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ASSESSMENT OF EMERGENCY AIRWAY MANAGEMENT TECHNIQUES IN KOREA USING AN ONLINE REGISTRATION SYSTEM: A MULTICENTER STUDY

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☐ Abstract—Background: The investigators developed a Web-based online registration system to identify the current status of trauma airway management. Objectives: The purpose of the study was to identify first-pass success (FPS) rate of the intubation methods and devices that are currently used, as well as the factors that affect FPS in trauma patients. Methods: This study was designed as a prospective, observational multi-center study. We obtained clinical data of intubated trauma patients in 13 academic emergency departments in Korea. After performing an intubation, each patient's data were entered into a Web-based registry. Logistic regression analyses were conducted to identify the factors that affect FPS. Results: The FPS rate was 80.6% in all trauma patients. The curved-blade laryngoscope was the most commonly used instrument, and was applied to 1395 patients (76.2%) during first attempt. Video laryngoscopy was applied to 341 patients (18.6%). In the multivariate logistic regression analysis, factors that affected FPS in difficult airway trauma patients were emergency physicians, senior physicians, and video laryngoscopy (odds ratio 2.42, 95% confidence interval 1.04–5.65; 1.80, 1.16–2.79; and 2.16, 1.39–3.33, respectively). Conclusions: Emergency physicians in Korea are prepared for trauma patient airway management. The backup by experienced senior physicians, and preparation and training for video laryngoscope could assist FPS for trauma patients.   © 2015 Elsevier Inc.

☐ Keywords—emergency; airway; trauma

INTRODUCTION

Airway management is an essential part of trauma care. Trauma patients with an unprotected airway are at an increased risk for aspiration, airway disruption, or injury and need proper airway management in the emergency department (ED). Trauma airways are potentially difficult to manage due to both anatomical disruption and the possibility of unexpected airway obstructions, such as oral bleeding and anterior neck hematoma. Many patients are not fasted at time of injury, which increases the potential risk of vomiting and aspiration [1]. In addition, many patients are immobilized with a cervical spine collar, which makes direct laryngoscopic orotracheal intubation more difficult [2].

Despite the importance of airway management in trauma patients, there is insufficient evidence of competency during intubation performance, and most studies are from a single institution or limited to management of nontrauma patients [3–7]. Overall assessment of the practice of trauma airway management contributes to policy development, additional training programs, and evidence-based practice guidelines.

The investigators developed a Web-based trauma airway management registry to assess the current status of trauma airway management in Korea. The purpose of

this study was to identify first-pass success (FPS) rate of the intubation methods and devices that are currently used, as well as the factors that affect FPS in trauma patients.

MATERIALS AND METHODS

Study Design

This study was designed as a prospective, observational multi-center study. The data in this study were extracted from the Korean Emergency Airway Management Registry (KEAMR). KEAMR was performed in 13 academic EDs for the purpose of identifying the status of airway management in Korea. The data were collected from March 2006 to December 2010. Emergency physicians were available 24 h a day in all of the EDs, and the EDs run 4-year emergency medicine residency training programs. In every ED, intubations are performed both by emergency physicians (residents and emergency medicine board specialist) and physicians from other specialties (residents only). This study was approved by the institutional review board of each participating hospital.

Participant Selection

The trauma patients who received intubation attempts in 13 EDs were included in this study. Patients who arrived at the ED already intubated and patients being intubated for non-trauma-related issues were excluded.

Data Collection and Processing

We collected data using a standardized form (Appendix) that was developed through discussion and consensus with the investigators of each ED. After performing an intubation, the intubator completed the form and entered into the Web-based registry (http://keams.or.kr/keamr). The collected variables of the registry included the age, sex, intubation indications, the presence of a crash airway, the presence of a difficult airway, the glottis exposure grade, the number of attempts, the intubator's level of training and specialty, intubation method, device used for each intubation attempt, intubation success or failure, and adverse events.

We defined a crash airway as a patient who presented in an unresponsive state (8). A difficult airway was defined as a case in which the first intubator anticipated the difficult airway considering three dimensions of difficulty: difficult laryngoscopy and intubation, difficult bag-mask ventilation, and difficult cricothyrotomy. We

recommended that the intubators use a mnemonic method suggested by Murphy and Walls, such as LEMON (we modified the original mnemonic partially and define LEMON as Look externally, Evaluate 3-3-2, Morbid obesity, Obstruction, Neck mobility) for difficult laryngoscopy and intubation, MOANS (Mask seal, Obese, Aged, No teeth, Stiff/Snore) for difficult bag-mask ventilation, and SHORT (Surgery, Hematoma, Obesity, Radiation, Tumor) for difficult cricothyrotomy (9). If the assessment of a difficult airway could not be performed prior to intubation, additional airway assessment after the intubation was also recommended. The glottic exposure grade was evaluated with the use of the modified Cormack & Lehane classification (10). Intubation methods were classified as rapid sequence intubation (RSI), orotracheal intubation without medication, orotracheal intubation with sedative only, and cricothyrotomy prior to intubation attempt.

An attempt was defined as a single insertion of the device past the teeth. The success of intubation was defined as the proper placement of the endotracheal tube through the vocal cords. FPS was defined as successful intubation on the first attempt. The transfer of intubation to another intubator or a change in intubation technique was considered to be a failure. Those with 1 to 3 years of postgraduate training were defined as junior physicians and those with 4 or more years as senior physicians. Any missing or unreliable data were excluded from the analysis.

Data Analysis

We calculated study sample size with G*Power 3.17 (Franz Faul, Germany). For multivariate logistic analysis, 1294 participants would be required ($\alpha = 0.05$, $\beta = 0.2$, multiple correlation coefficient = 0.1, drop rate 10% for four independent variables). The nominal variables were presented as frequency and percentage, and continuous variables were presented as means and SDs in normal distribution. Data were presented as median and interquartile ranges when variables did not follow a normal distribution. We compared success rates and analyzed data based on difficult airways, crash airways, the glottis exposure grade, and the level of training of the physicians. We analyzed the FPS rate depending on the methods and devices. For continuous variables, the t-test and Wilcoxon test were used to identify differences among groups and, for nominal variables, χ^2 test was used. A multivariate logistic analysis was performed to find the variables that had an independent effect on FPS. p-Values <0.05 were considered statistically significant. We used SPSS 13.0 for Windows (SPSS Inc., Chicago, IL) for all statistical analyses.