

Article Appraisal

**Article:**  Comparing Emergency Department First-Attempt Intubation Success With Standard-Geometry and Hyperangulated Video Laryngoscopes

**Date of Journal Club:**  16 March 2021

**Resident Reviewer Name(s) and Residency Affiliation:**  J. Michael Wafler, PGY3 EM

**Faculty Methodology/Bio-statistics Resource Person:**  Dr John Tallon



**Background and Study Objective(s):**

Video laryngoscopy use has been increasing over the last decade and currently, two common blade shapes are used for video laryngoscopy. These include a standard-geometry Macintosh-style blade capable of facilitating both indirect and direct visualization of the oropharyngeal and laryngeal structures, and a hyperangulated blade capable of indirect visualization only. One purported advantage of indirect video laryngoscopy is the minimal manipulation of the soft tissues and neck which may be beneficial in trauma and unstable c-spine scenarios. Frequently the standard-geometry blade is used with the addition of bougie as indicated, whereas the hyperangulated blade is used with a model-specific angulated rigid stylet.

Previous research comparing blade style use in video laryngoscopy has been limited. A single-center study including 463 patients failed to demonstrate a significant difference in intubation success when using hyperangulated versus standard geometry blades (Moiser et al.). In this study, utilizing data from the National Emergency Airway Registry (NEAR) database, authors compared first-attempt intubation success between patients intubated with video-based standard geometry versus hyperanguilated blades.

**Study Design:**

This study was a prospective, international, multicenter registry of emergency department intubation data from 25 academic centres in the United States, Australia, and Canada. Data was collected on patients intubated between January 1, 2016 and December 31, 2018. Each participating center had a site investigator tasked with ensuring data entry > 90% of all intubations performed in the Emergency Department only. Each site investigator submitted a compliance plan approved by the central registry-coordinating center, which specified methods to identify monthly intubations performed at each center. The coordinating NEAR center then cross-referenced quantify of intubations performed at each site against numbers of intubations entered into the database to determine the overall proportion of intubations captured.

Patients were eligible for inclusion if they were ≥ 14 years of age, orally intubated in an emergency department at a participating NEAR site using video laryngoscopy with a standard-geometry or hyperangulated blade. Patients were excluded from analysis if they were intubated using solely topical anesthesia, missing data for primary outcome or age, intubated using a hyperangulated blade with tube channel, or if the study site failed to document ≥ 90 percent of intubations.

The primary outcome was first-attempt success rate in intubation, defined as a single insertion of the laryngoscope blade into the mouth. Secondary outcomes were successful intubation without adverse events, proportion of patients with Cormack-Lehane grade 1 or 2 with the first attempt, changing the intubation device after a failed first attempt, hypoxemia, or lowest oxyhemoglobin saturation. Adverse events included were cardiac arrest, airway injury, hypoxemia, laryngoscopes failure, dental or lip trauma, and iatrogenic bleeding. These specific adverse events were included in the study as authors felt that they were most attributable to challenging laryngoscopy, prolonged intubation attempt, and style of laryngoscope.

Statistical analysis was performed through two modalities. Authors first evaluated unadjusted differences between groups for primary and secondary outcomes based upon blade geometry. In an attempt to account for differences across patients and physicians, the authors employed multiple logistic regression to determine whether blade shape was independently associated with first-pass success. Further, a second regression was completed to evaluate intubation success without adverse events as previously defined. The independent variable of interest was blade shape, standard geometry versus hyperangulated. Multiple logistic regression included covariates in the model including age, male sex, obesity, medical versus traumatic indication for intubation, initial impression of airway difficulty, presence of any specific difficult airway characteristics, patient positioning, use of a neuromuscular-blocking medication, and physician intubation experience (emergency medicine residency year 3 or 4, fellow, attending physician or other). Authors removed cases from regression models with missing data for any variables included as model covariates.

**Results:**

During the study period, 11,927 of 19,071 (62.5%) recorded intubation encounters met inclusion criteria for analysis, including 7,255 (61%) using a standard-geometry blade and 4,672 (39%) using a hyperangulated blade. WIth respect to standard-geometry blade use, 97.6% were performed with the *C-MAC* Macintosh laryngoscope and 34% assisted with a bougie. 87.8% of hyperangulated blade intubations were performed with a hyperangulated *GlideScope* laryngoscope, with the majority of the remainder (11.7%) performed with the *C-MAC* D-blade. Hyperangulated geometry was more frequently used for trauma (33% versus 20%) and had a higher proportion of anticipated and confirmed difficult airway characteristics compared to standard geometry intubations (65% versus 47%).

Initial analysis of unadjusted data, not accounting for covariates, demonstrated similar first-pass success rates between standard-geometry and hyperangulated blades, 91.9% and 89.2% respectively. The absolute difference for first attempt success based on laryngoscope type was 2.7 with a 95% confidence interval from 1.6 to 3.8. After adjustment using multiple logistic regression, the odds ratio for first attempt success based on laryngoscope type was 1.32 with a 95% confidence interval from 0.81 to 2.17. Further, the odds ratio for first attempt success without any adverse events was 1.11 with a 95% confidence interval from 0.84 to 1.49.

To determine the robustness of the results, authors performed two sensitivity analyses to assess the impact of two specific scenarios on results. Analysis one determined whether site differences had a strong effect on the multivariable model for the primary outcome. Authors removed all encounters for site 1 (N=2,632, composing 24% of total intubations) of the 25 sites, but left the remainder of the model unchanged. This sensitivity analysis indicated no association between blade shape and first-attempt success with an adjusted odds ratio for standard-geometry laryngoscope versus hyperangulated laryngoscope 1.01 [95% CI 0.74 to 1.38]. Authors did not describe the specific method or algorithm used for cluster analysis in the regression model.

In the second sensitivity analysis, not accounting for clustering by site, use of the standard-geometry blade was associated with higher first-attempt success with an adjusted odds ratio for standard-geometry laryngoscope versus hyperangulated laryngoscope 1.32 [95% CI 1.14 to 1.54].

**Validity of Results:**

This study addressed a focused clinical question with objective, clinically relevant outcomes. Specifically, the study examined the use of video laryngoscopy with standard-geometry and hyperangulated blades with respect to intubation success and related adverse outcomes. Study authors demonstrated no conflicts of interest and the degree to which each other contributed to the study was clearly defined. Several factors were identified that may influence the overall validity of the results.

Given that this study was observational in nature, randomization was not utilized and study groups were not equivalent at baseline. The hyperangulated patient group had overall more complex airway characteristics including a greater degree of obesity, trauma-related intubations, initial impression of difficult airway, less preoxygenation utilized, and specifically less apneic oxygenation.

Despite the use of a multivariate logistic regression in analysis, the possibility remains that confounding variables addressed in the analyses did in fact affect blade selection. Although including covariates attempts to partially mitigate selection, it is possible that results would be different if physicians selected blades without regard to patient characteristics in a true randomized fashion.

**Generalizability of Results:**

This study was conducted using data drawn from large academic centres, therefore generalization to community centres may be affected. Within the data set there was significant variability in blade geometry between sites, varying between <1% to 100% using the standard geometry blade. This could suggest physician familiarity with the blade shape between sites may affect outcomes. Further, the brand of the video laryngoscope was not included in the analysis itself and only in the inclusion criteria. As many centers have different equipment available, generalizability could be limited.

Study analysis was unable to completely account for intubator experience, where trainees performed more than 90% of intubations. This factor limits generalizability to physicians with substantial intubating experience, or centers where there are significantly fewer trainees present. Although the study attempted to account for differences in experiences by including resident training year in analysis, a more meaningful variable would be the number of previous intubation attempts ideally with each blade type. Unfortunately, this data would likely be challenging to capture and was not available as part of the NEAR registry.

**The Bottom Line:**

This was a multi-center observational study utilizing international registry data that included a significant sample size of 11,927 patients undergoing either video laryngoscopy with standard-geometry or hyperangulated blades. The coordinating center of the NEAR database, on which this study was drawn, evaluated all entries for data consistency. Each study site was required to have completed data collection forms for at least 90% of intubations performed to be included in the database. To account for differences in patient and physician characteristics, authors used multiple logistic regression with a number of covariates. Further, authors performed 2 sensitivity analyses to determine whether site differences had a significant effect on the results for the primary outcome. Overall there was no difference between standard-geometry versus hyperangulated blades in first-attempt intubation success when adjusting for potential confounding variables. Prior research indicates that each blade has theoretical benefits in different clinical scenarios, and as such physicians should use patient factors, clinical judgment, and prior experience in choosing the type of laryngoscope.