Effect of Dynamic Versus Stylet-Guided Intubation on First-Attempt Success in Difficult Airways Undergoing Glidescope Laryngoscopy: A Randomized Controlled Trial

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BACKGROUND: Tracheal intubation failure in patients with difficult airway is still not uncommon. While videolaryngoscopes such as the Glidescope offer better glottic vision due to an acute-angled blade, this advantage does not always lead to an increased success rate because successful insertion of the tube through the vocal cords may be the limiting factor. We hypothesize that combined use of Glidescope and fiberscope used only as a dynamic guide facilitates tracheal intubation compared to a conventional Glidescope technique with a preshaped nondynamic stylet.

METHODS: One hundred sixty adult patients with predicted difficult airway were randomly assigned to a conventional Glidescope (standard Glidescope group) or a combined Glidescope + fiberscope group intubation. In the Glidescope + fiberscope group under direct vision from the Glidescope, tracheal intubation was performed using the fiberscope as a guide without using fiberoptic vision, while in the standard Glidescope group, a conventional stylet-guided intubation technique was performed. We evaluated the rate of tracheal intubation success at first attempt as the primary end point (Fisher exact test). The difference between groups in airway injury, time to successful intubation, and the need for an alternative technique was also evaluated.

RESULTS: First-attempt intubation success was higher in the Glidescope + fiberscope group than in the standard Glidescope group (91% vs 67%; $P = .0012$; fragility index, 8; absolute risk reduction, 24% [95% CI, 12%–36%]). Median time to successful tracheal intubation was shorter in the Glidescope + fiberscope group (50 vs 64 seconds; $P = .035$). Airway injury rate was lower in the Glidescope + fiberscope group than in the standard Glidescope group (1% vs 11%; $P = .035$; fragility index, 1; absolute risk reduction, 10% [95% CI, 3%–18%]). Alternative rescue technique requirements to achieve tracheal intubation were higher in the standard Glidescope group (24% vs 4%; $P < .001$; fragility index, 7).

CONCLUSIONS: The use of a dynamic, flexible guide during a Glidescope laryngoscopy in patients with a predicted difficult airway compared to a standard intubation technique improves first-attempt intubation success, decreases the incidence of airway injury and time to successful intubation, as well as the need of an alternative technique to succeed. (Anesth Analg XXX;XXX:00–00)

KEY POINTS

- **Question:** Does using a fiberscope as a flexible guide during a Glidescope laryngoscopy improve the first-attempt tracheal intubation success in patients with predicted difficult airway compared to a standard Glidescope laryngoscopy technique?
- **Findings:** First-attempt intubation success was significantly higher using the fiberscope as a dynamic guide during a Glidescope laryngoscopy compared to the control standard stylet-guided intubation.
- **Meaning:** Using a flexible, dynamic guide during a Glidescope laryngoscopy can improve success rate as well as decreasing time to intubation and morbidity.

Reducing difficult airway–failed intubations remains paramount for anesthesiologists. Nonetheless, failure rate ranges from 0.5% to 10% of patients depending on the definition of difficult airway.[1] As a result, videolaryngoscopy has garnered significant clinical implementation because it provides better visualization of the larynx.[2,3]

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Videolaryngoscopy reduced failed intubations significantly when compared with direct laryngoscopy in adults with anticipated difficult airway[4] and is even displacing awake fiberoptic intubation[5] in the same clinical scenario due to shorter intubation time with equal rate of success.[6,7]

Devices like the C-MAC with D-Blade (Karl Storz, Tuttlingen, Germany) or the Glidescope (Verathon, Bothell, WA) offer better glottic vision due to an acute-angled blade. However, this advantage does not always lead to increased success rate because increasing angulation may entail difficulty to pass the tracheal tube through the vocal cords[8] within a reduced space combined with a very high or deep glottis and drooping epiglottis. While using a bougie during direct laryngoscopy improves first-attempt intubation success,[9] with an acute-angled videolaryngoscopy blade, a bougie does not always help to reach a very anterior glottis, and it is more common to use a preformed 60°-angled stylet.[10] Both the bougie and the stylet work as a static guide because the tube tip position cannot be adjusted once the maneuver has started.

Guides with dynamic capabilities, such as the Parker Flex-It Directional Stylet (Parker, Highlands Ranch, CO) or the Endoflex ETT (Merlyn, Tustin, CA), allow modifying the tip direction during the maneuver to achieve the right angulation toward the glottis. However, these devices provide a single direction and limited range of dynamic flexion with a poorer overall performance compared to the fiberscope. The combined use of videolaryngoscopy with a fiberscope as a dynamic guide for intubation in patients with difficult airway has been only previously described in case reports and case series as far as we are aware.[11–13]

This trial aimed to evaluate the combined use of Glidescope and fiberscope as a flexible, dynamic guide for intubation in patients with difficult airway predictors. We tested the hypothesis that this combined use improves first-attempt intubation success compared to standard Glidescope use. As secondary end points, we assessed the association of this technique with time to successful intubation and oxygen saturation measured by pulse oximetry (Spo_2) at intubation, the rate of airway injury, and use as a rescue technique.

METHODS

This open-label, randomized, 2-parallel arm trial was conducted after obtaining approval from the Hospital Universitario y Politecnico la Fe's institutional review board (February 15, 2017, Chairman Dr Rodriguez Capellan) and was performed in compliance with Consolidated Standards of Reporting Trials guidelines. Written informed consent was obtained from every participant. The trial was prospectively registered at clinicaltrials.gov before patient enrolment (NCT02627755; principal investigator: G.M.; date of registration: December 11, 2015). One hundred sixty adult patients scheduled for surgery requiring tracheal intubation were included. Patients were enrolled from December 2017 to August 2018. The history and physical examination records of all patients scheduled for surgery were screened for predictors of difficult airway. These are usually qualitatively recorded in our institution (eg, cervical movement or mouth opening = normal or reduced). In the preoperative period, patients with recorded difficult airway predictors were double checked and predictors were quantitatively reassessed.

Inclusion criteria were as follows: (1) ≥18 years of age with planned oral tracheal intubation; (2) simplified Arné score ≥11[14] (Supplemental Digital Content, Table 1, http://links.lww.com/AA/C754); and (3) ratio between neck circumference and thyromental distance >4.[15] Patients had to fulfill either one of the criteria (2) and (3) or both. Exclusion criteria were as follows: (1) ≤18 years of age; (2) mouth opening ≤2 cm; (3) planned awake fiberoptic intubation; and (4) planned nasal intubation.

The preoperative airway evaluation included the following items (full details in Supplemental Digital Content, Table 1, http://links.lww.com/AA/C754: (1) cervical circumference assessed at the cricoid cartilage level; (2) thyromental distance; (3) previous knowledge of difficult intubation; (4) modified Mallampati grade; (5) clinical symptoms of airway pathology; (6) pathologies associated with difficult intubation; (7) inter-incisor gap and mandible luxation; and (8) maximum range of the head and neck movement. Criteria from (2) to (7) were used to calculate Arné score.

Preoperative quantitative assessment of difficult airway predictors was performed by one of the trialists who was provided with a written cognitive aid. Intubations were performed by the attending hospital staff anesthesiologist (30 anesthesiology consultants with homogenous Glidescope usage experience). There is no in training or visiting personnel at our institution, and all board certified-anesthesiologists have ≥1 year of experience in Glidescope and have experience in fiberoptic handling.

Patients were randomly allocated into 2 groups (1:1 allocation ratio) by a sequence generated from a pseudorandom number seed. Patients' allocation was kept in sealed and consecutively numbered opaque envelopes, which were opened after informed consent was obtained. In both groups, the attending anesthesiologist used Glidescope with an acute-angled blade to obtain best glottic visualization. In the standard Glidescope group, intubation was performed following the recommendations of the manufacturer. We used a standard malleable stylet (Satin Slip; Mallinckrodt, St Louis, MO). In the Glidescope + fiberscope group, intubation was performed using the fiberscope (single-use aScope; Ambu, Copenhagen, Denmark) as a dynamic stylet inside the tube under Glidescope laryngoscopy view without using fiber optic vision neither directly nor through a camera (Supplemental Digital Content, Video 1, http://links.lww.com/AA/C754).

After standard monitoring, patients were administered 100% oxygen with facemask for 3 minutes in nonobese patients (body mass index, ≤35 kg/m^2) and 5 minutes with 10 cm H_2O of continuous positive airway pressure in obese patients (body mass index, ≥35 kg/m^2). Anesthetic induction position was sniffing (in nonobese patients) or ramped (external auditory meatus at the level of the sternal notch) in obese patients. Induction of anesthesia was achieved with propofol 2–3 mg/kg and fentanyl 1–2 μg/kg. Neuromuscular blocking agents were used in all patients. Tracheal intubation was performed either after 90 seconds of a rapid sequence induction dose of neuromuscular blocking agent or with a train-of-four count of 0. Tube size was not standardized and was chosen by the attending anesthesiologist according to clinical judgment.

The primary end point of the study was first-attempt intubation success defined as tracheal tube placement (confirmed by end-tidal carbon dioxide) with a single laryngoscopy maneuver with the Glidescope. The attempt was considered a failure when (1) Glidescope was removed from the mouth; (2) Spo_2 dropped at <90% before achieving intubation; (3) there was a need to change to another intubating device. The attending anesthesiologist performed laryngoscopy maneuver; after obtaining the best possible glottic visualization, the Glidescope was held in place by the attending anesthetic nurse and intubation through the fiberscope was performed with indirect video visualization from the Glidescope. If the first attempt of intubation failed, the strategy, as well as the rescue technique to use, was at the attending anesthesiologist's discretion without any prespecified approach. Other data recorded included time to successful intubation defined as the time interval between blade insertion into the mouth and tube cuff insufflation, number of intubation attempts, device with which intubation was achieved, Cormack–Lehane scale as assessed by indirect video visualization, airway injury defined as any bleeding, gum/pharyngeal or teeth lesion, need for increased force on laryngoscope as per attending anesthesiologist judgment, need for external laryngeal manipulation, need for help from a fellow anesthesiologist, and vocal cord mobility (any abduction/adduction movement scored as yes). Intubation difficulty scale score was calculated based on the items recorded (Supplemental Digital Content, Table 2, http://links.lww.com/AA/C754).[16]

Statistical Analysis

Normality of distributions was assessed by inspection of quantile–quantile plots. Data are presented as mean (SD) or counts (percentages) if not otherwise specified. The rate of success of tracheal intubation at first attempt (primary outcome) was tested for superiority with Fisher exact test. As for secondary outcomes, we tested for superiority as follows: time to successful intubation with Mann-Whitney *U* test, airway injury rate with Fisher exact test, Spo_2 at intubation with Mann-Whitney *U* test, and need for alternative rescue technique with Fisher exact test. A Holm correction for multiple comparisons was used to control for increased type I error. We applied a correction for 5 outcomes (1 primary and 4 secondary) and report adjusted *P* values. For significant results in categorical variables, the fragility index was also reported.[17]

In a post hoc analysis, we fitted a logistic regression model with the rate of success of intubation at first attempt as the dependent variable and the study group, age, cervical circumference/thyromental distance ratio, reduced thyromental distance, modified Mallampati score, type of surgery, neck movement range, incisor gap distance and mandible luxation, pathologies associated with difficult intubation, and clinical symptoms of airway pathology as covariables to control for baseline imbalances.[18]

We estimated the sample size considering a 13% increase from a baseline intubation success rate using the Glidescope at first attempt as clinically significant. Assuming a baseline success rate of 86%,[19] we calculated that 158 patients would be required (79 per arm) to achieve a significant result with an α error of 5% and power of 80% with a Fisher exact test. In anticipation of possible sample losses, 160 patients were recruited.

All analyses were in R statistical software version 3.5.1 (The R Foundation for Statistical Computing, Vienna, Austria; www.r-project.org). Statistical significance was set for 2-tailed *P* value <.05.

RESULTS

We assessed 219 patients for eligibility between December 2017 and August 2018; after checking for exclusion criteria, we randomized 160 patients either to the Glidescope + fiberscope group or the standard Glidescope group (Figure 1). Two patients were excluded from analysis because of screening failure (n = 1) and Glidescope malfunctioning (n = 1). Patient characteristics are shown in Table 1.

Table 2 reports the simplified Arné score items. Almost all patients have a large neck circumference (cervical circumference/thyromental distance was >4 in 97% of patients), and the majority have a Mallampati score of III or IV (65%). Limitations in neck movement and mouth opening were present in 43% and 42% of subjects, respectively. Every patient presented ≥2 criteria associated with difficult airway including previous history of difficult airway (8% of the sample).

Primary and secondary outcome results and measures of association are shown in Table 3 and Figure 2. The success rate of intubation at first attempt was 91% in the Glidescope + fiberscope group and 67% in the standard Glidescope group (*P* = .001; fragility index, 8). Ninety-four percentage of failure was caused by the need of a new laryngoscopy attempt (31 of 33 total failures at first-attempt intubation), and 6% (2/33) was caused by a desaturation (Spo_2, <90%) that required ventilation as detailed in the study protocol. Median time to successful intubation was 50 seconds (interquartile range, 80 seconds) in the Glidescope + fiberscope group and 64 seconds (interquartile range, 24 seconds) in the standard Glidescope group (*P* = .035). Airway injury rate was 1% (1/78; 95% CI, 0.2%–8%) in the Glidescope + fiberscope group and 11% (9/70; 95% CI, 6%–20%) in the standard Glidescope–stylet group (*P* = .035; fragility index, 1). There was no statistically significant difference between groups in Spo_2 at intubation (*P* = 1).

Table 4 reports laryngoscopy-associated variables. Ninety-three percentage of patients presented a Cormack–Lehane grade of I or II. Four percent of the Glidescope + fiberscope group and 24% of the standard Glidescope group patients required an alternative technique to achieve intubation (*P* < .001; absolute benefit increase, 21% [95% CI, 11%–32%]; fragility index, 7). As for alternative methods used, in 24 cases (72% of failed first attempts), intubation was achieved with the Glidescope + fiberscope technique, 20 times (77% of failed first attempts in that group) in the standard Glidescope group and 4 times (57% of failed first attempts in that group) in the Glidescope + fiberscope group. Other alternative techniques used were standard Glidescope (12%), conventional direct laryngoscopy with Macintosh blade (14%), and bougie use (1%).

The post hoc analysis fitting a multivariable logistic regression model to control for baseline characteristics imbalances (Supplemental Digital Content, Table 3, http://links.lww.com/AA/C754) returned an adjusted relative risk for first-attempt success of 1.22 (95% CI, 1.16–1.26; *P* = .001) in the Glidescope + fiberscope group.

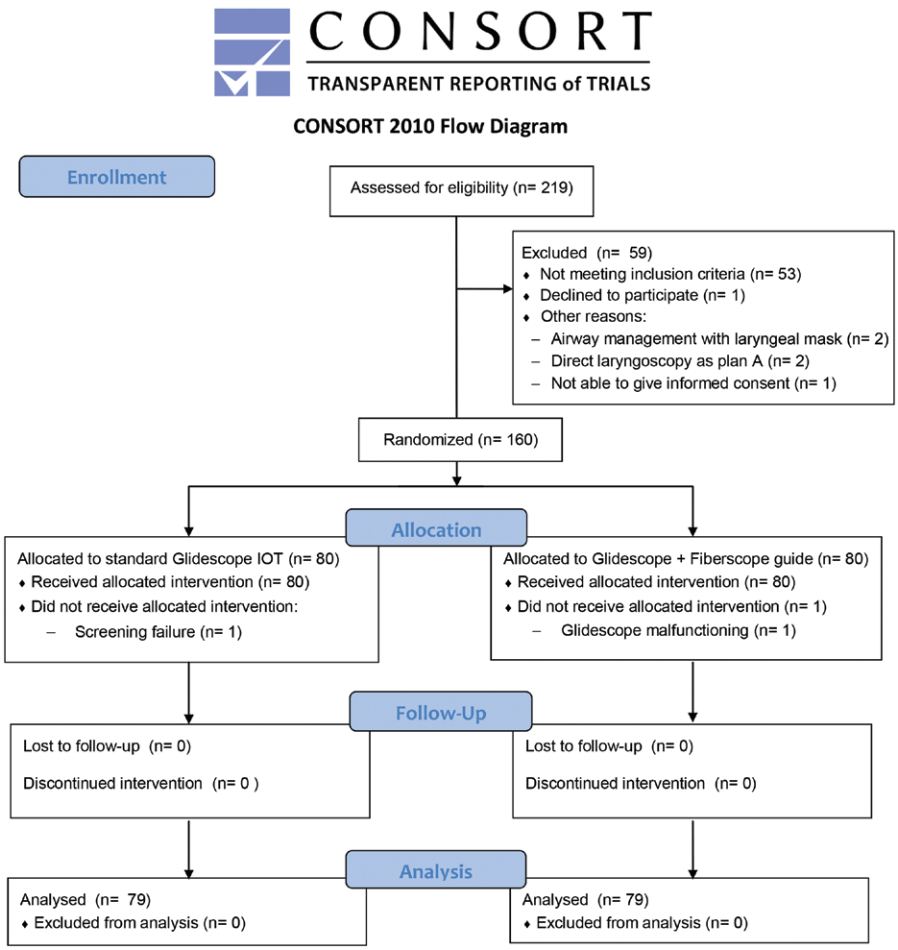

Figure 1. CONSORT 2010 flow diagram. CONSORT indicates Consolidated Standards of Reporting Trials; IOT, tracheal intubation.

Table 1. Baseline Characteristics of Patients Included in the Study

	Standard Glidescope (n = 79)	Glidescope + Fiberscope (n = 79)	Total (n = 158)	Standardized Difference
Age (y)	52.6 (11.9)	54.4 (12.8)	53.5 (12.3)	0.14
Arné simplified score	11 (7)	11 (7)	11 (7)	0.09
Cervical circumference (cm)	43.8 (6)	43.9 (5)	43.8 (6)	0.03
Thyromental distance (cm)	8 (1)	8 (1)	8 (1)	0.19
Cervical circumference/thyromental distance ratio	5.38 (1.26)	5.61 (1.44)	5.49 (1.35)	0.18
Height (cm)	168 (9)	167 (10)	167 (10)	0.06
Weight (kg), median (25th–75th percentile)	100 (85–124)	102 (92–122)	101 (90–123)	0.08
Body mass index (kg/m^2), median (25th–75th percentile)	36 (30–43)	38 (33–44)	37 (32–44)	0.13
Gender, N (%)				0.05
Male	40 (51)	38 (48)	78 (49)	
Female	39 (49)	41 (52)	80 (51)	
ASA physical status, N (%)				0.01
I	6 (8)	3 (4)	9 (6)	
II	45 (57)	18 (64)	95 (60)	
III	27 (34)	3 (10)	53 (33)	
IV	1 (1)	0 (0)	1 (1)	
Type of surgery, N (%)				0.3
Bariatric	35 (44)	39 (49)	74 (47)	
Otorhinolaryngology/maxillofacial	14 (18)	14 (18)	28 (17)	
Orthopedic	15 (19)	14 (18)	29 (18)	
General	14 (18)	12 (15)	26 (17)	
Neurosurgery	1 (1)	0 (0)	1 (1)	

Values are mean (SD) except as noted.
Abbreviation: ASA, American Society of Anesthesiologists.

Table 2. Arné Score Items by Group

	Standard Glidescope (n = 79)	Glidescope + Fiberscope (n = 79)	Total (n = 158)	Standardized Difference
Previous knowledge of difficult intubation?				0.14
No	71 (90)	74 (94)	145 (92)	
Yes	8 (10)	5 (6)	13 (8)	
Pathologies associated with difficult intubation?				0.10
No	57 (73)	54 (68)	111 (70)	
Yes	21 (27)	25 (32)	46 (30)	
Clinical symptoms of airway pathology?				0.35
No	60 (76)	47 (59)	107 (68)	
Yes	19 (24)	32 (41)	51 (32)	
Incisor gap and mandible luxation				0.19
Incisor gap ≥5 cm or mandible luxation >0	46 (58)	46 (58)	92 (58)	
3.5 < incisor gap <5 cm and mandible luxation = 0	24 (31)	28 (34)	52 (33)	
Incisor gap <3.5 cm and mandible luxation <0	9 (10)	5 (6)	14 (9)	
Thyromental distance (cm)				0.15
≥6.5	75 (95)	72 (91)	147 (93)	
<6.5	4 (5)	7 (9)	11 (7)	
Maximum range of neck movement				0.36
Above 100°	52 (66)	38 (48)	90 (57)	
About 90° (90 ± 10)	25 (32)	38 (48)	63 (40)	
Below 80°	2 (2)	3 (4)	5 (3)	
Modified Mallampati score				0.41
Class 1	9 (11)	9 (11)	18 (12)	
Class 2	22 (28)	15 (19)	37 (23)	
Class 3	36 (46)	50 (63)	86 (54)	
Class 4	12 (15)	5 (6)	17 (11)	

Values are presented as count (%).

Table 3. Primary and Secondary Outcomes Effect Sizes

	Standard Glidescope (n = 79)	Glidescope + Fiberscope (n = 79)	Relative Risk	Absolute Benefit Increase/ Risk Reduction	*P* Value
First-attempt tracheal intubation success	53/26 (67%) (56%–77%)	72/7 (91%) (83%–96%)	3.7 (1.7–8.0)	24% (12%–36%)	**.001**
Airway injury	9/70 (11%) (6%–20%)	1/78 (1%) (0.8%–8%)	0.89 (0.82–0.97)	10% (3%–18%)	.035
				Difference	
Time to successful tracheal intubation	64 (54–87)	50 (45–58)		**14 (2–29)[a]**	.035

Values are median time in seconds or yes/no counts (%) and effect size estimate (95% CI).
Bold values are statistically significant.
[a]CI obtained with the Hodges–Lehmann estimator.

DISCUSSION

The use of a flexible guide during a Glidescope laryngoscopy in patients with a predicted difficult airway (1) improves first-attempt tracheal intubation success; (2) decreases the incidence of airway injury; (3) decreases time to achieve successful intubation; and (4) the need of an alternative technique to achieve successful intubation compared to a standard intubation technique. The effect of the combined technique is significant even after controlling for baseline imbalances. Of note, the trials' primary end point results are remarkably robust because the fragility index is twice the median index value for anesthesiology studies in the literature.[20]

Our investigation has several strengths. First, we specifically studied patients with high probability of difficult airway to assess the effect size of this technique in the most challenging intubation scenario. To this purpose apart from the cervical circumference criterion, we used a difficult airway definition based on a comprehensive test of prelaryngoscopy features (Arné score).[14] Second, a reasonably experienced group of providers was chosen as restricting Glidescope use to a population of really expert providers may have hindered external validity of our results. Likewise, we aimed to enhance external validity by not restricting tube choice. Furthermore, we conducted a supplementary analysis to control for potential confounders such as different inclusion criteria or laryngoscopy conditions.

Current guidelines of Difficult Airway Society[21] recommend maximizing the likelihood of successful intubation at the first attempt as the probability of success declines with every attempt and repeated laryngoscopy can potentially lead to a "'cannot intubate and cannot oxygenate" situation. Also, the role of videolaryngoscopy is highlighted for plan A, and some authors even advocate for establishing videolaryngoscopy as the first-line device.[22] In this framework, increasing the success rate of videolaryngoscopy is critical.

We observed significantly fewer airway injuries in the Glidescope + fiberscope group than in the standard Glidescope–stylet group (1% vs 11%; $P = .035$), most probably because fewer intubation attempts were made in the study group but also because fiberscope allows smoother

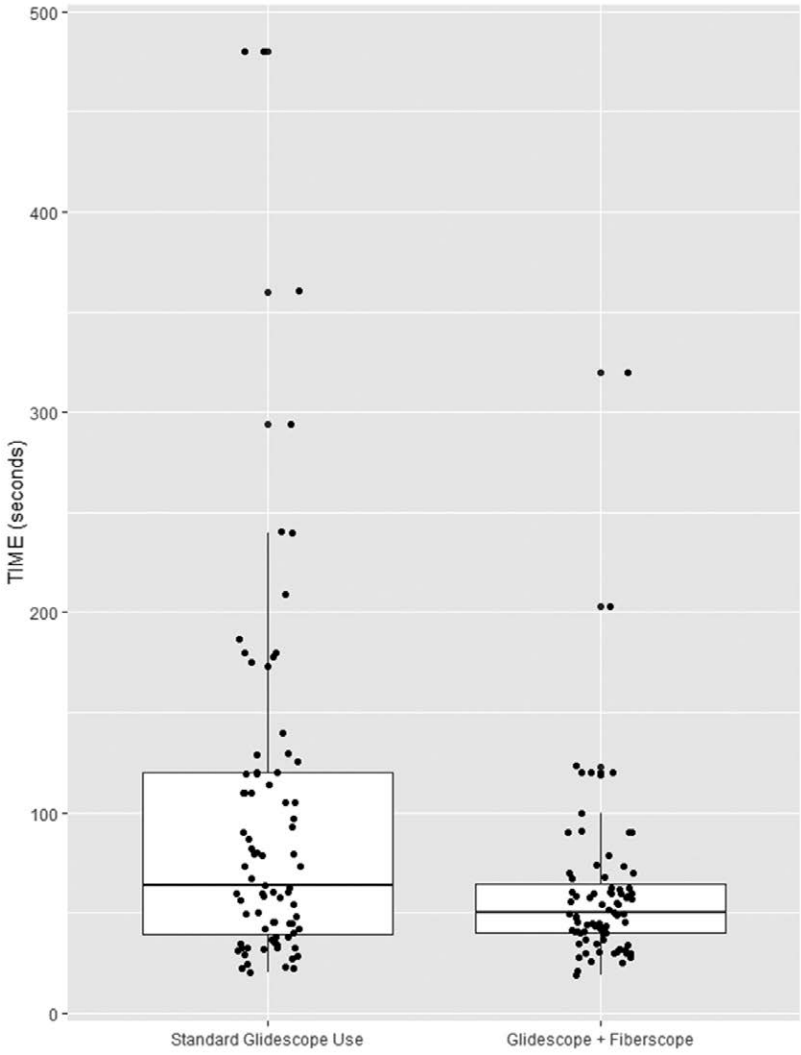

Figure 2. Time-to-successful tracheal Intubation boxplot and distribution. TME indicates time until successful intubation.

movements than a preformed tube with a stylet. Repeated intubation attempts are the main reason why we found a significant difference in time to successful intubation between groups with a shorter median time in the Glidescope + fiberscope as well. This result is in line with previous reports in patients and manikin studies that tie acute-angled blade videolaryngoscopy with increased risk of mucosal damage due to the reduced space available to advance the tube, especially if a stylet is used to angle sharply the tube tip.[23] As for absolute time values, median time to successful tracheal intubation in our study is in line with what is considered a reasonable threshold for intubation time (60 seconds)[24] and with Glidescope median tracheal intubation time reported in a large study in simulated difficult airways.[25]

We also found that the need for an alternative rescue technique to achieve intubation was greater in the standard Glidescope–stylet group (4% in the Glidescope + fiberscope group versus 24% in the standard Glidescope–stylet group; $P < .001$; fragility index, 7). Furthermore, a combined Glidescope + fiberscope technique was the preferred method of rescue in both the standard Glidescope–stylet group (72% of cases) and the study group. In 2 large studies[26,27] using common airway assessment and a multivariable risk model, both tests revealed that 89%–91% of difficult intubations were unanticipated and unpredicted. Furthermore, clinicians predicted only half (40%–55%) of the difficult intubations.[28] This highlights the potential of the combined use of a videolaryngoscopy with a flexible guide even in case of unpredicted difficult airway which draws from the enhanced glottic visibility provided by a videolaryngoscopy while getting around the issue of maneuverability. However, further studies are warranted to have a definitive answer to this question because our focus was on patients with predicted difficult airway.

Glidescope is the most studied videolaryngoscopy, and it has a success rate of 96% in the predicted difficult airway, and a success rate of 94% as a rescue device when direct laryngoscopy fails.[29] In a meta-analysis, first-attempt tracheal intubation success rate was 92%.[30] As we mentioned above, we selected a population with more stringent criteria of difficult airway. This choice explains in part the lower rate of success we observed in the standard Glidescope intubation group compared to other studies in which less strict criteria of difficult airway were used and tracheal intubation providers were further trained in device management.[31] Nevertheless, videolaryngoscopy has varying success rate depending on videolaryngoscopy model and operator experience.[32,33] The

Table 4. Laryngoscopy-Related Variables as Detailed by the Intubation Difficulty Scale

	Standard Glidescope Group (n = 79)	Glidescope + Fiberscope (n = 79)	Total (n = 158)	*P* Value
No. of intubation attempts				**<0.001**[a]
1	55 (70)	72 (91)	127 (80)	
2	15 (19)	7 (9)	22 (14)	
3	9 (11)	0	9 (6)	
No. of operators				0.78[b]
1	71 (90)	73 (92)	144 (91)	
2	8 (10)	6 (8)	14 (9)	
No. of alternative techniques				**<0.001**[a]
0	59 (76)	76 (96)	135 (85)	
1	20 (24)	3 (4)	23 (15)	
Cormack–Lehane grade				0.32[a]
1	52 (66)	59 (75)	111 (70)	
2	22 (28)	14 (18)	36 (23)	
3	5 (6)	5 (6)	10 (6.5)	
4	0	1 (1)	1 (0.5)	
Lifting force required,[c] (yes/no)	39/40 (49)	28/51 (35)	67/91 (42)	0.10[b]
External laryngeal pressure,[c] (yes/no)	43/36 (54)	29/50 (37)	72/86 (45)	0.04[b]
Cord mobility,[c] (yes/no)	8/71 (10)	4/75 (5)	12/146 (7)	0.37[b]
Intubation difficulty scale score	2 (1 – 3)	1 (0 – 1)	1 (1 – 2)	0.004[d]
Intubating conditions by intubation difficulty scale				0.13[a]
Easy (intubation difficulty scale = 0)	26 (33)	34 (43)	60 (38)	
Slightly difficult (0 < intubation difficulty scale ≤5)	44 (56)	42 (53)	86 (54)	
Moderate to major difficulty (5 < intubation difficulty scale)	9 (11)	3 (4)	12 (8)	

Values are count (%) and median (25th–75th percentile) for intubation difficulty scale.
Bold values are statistically significant.
[a]Fisher exact test.
[b]χ^2 test.
[c]Percentage reported is for the number of events.
[d]Wilcoxon rank sum test.

differences in the definition of predicted difficult airway used as inclusion criteria in clinical trials also produce substantial variability in success rate. When difficult airways are defined as patients with cervical spine immobilization, failure at first attempt using videolaryngoscopy was 9.9%,[34] while failure at first attempt in obese patients was 6%–23%.[35] We used the Glidescope because of convenience, but other acute-angled blade devices available on the market could have been chosen without changing the rationale of the study.

This trial has several limitations. First, we did not conduct any follow-up outside the operating room to monitor injuries because we focused primarily on the laryngoscopy maneuver. Also, we found that Spo_2 at intubation was not significant, but protocol allowed to ventilate patients when saturation fell below 90% and count it at failed attempt, and this explains why we found no difference. Third, blinding the intubation provider to the airway device being used was impossible, leading to a potential bias. Another limitation comes from the subjective nature of grading preoperative difficult airway predictors and laryngoscopy conditions. While we found no differences in intubating conditions based on intubation difficulty scale score between groups, external laryngeal manipulations showed significant difference. Because this is a device-related factor, these findings should be viewed as exploratory. Fifth, this technique requires an external assistant at least to hold the Glidescope while the intubation is performed with the fiberscope; however, there was no increased need for help from a fellow anesthesiologist between techniques and the help was provided by an assistant. Moreover, patients with difficult airway frequently require external help anyway (eg, manipulation of the glottis). Sixth, because we compared a dynamic guide (a fiberscope) to a static preshaped stylet, we cannot generalize to other commercial dynamic stylets although they have reduced flexion capabilities compared to an fiberscope. Finally, a single-use fiberscope was used for the study. If this technique is to be implemented on a regular basis, price can become an issue. Either using a reusable device or design a flexible guide without optical fibers (vision comes from the Glidescope) can overcome this problem.

In conclusion, using a flexible and dynamic guide to guide the intubation during laryngoscopy with the Glidescope increases the rate of success at first attempt and reduces morbidity compared to a standard Glidescope intubation technique.

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DISCLOSURES

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