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Strategies to prevent airway complications: a survey of adult intensive care units in Australia and New Zealand

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Editor's key points

- The NAP4 and other reports highlighted that airway complications are common in intensive care.
- This survey assessed how strategies to avoid airway complications are implemented in practice in Australasian intensive care units.
- There are gaps in availability of personnel, equipment, and provision of simple safety measures.
- Patients may be at avoidable risk of airway complications unless these issues are addressed.

Background. There is growing evidence that airway complications are relatively common in critical care. Strategies have been suggested to decrease their incidence.

Methods. We conducted a telephone survey of all adult intensive care units (ICUs) in Australia and New Zealand to establish the current practice regarding strategies used to reduce airway complications in five key areas: (i) use of capnography; (ii) care of oral tracheal tubes; (iii) care of tracheostomy tubes; (iv) difficult and failed intubation; and (v) training and medical staffing.

Results. Of 176 ICU meeting inclusion criteria, 171 agreed to participate. Capnography is used during tracheal intubation in 88% of ICUs and for continuous monitoring in 64%. Protocols for advancing or partially withdrawing malpositioned tracheal tubes are used by 54% of units, with most allowing repositioning by unaccredited nurses. A small minority of ICUs use bed head signs to identify patients with 'critical airways' or laryngectomy, while only 8% have specific protocols for the care of these high-risk patients. Tracheostomy emergency algorithms are available in 13% of ICUs. At night, a doctor is exclusively assigned to 73% of units, although in 72%, the night doctor is not required to have prior anaesthetic/airway training. In 97% of the institutions surveyed, the senior doctor relied upon for airway emergencies at night is either non-resident or working elsewhere in the hospital.

Conclusions. Our data suggest that several possible strategies for avoiding airway complications in ICU patients dependent on an artificial airway are poorly implemented. This may expose these patients to avoidable risk.

Keywords: airway management; clinical protocols; intensive care; safety; tracheal intubation; tracheostomy

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The Eighth Report of the Confidential Enquiries into Maternal Deaths in the United Kingdom describes a maternal death in a critical care ward after repeated displacements of her tracheostomy.[1] Sadly, this tragic case is not an isolated incident, as there is increasing evidence that airway complications and subsequent adverse outcomes in the intensive care unit (ICU) are more common than previously recognized. The Fourth National Audit Project of the Royal College of Anaesthetists and Difficult Airway Society (NAP4) observed that airway complications were considerably more frequent in an ICU setting than during anaesthesia and that these complications were more likely to result in permanent harm.[2 3] These findings are in keeping with a 2009 analysis of airway-related incidents reported to the UK National Patient Safety Agency (NPSA).[4]

Difficult tracheal intubation is more common outside the controlled environment of the operating theatre,[5] and critically ill patients commonly have a reduced physiological reserve, making them more prone to rapid decreases in oxygen saturation. However, as in the case of the maternal death mentioned above, the majority of airway complications (82% in the NPSA analysis) occur not at the time of tracheal intubation or tracheostomy formation, but after placement of these artificial airways.[4] Various strategies have been proposed to minimize the risks associated with the use of airway devices in the ICU,[3] including the routine application of capnography,[6] airway alert signs[7], standardized protocols,[8] and the availability of appropriate equipment to assist airway management.[9]

The rate of deaths related to airway complications is ~70 times greater for patients in critical care units than for patients undergoing general anaesthesia.[2 3 10] Despite this, there has never been a comprehensive assessment of strategies used to minimize complications associated with artificial airways in the ICU. We therefore performed a survey of ICUs in Australia and New Zealand to establish the current practice in this area.

Methods

The Northern Sydney Central Coast Human Research Ethics Committee approved the study. Between February and April 2011, we conducted a telephone survey of all ICUs listed on the Australia and New Zealand Intensive Care Society Centre for Outcome and Resource Evaluation (ANZICS CORE) database.[11]

A standardized telephone questionnaire was developed and piloted in five ICUs (Appendix). Paediatric ICUs and those not accepting mechanically ventilated patients were excluded from the survey. In those units caring for a mixture of adult and paediatric patients, questions were asked specifically relating to their practice in adults. We aimed to investigate the current practice in five key areas of airway management: (i) the availability and use of capnography; (ii) care of oral tracheal tubes; (iii) care of tracheostomy tubes; (iv) difficult and failed intubation; and (v) training and medical staffing.

Each ICU was telephoned and questions were directed to a senior nurse (either the Nurse Unit Manager or Clinical Nurse Consultant). At the beginning of the telephone conversation, we introduced the contents of the survey and confirmed with all respondents that they were the most appropriate person to answer the questions. Participants were able to give multiple answers to some questions, so that some percentages total greater than 100%.

All data were anonymized and participants were assured that no institution would be identifiable in any publication. Data were analysed using Microsoft Excel spreadsheet software (Microsoft Corporation, Redmond, WA, USA).

Results

Of the 186 ICUs contacted, 181 agreed to participate in the survey (97% response rate). Of these, three are paediatric-only and seven do not accept mechanically ventilated patients. These were excluded from further analysis, leaving a total of 171 ICUs in the study.

Availability and use of capnography

The ability to measure expired carbon dioxide is available in all but one of the institutions surveyed (170, 99%), with the vast majority having access to waveform capnography (157, 92%). Ninety-eight units (57%) have disposable colorimetric end-tidal CO_2 monitoring and 40 (23%) have non-waveform electronic capnometers. Six (4%) have only colorimetric indicators. Capnography is used routinely during tracheal intubation in 151 ICUs (88%), with 110 (64%) utilizing it throughout the duration of mechanical ventilation.

Care of tracheal tubes

To secure oral tracheal tubes, 114 ICUs (67%) use cotton ties, 90 (53%) a specific device, and 48 (28%) an adhesive tape. In total, 75 units (44%) use more than one method to secure oral tracheal tubes and six (4%) have all three methods available.

In the majority of ICUs, all nurses are allowed to advance and partially withdraw malpositioned oral tracheal tubes, a practice which does not vary significantly between those institutions that have a protocol for the procedure and those that do not (Table 1). One hundred and twenty ICUs (70%) collect data about accidental tracheal extubation.

Care of tracheostomy tubes

Twenty-six ICUs (15%) routinely use a bed head sign to denote the type and size of tracheostomy. Sixty-nine of the units surveyed (40%) care for laryngectomy patients in the immediate postoperative period. Of these, seven (10%) routinely place a bed head sign to forewarn that the patient has an end-stoma and their trachea cannot be intubated orally. A further three (4%) are currently implementing a policy to display such signs. The significant majority of ICUs have a protocol for the equipment that should be present at the bedside of patients with a tracheostomy tube and correspondingly have better availability of such equipment compared with ICUs without a protocol (Table 2).

A minority of those surveyed (22, 13%) have a specific algorithm for the emergency management of blocked or displaced tracheostomy tubes, while six (4%) are currently developing one. One hundred and nine units (64%) collect data about the accidental displacement of tracheostomy tubes.

Difficult or failed intubation

Ten ICUs (6%) use a bed head sign to denote a patient whose trachea was difficult to intubate or who has a critical airway

Table 1 Personnel and methods used to advance or partially withdraw malpositioned tracheal tubes (TTs) in all ICUs (n=171); ICUs with a protocol (n=93); ICUs without a protocol for repositioning TTs (n=73). Five ICUs reported that they were unsure if they had a protocol. Data presented as number (%) of ICUs

	All ICUs (n=171)	ICUs with protocol (n=93)	ICU without protocol (n=73)
Personnel permitted to partially withdraw oral tracheal tubes			
Doctor only	21 (12)	11 (12)	10 (14)
All ICU nurses	102 (60)	54 (58)	43 (59)
Accredited ICU nurses	48 (28)	28 (30)	20 (27)
Personnel permitted to advance oral tracheal tubes			
Doctor only	32 (19)	17 (18)	15 (21)
All ICU nurses	95 (56)	52 (56)	38 (52)
Accredited ICU nurses	44 (26)	24 (26)	20 (27)
Use of gum elastic bougie or airway exchange catheter			
Routinely used	16 (9)	9 (10)	7 (10)
Not routinely used	155 (91)	84 (90)	66 (90)