If at First You Don't Succeed: Patient Characteristics Associated with First-Attempt Failure of Video Laryngoscopy in the Intensive Care Unit

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For the millions of critically ill adults who require endotracheal intubation each year, procedural complications are common and often life-threatening. Mitigation of those complications by means of new tools and techniques is an active focus of clinical critical care research.

Video laryngoscopy, in particular, has revolutionized the ability of operators to visualize the vocal cords by enabling a better view of the glottis than direct laryngoscopy, as demonstrated in cohort studies (1, 2) and randomized trials (3, 4). Whether the improved view with video laryngoscopy translates into easier tube placement or decreased procedural complications during emergent intubation remains unclear. Although early studies suggested benefit (1–3), more recent, controlled trials have demonstrated no difference (4–6), or even harm (7), compared with direct laryngoscopy. The increasing application of video laryngoscopy in intensive care units (ICUs) and the uncertain effect of video vs. direct laryngoscopy on procedural outcomes raise a new and important question: Why does emergent intubation by video laryngoscopy sometimes fail?

In this month's issue of the *AnnalsATS*, Joshi and colleagues (pp. 368–375) (8) report the first large-scale examination of this question. In a retrospective analysis of prospectively collected data from 906 patients undergoing intubation using video laryngoscopy at a single academic medical ICU, the authors explore the relationship between 11 different difficult airway

characteristics and failure to intubate on the first laryngoscopy attempt ("first-attempt failure"). In the medical ICU studied, intubations were performed by residents and fellows under the supervision of critical care attending physicians. Notably, anesthesiologists were not members of the procedural team.

First-attempt failure occurred in nearly one of five cases. Failure was more common with less experienced operators, and internal medicine residents in particular, and when neuromuscular blockade was not used. After accounting for these factors, the authors found an independent relationship between the presence of blood or edema in the airway and first-attempt failure, with a suggestion that obesity and cervical immobility might also be associated with failure to intubate. Conversely, they found many previously identified risk factors for difficult direct laryngoscopy (e.g., limited mouth opening, large tongue, short neck) did not associate independently with first-attempt failure (9).

These results are intuitively appealing. The design of the video laryngoscope, with a camera mounted on the laryngoscope blade, may circumvent the difficult airway characteristics that make obtaining a direct view with direct laryngoscopy challenging (e.g., limited mouth opening, large tongue, short neck). Yet, factors that impair the function of the camera (e.g., blood in the airway) or physically hinder passage of an endotracheal tube even when an adequate view is obtained (e.g., airway edema, cervical immobility) may limit the utility of video

laryngoscopy. Less experienced operators may be particularly vulnerable to the difficult airway characteristics identified, especially the unforeseeable ones (e.g., blood in the airway), a hypothesis worth testing in future studies.

An important strength of the study by Joshi and colleagues is the setting (8). Airway management in the ICU differs fundamentally from elective intubations in the operating room, a point nicely demonstrated by the two factors identified as contributing to first-attempt failure in the current study: airway blood and edema. Both these factors would be uncommon in a study of video laryngoscopy during preoperative intubation. Enrolling almost a thousand patients with an event rate of nearly 20% provided adequate power to account for known confounders by multivariable modeling, and the authors' findings remained consistent across multiple sensitivity analyses. Data collection used a standardized data collection sheet and a set of patient and procedural characteristics that could reasonably be evaluated during emergent intubation. Although employing more granular definitions for each difficult airway characteristic (e.g., limited mouth opening <3 cm) (9) would have made the findings easier to interpret and reproduce, the authors' simplified approach is likely reflective of routine practice in which use of more detailed criteria may be infeasible. The similarity

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between rates of difficult airway characteristics reported in the current study and prior studies of ICU intubation (9, 10) provides further reassurance about the manner in which these key factors were assessed.

In addition to these strengths, the study has some important limitations. Both the difficult airway characteristics and the primary outcome of first-attempt failure were self-reported by the operator after the intubation. Reliance on self-reported data is problematic in airway management research (11, 12), and even more so when studying the relationship between difficult airway characteristics and first-attempt failure. Operators may be more likely to report the presence of difficult airway characteristics after a failed first attempt. Moreover, as the authors acknowledge in the discussion, this reporting bias “may be greatest for the difficult airway characteristics most directly responsible for a failed attempt, thus overestimating their risk and underestimating the risk of those characteristics more indirectly related.” This bias is of particular concern because potentially important, but less direct, factors (e.g., short neck, large tongue) may have been self-reported less frequently than more direct factors (blood

and edema in the airway) after first-attempt failure.

Another potential limitation is selection bias: patients with difficult airway characteristics that would have predisposed to first-attempt failure with video laryngoscopy may have been identified by treating clinicians and intubated using flexible fiberoptic laryngoscopy (5% of intubations) or direct laryngoscopy (13% of intubations). Whether the difficult airway characteristics associated with first-attempt failure in this study represent those common to all intubations in the ICU or are unique to intubations attempted by video laryngoscopy compared with direct laryngoscopy is not explicitly reported. Comparison of this study of video laryngoscopy with prior studies of direct laryngoscopy is limited by differences in patient and operator population. Finally, the prior intubating experience of operators in the study was predominantly with video laryngoscopy, and the difficult airway characteristics associated with first-attempt failure with video laryngoscopy might differ for operators whose prior intubating experience is primarily with direct laryngoscopy.

We commend Joshi and colleagues for advancing a novel and important question in a challenging field of study (8). Future research on this topic should examine

the factors associated with first-attempt failure with video laryngoscopy vs. direct laryngoscopy in recent ICU trials (to circumvent selection bias and observer bias), rigorously compare hyperangulated and nonhyperangulated video laryngoscopy devices with regard to first-pass success in the presence of different difficult airway characteristics, and push beyond the surrogate outcome of first-attempt success or failure toward minimizing common procedural complications (e.g., hypoxemia), preventing rare catastrophes (e.g., cardiac arrest), and optimizing patient-centered outcomes (e.g., ventilator-free days, mortality).

For now, clinicians responsible for airway management in ICUs should become experienced with at least one direct laryngoscopy and one video laryngoscopy device, understand the strengths and limitations of each, and consider a “personalized” approach in which the characteristics of the patient, the operator, and the device guide choice of laryngoscope for each intubation in the ICU. Armed with this approach, and the knowledge afforded by the work of Joshi and colleagues, clinicians will be poised for first-attempt success. ■

Author disclosures are available with the text of this article at www.atsjournals.org.

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