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SHORT COMMUNICATION

GlideScope videolaryngoscope reduces the incidence of erroneous esophageal intubation by novice laryngoscopists

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Abstract The purpose of this study was to evaluate the performance of the GlideScope videolaryngoscope for tracheal intubation by novice laryngoscopists compared with that of the Macintosh laryngoscope. Under supervision by staff anesthetists, non-anesthesia residents performed tracheal intubation using either the GlideScope videolaryngoscope ($n = 100$) or Macintosh laryngoscope ($n = 100$). The time required for airway instrumentation, the number of attempts required until successful intubation, and erroneous esophageal intubation were investigated. There were no significant differences in the time needed to secure the airway between the GlideScope videolaryngoscope and the Macintosh laryngoscope. Fewer attempts until successful intubation were made with the GlideScope videolaryngoscope than with the Macintosh laryngoscope ($p < 0.05$). Erroneous esophageal intubation with the GlideScope videolaryngoscope was less frequent than with the Macintosh laryngoscope ($p < 0.05$). Compared to the Macintosh laryngoscope, the GlideScope videolaryngoscope reduces the incidence of erroneous esophageal intubation by less experienced laryngoscopists.

Keywords Tracheal intubation · GlideScope videolaryngoscope · Macintosh laryngoscope

The GlideScope videolaryngoscope (Verathon Medical Inc., Bothell, WA, USA) provides a high-grade, indirect close-proximity view of the glottis on a monitor screen without aligning the oral, pharyngeal, and laryngeal axes [1]. Better glottic exposure may be advantageous, especially to non-anesthesia physicians who only perform tracheal intubation occasionally [2–5]. We conducted a randomized study to compare the performance of the GlideScope videolaryngoscope with that of the conventional Macintosh laryngoscope when used by novice laryngoscopists.

After approval of the study by the local ethics committee, written informed consent was obtained from surgical patients. Patients with a history of previously difficult intubation and those with cervical spine fracture or cervical spine instability were excluded. In all, 29 non-anesthesia residents performed tracheal intubation during their anesthesia training (median period, 6 weeks; range 1–18 weeks) using the first-generation GlideScope videolaryngoscope ($n = 100$) or Macintosh laryngoscope ($n = 100$). The trainees received a short demonstration of the GlideScope videolaryngoscope device and were allowed 5–6 practice intubations using a manikin before using the device clinically. Allocation to the two groups was assigned randomly using numbers drawn from a random numbers table. Patients were comparable with respect to age (GlideScope, 50 ± 16 years vs. Macintosh, 53 ± 17, mean ± SD), weight (60 ± 13 kg vs. 61 ± 12), height (158 ± 8 cm vs. 159 ± 11) and body mass index (24 ± 4 kg/m^2 vs. 24 ± 4). A staff anesthetist supervised each laryngoscopy and an independent observer recorded the duration of tracheal intubation attempts using a stopwatch. When the novice personnel encountered difficulty in visualizing vocal cords and also placing the tube into the trachea, airway operators were allowed to ask a supervisor to help solve the problem, and the supervising staff gave suggestions or instructions. The supervising anesthesiologist obtained only verbal information from the resident

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Table 1 Differences in tracheal intubation procedure performed by non-anesthesia residents using the GlideScope videolaryngoscope and Macintosh laryngoscope

	GlideScope	Macintosh	*p* value
Time to intubation (s)[a]	64 ± 33	72 ± 47	0.13
Number of attempts required for successful intubation, 1/2/3/4 times[b]	94/5/1/0	77/13/9/1	0.03
Erroneous intubation of the esophagus[c]	0	6	0.04

[a] Mean ± SD (Student's *t* test)

[b] Number of cases (Mann–Whitney *U* test)

[c] Number of cases (Yates' corrected chi-square test)

during the intubation procedure with the Macintosh laryngoscope. With respect to the GlideScope videolaryngoscope, supervising staff obtained visual information through a monitor in addition to verbal information. The time needed to secure the airway was defined as the time from interrupting bag-mask ventilation to connecting the endotracheal tube to the anesthesia circuit. When the first intubation attempt failed, the patient's lungs were ventilated again with 100% oxygen via bag-mask ventilation to avoid oxygen desaturation, and the duration of the subsequent attempt was added to the time required to secure the airway. Correct placement of the tracheal tube was confirmed by the appearance of the end-tidal CO_2 trace on the monitor screen. The incorrect tube placement was identified immediately and tracheal intubation was subsequently established successfully. The time required for instrumentation, the number of attempts required until successful endotracheal intubation, and erroneous esophageal intubation were recorded for each patient. Sample size was calculated with a difference of 26 s in intubation time and a standard deviation (SD) of 35 [2]; a total number of 80 cases were required to identify a significant difference with 90% power at the 5% difference level. Data were analyzed appropriately using Student's *t* test, the Mann–Whitney *U* test, the chi-square test, or the logrank test. A *p* value of <0.05 was considered significant. There were no differences in the time needed to secure the airway between the GlideScope videolaryngoscope and the Macintosh laryngoscope (Table 1, Fig. 1). Fewer attempts were needed until successful intubation with the GlideScope videolaryngoscope than with the Macintosh laryngoscope (Table 1). Erroneous intubation of the esophagus was less frequent with the GlideScope videolaryngoscope than with the Macintosh laryngoscope (Table 1).

The use of the GlideScope videolaryngoscope, compared with the Macintosh laryngoscope, was associated with fewer erroneous esophageal intubations and fewer attempts until successful intubation, while there were no differences in time required for airway instrumentation when used by inexperienced laryngoscopists.

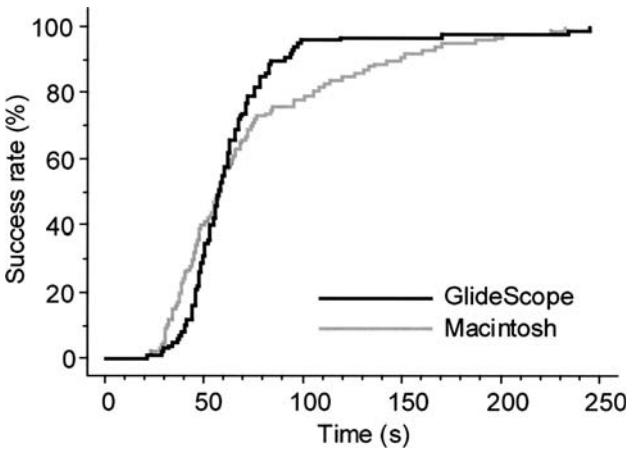

Fig. 1 Kaplan–Meier plot demonstrating the success rate of tracheal intubation as a function of time. The logrank test showed no difference between the GlideScope and Macintosh techniques

Currently, the most widely accepted method for tracheal intubation is direct laryngoscopy using the Macintosh laryngoscope. Using this conventional technique, only a laryngoscopist can view the glottis during the instrumentation. Supervisors cannot watch the oral cavity at the same time as the airway operator and give advice through the traditional "over the shoulder" approach. In contrast to the standard Macintosh laryngoscope, the GlideScope videolaryngoscope, equipped with a separate monitor screen, provides a close view of the glottis and the passage of the tracheal tube to both the airway operator and supervisors, meaning that supervisors can provide advice and recommendations based on the same image on the monitor. The enhanced demonstration capability provided by the GlideScope videolaryngoscope [3, 5] may have lessened the incidence of erroneous esophageal intubation by the inexperienced laryngoscopists in our study.

Nouruzi-Sedeh and colleagues showed that the time needed for tracheal intubation by novice personnel was 89 ± 35 s for direct Macintosh laryngoscopy versus 63 ± 30 s for the GlideScope technique. In their work, failed intubations (Macintosh group, 49 out of 100 intubations; GlideScope group, 7 out of 100 intubations) were

set to 120 s in the analysis of intubation time [2]. In our study, when the first intubation attempt failed, the duration of the subsequent attempt was added to the time required to secure the airway. Our time to complete tracheal intubation was an actual measurement. This difference in method between the two studies makes a direct comparison between them difficult.

For novice laryngoscopists, the time needed to secure the airway using the Macintosh laryngoscope was unusually long. The Pentax AWS and the Airtraq optical laryngoscope have been reported to shorten the intubation time needed by novice users [6, 7]. This may be due to the built-in guiding channel for tracheal intubation. In the current study, the GlideScope videolaryngoscope did not shorten the intubation time, possibly because it lacks the integrated tracheal tube guidance system.

Tracheal intubation using the GlideScope videolaryngoscope, compared to the Macintosh laryngoscope, may be advantageous for medical personnel who only occasionally perform tracheal intubation. The GlideScope videolaryngoscope reduces the incidence of inaccurate and erroneous tracheal intubation in this group of users.

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References

1. Cooper RM, Pacey JA, Bishop MJ, McCluskey SA. Early clinical experience with a new videolaryngoscope (GlideScope) in 728 patients. Can J Anaesth. 2005;52:191–8.
2. Nouruzi-Sedeh P, Schumann M, Groeben H. Laryngoscopy via Macintosh blade versus GlideScope: success rate and time for endotracheal intubation in untrained medical personnel. Anesthesiology. 2009;110:32–7.
3. You JS, Park S, Chung SP, Park YS, Park JW. The usefulness of the GlideScope video laryngoscope in the education of conventional tracheal intubation for the novice. Emerg Med J. 2009; 26:109–11.
4. Lim Y, Lim TJ, Liu EH. Ease of intubation with the GlideScope or Macintosh laryngoscope by inexperienced operators in simulated difficult airways. Can J Anaesth. 2004;51:641–2.
5. Doyle DJ. GlideScope-assisted fiberoptic intubation: a new airway teaching method. Anesthesiology. 2004;101:1252.
6. Hirabayashi Y, Seo N. Tracheal intubation by non-anaesthetist physicians using the Airway Scope. Emerg Med J. 2007;24:572–3.
7. Hirabayashi Y, Seo N. Airtraq optical laryngoscope: tracheal intubation by novice laryngoscopists. Emerg Med J. 2009;26:112–3.