



Original Article

Comparisons of the GlideScope and Macintosh Laryngoscope in Tracheal Intubation by Medical Students on Fresh Human Cadavers

Pei-Chin Lin^{1,2}, Jimmy Ong^{1,2}, Chia-Ling Lee^{1,2}, Tsung-Ying Chen^{1,2}, Yi Lee^{1,2}, Hsien-Yong Lai^{1,2,3*}

¹Department of Anesthesiology, Buddhist Tzu Chi General Hospital, Hualien, Taiwan

²School of Medicine, College of Medicine, Tzu Chi University, Hualien, Taiwan

³Institute of Physiological and Anatomical Medicine, Tzu Chi University, Hualien, Taiwan

Article info

Article history:

Received: September 30, 2008

Revised: November 19, 2008

Accepted: December 30, 2008

Keywords:

Cadavers

GlideScope

Laryngoscopy

Tracheal intubation

Abstract

Objective: The GlideScope Video Laryngoscope (GS) is an intubating device that provides equal or better glottic views than conventional laryngoscopes, but correct tube placement is more time-consuming, even when performed by experienced operators. The aim of this study was to investigate the use of the GS compared with the more conventional Macintosh laryngoscope in easy and difficult tracheal intubation when performed by inexperienced medical students on fresh human cadavers.

Patients and Methods: Forty-one medical students were assigned to perform tracheal intubation using the direct Macintosh laryngoscope (DL) and the GS. Each student was given four attempts, with a maximum of 180 seconds for each attempt, to successfully intubate the trachea with a 6.5-mm tracheal tube in each of two scenarios, one with an easy airway and the other with a difficult airway cadaver.

Results: The total time of intubation for the easy airway cadaver was significantly longer in the GS group (61.4 ± 4.8 seconds *vs.* 40.6 ± 5.3 seconds; $p < 0.001$) despite the modified Cormack-Lehane scores showing no difference between the two groups. In the difficult airway cadaver, total time of intubation was significant shorter in the GS group (64.3 ± 6.5 seconds *vs.* 98.7 ± 10.2 seconds; $p < 0.001$).

Conclusion: Most inexperienced operators found the GS to be more time-consuming for tracheal intubation than DL in the easy airway cadaver. However, an obvious advantage was demonstrated when the GS was used for the difficult airway. (*Tzu Chi Med J* 2009;21(2):147–150)

*Corresponding author. Department of Anesthesiology, Buddhist Tzu Chi General Hospital, 707, Section 3, Chung-Yang Road, Hualien, Taiwan.
E-mail address: hamalai@yahoo.com.tw

1. Introduction

The GlideScope Video Laryngoscope (Verathon Medical B.V., Boerhaaveweg, IJsselstein, The Netherlands) is a video system for tracheal intubation and is of great potential value for difficult airway management without the need for in-line manual stabilization of the head and neck (1). It may also play a role in managing the airways of trauma patients with potential cervical injuries or cervical instability pending tracheal intubation (2), and provide an alternative option for patients with ankylosing spondylitis (3). It has a camera embedded into a plastic, angulated laryngeal blade and displays an image on a liquid crystal monitor. The angulated blade provides a better laryngeal view for operators to see the opening of the larynx and thus facilitates intubation.

Although previous studies have demonstrated that inexperienced operators had a shorter tracheal intubation time (TTI) when using the GlideScope (GS) than with direct laryngoscopy (DL) in patients with simulated difficult airways (4) and some authors revealed that the GS provided a laryngoscopic view equal to or better than that of DL, it took an additional 16 seconds (on average) for tracheal intubation (5), so we initially hypothesized that there would not be any significant difference in time between the two methods when used by operators without prior experience in intubation. Therefore, the aim of this study was to investigate the possible differences between GS and DL in terms of the time taken to perform oral tracheal intubation on fresh cadavers with both easy and difficult airways by inexperienced medical students.

2. Materials and methods

This study was approved by the ethics committee of Tzu Chi University and Tzu Chi General Hospital and the consent of the corpses' families in performing postmortem scientific research were obtained. Our research was conducted in a university anatomical laboratory (School of Medicine, Tzu Chi University). The cadavers' characteristics and airway assessments were evaluated prior to the study. One of the cadavers was a 48-year-old female with normal body mass index. Her inter-incisor gap distance was 5 cm and the thyromental distance was 8 cm. An initial airway assessment by an experienced anesthetist who had used the GS more than 1000 times demonstrated a modified Cormack and Lehane grading system (MCLS) of grade I by both GS and DL. The cadaver we selected as a difficult intubation model was a 52-year-old male. He had prominent protruding teeth and short neck. The inter-incisor gap was 4 cm and the thyromental distance only 5.5 cm. Tracheal intubation by the same anesthetist revealed a MCLS grade III by DL and

grade IIa by GS. Thus, we selected this cadaver as our difficult intubation model.

Forty-one medical students, all of them inexperienced in tracheal intubation, were voluntarily recruited for this study. They were given instructions and allowed to practice intubation on a human patient simulator for at least five consecutive attempts with both GS and DL until they were competent in tracheal intubation with both devices. Each student was then given four attempts, with a maximum of 120 seconds for each attempt, to intubate the trachea with a 6.5-mm tracheal tube in both cadavers. The students were randomly divided into two groups, the first group used DL for tracheal intubation on their cadaver and then GS; the second group used GS for their initial tracheal intubations and subsequently performed DL intubation. All students intubated the cadaver with a normal airway twice and then intubated the cadaver with the difficult airway. A failed intubation attempt was defined as an attempt in which the trachea was not intubated or where intubation of the trachea required longer than 120 seconds to perform. In both groups, the body was placed in a "sniff" position with a pillow under the head. Endotracheal tubes were also introduced into the cadavers with a metal stylet inside to make the tube stiffer. GS was then inserted in the midline with the uvula seen as the first landmark after the blade was introduced. Further advancement of the blade then followed to the epiglottic vallecula. Correct placement of the endotracheal tube was confirmed by fiberoptic bronchoscopy after each intubation.

The TTI was defined as the time taken from when the blade first passed the incisors until bilateral breathing sounds were detected.

A Wilcoxon signed ranked sum test was also used to compare the times for successful intubation. McNemar's test was then used to compare success rates and a binomial test was used to assess the operator's choice of intubating device. A p value <0.05 was regarded as statistically significant.

3. Results

Table 1 shows the MCLS scales of DL and GS for easy airway intubation and revealed no significant difference between the two groups. The success rate of tracheal intubation also showed no difference between the GS and DL groups (35/41 *vs.* 36/41), but TTI was significantly longer in the GS group in easy airway intubation (61.4 ± 4.8 seconds *vs.* 40.6 ± 5.3 seconds; $p < 0.001$).

Table 2 shows the MCLS scales of DL and GS in difficult airway intubation and revealed a significant difference between the two groups. All of the 41 MCLS scales revealed better results in the GS group.

Table 1 — Comparison of MCLS grades between GS and DL (n=41) in cadaver with easy airway (p=0.87, McNemar’s χ^2 test)

DL	GS					Total
	I	Ila	Ilb	III	IV	
I	32	1	0	0	0	33
Ila	5*	1	0	0	0	6
Ilb	2*	0	0	0	0	2
III	0	0	0	0	0	0
IV	0	0	0	0	0	0
Total	39	2	0	0	0	41

*Students with improvement in MCLS grade. MCLS = modified Cormack-Lehane score; GS = GlideScope intubation; DL = direct laryngoscopic intubation.

Table 2 — Comparison of MCLS grades between GS and DL (n=41) in cadaver with difficult airway (p<0.001, McNemar’s χ^2 test)

DL	GS					Total
	I	Ila	Ilb	III	IV	
I	0	0	0	0	0	0
Ila	0	0	0	0	0	0
Ilb	0	0	0	0	0	0
III	21*	13*	1*	0	0	35
IV	4*	1*	1*	0	0	6
Total	25	14	2	0	0	41

*Students with improvement in MCLS grade. MCLS = modified Cormack-Lehane score; GS = GlideScope intubation; DL = direct laryngoscopic intubation.

The success rate of tracheal intubation also showed improvement in the GS group (36/41 vs. 18/41). TTI was significantly shorter in the GS group compared with the DL group (64.3±6.5 seconds vs. 98.7±10.2 seconds; $p<0.001$).

4. Discussion

The first finding of this study was the different characteristics of the GS in TTI when comparing easy and difficult intubations. The results demonstrated that although the GS has potential in difficult intubation, it is not suitable for easy or routine airway management. Our results show that the GS prolongs TTI and increases the difficulty of tracheal intubation in easy airways. We recommend, therefore, that this device should not be suggested for routine airway management. Furthermore, some researchers have reported that the GS may lead to palate perforation, tonsillar injuries or similar complications. We suggest, therefore, the use of this device as a “second-line” alternative in the following situations: recognized difficult airways with no restriction of mouth and in unanticipated difficult intubation by DL.

GS is a device that is designed for difficult airway management or trauma patients requiring tracheal intubation who are wearing cervical collars (1). It also provides us with a good alternative for trainees to study and learn the techniques of tracheal intubation because a camera is embedded in the blade and incorporated with a liquid crystal display monitor that allows a visualization of airway anatomy and the entire process of tracheal tube placement.

The operator and assistant can cooperate in their movements simultaneously, resulting in a shortened learning curve for a first-time user (6). Moreover, it has a 60° angle blade that provides a view of the larynx, which makes it easier to lift the epiglottis when compared to the Macintosh laryngoscope. Previous studies have described the use of the GS in a simulator and found that anesthetists took longer to intubate than with the DL in easy laryngoscopy scenarios, but vice versa in the simulated difficult laryngoscopy scenarios (7). Because ethical and practical issues in conducting trials of new equipment precluded its use in real patients, a proposal of using cadavers was suggested.

This became a valuable teaching and learning tool for trainees because we did not have to be concerned about the risk of desaturation when students manipulated the airway. In this study, there were no differences in success rate between the two devices in easy airways, but the GS took much more time. This finding is consistent with the results of other studies by experienced anesthetists. Our primary hypothesis was that there would not be much difference in intubation time for inexperienced users when using the two devices. However, we found that most of the students’ eye-hand coordination during manipulation of the endotracheal tube was poor.

In addition, the following techniques of intubation were recommended in the manufacturer’s guidelines (1) and a number of researchers (8,9) in order to enhance the likelihood of successful and shorter intubation time. Firstly, the endotracheal tube was fitted with a Parker Flex-It stylet which enabled adjustment to an anterior angulation during insertion of the tube through the vocal cords. Secondly, an endotracheal tube with stylet was configured to the shape of the GS. Thirdly, the tube was inserted into the lateral side of the patient’s mouth because the presence of a camera on the GS blade made midline entry more difficult.

Finally, sometimes the tip of the endotracheal tube impinged at the opening of the vocal cords, causing difficulty when trying to pass it through the trachea. This could have been the result of the blade trying to lift the epiglottis, causing the trachea to hyperextend. So, reducing the force of elevating the epiglottis was suggested.

The major limitation of this study was the differences in intubating conditions between fresh cadavers

and clinical patients. Thus, whether the results can be applied in clinical patients under anesthesia should be determined and needs further investigation. But due to the ethical and practical issues, most research on new airway equipment cannot be performed in real patients. At present, we always use human airway simulator models for training and research purposes, but these intubating conditions are also quite different from clinical situations. Fresh human cadavers provide an alternative and realistic tool for tracheal intubation training.

In easy airway intubation, GS and DL presented similar success rates and glottic views, but GS had a longer TTI than DL. In difficult airway intubation, GS had improved glottic views, shorter TTI and higher success rate than DL.

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