http://dx.doi.org/10.1016/j.jemermed.2014.04.021

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PREVALENCE OF DIFFICULT AIRWAY PREDICTORS IN CASES OF FAILED PREHOSPITAL ENDOTRACHEAL INTUBATION

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□ **Abstract—Background:** Difficult airway predictors (DAPs) are associated with failed endotracheal intubation (ETI) in the emergency department (ED). However, little is known about the relationship between DAPs and failed prehospital ETI. Objective: Our aim was to determine the prevalence of common DAPs among failed prehospital intubations. Methods: We reviewed a quality-improvement database, including all cases of ETI in a single ED, over 3 years. Failed prehospital (FP) ETI was defined as a case brought to the ED after attempted prehospital ETI, but bag-valve-mask ventilation, need for a rescue airway (supraglottic device, cricothyrotomy, etc.), or esophageal intubation was discovered at the ED. Physicians performing ETI evaluated each case for the presence of DAPs, including blood/emesis, facial/neck trauma, airway edema, spinal immobilization, short neck, and tongue enlargement. Results: There were a total of 1377 ED ETIs and 161 had an FP-ETI (11.8%). Prevalence of DAPs in cases with FP-ETI was obesity 13.0%, large tongue 18.0%, short neck 13%, small mandible 4.3%, cervical immobility 49.7%, blood in airway 57.8%, vomitus in airway 23.0%, airway edema 12.4%, and facial or neck trauma 32.9%. The number of cases with FP-ETI and 0, 1, 2, 3, or 4 or more DAPs per case was 22 (13.6%), 43 (26.7%), 23 (24.3%), 42 (26.1%), and 31 (19.3%), respectively. Conclusions: DAPs are common in cases of FP-ETI. Some of these factors may be associated with FP-ETI. Additional study is needed to determine if DAPs can be used to identify patients that are difficult to intubate in the field.   © 2014 Elsevier Inc.

INTRODUCTION

Prehospital endotracheal intubation (ETI), especially in patients presenting with certain conditions, has been controversial (1–4). One of the key issues in this debate is failure of successful tube placement in the trachea. In this setting, ETI may be best viewed as a procedure with potential benefits as well as risks (5). Failure to appropriately place the endotracheal tube, dislodgement of the endotracheal tube, or multiple ETI attempts can result in poor patient outcomes (6). Reports have identified unrecognized ETI failure in 3%–25% of patients undergoing prehospital ETI (6,7). Not surprisingly, these failed ETI attempts have been shown to increase mortality (8).

Low ETI success rates and the lack of clear evidence that prehospital ETI improves outcomes has led to a call by some to abandon prehospital ETI altogether (9,10). However, other studies have reported ETI success rates >95% in the prehospital setting (4,11). These high success rates, in combination with strategies aimed at optimizing postintubation ventilation, have demonstrated improved outcomes in patients with

traumatic brain injury (4). This suggests that improving ETI success may be one key step to improving patient outcomes (5).

Identification of patients that may be difficult to intubate is a key component of airway management in the prehospital setting (12). If these patients are identified early, providers can elect to use an alternative airway with improved chances of success in a given patient population (13–17). A variety of methods have been used to identify patients that may be difficult to intubate. Several scoring systems have been studied in the in-hospital setting and are predictive of having difficulty when attempting direct laryngoscopy (18,19). Practical utilization of these scoring systems in the prehospital setting may be difficult. These patients are frequently unconscious or otherwise unable to follow instructions, which prevents adequate preprocedure evaluation of the oral-pharyngeal opening or the quality of laryngoscopic view.

Other predictors of difficult prehospital ETI have been evaluated. Garza et al. demonstrated that pediatric cardiac arrest patients and adult traumatic arrest patients were seven times more likely to have a failed prehospital (FP) ETI than adult patients with a nontraumatic cardiac arrest (20). Others have evaluated a wide variety of factors that may be associated with a difficult prehospital ETI and found several factors associated with increased odds of failure, including trismus, inability to pass the tube through the cords, inability to visualize the cords, intact gag reflex, i.v. insertion before ETI, increased patient weight, and electrocardiogram lead placement before ETI (21). Others have identified several factors associated with increased odds of difficult physician ETI in the field, such as airway obstruction, intubation on the floor, and hyoid-mental distance >3 fingers (22). Finally, anatomic and physiologic criteria (Table 1) have been identified in the ED setting that, when present, predict a difficult airway (13,23). In this report, we identify the prevalence of these difficult airway predictors (DAPs) in cases of FP-ETI.

MATERIALS AND METHODS

Study Design

We conducted a retrospective analysis of all patients undergoing ETI in the ED during a 3-year period (July 1,

Table 1. Difficult Airway Predictors

Anatomic	Pathologic
Obesity	Blood in airway
Large tongue	Vomitus in airway
Short neck	Airway edema
Small mandible	Facial or neck trauma
	Cervical immobility

2007–June 28, 2010). Data from this period was utilized because primary placement of an alternative airway or transport of patients with bag-valve-mask (BVM) ventilation only was not standard practice at this time. Data were prospectively collected on all patients undergoing ETI in the ED using a simple one-page data-collection tool developed for a quality-improvement (QI) database. The intubator completed data-collection sheets immediately after each ETI. Structured data forms were cross-referenced to professional billing records to identify any missing data forms. If an intubation was identified without a completed form, the operator was sent a blank form for completion. The number of forms completed after the time of patient care varied with resident training cycles and ranges from 6% to 7%. This form documented the presence or absence of DAPs (see Table 1), whether ETI was attempted in the prehospital setting, success or failure of ETI in the ED, as well as multiple other demographic and performance characteristics. Data were then entered into an Excel (Microsoft, Redmond, WA) spreadsheet for analysis and grouping of patient populations. The University of Arizona Institutional Review Board approved retrospective analysis of this QI data for the purpose of this study and determined that informed consent was not necessary.

Setting

This study was conducted in an urban, university-based, tertiary care, Level I trauma center with an annual ED census of approximately 70,000 patients. The majority of patients meeting inclusion criteria were cared for by one of several fire-based emergency medical services (EMS) agencies providing paramedic-level care or one of five helicopter emergency medical services (HEMS) staffed by paramedics and flight nurses. At the time of this study, two of the ground-based agencies and all of the HEMS agencies performed rapid sequence intubation (RSI). In the ED, ETI was performed by emergency medicine residents (postgraduate year 1–3) with oversight from emergency medicine attending physicians. Airway management in this ED is ultimately the responsibility of the attending emergency physician, who determines which physician will perform the intubation and what technique will be used on a case-by-case basis.

Subjects

All patients requiring ETI in the ED during the study period were entered into the database. Patients with successful prehospital ETI were not included because this QI database is made up only of those patients who are intubated in the ED. This limited our study to reporting on the prevalence of DAPs in the FP-ETI group. Data on cases of