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Original Contributions

EMERGENCY AIRWAY MANAGEMENT: A MULTI-CENTER REPORT OF 8937 EMERGENCY DEPARTMENT INTUBATIONS

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□ **Abstract—Objective: Emergency department (ED) intubation personnel and practices have changed dramatically in recent decades, but have been described only in single-center studies. We sought to better describe ED intubations by using a multi-center registry. Methods: We established a multi-center registry and initiated surveillance of a longitudinal, prospective convenience sample of intubations at 31 EDs. Clinicians filled out a data form after each intubation. Our main outcome measures were descriptive. We characterized indications, methods, medications, success rates, intubator characteristics, and associated event rates. We report proportions with 95% confidence intervals and chi-squared testing; *p*-values < 0.05 were considered significant. Results: There were 8937 encounters recorded from September 1997 to June 2002. The intubation was performed for medical emergencies in 5951 encounters (67%) and for trauma in 2337 (26%); 649 (7%) did not have a recorded mechanism or indication. Rapid sequence intubation was the initial method chosen in 6138 of 8937 intubations (69%) and in 84% of encounters that involved any intubation medication. The first method chosen was successful in 95%, and intubation was ultimately successful in 99%. Emergency physicians performed 87% of intubations and anesthesiologists 3%. Several other specialties comprised the remaining 10%. One or more associated events were reported in 779 (9%) encounters, with an average of 12 per 100 encounters. No medication errors were reported in 6138 rapid sequence intubations. Surgical airways were performed in 0.84% of all cases and 1.7% of trauma cases. Conclusion: Emergency physicians perform the vast majority of ED intubations. ED intubation is performed more commonly for medical than traumatic indications. Rapid sequence intubation is the most common method of ED intubation.** © 2011 Elsevier Inc.

□ **Keywords—airway management; rapid sequence intubation; Emergency Department; emergency physician; registry; airway; emergency airway**

INTRODUCTION

The advent of emergency medicine as a specialty has led to advances in emergency airway management. Resi-

[1]See Appendix for listing of NEAR II investigators. RMW conceived the project and served as principal investigator, designed the data form and database management system, designed the study, and was primary author and final editor of the manuscript. CAB oversaw compliance for all sites within the study, served as primary site investigator at the Brigham and Women's site, served on the coordinating committee, oversaw data management and retrieval, and was responsible for the integrity of the database. AEB served as the site investigator at the largest enrolling center, performed sub-analyses, and participated in the writing and editing of the revised manuscript. DJP imported, merged, and organized the data, performed all statistical analyses, prepared all tables, and contributed, by writing or editing, to all sections of the manuscript.

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dency training in emergency medicine emphasizes airway management, including use of rapid sequence intubation (RSI), defined as intubation after rapid induction and paralysis (1,2). Several previous studies, mostly with small samples, have reported intubation success rates within single institutions, but comprehensive large multicenter studies are lacking (3–7).

Although intubation frequently is performed in emergency departments (EDs) today, little is known about why and how ED patients are intubated, and by whom. Surveillance of critical emergency procedures is essential for reasons of public health, policy, and clinical practice development. Our goal in this report is to describe emergency intubation indications, methods used, operator characteristics, and adverse event rates using a multi-center registry model.

METHODS

Study Design

This was a prospective observational multi-center data registry, with all data collection planned a priori. The Institutional Review Board of each participating center approved the protocol prospectively.

Study Setting and Population

We formed a network of 31 centers, both academic and community, that collected data from September 1997–June 2002 (Appendix). All ED patients with attempted endotracheal intubation were eligible for inclusion. We conducted an audit of one center to estimate reporting compliance, though we did not monitor compliance continuously.

Study Protocol

Case ascertainment was passive, relying on self-report by intubators on duty in the ED. A site investigator at each site was responsible for ensuring highest possible data capture. After intubating, clinicians entered data into a standardized form. Data were sent to the coordinating center, where they were reviewed and then entered into a relational database (Microsoft Access; Microsoft, Redmond, WA). Authors DJP and CAB reviewed all entered data for completeness and referenced original data forms when necessary to resolve missing variables.

We describe each encounter by "method" and number of "attempts." We define a "method" as a single set of medications or devices, such as rapid sequence intubation with a Macintosh laryngoscope. We define an "attempt" as a single effort to place an airway. Each encounter could have one or more methods, and each method could have one or more attempts. This allowed us to track different methods in sequence, for example, when failed direct laryngoscopy ("method 1," perhaps with several laryngoscopic "attempts") led to cricothyrotomy ("method 2").

In describing undesirable events associated with intubation, we avoid the term "complication" because not all undesirable events are complications, and the definition of "complication" varies among studies. We wished to capture all possible undesirable events, whether or not they might be interpreted as true complications. For example, immediately recognized and corrected mainstem intubation would be an "event" but not a "complication," whereas unrecognized esophageal intubation with desaturation would be an "event" properly described as a "complication." We defined "event" as any unintended undesirable incident associated with either the act of laryngoscopy and endotracheal tube placement or the administration of intubation medications.

Measurements

We report information about the distribution of:

1. Indications for intubation at participating EDs. We divide encounters into medical vs. trauma.
2. Methods used to intubate, including devices and medication regimens.
3. Success rates of intubation, by method and by encounter.
4. Intubators' specialties.
5. Associated events.

Data Analysis

We present descriptive data as proportions with 95% confidence intervals (95% CI). Odds ratios are reported with 95% CI and *p*-value via chi-squared testing. We performed all analyses with SAS 9.12 (SAS Institute, Cary, NC).

RESULTS

The final database included 8937 encounters. Table 1 shows the primary indications for intubation. Table 2 shows the initial method of airway management for each subject. RSI was the initial method chosen in 6138 of 8937 intubations (69%) and in 84% of encounters that involved any intubation medication. Induction agents or sedatives, without neuromuscular blockade, were chosen