



## 4<sup>th</sup> National Audit Project of The Royal College of Anaesthetists and The Difficult Airway Society (NAP4) Major Complications of Airway Management in the United Kingdom

*Tim Cook, Nick Woodall, Chris Frerk (Editors). Report and findings March 2011. National Patient Safety Agency – Patient Safety Division. The Intensive Care Society. The College of Emergency Medicine. ISBN 978-1-900936-03-3*

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Drs Cook, Woodall, and Frerk have completed an impressive study not seen previously in the airway management literature, and their report is published in both book form and as an open-source document (<http://www.rcoa.ac.uk/index.asp?PageID=1089>).

Prospectively over a one-year period, the authors gathered patient cases of major airway complications which occurred throughout the four countries of the United Kingdom (UK). Importantly, the study was carried out in multiple areas of the hospital, including the operating room (OR), intensive care unit (ICU), and emergency department (ED). The authors defined major airway complications as those leading to death, brain damage, emergency surgical airway, or unexpected ICU admission.

How did they accomplish this task? Briefly, the anesthesia department in every hospital of the publicly funded National Health System was contacted and asked to participate, and *all 309 hospitals agreed to take part*. One clinician in each hospital took on the role of lead reporter (LR). Either the LR or the clinician involved in the case submitted information on a secure website. A study moderator was available to discuss whether a case met inclusion criteria, and a panel of representatives from the multiple organizations endorsing the study met to review the cases with respect to both inclusion criteria and contributory factors. Various patient safety organizations, the Difficult Airway Society, and other associations, colleges, and societies in anesthesia, emergency medicine, otorhinolaryngology, and intensive care were involved in this panel.

The authors' first objective was to estimate the incidence of these complications. Prior to this study, the largest dataset of airway complications was maintained in the American Society of Anesthesiologists' Closed Claims database.<sup>1</sup> This database, while extremely useful, is limited to cases which have been litigated and settled. By definition, the database is retrospective, lacking an associated denominator, and does not include airway complications which have never been litigated. One criticism of this report concerns the authors' attempt to determine the annual "denominator" of the total number of patients undergoing anesthesia in the UK each year. Data were based on a two-week collection of each LR's self-reporting estimate of anesthesia type and frequency at his/her hospital, and these results were then multiplied by twenty-five. Unfortunately, the report does not include such data from the ICU or ED. The derived denominator is not necessarily an accurate reflection of the annual total, although it is a starting point.

After final review, 184 cases were included in the report: 133 from anesthesia, 36 from the ICU, and 15 from the ED.

The report continues with a review of several topics in airway management organized by department, airway intervention (i.e., bag-valve-mask ventilation, extraglottic device use, tracheal intubation, and surgical airway), as well as patient population (e.g., obstetrics, the obese, pediatrics, and patients with head and neck pathology). Invited experts "set the stage" in their fields and highlighted the most important airway issues that emerged based on the cases they had collected. The chapters are well written and logical. The authors also deal with organizational issues, human factors, and training, which is a strong acknowledgement that airway management does not occur in isolation. There is an excellent executive summary at the beginning of the book for readers wishing to discover the "bottom line" messages quickly; however, one drawback is the very

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intermittent use of captions in the pictures throughout each chapter.

In my view, the most important contribution that NAP 4 imparts to the airway management literature is the identification of issues—with the support of its gathered cases—we either had not known or had not appreciated as systemic problems. For example, one new issue identified is the high failure rate of percutaneous cricothyrotomy performed by anesthesiologists; only nine of 25 attempts (36%) were successful. An open surgical technique was associated with a 100% success rate of tracheal cannulation, although not all patients survived. It is open for discussion whether the difference in success rates results from an inferiority of the percutaneous technique or failure to acquire or maintain skills, but the report does strongly suggest that these questions should be explored further. The rate of tracheostomy tube displacement is highlighted as a systemic issue, particularly during movement of the obese patient. Fourteen tracheostomy tubes were dislodged accidentally, all in the ICU, with 50% mortality. The authors urge manufacturers to take heed of this information and change the design of these devices.

Lack of availability or use of standardized predictable well-maintained equipment is highlighted as an issue in the ED, ICU, and OR. For example, although continuous carbon dioxide (CO<sub>2</sub>) monitoring is used almost universally in the OR, it was used only in a minority of cases in the ED and ICU. Lack or failure of interpretation of continuous CO<sub>2</sub> monitoring was thought to contribute to 70% of deaths in the ICU. Continuous CO<sub>2</sub> monitoring is recommended as a required monitor for the intubated patient, regardless of location.

Acute airway management is practised by multiple medical specialties who provide a mix of skill levels in various hospital locations during all hours of the day and night. The immense emotional and professional pressure to “get the tube in the hole”, frequently in front of a rapidly gathering crowd, can invite poor judgement, fixation errors, and miscommunication. Poor judgement (e.g., not recognizing a deteriorating situation or lack of a back-up plan) and deficits in education and training were found to be either causal or contributory in 62% and 47% of cases in the OR and ICU, respectively. Conversely, good judgement was found to prevent a worse outcome in 13% of cases.

The most important goal in airway management is getting oxygen to tissue.<sup>2</sup> Unfortunately, few clinicians are proud to claim they successfully managed bag-valve-mask ventilation of a patient until another clinician with a larger set of airway skills arrived. One of the largest strengths of the NAP 4 report is emphasis on the need to build robust reliable team structures supported with the proper equipment to provide the safest possible patient care during tracheal intubation, maintenance, and tracheal extubation of the ventilated patient. The need to have a failed airway strategy for every patient is highlighted repeatedly. The authors encourage the anesthesia community to play a leadership role in these endeavours both inside and outside the OR; kudos for the researchers in supporting these efforts.

In conclusion, the NAP 4 report makes for fascinating reading for any clinician with airway management responsibilities. The authors present immense detailing of the potential pitfalls in airway management, over several specialties and patient populations, using the prospectively captured cases affirm just how important these issues are. The amount of effort and passion the researchers have invested into this research project spanning four countries prospectively for a year period is staggering, and the dividends pay off handsomely for all of us. In my opinion, this study will become the standard for airway research in large populations. The authors not only produced a work that any healthcare worker involved in airway management should keep on their bookshelf, but they have also kindly made their work an open source document on the internet.

My only remaining question: When do we get started on our own audit in Canada?

**Competing interests** None declared.

## References

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