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Comparison of videolaryngoscopy alone with video-assisted fibreoptic intubation in a difficult cadaver airway model

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Editor,

Videolaryngoscopy (VLS) has gained widespread popularity over the past few years, especially for management of difficult airways.[1] However, even with VLS, intubation of the trachea can be challenging. For these situations a video-assisted fibreoptic intubation (VAFI) technique has been suggested.[2] A VLS is used to obtain the best possible glottic view and a fibrescope preloaded with a tracheal tube is introduced to intubate the trachea. This allows the practitioner the option of using both video screens for optimal vision. Recently, VAFI has been compared with VLS in patients with predictors of a difficult airway, but the results were not conclusive.[3,4] In addition, predictors of a difficult airway in patients have limited diagnostic accuracy.[5] It is, therefore, important to compare the effectiveness of VAFI versus VLS in an established difficult airway. For this purpose, a human cadaver model can be used, such as a Fix for Life (F4L) cadaver model, which was described as a suitable and realistic airway model.[6]

The primary aim of this study was to compare intubation success rates of VAFI with VLS alone in the F4L cadaver. Secondary outcomes were time until successful intubation, percentage of glottic opening (POGO) and a verbal rating score (VRS) for realism of the difficult airway in the F4L cadaver on a 1 to 10 scale (1 = worst score, 10 = best score).

The Medical Ethics Review Committee of Amsterdam UMC, Vrije Universiteit (Amsterdam, the Netherlands. Reference 2019.123) waived formal approval on 6 March 2019. A F4L cadaver with a Cormack–Lehane grade 4 on direct laryngoscopy was selected by consensus of three experienced anaesthesiologists. Anaesthesiologists and senior trainees participated after informed consent. Experience with VAFI was recorded. Each participant was randomly assigned with a closed envelope technique to the order of the intubation procedures; to either first intubate the trachea with the VLS and subsequently with the VAFI technique, or vice versa. For both intubation techniques, the VLS used was a Glidescope (Verathon Medical, Burnaby, Canada) with an acute angled size 3 blade. For the VAFI technique, a flexible fibrescope (Ambu aScope 4, Ambu A/S, Ballerup, Denmark, regular size, outer diameter 5.5 mm) was additionally provided.

After randomisation, each participant was instructed to intubate the trachea using the assigned order of techniques. A maximum of 300 s was allowed per procedure for successful intubation. Multiple attempts were allowed within this timeframe. After completion of both techniques, the participants gave a VRS.

As reliable a priori estimates for the within-participant correlation were not available, the sample size estimation was based on a Pearson's χ^2 test for two independent proportions. Assuming a successful intubation rate of 60% with the VLS in this difficult airway model and an expected successful intubation rate of 90% in the VAFI group, a sample size of at least 29 participants per group was necessary. To compensate for potential dropouts, we targeted 33 participants in total.

Generalised estimating equations were used for the comparison of success rates, time and POGO scores. The technique and the period, as well as the interaction of period and technique were included in the model to assess main effects of the technique, the period and carry-over effects, respectively. If a significant carry-over effect was to be detected, only the technique performed in period 1 was subsequently analysed. For categorical and continuous variables, the Pearson's χ^2 test or Mann–Whitney U test, as appropriate, were used. For the VRS, the mean ± SD was calculated. Significance was set at a P value of 0.05.

All but one of the participants were familiar with the concept of VAFI, and 19 had previous practical experience with this technique. Seventeen were randomised to start with VLS, and 16 started with VAFI. Success rates of tracheal intubation, time and POGO scores per period are presented in Table 1. The mean ± SD VRS was 7.6 ± 1.9. Analysis of the effect of the first intubation technique on the success of the second technique revealed a significant carry-over effect. Consequently, period 2 was excluded from the subsequent analyses of success rates, time and glottic view. The characteristics of the F4L cadaver model are presented in Table 2.

The visualisation of the glottis was markedly higher with the VAFI technique compared with VLS, which seems to translate to a higher success rate of tracheal intubation (75.0 versus 41.2%, $P = 0.049$). The time until successful intubation was not different between both techniques.

Table 1 **Observed outcomes of success rate of tracheal intubation, time and percentage of glottic opening scores with the videolaryngoscope and video-assisted fibreoptic intubation techniques**

	VLS	VAFI	P*
Success rate; *n*			
Period 1[a]	7 (41.2%)	12 (75.0%)	0.049
Period 2	15 (93.8%)	13 (76.5%)	
Time (s)			
Period 1[a]	103.7 ± 51.7	148.3 ± 71.8	0.299
Period 2	90.8 ± 55.6	126.2 ± 69.1	
POGO score (%)			
Period 1[a]	29.1 ± 26.1	60.0 ± 37.9	0.015
Period 2	60.3 ± 26.2	71.9 ± 26.9	

Values are number (%) or mean ± SD. POGO, percentage of glottic opening; VAFI, video-assisted fibreoptic intubation; VLS, videolaryngoscopy. [a] In period 1 the participant either started with VLS or VAFI. In period 2 the alternate technique was performed by the participant. *Because of a significant carry-over effect of performing VAFI first and VLS second, only the results of period 1 were analysed.

Table 2 **Characteristics of the Fix for Life cadaver model**

Age at demise (years)	75
Sex	Female
Length (m)	1.66
Weight (kg)	61
BMI ($kg\,m^{-2}$)	22.1
Dental status	Complete
Neck circumference (cm)	38
Thyromental distance (cm)	4.5
Sternomental distance (cm)	14

Overall, the F4L cadaver model received promising scores for realism as a difficult airway model.

In a previous study, no difference was found in intubation success, number of intubation attempts or time to intubation between both techniques.[3] In another study, the primary end point was defined as first-attempt intubation success, and this was significantly higher in the VAFI group (91%) compared with VLS (67%).[4] In both studies, the majority (>80%) of included patients presented a Cormack–Lehane grade 1 or 2, making it questionable if these airways were indeed difficult to intubate. A major strength of our study is that we provided a true difficult airway, also illustrated by the relatively low intubation success rates.

Our study has several limitations. We used a cadaver model and not a real patient. However, to evaluate the benefits of a relatively new intubation technique for a difficult airway like VAFI, and to compare it with an already highly successful technique such as VLS, a pre-procedurally established true difficult airway appeared advantageous to allow for standardised observations. Moreover, the second time point was discarded in the analysis due to a significant carry-over effect, as recommended in the statistical literature.[7] This led to a lower than the a priori calculated sample size. The limited sample size may explain the only marginally significant result for the primary outcome. Nonetheless, the data provide evidence for a higher success rate of the VAFI technique compared with VLS at the predetermined alpha level, and the finding is plausible given the significantly higher POGO scores.

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References

1 Frerk C, Mitchell VS, McNarry AF, *et al.* Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults. *Br J Anaesth* 2015; **115**:827–848.
2 Sanfilippo F, Chiaramonte G, Sgalambro F. Video laryngoscopes and best rescue strategy for unexpected difficult airways: do not forget a combined approach with flexible bronchoscopy!. *Anesthesiology* 2017; **126**:1203.
3 Lenhardt R, Burkhart MT, Brock GN, *et al.* Is video laryngoscope-assisted flexible tracheoscope intubation feasible for patients with predicted difficult airway? A prospective, randomized clinical trial. *Anesth Analg* 2014; **118**:1259–1265.
4 Mazzinari G, Rovira L, Henao L, *et al.* Effect of dynamic versus stylet-guided intubation on first-attempt success in difficult airways undergoing glidescope laryngoscopy: a randomized controlled trial. *Anesth Analg* 2019; **128**:1264–1271.
5 Norskov AK, Rosenstock CV, Wetterslev J, *et al.* Diagnostic accuracy of anaesthesiologists' prediction of difficult airway management in daily clinical practice: a cohort study of 188 064 patients registered in the Danish Anaesthesia Database. *Anaesthesia* 2015; **70**:272–281.
6 van Emden MW, Geurts JJ, Schober P, *et al.* Comparison of a novel cadaver model (Fix for Life) with the formalin-fixed cadaver and manikin model for suitability and realism in airway management training. *Anesth Analg* 2018; **127**:914–919.
7 Hills M, Armitage P. The two-period cross-over clinical trial. *Br J Clin Pharmacol* 1979; **8**:7–20.

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Accidental extubation in prone position

Report of two cases and proposal of an algorithm for airway management

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Editor,

Accidental extubation during prone-positioned surgery is an exceptional life-threatening event.[1] Optimal airway