

## Article Appraisal

**Article:** Head-Elevated Patient Positioning Decreases Complications of Emergent Tracheal Intubation in the Ward and Intensive Care Unit

**Date of Journal Club:** November 3 2016

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### Background and Study Objective(s):

Head-elevated patient positioning has been previously demonstrated to prolong time to desaturation and improve glottic visualization during endotracheal intubation in the operating room. However, data in the emergent setting is lacking. The authors hypothesized that back-up head-elevated patient positioning would be associated with fewer airway-related complications during emergent intubations within ED, ICU, and hospital ward settings.

### Study Design:

A retrospective cohort of all intubations performed on the ward and intensive care unit by the anaesthesia airway team at two large University of Washington-affiliated academic hospitals between November 2013 and April 2015. Patients were excluded if they were <18 years old, if CPR was ongoing, if a method other than direct laryngoscopy (i.e. video laryngoscopy) was chosen for the initial intubation attempt, or if the endotracheal intubation was inadequately documented. Electronic and written medical records were reviewed to obtain baseline patient characteristics and details of the intubation. The primary outcome was the occurrence of a composite of intubation-related complications: difficult intubation (defined as  $\geq 3$  attempts or >10 minutes until tube confirmation or the need for a surgical airway), hypoxemia ( $SpO_2 < 90\%$  during intubation or within 15 minutes thereafter), pulmonary aspiration, or esophageal intubation. The exposure variable of interest was patient positioning during intubation: either a supine (head of bed 0-30 degrees elevated) or head-elevated ( $\geq 30$  degrees elevation) position. Multivariable logistic regression was used to predict the odds of primary outcome occurrence in the supine versus head-elevated patient groups after adjusting for predicted intubation difficulty (MACOCHA score  $\geq 3$ ) and BMI.

### Results:

528 patients comprised the final study cohort, 336 in the supine group and 192 in the head-elevated group. The primary outcome occurred in 22.6% of patients in the supine group and 9.3% of patients in the head-

elevated group. After adjusting for MACOCHA score and BMI, the odds ratio of encountering the primary endpoint using head-elevated versus supine positioning was 0.47 (95% CI 0.26–0.83; P = 0.01). Additional sensitivity analyses adjusting for operator experience (OR 0.50, 95% CI 0.26–0.93; P = 0.03) and year of intubation (OR 0.44, 95% CI 0.24–0.9–; P = 0.008) had no significant effect on the study results. The primary outcome was largely driven by a reduction in the rate of esophageal intubation, aspiration, and hypoxemia in the head elevated group versus supine group (Model 2 OR 0.40, 95% CI 0.21-0.76) as opposed to a reduction in difficult intubation (Model 3 OR 0.88, 95% CI 0.24-3.21).

### **Validity of Results:**

The odds ratio of the primary endpoint between head-elevated and supine groups in this cohort was demonstrative of a large effect size (adjusted OR 0.47). The journal club was confident in the papers' conclusion that a head-elevated positioning is associated with fewer peri-intubation adverse events than a supine positioning. However, we felt that methodological limitations in the study design likely led to an overestimation of the true effect size. First, although authors adjusted for MACOCHA score, it was adjusted as a binary variable (score <3 versus ≥3) rather than as a nominal variable, which limits the efficacy of this correction. Second, authors did not mention the prevalence of spinal cord injuries or C-spine collars in the patient cohort. If present, these characteristics often preclude head-elevated positioning and thus would be over-represented in the supine group of patients. As cervical spine collars impede ease of intubation, this would result in a higher expected rate of peri-intubation complications in the supine group.

### **Generalizability of Results:**

This paper is well generalized to our Emergency Department population, though several aspects of the paper bear further discussion. First, the authors only included those patients in whom direct laryngoscopy (vs video) was planned for the initial attempt. It is suspected that this inclusion criteria was chosen in order to improve their likelihood of demonstrating a significant difference in difficult intubation rates between the two groups: head-elevated positioning is likely to improve glottic visualization in direct laryngoscopy (by better aligning the laryngeal axis, pharyngeal axis, and axis of the mouth with the line of vision) but not in video laryngoscopy. However, seeing as though the difference in primary outcome between groups was driven primarily by lower rates of hypoxemia, aspiration, and esophageal intubation in the head-elevated group (Model 2 OR 0.40, 95% CI 0.21-0.76) as opposed to a reduction in difficult intubation (Model 3 OR 0.88, 95% CI 0.24-3.21), we do not think that this impairs generalizability to any great extent. Second, this paper did not enrol patients intubated in the Emergency Department. This was due to difficulty in categorizing provider experience in the ED (the intubation expertise of emergency medicine residents is likely more heterogenous than that of anesthesia residents) and a lack of documentation (Emergency Medicine residents were not required to generate structured procedure notes in the same fashion as their anesthesia colleagues). However, we did not think this impaired generalizability to the ED population. Emergent intubation is performed in a similar fashion, under comparable environmental and patient pressures, whether done in the ED, ICU, or on the hospital ward.

### **The Bottom Line:**

Elevating the head of patient stretchers >30 degrees during emergent intubation is associated with a reduction in peri-intubation complications as compared to supine patient positioning. Rates of esophageal intubation, aspiration, and hypoxemia are certainly reduced, and there may be a reduction in cases of difficult intubation. These findings are likely generalizable to all emergent intubations in the Emergency Department. However, due to significant between-group differences in MACOCHA scores and operator experience, as well as shortcomings in the statistical adjustments performed, we suspect the true effect size of head elevated patient positioning is slightly less than that concluded by the authors.