BJA

British Journal of Anaesthesia, 120(1): 173–180 (2018)

doi: 10.1016/j.bja.2017.11.014
Advance Access Publication Date: 21 November 2017
Respiration and the Airway

RESPIRATION AND THE AIRWAY

Universal videolaryngoscopy: a structured approach to conversion to videolaryngoscopy for all intubations in an anaesthetic and intensive care department

T.M. Cook[1,2,*], N.J. Boniface[1], C. Seller[1], J. Hughes[1], C. Damen[1], L. MacDonald[1] and F.E. Kelly[1]

[1]Royal United Hospitals NHS Foundation Trust, Bath, Combe Park, Bath BA13NG, UK and [2]School of Clinical Sciences, University of Bristol, Bristol, UK

*Corresponding author. E-mail: timcook007@gmail.com

Editorial about this article by R.M. Cooper, BJA 2018:120:13-15, doi: 10.1016/j.bja.2017.11.017.

Abstract

Background: Videolaryngoscopy (VL) is increasingly used, but not yet routine practice, for tracheal intubation. Few departments formally trial equipment before adopting it into practice. We describe the decision-making and implementation processes that our department used when introducing universal VL, with the C-MAC© (Karl Storz, Germany), throughout our anaesthesia and intensive care departments.

Methods: We used a structured process to assess the feasibility of a change to universal VL. After departmental training, we undertook a 2 month trial period of mandating VL for all adult in-theatre intubations. Thereafter, VL remained widely available, but not mandated. We regularly surveyed anaesthetists and anaesthetic assistants to evaluate departmental opinion regarding the introduction of universal VL.

Results: Before the trial period, one-third of anaesthetists judged that universal VL would be of overall benefit to patient safety, team dynamics, and quality of care. Reservations from both junior and senior anaesthetists focused on training concerns. Support for a changeover to VL, amongst both anaesthetists and anaesthetic assistants, increased throughout the trial period. Six months after the 2 month trial, support had grown further and was almost unanimous. Anaesthetists reported significant benefits in clinical performance, teaching, and human factors, especially teamwork and situation awareness.

Conclusions: Performing a formal and prolonged trial of mandatory VL in theatre led to changes in perceptions and departmental consensus. As a result of the trial, the department agreed to the use of C-MAC© videolaryngoscopy as the default intubation technique throughout theatres and intensive care, with removal of standard Macintosh laryngoscopes from routine use.

Key words: airway; difficult; complications; human factors; intubation; patient safety; videolaryngoscopy

Editorial decision: August 4, 2017; **Accepted:** August 29, 2017

Editor's key points

- Videolaryngoscopes are potentially useful for tracheal intubation.
- The authors report that it was feasible to replace all direct laryngoscopes by videolaryngoscopes in all operating theatres and intensive care units of their hospital.
- This replacement might lead to improved patient care.

Several authors have called for videolaryngoscopy (VL) to be used either as first choice or for all intubations,[1–5] but its use is currently much lower, being 3% in one large series where VL was used as a rescue technique.[6] One editorial stated that 'videolaryngoscopes should replace direct laryngoscopes as smart phones have replaced standard cell phones: they should be used for all intubations'.[1] A recent survey examining UK use of VL showed that, although 92% of hospitals have VL available in theatre and 50% in the intensive care unit (ICU), their use is relatively uncommon; 50% of those who have VL available for anaesthesia reported infrequent routine use and none reported universal use.[7] Choice of videolaryngoscope in the same survey was through formal evaluation in only 18% of hospitals.[7] In a 2011 North American survey of residency training, VL was taught in 80% of programmes.[8]

Our department has 16 operating theatres spread over three separate locations, and uses ~5000 laryngoscope blades for in-theatre intubation each year (intubation rate ~33% of general anaesthetics). After manufacturing changes to our usual standard Macintosh laryngoscope design, the department planned to replace all current Macintosh laryngoscope stock, presenting an opportunity to reconsider our future needs. We were also aware that we were not fully compliant with the Medicines and Healthcare products Regulation Authority (MHRA) guidance on decontamination of laryngoscope blades and handles, which states that decontamination of both the laryngoscope blade and handle is necessary.[9]

Our options were as follows: (i) to replace our obsolete Macintosh laryngoscopes with new ones; or (ii) to provide VL for all intubations.

When our evaluation started, in 2013, the Storz C-MAC© (C-MAC, Karl Storz GmbH, Tuttlingen, Germany) had been in use in our department as a back-up device for laryngoscopy for 3yr, in each of three theatre suites and in the ICU.

The C-MAC© incorporates a video system mounted into a Macintosh-shaped blade. The device enables the clinician to choose to use the device as a conventional Macintosh blade (direct laryngoscopy) or to view the video image, from a camera positioned in the distal portion of the blade, on a portable screen (videolaryngoscopy). Direct laryngoscopy requires displacement of oral and submandibular tissues to gain a direct line of sight, from upper incisors to the laryngeal inlet, and the viewing angle obtained in this manner has been measured as 15°. The camera incorporated into the C-MAC© laryngoscope blade moves the user's viewpoint distal to the mid-point of the blade, and so extends the viewing angle to 80°.[10] In addition to the standard C-MAC© blade, a D-blade is available, which has increased curvature and a more distally placed camera, designed to 'see around the corner' and therefore increase the ease of laryngoscopy when direct laryngoscopy is difficult.[10]

Based on previous evaluations of this and other devices and review of the literature, the anaesthetic department judged that the device was the best candidate for our departmental conversion to universal VL. The C-MAC was chosen because of its similarity to the conventional Macintosh laryngoscope, the availability of an extra-curved blade for difficult procedures, the inclusion of a screen separate from the laryngoscope blade, and the considerable experience already gathered with the device by ourselves, supported by the anaesthetic literature. Thus, our conversion to universal VL entailed an expansion of current provision rather than introduction of a new device.

Methods

After departmental discussion, we undertook a six-stage, structured process to explore the adoption of VL with the C-MAC© as our default first-choice intubation technique (which we termed 'universal videolaryngoscopy'), with removal of Macintosh laryngoscopy from routine practice. The six steps were as follows.

(i) *Pre-trial survey*. A departmental survey to determine anaesthetists' views regarding the proposal.
(ii) *Logistics planning*. Liaison with theatres, anaesthetic assistants, central sterile services, and the infection control team about the practicalities and implications for decontamination.
(iii) Provisional capacity planning and cost analysis.
(iv) *Feasibility trial*. A 2 month trial period, during which standard Macintosh laryngoscopes were temporarily removed and the only laryngoscopes available for adult intubations in theatre and ICU were C-MACs©. A further survey of anaesthetists and anaesthetic assistants was carried out at the mid-point of this trial to identify problems and enable corrective actions.
(v) *Post-trial surveys*. Further surveys of departmental opinion at the end of the trial and 6 months later.
(vi) *Business case and implementation of change*. We planned to implement a changeover to universal VL in theatres and ICU if our department agreed that this was desirable. Knowledge from steps (i)-(v) (particularly learning about capacity needs and decontamination/infection control issues) would be used to inform a business case to support such implementation.

All users of the C-MAC© were trained in the use of the C-MAC©, including use of the standard blades and D-blades, in departmental educational sessions, out-of-theatre airway workshops, and in-theatre training sessions, and competence was assessed before use on patients.

Feasibility trial

For a 2 month trial period, standard Macintosh laryngoscopes were removed from all theatres and replaced by C-MAC© systems. A C-MAC© videolaryngoscope was used as the first-choice laryngoscope for all in-theatre intubations in adults (main theatres, day surgery, and obstetrics). Paediatric intubations and all intubations out of theatre were not included in the trial, although the C-MAC© was already at this time the default technique for intubation in our ICU, and this did not change. Users were asked to report problems with availability, the use of the C-MAC©, and failed intubations.

Seven additional C-MAC© units and blades were loaned by Storz for the purpose of the trial. Each emergency theatre (general emergencies, trauma, and obstetric emergencies) was