

RESPIRATION AND THE AIRWAY

Anticipation of the difficult airway: preoperative airway assessment, an educational and quality improvement tool

D. Cattano^{1*}, P. V. Killoran¹, D. Iannucci¹, V. Maddukuri¹, A. V. Altamirano¹, S. Sridhar¹, C. Seitan¹, Z. Chen² and C. A. Hagberg¹

¹ Department of Anesthesiology and ² Center for Clinical and Translational Sciences, University of Texas Health Science Center Medical School at Houston, 6431 Fannin Street, Houston, TX 77030, USA

* Corresponding author. E-mail: davide.cattano@uth.tmc.edu

Editor's key points

- This study addresses the impact of a comprehensive airway assessment form, including all 11 ASA's airway risk factors, on resident education, while assessing is of questionable value.
- Completion of this specially designed airway assessment form led to significantly better documentation; however, it did not appear to have a clinically significant impact.

Background. Assessment of the potentially difficult airway (DA) is a critical aspect of resident education. We investigated the impact of a new assessment form on airway prediction and management by anaesthesia residents. We hypothesized that residents would demonstrate improvement in evaluation of DAs over the study duration.

Methods. After IRB approval, anaesthesia residents were randomized into two groups: control (existing form) and experimental (new form). Data were collected prospectively from August 2008 to May 2010 on all non-obstetric adult patients undergoing non-emergent surgery.

Results. Eight thousand three hundred and sixty-four independent preoperative assessments were collected and 8075 were analysed. The experimental group had the higher completion rate than the control group (94.3% vs 84.3%, $P=0.001$). DA prediction was higher for the control group (71.2%) compared with the experimental group (69.1%; $P=0.032$). A significant improvement in prediction rates was found over time for the experimental group (likelihood estimate=0.00068, $P=0.031$).

Conclusions. The use of a comprehensive airway assessment did not improve resident ability to predict a DA in an academic, tertiary-based hospital, anaesthesiology residency training programme.

Keywords: airway; education, medical students

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Airway management remains one of the most important responsibilities of an anaesthetist,¹ yet documentation of the clinical assessment, which is a professional requirement,² is often incomplete.³ Poor airway management has been recognized as a serious patient safety concern for almost three decades,^{4–7} highlighting the need for careful airway assessment before the induction of anaesthesia.^{8–21} While improvements in patient monitoring,²² airway devices,²³ and clinical protocols and training^{24–30} have reduced the risk associated with an unpredicted difficult airway (DA), these changes have not reduced the incidence of unexpected DAs in clinical practice. Since the consequences of an unanticipated DA are potentially catastrophic, proper education and training are a continued necessity.

This study addresses this gap in knowledge by evaluating the impact of a comprehensive airway assessment form on resident education, while assessing is of questionable value.⁸ We hypothesized that a new comprehensive airway

assessment form would result in greater resident recognition of the 11 important airway features recommended by the ASA.¹ Based on this hypothesis, the overall aim of the present investigation was to document the effect of a more comprehensive airway assessment form on resident education.

Methods

This prospective, randomized, single-blind study was conducted from August 2008 to May 2010 at a Level 1 academic trauma center (Memorial Hermann Hospital, Texas Medical Center, Houston, TX, USA). After obtaining IRB approval (HSC-MS-07-0144), adult patients non-obstetric presenting for elective surgery requiring general anaesthesia, which did not already have their airway secured, were enrolled in the study. For patients who received more than one anaesthetic during the study period, data were collected independently for each anaesthetic encounter. Patients were provided

with a written document describing the study and gave a verbal consent to participate.

All residents enrolled at the University of Texas Medical School at Houston anaesthesia residency programme for the academic year 2008–9 were recruited at the start of the study. An additional 24 incoming residents were enrolled during the second academic year (2009–2010) of the study, giving a total of 91 residents (Fig. 1). Each resident provided a verbal agreement to be enrolled on the quality improvement project. One resident joined the programme off-cycle in March 2008 and was enrolled in the study as a CA 1 (a first year anaesthesia resident) (experimental group) for the remaining 2008–9 academic year and was also enrolled for the second year. No residents dropped from, or transferred in or out of the programme. Residents were randomized into two groups—an experimental group, which used the comprehensive airway assessment form in addition to the existing anaesthesia record, and a control group, which only used the existing anaesthesia record. Randomization was performed after stratification by year of training and based on 1:1 randomization. Experimental and control residents had a one-on-one tutorial (1 day, 3–4 practice assessments) on how to complete the data forms, respectively, followed by 1 month of validation at the beginning of each resident's rotation. Afterward, once a month, the residents' assessments were audited for quality control.

The new comprehensive airway assessment form (Appendix 1) required a detailed assessment of the patient's airway history and physical examination compared with the existing anaesthesia preoperative assessment form (Appendix 2). A common form to the experimental and control group was used to collect postoperative outcome data (Appendix 3).

For the purposes of this study, difficult mask ventilation (DMV) was defined as difficulty in maintaining a mask seal and obtaining satisfactory capnography (end-tidal CO₂ and tidal volume).² If mask ventilation was attempted and determined to be difficult, the severity was graded either mild (requiring oral/nasal airway), moderate (can ventilate with assistance), severe (cannot ventilate with a facemask), or extreme (cannot ventilate with the supraglottic device). However, the use of neuromuscular blocking agent, type, dosage, time of administration, and use as a rescue were not included as outcome.

Difficult supraglottic airway (DSGA) was defined as either inability to physically place a supraglottic device or inadequacy of ventilation, oxygenation, or airway protection after placement that required conversion to an alternative technique. If placement of a supraglottic device was attempted, level of difficulty, number of attempts, and type of device were documented. Difficult direct laryngoscopy (DDL) was defined as the difficulty in visualizing any portion of the vocal cords after conventional laryngoscopy requiring more than one attempt.² If direct laryngoscopy was attempted, the type of blade, number of attempts, Cormack–Lehane grade, and any difficulties encountered were documented. Difficult intubation (DI) was defined as proper insertion of the tracheal tube with conventional laryngoscopy requiring

multiple attempts.² If intubation was attempted, the number of attempts and the presence of any difficulties were documented. Difficult surgical airway (DSA) was defined as a difficult cricothyrotomy or tracheostomy, open or percutaneous, performed electively or emergently, to manage a DA due to bleeding, poor orientation and difficult instrumentation, and defined by the surgeon as technically difficult. DA was defined as the occurrence of DMV, DSGA, DDL, DI, or DSA. If a surgical airway was attempted, it was classified as either emergent or elective and either difficult or easy, with the number of attempts recorded.

Statistical analysis

Our database includes 9117 postoperative encounters; a small subset of patients received multiple anaesthetics ($n=155$, 1.7%). Patients who received multiple anaesthetics were excluded from statistical analysis. All statistical analyses were conducted using SAS 9.2 (SAS Institute, Cary, NC, USA). Data on the completeness of documentation were analysed using a χ^2 test; accuracy of prediction was defined as the sum of correct assessments and significance determined using a χ^2 test, while the changes of prediction accuracy over time among groups were analysed by a logistic regression. A P -value of <0.05 was considered significant.

Results

A total of 8364 independent preoperative assessments were completed. Incomplete assessments (>4 risk factors not completed) were excluded, resulting in a total of 8075 assessments included in our analysis. Three thousand three hundred and thirty-two (41%) were performed by the experimental group and 4743 by the control group (59%) (Fig. 2). A total of 1560 (17%) of all postoperative assessments ($n=9117$) were reported as DA.

No difficult surgical or invasive airways were reported. The frequency of each particular event was similar between all groups (Fig. 2), and ranged from 7.17% to 8.79% for DMV, 5.59% to 5.64% for DDL, 4.09% to 4.98% for DI, and 1.38% to 1.43% for DSGA.

Completeness of airway examination documentation

Results are shown in Table 1 and demonstrate significant differences between the two groups. The experimental group had a higher rate of completion than the control group (94.3% vs 84.3%; $P<0.001$).

Overall recognition of the DA

The experimental group correctly predicted a DA in 2397 out of 3471 patients (69.1%). The control group predicted 3551 out of 4984 patients (71.2%) correctly, which was significantly higher ($P=0.032$) than the experimental group (Table 2).

Impact on resident education

Prediction accuracy for each day of the study was calculated and graphed as a 30 day moving average for the entire study period (Fig. 3). The multiple logistic regression model created

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