airway device evaluation project team (ADEPT) guidance on the selection of airway devices. It recommends at least level 3b evidence for airway devices that are used in clinical practice[3].

After approval by the institutional research ethical committee and written informed consent, 58 ASA 1 and 2 adult patients, age >18 yr were enrolled in the study. Randomisation was done using sealed envelope technique and patients were divided into 29 each IRRIS group and control group (non-IRRIS). All patients received TIVA with target-controlled infusion propofol and neuromuscular block with vecuronium bromide. Our primary outcome was total time to pass a fibrescope from the mouth to glottic opening, and the secondary outcomes were the number of manoeuvres such as head tilt, chin lift, jaw thrust, and lingual traction.

The time taken was 30 s to complete the first 25% of the IRRIS patients, compared with more than 40 s for controls. This time difference becomes wider when we reach the 50% completed mark, with 50% of IRRIS patients completed in just under 40 s, against 57 s for the controls. Meanwhile, 75% of IRRIS patients complete in just more than 50 s, whereas the controls take 80 s. The time difference to pass the fibrescope through the glottic opening was significant in both groups (P=0.011). Head tilt plus chin lift was the common manoeuvre used in both groups; 20 times in the IRRIS group and 14 times in controls. Head tilt plus chin lift plus jaw thrust was used five times in both groups. In two patients of IRRIS group head tilt plus chin lift plus jaw thrust plus lingual traction was used as compared with a similar number of manoeuvres used six times in controls. We conclude that the IRRIS device can be a great addition for anaesthetists who are less familiar with FOI. We also suggest that, by using the IRRIS device, we can reduce hypoxia time in difficult airway patients with respiratory compromise.

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Evaluation of the McGrath MAC™ and Macintosh laryngoscope for tracheal intubation

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Direct laryngoscopy (DL) using a Macintosh blade is the first choice for tracheal intubation in many hospitals. The value of videolaryngoscopy using a Macintosh-shaped blade for routine intubation is currently unclear; few RCTs comparing this technique with DL are currently available.[1] We hypothesised that using the McGrath MAC (McG; Medtronic, Dublin, Ireland) for routine intubation in the operating room results in a higher first-pass intubation success rate (FPS) compared with conventional DL.

This trial was a multicentre, open-label, patient-blinded, randomised controlled clinical trial and approved by the ethics committees of participating centres before patient recruitment. Patients who had elective surgery with tracheal intubation were included in this study. Patients were excluded if a difficult intubation was expected, age <18 yr, ASA 4, and a high-risk of aspiration. The primary end point was FPS; the secondary endpoints were the influence of the provider experience, time to intubation, Intubation Difficult Score (IDS >5 points: difficult intubation), and adverse events (e.g., hypoxaemia or soft tissue injury).[1] A χ^2 test was used to compare FPS between the two groups. Data are expressed as median (inter-quartile range [IQR]).

A total of 2171 patients (McG, n=1084; DL, n=1087) were included. FPS was higher with the McG (1019/1084; 94%) compared with DL (896/1087; 82%) (P<0.0001). Time for intubation was significantly shorter with DL (34 s; IQR, 26–45) compared with McG (36 s; IQR, 26–47) (P=0.0005). The IDS was higher (>5) using DL (61/1087; 5.6%) compared with the McG (13/1084; 1.2%) (P<0.0001). There were no significant differences in intubation-associated adverse events between groups (P=0.15).

These results reflect the effectiveness of using videolaryngoscopy as a first choice for routine intubation in a large controlled trial for elective surgery patients with anaesthesiologists at various levels of experience. Intubation time was shorter using direct laryngoscopy; however, we do not consider this to be clinically relevant. Based on these results, videolaryngoscopy using a Macintosh-shaped blade can be recommended as a first choice instrument in elective surgery patients.

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Virtual reality simulation to teach videolaryngoscopy: a preliminary validation study

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Virtual reality (VR) is a technology increasingly used in the field of medicine to teach specific skills and procedures. It has been shown to improve the learning experience compared with various simulation models for airway management. [1–3] Videolaryngoscopy (VL) requires specific skills and a dedicated understanding of the patient airway and equipment. Type of blade, tracheal tube, and need for stylet or bougie have been shown to be an important part of success depending on the clinical situation.

The aim of this study was to report about an innovative airway management VR simulator, which assesses the choice

of equipment and timings related to specific VL intubation skills in three evolving airway scenarios, and user perception. A VR gamified simulator based on a real operating room setting was designed by the Department of Anaesthesiology of the University Hospital of Lausanne, Switzerland, in collaboration with Lucid Reality Labs (Kyiv, Ukraine) and Medtronic RMS EMEA It was developed for usage on an HTC Vive Pro and consisted of a VR-grade laptop, two infrared cameras, and a pair of VR controllers for movements tracking (1.5 mm accuracy).

Three airway scenarios were created: a 58-yr-old obese and bearded man, a 5-yr-old child, and a 42-yr-old woman. The latter scenario included an unexpected difficult visualisation of the trachea with the need to switch to a hyperangulated blade and styletted tracheal tube. An ideal VL mouth-introduction (VLMI) path was taught to the VR software. Ethical approval was granted, and data were collected during five international anaesthesia conferences and two specific airway management meetings (CHU UCL Namur, Belgium 2018 and Difficult Airway Society, Edinburgh, Scotland, 2018) on voluntary participants. A 4 min practical teaching session was followed by an automatic recording of choice of scenario, type and size of blade, tracheal tube size, time to complete intubation, force used for VL, number of vocal cord contacts, and damaged teeth. Introduction path of the VL was compared with the VLMI path. Participants were also asked about the usefulness for education and interest in acquiring a similar simulator for in-hospital usage.

We enrolled 437 participants from 18 countries who played the VR simulation on 491 scenarios; assessment was possible on 439. Participants were practising anaesthesiologists followed by department chairs, residents, nurses, and airway fellows. The 'woman' scenario was the most played (47.2%) and the 'child' the least (13.4%). The wrong blade was chosen in 160 (36.0%) situations, of which 51% were in the 'man' scenario. Time to intubate was longer and VL force higher in the 'man' scenario, whereas vocal cord contact and damaged teeth were higher in the 'woman' scenario. The 'child' scenario generated the least vocal cord contacts. The VR simulator was identified as useful for teaching by 273 participants (71%), and 248 (65%) had interest in acquiring it.

The VR simulator generated high interest during anaesthesia conferences and allowed identification of areas where further emphasis on VL teaching might be necessary. It was recognised as a useful tool to improve specific skills and performance and could complement available training tools.

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Ultrasonography reduces vertical incision size of front-of-neck access on a non-palpable porcine larynx model

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Ultrasonography has been shown to improve correct identification of the cricothyroid membrane (CTM).[1] In patients with difficult neck landmarks, airway guidelines suggest making a vertical incision of up to 8 cm for landmark identification during front-of-neck access (FONA).[2] In this randomised controlled simulation study, we investigated the role of ultrasound (US) on FONA performance using the scalpel–bougie–tube (SBT) cricothyrotomy on a non-palpable US-compatible porcine larynx model.

After ethics approval, consented anaesthesia and emergency medicine trainees (Mount Sinai Hospital, University of Toronto) were randomised to US (n=14) and non-US (NUS; n=15) groups. All participants received didactic and hands-on teaching of ultrasonography and SBT on neck models and porcine larynx. Within 1 week later, participants performed SBT-cricothyrotomy on a non-palpable porcine larynx model, consisting of a pig larynx embedded in an US-compatible semi-solid gel covered with an opaque skin-like membrane where the CTM is non-palpable. Participants in the US group used ultrasonography and those in the NUS group used finger palpation to identify the CTM. Primary and secondary outcomes are described in Table 6. The ultrasound machine was operational and ready to use before front-of-neck access.

The vertical incision (primary outcome) in the US group was significantly shorter than that in the NUS group. The rate of injury severity and correct tube placement were similar between groups. Although the time to complete cricothyrotomy appears longer in the US group, the difference between groups was not significant. The mean time to

Table 6 Summary of primary and secondary outcome data

	US group (n=14)	NUS group (n=15)	P-value
Primary outcome **Vertical size incision (mean (STD) mm)**	**31.2 (17.3)**	**77.4 (38.8)**	**<0.001***
Secondary outcomes None–mild/moderate–severe injuries (n, %)	10/4 (71)	10/5 (67)	1**
Procedural time to complete FONA (s)	174 (91.2)	120 (64.8)	0.081*
Time to identify CTM by US (s)	38 (17.6)	N/A	N/A
Correct tube placement (n, %)	8/14 (57)	10/5 (67)	0.7**

*Student's t-test and **Fischer's exact test were used for statistical analyses with P<0.05 as statistically significant.