Tracheal intubation in critically ill adults: failing to plan is planning to fail

Safe provision of advanced airway management is a defining element of care for critically ill patients whether they are in the emergency department, acute ward or intensive care unit.

However, while tracheal intubation is often life-saving it has always been recognized as clinically challenging and potentially lethal, especially in the critically ill. These patients have a reduced ability to tolerate its physiological trespass and are particularly likely to come to harm during technical difficulty or failure. Rates of death and brain damage resulting from airway management problems in emergency department and intensive care unit patients may be respectively 40 and 60 times higher than in the operating theatre. Despite this, intubation of the critically ill patient has attracted relatively little attention and advances in techniques used in anaesthesia may only be slowly adopted (Cook et al, 2011).

Intubation guidelines are already established in various clinical settings and now the Difficult Airway Society, together with the Intensive Care Society, Faculty of Intensive Care Medicine and Royal College of Anaesthetists, has produced the UK's first national airway management guideline, focussing on critically ill adults (Higgs et al, 2018). The guideline covers tracheal intubation, management of the intubated patient to avoid and detect airway displacement, extubation and special patient groups such as the obese or burnt patient.

Dr Andy Higgs, Consultant in Anaesthesia and Intensive Care Medicine, Department of Critical Care, Warrington Hospitals, Cheshire WA5 1QG

Professor Tim Cook, Consultant in Anaesthesia and Intensive Care Medicine, Department of Anaesthesia and Intensive Care, Royal United Hospitals Bath NHS Foundation, Bath

Correspondence to: Dr A Higgs (andyhiggs@doctors.org.uk)

For reasons of space this editorial focuses only on tracheal intubation. It is hoped that the guideline will be incorporated into the clinical practice of all clinicians dealing with this demanding area and thereby improve the reliability and safety of airway management for these most vulnerable patients.

Human factors

American surgeon and patient safety guru Atul Gawande (2007) claims that intensive care medicine has become the art of managing extreme complexity; during emergency tracheal intubation in the critically ill this extreme complexity is managed within an unforgivingly fast timescale.

Recognizing this, the guidelines emphasize the importance of human factors and how an understanding of human factors science may improve outcomes by raising the performance of the whole multidisciplinary airway team, rather than concentrating on individual operators' technical proficiency (Cook et al, 2011; Flin et al, 2013). This acknowledges the fact that difficult intubation is twice as common in the intensive care unit than in the operating room and as the intubation attempt fails, the operator may become cognitively overwhelmed by the procedure and the often precipitous physiological decline of the patient.

Careful preparation and planning each team member's role if difficulty arises and sharing the plan of which interventions may help is crucial. This is facilitated by carrying out a pre-induction checklist with all team members present and having the airway algorithm specifically designed for critically ill patients displayed prominently during the procedure. The checklist considers in turn the patient, equipment, team and explicit preparation for how the procedure will be managed if there is difficulty (Gawande, 2007; Cook et al, 2011; Flin et al, 2013; Higgs et al, 2018).

Together, the team must decide whether awake intubation is indicated, but if general anaesthesia is chosen, the team must determine – before the patient is anaesthetized – whether the patient should be woken up and intubation abandoned if difficulty arises. This is common in anaesthetic practice, but often more challenging (or impractical) and much less applicable in the critically ill when, for instance, the indication for intubation in the first place is that the patient cannot breathe or is unconscious. For the first time, the document enumerates the various tasks which must be completed during intubation and how the multiple team roles may be most effectively achieved, depending on how many staff are available for the procedure.

Assessment

Risk factors for complicated airway management are different in critically ill patients and the guideline includes the only validated method of assessment for intensive care unit intubation, the MACOCHA score (De Jong et al, 2013). A cut-off value of ≥3 is used to identify potential difficulty and the need to actively consider videolaryngoscopy from the outset.

The importance of checking the accessibility of the cricothyroid membrane or at least the cervical midline before induction is emphasized. Simply identifying the midline may be more useful than the level of the membrane itself as the latter is relatively unreliable and its position moves as the patient's position is changed from the flexed neck intubation position to maximally extended when front of neck airway is needed.

Pre- and per-oxygenation

The utility of modern methods of pre-oxygenation and per-oxygenation are described. Pre-oxygenation refers to maximizing the lungs' reserves of oxygen before induction and per-oxygenation refers to how oxygen levels are maintained after anaesthesia has commenced. Patients at risk of hypoxaemia need to be pre-oxygenated

with 100% oxygen and some form of positive pressure. Options include non-invasive ventilation (Baillard et al, 2006) or, more common in the UK, continuous positive airway pressure from a Water's circuit or, increasingly, high flow nasal oxygen. Per-oxygenation is managed with mask ventilation between laryngoscopy attempts and continuous nasal apnoeic oxygenation. The latter is ideally performed using high-flow circuits providing warm humidified gas, but dry oxygen at 15 litres/min via standard nasal cannulae is acceptable if high-flow oxygen is not immediately available or if the high-flow circuit prevents adequate mask seal.

Intubation

The team is prompted to nominate someone to note the time when the attempt begins. During difficult intubation, operators may become distracted by procedures, a desire to succeed and by the patient's physiological decline. It is common to lose appreciation of time, of attempts taken and of the central goal – to achieve oxygenation without patient harm. This loss of 'situation awareness' is seen in many airway disasters where multiple attempts, over periods of 45–60 minutes, transform a difficult airway into an impossible one, with fatal consequences. Knowing the time taken and strictly limiting the number of attempts taken for each procedure are both important barriers to procedural stagnation and aim to promote acknowledgement that a procedure has failed and encourage timely progression through the algorithm.

A modified rapid sequence approach is recommended and the use of ketamine is encouraged. Rocuronium may be preferable to achieve neuromuscular blockade rather than succinylcholine in the critically ill: while both drugs work sufficiently rapidly, the latter may wear off too quickly during prolonged intubations, when full blockade is required. Rocuronium also avoids potentially fatal hyperkalaemia in these at-risk patients.

Having a low threshold to use a videolaryngoscope is emphasized, as videolaryngoscopy improves view and success when faced with difficult patients (Lewis et al, 2017). As critically ill patients have physiologically difficult airways, there is an argument for using a videolaryngoscope from the outset, although there is a lack of robust evidence on this issue at present. When a videolaryngoscope is chosen routinely a Macintosh blade videolaryngoscope is logical as this should facilitate awkward intubations without slowing down easy ones. A hyperangulated blade is suitable as a rescue videolaryngoscope. Operators must be trained before videolaryngoscope use, as without training there is likely no benefit (Lewis et al, 2017). The guideline authors recommend that a videolaryngoscope with a screen visible to the whole team is beneficial in enabling all team members to appreciate progress or difficulty.

Airway rescue

If intubation fails, the guideline recommends that this is openly declared. Airway rescue with a second generation supraglottic airway device is recommended because the better airway seal facilitates ventilation in patients with reduced lung compliance. A drainage channel may reduce the risk of pulmonary aspiration.

The guideline borrows from the Vortex approach to airway management (Chrimes, 2016) which advocates alternating airway rescue manoeuvres (supraglottic airway devices and facemask ventilation) with up to three attempts (or a single optimal attempt) before formally declaring 'cannot intubate, cannot oxygenate' and proceeding to front of neck airway.

The guideline emphasizes early preparation for front of neck airway, starting from the first intubation failure. When front of neck airway is required a scalpel-bougie-tube cricothyroidotomy is advocated.

Uniquely, the guideline acknowledges that the primary airway manager may not be an expert, and this is more often the case in the intensive care unit and in the emergency department than in the operating theatre (Cook et al, 2011). The guideline provides specific provision for arrival of a more expert airway manager, who may choose to undertake procedures that have already failed in the hands of the primary operator. These 'expert attempts' should be justified, brief and singular and should not delay transition to front of neck airway when it is indicated. **BJHM**

KEY POINTS

- Tracheal intubation is a common life-saving procedure, but has its own complications including death and brain damage.
- Difficult intubation is twice as common in critically ill patients as in the operating room.
- Traditional airway guidelines relate to intubation during anaesthesia for surgery and are not applicable to critically ill patients.
- The Difficult Airway Society has led production of UK national guidelines aimed at emergency department and intensive care unit patients.
- Improved human factors and optimal team performance are likely more important than technical proficiency in improving outcome.

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