

Assessment of Emergency Medical Services Personnel Compliance with Escalating Airway Algorithm Protocol

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ABSTRACT

Introduction. When emergency medical services (EMS) personnel respond to emergencies, the decisions they make often can mean life or death for the patient. This is especially true in the case of advanced airway management. Protocols are set in place to ensure that the least invasive airway management techniques are used initially before more invasive techniques. The purpose of this study was to determine how often EMS personnel followed this protocol, while adequately achieving the goals of appropriate oxygenation and ventilation.

Methods. This retrospective chart review was approved by the Institutional Review Board of the University of Kansas Medical Center. The authors reviewed the Wichita/Sedgwick County EMS system for cases during 2017 in which patients required airway support. We examined de-identified data to determine if invasive methods were applied in sequence. Cohen's kappa coefficient (κ) and immersion-crystallization approach were used to analyze the data.

Results. A total of 279 cases were identified in which EMS personnel used advanced airway management techniques. In 90% ($n = 251$) of cases, less invasive techniques were not used prior to more invasive techniques and in 80% ($n = 222$) of cases, the more invasive technique was used alone. A dirty airway was the most common reason for the EMS personnel's choice of using more invasive approaches in achieving the goals of appropriate oxygenation and ventilation.

Conclusions. Our data showed that EMS personnel in Sedgwick County/Wichita, Kansas often deviated from the advanced airway management protocols when caring for patients in need of respiratory intervention. Dirty airway was the main reason for using a more invasive approach in achieving the goals of appropriate oxygenation and ventilation. It is important to understand reasons why deviations in protocol were occurring to ensure that current protocols, documentation, and training practices are effective in producing the best possible patient outcomes. *Kans J Med* 2023;16:53-55

INTRODUCTION

Airway management is a fundamental component of emergency medical services in the prehospital setting. Emergency medical service (EMS) personnel are faced with unique challenges regarding airway management given the urgency and unpredictability of their patient encounters. The equipment and techniques utilized for airway

management vary based on the clinical scenario. In situations where basic (head-tilt, jaw-thrust) and intermediate (bag-mask-ventilation, oral or nasal airway devices) airway management techniques are not enough, advanced airway management techniques need to be utilized. In order of invasiveness, advanced airway techniques include supraglottic airway devices (SGAs), endotracheal intubation (ETI), and surgical methods (cricothyrotomy). SGA placement requires less training than ETI.

In studies demonstrating poor outcomes related to prehospital-attempted endotracheal intubation, both training and skill level of the provider were often low.¹ Carney et al.² reviewed 99 studies and determined that there were no strongly supported differences in primary outcomes when comparing SGA to ETI in the prehospital setting. Prehospital ETIs have been found to correlate with higher incidence of mortality among trauma patients.³ Given this information, SGA may be more appropriate in certain pre-hospital encounters. Carney et al.² supported a protocol that emphasized the simplest (and least potentially harmful) form of intubation including the use of an SGA when patients cannot be intubated or ventilated by bag-valve-mask.⁴ Furthermore, approaching difficult airways with a pre-determined algorithm has been proven beneficial by the American Society of Anesthesiologists.⁵

On May 1, 2013, the Wichita/Sedgwick County EMS System implemented an Escalating Airway Algorithm for patients requiring assistance in ventilation. The implementation was to ensure that patients in need of respiratory intervention would be managed with the least invasive method that adequately achieved the goals of appropriate oxygenation and ventilation. This protocol defined specific measures that should be taken by EMS personnel when caring for patients that required airway support. The protocol emphasized that the least invasive methods of support should be administered before more invasive measures are applied. There are two invasive methods of airway support that are prescribed in the protocol, iGel[®] and endotracheal tube (ETT). An iGel[®] is a second-generation supraglottic airway device that is less invasive and thus, per the protocol, should be attempted prior to ETT.

There are instances where the sequence of the protocol is not followed and ETT is placed before an iGel[®]. While there may be numerous reasons for straying from the protocol, we suspected that a "dirty airway" was the most frequent justification for using more invasive methods of airway management before attempting less invasive methods. The purpose of this study was to determine how often EMS personnel ensured that patients in need of respiratory intervention were managed with the least invasive method that adequately achieved the goals of appropriate oxygenation and ventilation. The information gathered from the study could benefit the leadership of the EMS system to develop appropriate training procedures that will help the EMS personnel to contribute better to preferable outcomes for patients requiring airway support.

METHODS

This retrospective chart review was approved by the University of Kansas Medical Center's Institutional Review Board. The Wichita/Sedgwick County EMS System, called the HealthEMS, was reviewed for calls/cases where patients required airway support, from January 1, 2017, to December 31, 2017. The sequence employed by the EMS personnel when caring for patients that required airway support with an endotracheal tube was examined. De-identified data were examined to determine if the invasive methods of airway support were applied in sequence when the EMS personnel cared for patients. Two co-authors (CH and DR) independently reviewed the data.

Statistical Analyses. Frequency distributions were calculated to examine the number of cases where proper sequencing was followed (iGel® was attempted prior to ETT) and the number of cases where proper sequencing was not followed (iGel® was not attempted prior to ETT). Cohen's kappa coefficient (κ) was used to measure the reviewers' inter-rater agreement for the reasons the EMS personnel gave for not applying proper sequencing when caring for patients who needed airway support. All analyses were 2-sided with α of 0.05. The IBM SPSS (Statistical Package for the Social Sciences, version 26) was used for the statistical analysis.

The study team used an immersion-crystallization approach⁶⁻⁹ to analyze reasons the EMS personnel gave for not following the escalating airway algorithm. This analysis was done individually and in a group meeting. The immersion-crystallization approach offers researchers the opportunity to examine data in detail and periodically suspend the immersion process to reflect on emerging findings until consistent themes are identified.^{6,7}

RESULTS

The Cohen's κ calculation showed there was a good agreement between the two raters' assessment ($\kappa = 0.83$ (95% CI, 0.73 to 0.94); $p < 0.001$). As Table 1 shows, 279 cases were identified during the period where the EMS personnel used either iGel®, ETT only, or iGel® and ETT when caring for patients who required airway support. Of the 279 cases, iGel® was not attempted prior to the placement of an ETT in 251 (90%) of the cases and ETT alone was applied on 222 (80%) of the cases.

Table 1. How cases involving invasive airway management were treated (N = 279).

Airway Management	#	%
iGel® attempted prior to ETT	28	10
iGel® only	7	2.5
iGel® before ETT	21	7.5
iGel® not attempted prior to ETT	251	90.0
ETT only	222	79.6
ETT before iGel®	29	10.4

Note: #, frequencies; %, percentages; ETT, endotracheal tube

To determine reasons the EMS personnel gave for not following the escalating airway algorithm, 100 of the 251 cases were selected randomly for further analysis using the immersion-crystallization approach. The EMS personnel's reasons for deviating from the protocol are reported in Figure 1. Most of the reasons given were associated with airways that had the presence of blood, vomit, food, secretions, or whereby suction was performed prior to endotracheal intubation.

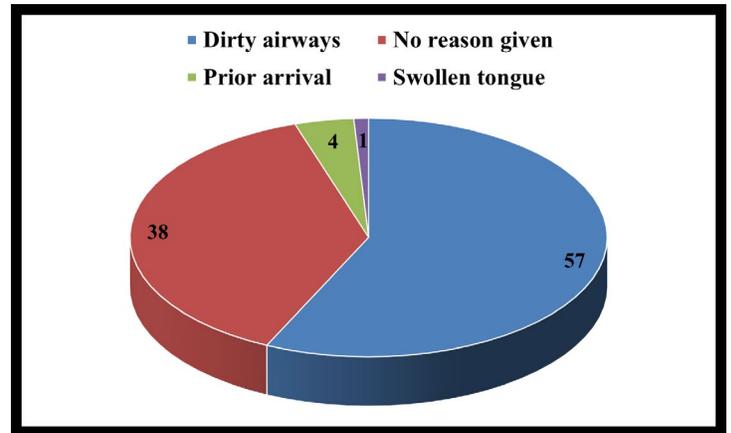


Figure 1. Reasons given by the EMS personnel for not following the escalating airway algorithm.

Note: Dirty airways: Airways that had the presence of blood, vomit, food, secretions, or whereby suction was performed prior to endotracheal intubation. Prior arrival: Endotracheal tube was placed at the facility the patient was prior to arrival of the EMS personnel.

DISCUSSION

The results of this study showed that EMS personnel in Sedgwick County/Wichita, Kansas often deviated from the advanced airway management protocols when caring for patients in need of respiratory intervention. In 90% of the cases, less invasive techniques such as iGel® were not attempted prior to more invasive measures such as ETT. More invasive measures (ETT) alone were applied in 80% of cases. These findings were consistent with results from a 2008 national study by Wang et al.¹⁰ where more invasive airway techniques like ETI were used by EMS personnel more frequently than less invasive advanced airway techniques like SGAs when caring for patients who needed respiratory intervention. The use of ETT as a first approach to achieve appropriate oxygenation and ventilation is common among EMS personnel across the country and did not seem to be unique to this Kansas county. Considering this information along with the higher incidence of mortality found to correlate with prehospital ETI in trauma patients, it is important to understand why iGel® was underutilized by EMS personnel for advanced airway management.³

In our study, a dirty airway was reported as the reason for not using less invasive techniques initially in 57% of the cases. Other reasons found were a swollen tongue and the patient having been intubated prior to receiving care from EMS. For more than one-third (38%) of cases, no reason was given. These findings were consistent with results from a 2014 study by Prekker et al.¹¹ in King County, Washington. In that study, the authors examined challenges paramedics faced during advanced airway management and found airway obstruction to be the most common challenge to intubate patients properly who needed airway support. These findings suggested that adherence to the escalating airway algorithm protocol may not be realistic in certain instances,

and the examination of specific cases and scenarios could be useful in determining those instances. This information also could be useful in determining if simply reinforcing the protocol, updating documentation procedures, or providing more regular training with devices such as iGel® would be beneficial.

Limitations. There were limitations to this study. First, this study was limited by the sample size being 279 cases collected from a single EMS system. The findings reported in this study only represented a snapshot of one out of 105 counties in the state of Kansas. However, our findings seemed to be consistent with those of similar studies and may be particularly applicable in areas with comparable community and population characteristics. Second, the data were reviewed retrospectively over the course of one year and the findings may not be a true reflection of how the EMS personnel often care for patients that required airway support with an endotracheal tube. More specifically, reasons found for deviating from the airway protocol were not as comprehensive as they could be due to a review of a single-year data, although comparable to similar studies.

Future studies could include data from several years to clarify the trend seen from this study and determine how advanced airway management by EMS personnel is carried out within various counties, states, or even across the country. This could lead to improvements in EMS training, protocols, and documentation procedures that would reflect experiences more realistically and current practices of EMS personnel. Finally, the study was limited by using 100 randomly selected cases out of 251 for further analysis. Including the remaining 151 cases in this analysis could help to paint a more detailed picture of obstacles EMS personnel face and how often they occur.

CONCLUSIONS

Protocols set in place by EMS systems nationwide all function to serve the same purpose; to ensure that patient safety is paramount. This is especially important in the case of advanced airway management. However, it is necessary that an accurate view of the challenges faced by EMS personnel and instances in which advanced airway protocols can or cannot be realistically followed is obtained to ensure that they most efficiently serve their purpose. Also, evaluating reasons why EMS personnel use of ETT is more frequent than what would be expected, and the obstacles reported can gain a better understanding of why deviations from airway protocols occurred so frequently. This study has offered valuable insight into the EMS system of Wichita/Sedgwick County Kansas, how advanced airway protocols were being adhered to, and the challenges faced by EMS personnel with regards to airway management. Further studies are needed to determine how EMS personnel can be best equipped to confront these challenges and ultimately contribute to preferable outcomes for patients requiring airway support.

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