

Video Laryngoscopy and Intubation Safety: The View Is Becoming Clear*

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Unplanned airway management, occurring in the ICU, operating room (OR), emergency department (ED), or elsewhere in the hospital, is a high-stakes event with the potential for dire consequences for the patient should intubation prove difficult or impossible and hypoxia ensue. Maximizing patient safety during these complex, high-risk procedures is paramount. Several studies have shown a strong correlation between the number of intubation attempts and the rate of peri-intubation adverse events, such as hypoxia, esophageal intubation, bleeding, and need for surgical rescue (1–3).

In this issue of *Critical Care Medicine*, Silverberg et al (4) report data on 115 intubations randomized, by even-odd allocation, to a first attempt with either direct laryngoscopy (DL) or GlideScope video laryngoscopy (VL) using a sedation-only pharmacologic approach with propofol. Patients with predicted airway difficulty, hypoxia (< 92%) despite mask ventilation, and nonurgent intubations were excluded. Patients were similar with regard to age, obesity, Acute Physiology and Chronic Health Evaluation score, and comorbidities.

They found significantly higher rates of first-pass success (73% vs 40%) and fewer overall attempts with the GlideScope compared with DL. In all cases when DL failed, the successful intubation was accomplished using the GlideScope, often on the first attempt. A previous study of intubations without neuromuscular blockade outside the OR, although not randomized, also found substantial superiority of VL over DL (5).

Despite the advent of VL over a decade ago, the direct laryngoscope continues to be the most commonly used device for emergency airway management (6). DL requires the intubator to use patient positioning and soft-tissue manipulation to create a direct line of sight to the glottic aperture. Patient

characteristics such as cervical spine immobility, large tongue, reduced mouth opening, and micrognathia can all contribute to difficult DL by preventing the operator from seeing the vocal cords (7).

VL creates a visual advantage by effectively placing the clinician's eye at or near the tip of the blade, beyond the obstructing anatomy of the mouth and pharynx. Although there is convincing evidence of the superiority of VL over DL, most empirical data are from observational registries and small cohort studies, not controlled experimental trials (5, 8–12). Randomized trials comparing GlideScope and conventional laryngoscopy are few and nearly all from the OR. These studies have shown that glottic visualization was better and intubation was easier (lower intubation difficulty scores) compared with DL, even in obese patients and difficult airways, although time to tube placement was slightly longer (13, 14). Randomized controlled trials involving emergency intubation are difficult because of the unplanned, immediate need for intubation and complexity of the informed consent process. One ED-based randomized trial looking at GlideScope VL versus DL in trauma intubations was plagued by sampling errors and high rates of randomization “opt-out,” making the results difficult to interpret (15). Although the deficit of “out-of-OR” experimental data is a methodological shortcoming, it is mitigated by what we know from observational studies across different healthcare settings: video-assisted devices have yielded superior glottic views and improved first-attempt success relative to conventional laryngoscopes, even in the face of difficult airway attributes that make DL challenging (9, 16–18).

Our recent multicenter study of more than 17,500 adult ED intubations showed that VL use is increasing, along with first-pass intubation success, over the last 10 years (19). This suggests that VL will likely overtake DL as the principal emergency intubation method in the near future.

A concerning finding in the current study is the remarkably low first-pass success in the DL group, especially in a cohort where predicted difficult airways were systematically removed. This likely reflects a lack of adequate operator experience or training with DL and the inferior intubating conditions provided by sedation-only intubations compared with rapid-sequence intubation (RSI). Novice operators perform better with a video laryngoscope, such as the GlideScope, than with a direct laryngoscope (20). However, sedation-facilitated intubations have lower rates of intubation success and higher reported complications compared with RSI in ED patients (6). Randomized OR studies also have shown inferior intubating conditions when neuromuscular blockade is not used (21). Similarly, there is evidence that neuromuscular blockade improves success for emergency intubations occurring outside of the OR or ED (22). In the absence of a difficult airway for which a planned awake technique is used, RSI should be the

*See also p. 636.

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standard approach for emergency airway management. In this study, it is possible that the performance gap between devices would not have been as impressive if intubation protocols involving neuromuscular blockade were used and the operators had more experience with DL. In addition, with video technology immediately available, the intubators may have aborted initial direct laryngoscopic attempts prematurely in favor of video technology when direct attempts proved challenging.

Initially, video laryngoscopes were thought of as “difficult airway” devices. Although this certainly is true, limiting their use only to intubations predicted to be difficult or proven difficult following failed DL attempts, misses the point. Nothing can ever guarantee intubation success; however, it is important to take all necessary steps to maximize first-attempt success. One key such step is selecting the best tool for the job. The study by Silverberg et al (4) adds to the growing body of literature supporting the notion that video laryngoscopes are first-line devices for emergent or urgent airways, regardless of anticipated difficulty. Institutions developing response teams for inpatient airway emergencies should employ a strategy of robust training, which must include difficult airway assessment, the appropriate use of neuromuscular blockade as part of a RSI algorithm, and use of a video laryngoscope as the principal intubation device.

Is it time to retire the DL as a first-line device? In a word, yes.

REFERENCES

- Mort TC: Emergency tracheal intubation: Complications associated with repeated laryngoscopic attempts. *Anesth Analg* 2004; 99:607–613
- Sakles JC, Chiu S, Mosier J, et al: The importance of first pass success when performing orotracheal intubation in the emergency department. *Acad Emerg Med* 2013; 20:71–78
- Hasegawa K, Shigemitsu K, Hagiwara Y, et al; Japanese Emergency Medicine Research Alliance Investigators: Association between repeated intubation attempts and adverse events in emergency departments: An analysis of a multicenter prospective observational study. *Ann Emerg Med* 2012; 60:749–754.e2
- Silverberg MJ, Li N, Acquah SO, et al: Comparison of Video Laryngoscopy Versus Direct Laryngoscopy During Urgent Endotracheal Intubation: A Randomized Controlled Trial. *Crit Care Med* 2015; 43:636–641
- Kory P, Guevarra K, Mathew JP, et al: The impact of video laryngoscopy use during urgent endotracheal intubation in the critically ill. *Anesth Analg* 2013; 117:144–149
- Walls RM, Brown CA 3rd, Bair AE, et al; NEAR II Investigators: Emergency airway management: A multi-center report of 8937 emergency department intubations. *J Emerg Med* 2011; 41:347–354
- Murphy MF, Walls RM: Identification of the difficult and failed airway. In: *Manual of Emergency Airway Management*. Walls RM, Murphy MF, Luten RC (Eds). Third Edition. Philadelphia, Lippincott Williams Wilkins/Wolters Kluwer Health, 2008, pp 81–93
- Mosier JM, Whitmore SP, Bloom JW, et al: Video laryngoscopy improves intubation success and reduces esophageal intubations compared to direct laryngoscopy in the medical intensive care unit. *Crit Care* 2013; 17:R237
- Sakles JC, Mosier J, Chiu S, et al: A comparison of the C-MAC video laryngoscope to the Macintosh direct laryngoscope for intubation in the emergency department. *Ann Emerg Med* 2012; 60:739–748
- Sakles JC, Mosier JM, Chiu S, et al: Tracheal intubation in the emergency department: A comparison of GlideScope® video laryngoscopy to direct laryngoscopy in 822 intubations. *J Emerg Med* 2012; 42:400–405
- Mosier JM, Stolz U, Chiu S, et al: Difficult airway management in the emergency department: GlideScope videolaryngoscopy compared to direct laryngoscopy. *J Emerg Med* 2012; 42:629–634
- Mosier J, Chiu S, Patanwala AE, et al: A comparison of the GlideScope video laryngoscope to the C-MAC video laryngoscope for intubation in the emergency department. *Ann Emerg Med* 2013; 61:414–420.e1
- Sun DA, Warriner CB, Parsons DG, et al: The GlideScope video laryngoscope: Randomized clinical trial in 200 patients. *Br J Anaesth* 2005; 94:381–384
- Andersen LH, Rovsing L, Olsen KS: GlideScope videolaryngoscope vs. Macintosh direct laryngoscope for intubation of morbidly obese patients: A randomized trial. *Acta Anaesthesiol Scand* 2011; 55:1090–1097
- Yeatts DJ, Dutton RP, Hu PF, et al: Effect of video laryngoscopy on trauma patient survival: A randomized controlled trial. *J Trauma Acute Care Surg* 2013; 75:212–219
- Brown CA 3rd, Bair AE, Pallin DJ, et al; National Emergency Airway Registry (NEAR) Investigators: Improved glottic exposure with the Video Macintosh Laryngoscope in adult emergency department tracheal intubations. *Ann Emerg Med* 2010; 56:83–88
- Tremblay MH, Williams S, Robitaille A, et al: Poor visualization during direct laryngoscopy and high upper lip bite test score are predictors of difficult intubation with the GlideScope videolaryngoscope. *Anesth Analg* 2008; 106:1495–1500
- De Jong A, Molinari N, Conseil M, et al: Video laryngoscopy versus direct laryngoscopy for orotracheal intubation in the intensive care unit: A systematic review and meta-analysis. *Intensive Care Med* 2014; 40:629–639
- Brown CA III, Bair AE, Pallin DJ, et al; NEAR III Investigators: Techniques, success, and adverse events of emergency department adult intubations. *Ann Emerg Med* 2014 Dec 19. [Epub ahead of print]
- 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; 110:32–37
- Naguib M, Samarkandi A, Riad W, et al: Optimal dose of succinylcholine revisited. *Anesthesiology* 2003; 99:1045–1049
- Wilcox SR, Bittner EA, Elmer J, et al: Neuromuscular blocking agent administration for emergent tracheal intubation is associated with decreased prevalence of procedure-related complications. *Crit Care Med* 2012; 40:1808–1813