

Selected Topics: Prehospital Care

COMPARISON OF NEUROLOGICAL OUTCOME BETWEEN TRACHEAL INTUBATION AND SUPRAGLOTTIC AIRWAY DEVICE INSERTION OF OUT-OF-HOSPITAL CARDIAC ARREST PATIENTS: A NATIONWIDE, POPULATION-BASED, OBSERVATIONAL STUDY

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Abstract—Background: The effect of prehospital use of supraglottic airway devices as an alternative to tracheal intubation on long-term outcomes of patients with out-of-hospital cardiac arrest is unclear. **Study Objectives:** We compared the neurological outcomes of patients who underwent supraglottic airway device insertion with those who underwent tracheal intubation. **Methods:** We conducted a nationwide population-based observational study using a national database containing all out-of-hospital cardiac arrest cases in Japan over a 3-year period (2005–2007). The rates of neurologically favorable 1-month survival (primary outcome) and of 1-month survival and return of spontaneous circulation before hospital arrival (secondary outcomes) were examined. Multiple logistic regression analyses were performed to adjust for potential confounders. Advanced airway devices were used in 138,248 of 318,141 patients, including an endotracheal tube (ETT) in 16,054 patients (12%), a laryngeal mask airway (LMA) in 34,125 patients (25%), and an esophageal obturator airway (EOA) in 88,069 patients (63%). **Results:** The overall rate of neurologically favorable 1-month survival was 1.03% (1426/137,880). The rates of neurologically favorable 1-month survival were

1.14% (183/16,028) in the ETT group, 0.98% (333/34,059) in the LMA group, and 1.04% (910/87,793) in the EOA group. Compared with the ETT group, the rates were significantly lower in the LMA group (adjusted odds ratio 0.77, 95% confidence interval [CI] 0.64–0.94) and EOA group (adjusted odds ratio 0.81, 95% CI 0.68–0.96). **Conclusions:** Prehospital use of supraglottic airway devices was associated with slightly, but significantly, poorer neurological outcomes compared with tracheal intubation, but neurological outcomes remained poor overall. © 2013 Elsevier Inc.

Keywords—out-of-hospital cardiac arrest; tracheal intubation; supraglottic airway device; neurological outcome; airway management

INTRODUCTION

Tracheal intubation has long been considered the gold standard for airway management during resuscitation after cardiac arrest. However, this method is now being

challenged by some experts, especially when the tracheal intubation is performed by inexperienced providers in prehospital settings (1). Critics of the technique cite incorrect placement of the endotracheal tube (ETT) and unnecessary interruption of chest compressions associated with the lengthy procedure as the major disadvantages of prehospital tracheal intubation (2).

Several supraglottic airway devices are currently in clinical use as alternatives to ETT, including the laryngeal mask airway (LMA) and the laryngeal tube, which can be used without the need for elaborate training for airway management (3–7). However, a systematic comparison of the clinical outcomes of ETT and supraglottic airway devices has not been conducted (8).

The aim of the current study was to compare the effects of tracheal intubation and insertion of supraglottic airway devices on neurological outcomes of patients with out-of-hospital cardiac arrest.

MATERIALS AND METHODS

Study Design

This study was approved by the Ethics Committee of Nara Medical University (Authorization Code: 260). We conducted a nationwide population-based observational study using a Japanese national database containing information about out-of-hospital cardiac arrests over a 3-year period from January 1, 2005 to December 31, 2007. The database was compiled by the Fire and Disaster Management Agency (FDMA) in Japan, and contained all out-of-hospital cardiac arrest cases that were transferred to hospitals by emergency medical service (EMS) personnel (9). The data set included age, sex, whether the collapse was witnessed, whether bystander cardiopulmonary resuscitation (CPR) was performed, cause of cardiac arrest (cardiac or non-cardiac origin), first documented cardiac rhythm, whether the patient was defibrillated by the EMS, whether epinephrine was administered by the EMS, whether advanced airway devices were used by the EMS, and, if so, the type of advanced airway device used, time course of resuscitation, and outcomes (10).

Setting

Japan contains approximately 128 million residents in an area of 377,914 km². A total of 807 fire departments with dispatch centers covered the whole nation as of 2007. The most highly trained prehospital emergency care providers are Emergency Life-Saving Technicians. Among ambulance attendants, only Emergency Life-Saving Technicians are authorized to use supraglottic airway devices other than ETT (11). ETT insertion is conducted only by Emergency Life-Saving Technicians who have

received specific training, including a minimum of 30 successful attempts at tracheal intubation in elective surgical patients under anesthesia (11).

The National Protocol for Resuscitation stated that bag-valve-mask ventilation (BVM) was to be used as the first choice for resuscitation, and that an advanced airway device should be considered only when the patient's airway could not be sufficiently secured or a long transportation period was expected (12).

Selection of Participants

We included all out-of-hospital cardiac arrest patients aged 15 years or older who were treated by EMS personnel using advanced airway devices. Patients younger than 15 years of age were excluded from this study because the National Protocol for Resuscitation states that tracheal intubation should be used only for patients aged 15 years or older. We also excluded patients for whom the type of advanced airway device was unknown.

Methods of Measurement

Patients were categorized into three groups according to the advanced airway devices used: ETT group; LMA group; and esophageal obturator airway (EOA) group. Any supraglottic airway devices designed to occlude the esophagus using a balloon were classified as EOAs. The EOAs included a laryngeal tube, a Combitube (an esophageal-tracheal twin-lumen airway device; Kendall Inc., Mansfield, MA), and an esophageal gastric tracheal airway. Cases with unsuccessful advanced airway device insertion and subsequent use of BVM were excluded. Cases in which the airway management method was changed midway were classified according to the airway device in use on arrival at the hospital.

Cardiac arrest was defined as the absence of cardiac mechanical activity, as confirmed by the absence of signs of circulation (10,13,14). The etiology of cardiac arrest was determined clinically by the physician in charge, in collaboration with EMS personnel. Cardiac arrest was presumed to be of cardiac origin unless external causes or any other non-cardiac causes (e.g., respiratory diseases, cerebrovascular diseases, or malignant tumors) were obvious (15). The external causes of out-of-hospital cardiac arrest included trauma, drowning, drug overdose, asphyxia, and hanging. Outcome data such as the 1-month survival and neurological status were collected by EMS personnel from the physicians in charge of the patients (16).

Data Collection and Processing

All the information was entered at local fire departments by EMS personnel using an online entry form, which

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