups of difficult and easy airway based on following criteria, and then the decision was made about the method of intubation. Any of the following criteria was considered as difficult airway: reduced neck extension either pathological or due to immobilization (<80° from neck flexion), decreased inter-incisor distance (<3 fingers), short thyromental distance (<6 cm), Mallampati score 3 or 4, and airway obstruction. Intubation of patients was performed by second or third-year residents of emergency medicine. In the cases of failed intubation including 1) Esophageal intubation 2) Changing to a different device or physician and 3) Inability to place endotracheal tube after three attempts, intubation was performed by an emergency medicine specialist. Within groups, intubation was performed by direct laryngoscopy or by video laryngoscopy. Direct laryngoscopy was performed by Macintosh laryngoscope (Made in Germany) with blade 3 and 4. Tracheal tube size was between 7.5 and 8.5, and the flexible guide was used in all cases. Video laryngoscopy was performed by GlideScope® GVL Reusable, Verathon Medical Company (Made in Canada) with blade 4. GVL used in this study included a camera attached to the laryngoscope blade connected to a wired colorful 7-inch screen. Tracheal tube size was 7.5 and 8.5, and the flexible guide was used in all cases. Duration of intubation, the number of intubation attempts and success or failure of intubation were recorded by another emergency medicine resident. Time was also recorded by a portable chronometer. Then, demographic and anthropometric characteristics of the patients were collected including age, sex, weight, and estimated height. The clinical characteristics of patients (the reason for requiring intubation) were also recorded. The collected data of two groups were compared and analyzed.

Statistical analysis

To describe quantitative data (age, Body Mass Index (BMI), and duration of intubation) mean and standard deviation were used. Frequency rate was used for describing qualitative data (the reasons for requiring intubation or the success of intubation). To evaluate the normal or abnormality of quantitative data, Kolmogorov-Smirnov was employed. Chi-square test was performed for comparison of nominal qualitative variables such as successful intubation in patients intubated with direct laryngoscopy or video laryngoscopy, and if the sample size was small, Fisher exact test or Monte Carlo test was used. Moreover, for comparison of quantitative data if normally distributed data, parametric *t*-student test and if not normal, nonparametric Mann-Whitney test were employed. Data analysis was performed by SPSS version 16 and $P \leq 0.05$ were considered statistically significant.

Results

A total of 97 patients with a requirement for

emergency intubation were enrolled in this study. Patients based on the mentioned criteria were divided into two groups of the easy and difficult airway and for each group; intubation was performed using direct laryngoscopy or GVL. Demographic and anthropometric characteristics of the patients in the easy airway and difficult airway groups are shown in Table 1.

As we see in Table 1, demographic and anthropometric characteristics of the patients in both easy and difficult airway groups were similar between patients intubated with direct laryngoscopy and video laryngoscopy (P>0.05).

Table 1. Demographic and anthropometric characteristics of the studied patients

Variables	Easy airway group		*P*-value	Difficult airway group		*P*-value
	Direct-L	Video-L		Direct-L	Video-L	
Age (yrs)	49.32±13.56	52.96±14.61	0.36	48.83±11.51	51.63±13.7	0.453
Sex (male)	17 (68%)	15 (60)	0.76	18 (78.3)	14 (58.3)	0.14
Weight (Kg)	65.51±16.64	68.62±14.71	0.23	71.62±18.08	62.24±20.55	0.081
Height (cm)	169.13±18.9	171.82±20.35	0.42	172.05±26.71	164.37±22.32	0.056
BMI (kg/m2)	23.22±4.8	22.02±4.55	0.82	24.41±5.58	22.09±4.92	0.35

Successful intubation rate with direct laryngoscopy and GVL methods in two groups of the easy and difficult airway is shown in Table 2. A significant difference for successful intubation at the first attempt (an attempt defined as placing a laryngoscope in the mouth and removing it regardless to that whether the tube is inserted or not) in easy airway group was not observed between direct laryngoscopy and GVL methods (P=0.29). But, in difficult airway group, a significant difference was found in successful intubation at the first attempt between direct laryngoscopy and GVL (P=0.036).

The time required for intubation defined as the time interval between placing the laryngoscope into the mouth and inserting the intubation tube to the vocal. This time was not different between direct laryngoscopy and GVL in easy airway group (P=0.64). Also, in easy airway group, no significant difference was found between two methods in terms of intubation time at the first attempt (P=0.83). But, in difficult airway group, both overall intubation time and first attempt intubation time were significantly shorter in GVL method compared with direct laryngoscopy method (P<0.001, P=0.001, respectively) (Table 3).

Table 2. Successful intubation rates with direct laryngoscopy and video laryngoscopy methods in two groups

Variables	Easy airway group		*P*-value	Difficult airway group		*P*-value
	Direct-L	Video-L		Direct-L	Video-L	
Successful intubation	25 (100)	25 (100)	----	20 (87)	23 (95.8)	0.27
Successful intubation at the first attempt	22 (88)	24 (96)	0.29	14 (60.9)	21 (87.5)	0.036

Table 3. Intubation time with direct laryngoscopy and video laryngoscopy methods in two groups

Variables	Easy airway group		*P*-value	Difficult airway group		*P*-value
	Direct-L	Video-L		Direct-L	Video-L	
Overall intubation time (sec.)	17.44±4.78	18.2±5.74	0.61	32.70±14.58	22.5±7.88	<0.001
First attempt intubation time (sec.)	16.5±4.18	17.71±5.3	0.39	28.43±12.51	21.48±7.8	0.001

Discussion

In this study, we matched the demographic and anthropometric characteristics of the cases in easy and difficult airway groups and also in subgroups of direct laryngoscopy and GVL. Moreover, successful intubation rate was similar with direct laryngoscopy and GVL in both easy airway and difficult airway. Successful intubation rate at the first attempt in easy airway group was not significantly different between direct laryngoscopy and GVL methods, but it showed statistically significant different in difficult airway group, (P=0.036). This finding is in accordance with the results of Di Marco *et al*., in 2011 which showed more successful first-attempt intubation rate in Airtraq versus Macintosh laryngoscopy for tracheal intubation by novices (14). In this study, intubation was also performed by the residents.

Moreover, Howard-Quijano *et al*., in their study showed that the overall intubation success rate is significantly higher in video-assisted methods compared with traditional instruction (15). Griesdale *et al*., in 2012 performed a systematic review and meta-analysis to compare video-laryngoscopy versus direct laryngoscopy for endotracheal intubation by non-experts and reported that in some studies, there was no difference between the video laryngoscopy and direct laryngoscope regarding successful first-attempt intubation, although there was significant heterogeneity (16).

On the other hand, in another study performed by Wetsch *et al*., in 2012 which compared different video laryngoscopes for emergency intubation in a standardized airway manikin with immobilized cervical spine by experienced anesthetists, reported that the overall success rate was higher when using conventional laryngoscopy rather than video laryngoscopy (17). The difference in the reported results might be due to factors like the skill of those who performed the intubation and also the situation in which the intubation was performed. Most of these studies were performed in the operating room for elective intubation, and few of them have been performed in emergency situations (18,19).

However, most of the studies have reported that video laryngoscopes provide a better view of the glottis. Serocki *et al*., in the study of comparison of conventional blade laryngoscopy with video-assisted blade laryngoscope and GlideScope for the management of the predicted difficult airway reported that both video laryngoscopes showed significantly better laryngoscopic view than direct laryngoscope (20). Also, Cooper and colleagues evaluated glottis view of patients with both video laryngoscopy and direct laryngoscopy and showed improvement in the glottis view in video laryngoscopy (21). But, in this study, using this scale was not possible and practical in an emergency situation; therefore, we didn't evaluate the glottis view of the participants.

Moreover, in the present study, in difficult airway group, both overall intubation time and intubation time at the first attempt were significantly shorter in GVL rather than direct laryngoscopy. These results were similar to the findings of some other studies. A randomized controlled trial performed on 130 patients with the Mallampati grade ≥3, and need to orotracheal intubation, compared the McGrath video laryngoscope with the C-MAC video laryngoscope in intubating adult patients with potential difficult airways reported that the C-MAC video laryngoscope shows a quicker intubation time, fewer intubation attempts, and more easy intubation compared with the McGrath video laryngoscope (22). Their study was the first study comparing the McGrath video laryngoscope with the C-MAC video laryngoscope in patients with one clinical marker of a potentially difficult airway. Also, Ayoub *et al*., in 2010 reported that the mean time for the first, second, and third successful tracheal intubations were significantly shorter in the GlideScope group than the Macintosh group (23). However, Ray and colleagues in a study compared video laryngoscopes with direct laryngoscopy in novice users and reported that intubation time is not different between the video laryngoscopes and direct laryngoscopy (24). The results of various studies related to the time of intubation in two methods of direct laryngoscopy and video laryngoscopy have even greater heterogeneity. The difference in the results of performed studies may be due to differences in definitions of intubation time, the situation of intubation and the used devices.

In conclusion, use of GlideScope is recommended in emergency situations and especially in cases of difficult airway because it increases the chance of successful intubation rate at the first attempt and decreases the time required for intubation. Although, more studies with higher sample sizes are required to obtain more accurate results.

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