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Brief Report

Prehospital endotracheal intubation vs extraglottic airway device in blunt trauma☆,☆☆,★

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ABSTRACT

Objective: The objective of the study is to compare outcomes in blunt trauma patients managed with prehospital insertion of an extraglottic airway device (EGD) vs endotracheal intubation (ETI). The null hypothesis was that there would be no difference in mortality for the 2 groups.
Methods: This is a retrospective study of blunt trauma patients with Glasgow Coma Scale score less than or equal to 8 transported by ground emergency medical services directly from the scene of injury to a single urban level 1 trauma center. Patients managed with only noninvasive airway techniques were excluded, leaving patients undergoing either EGD placement or ETI. Outcomes included in–emergency department (ED) traumatic arrest and hospital mortality. Multivariable logistic regression was used to control for the potential confounding effects of demographic and clinical variables. For all analyses, $P < .05$ was used to establish statistical significance.
Results: In bivariate analysis, patients managed with EGD were more likely than those managed with ETI to have an in-ED traumatic arrest (36.5% vs 17.1%; $P = .005$), but eventual hospital mortality did not significantly differ between the 2 groups (75.7% vs 67.1%; $P = .228$). After controlling for demographic and clinical characteristics, patients managed with EGD were no more likely than patients managed with ETI to experience traumatic arrest in the ED (adjusted odds ratio, 1.67; 95% confidence interval, 0.72-3.89), and there was also no difference in overall hospital mortality (adjusted odds ratio, 0.912; 95% confidence interval, 0.36-2.30).
Conclusion: In this preliminary, retrospective analysis, we found no difference in overall survival among trauma patients managed with prehospital EGD and those managed with prehospital ETI.

1. Introduction

Maintaining a secure patent airway is the first priority of all health care providers involved in the care of trauma patients [1]. Basic maneuvers such as chin lift and jaw thrust, oropharyngeal suctioning, and insertion of oral or nasal airways are primary steps used by emergency medical services (EMS) providers to maintain a patent airway. When a more definitive airway is needed, oral endotracheal intubation (ETI), placement of an extraglottic airway device (EGD), and cricothyroidotomy are among the options typically available to advanced EMS providers [2,3].

The standard for definitive airway management is direct laryngoscopy and ETI; however, some data in the current literature suggest increased morbidity and mortality in patients with traumatic brain injury (TBI) managed with prehospital ETI [4-8], and others have questioned the ability of EMS providers to maintain adequate ETI skills [9-11]. These concerns about ETI and the relative ease of EGD placement have led to increased utilization of EGDs such as the laryngeal mask airway, esophageal-tracheal combitube, King laryngeal tube, and pharyngeal tracheal lumen airway in prehospital care [3,12].

Despite the concerns about prehospital ETI and a trend toward EGDs, there are little published data concerning outcomes for trauma patients who undergo airway management with an EGD. There was also an anecdotal perception at our institution of poorer outcomes among trauma patients arriving with an EGD in place. We, therefore, undertook this study to directly compare outcomes in blunt trauma patients admitted to a level I trauma center who were managed with prehospital insertion of an EGD vs ETI. Our null hypothesis was that there would be no difference in the mortality rates of the 2 groups.

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2. Methods

This study was performed at a single urban American College of Surgeons–accredited level 1 trauma center serving a catchment of 2 million people in 11 central Texas counties and with an annual emergency department (ED) census of 75 000 patients. The trauma center receives patients from 16 different transporting ground EMS systems from urban, suburban, and rural communities. Of those systems, 11 provide paramedic level care and were included in this analysis. These systems allow primary airway management with either ETI or EGD; rapid sequence induction (RSI) is available in some, but not all of the systems.

We performed a retrospective study of all blunt trauma patients with Glasgow Coma Scale (GCS) score less than or equal to 8 who were transported by paramedic-staffed ground EMS systems directly from the scene of injury between January 2006 and June 2014. Patients who had their airway managed with noninvasive techniques were excluded, leaving only patients undergoing prehospital EGD placement or prehospital ETI. All data were extracted from trauma registry records and included EGD vs ETI, patient demographics (age and sex), prehospital and ED vital signs (pulse, systolic blood pressure [SBP], respiratory rate, and GCS), prehospital Revised Trauma Score (RTS), maximum Abbreviated Injury Scale (AIS) for each body region, and Injury Severity Score (ISS). Whether paramedics in the transporting EMS system had RSI capabilities was also recorded.

The primary outcome for this study was hospital mortality; secondary outcomes included in-ED traumatic arrest, hospital and intensive care unit (ICU) length of stay, and ventilator days. None of the demographic and clinical variables among the EGD and ETI patient groups were normally distributed, and they are, therefore, reported as median and interquartile range (IQR) or raw percentages. For bivariate analyses, continuous variables were compared using Wilcoxon rank sum test, and categorical variables were compared using Pearson χ^2, with $P < .05$ used to establish statistical significance. To account for potential confounding effects among the demographic, clinical, and outcome variables, multivariable logistic regression for both in-ED arrest and hospital mortality was conducted. The logistic regression models included the airway device, patient age and sex, and clinical variables potentially associated with both the chosen airway (ie, a $P < .20$ in the bivariate analysis) and the outcome of interest. $P < .05$ was used to establish statistical significance in the final models. The local institutional review board approved this study.

3. Results

During the study period, 162 blunt trauma patients managed with either ETI (n = 88; 54.3%) or EGD (n = 74; 45.7%) were transported to our trauma center directly from the scene of injury by 11 different paramedic-staffed ground EMS systems. Table 1 compares the demographic and clinical characteristics of the included patients. The EGD and ETI groups were demographically similar, and prehospital pulse rate and SBP did not differ for the 2 patient groups. Although the EGD and ETI groups also had similar median ISS (38 vs 34; $P = .063$), the EGD group appeared more clinically compromised with slower respirations (median, 0 vs 6; $P = .022$) and lower RTS (median, 4 vs 6; $P = .006$) than the ETI group. Patients in the ETI group were also more likely to have been transported by agencies with RSI capabilities ($P < .001$).

Table 2 shows the outcomes of the ETI and EGD groups. In the bivariate analyses, patients whose airways were managed with EGD were more likely than those whose airways were managed with ETI to have an in-ED traumatic arrest (36.5% vs 17.1%; $P = .005$), but eventual hospital mortality did not significantly differ between the 2 groups (70.5% vs 63.3%; $P = .228$). Patients whose airways were managed with EGD had significantly shorter median hospital lengths of stay than patients whose airways were managed with ETI (1 vs 3 days; $P = .038$), but there was no significant difference in the number of ICU or ventilator days. Patients transported by RSI capable EMS systems were less likely to have in-ED cardiac arrest, more likely to survive their injuries, and had longer hospital and ICU stays than patients transported by non-RSI systems (Table 3).

Table 1
Subject characteristics

	ETI (n = 88)	EGD (n = 74)	Significance
Age, median (IQR)	38 (24-54)	37 (25-56)	.894
Female, n (%)	33 (37.5)	19 (26.0)	.108
EMS SBP, median (IQR)	100 (62-122)	84 (0-134)	.344
EMS pulse, median (IQR)	87 (61-100)	85 (22-106)	.268
EMS respirations, median (IQR)	6 (0-12)	0 (0-10)	.022
EMS GCS, median (IQR)	3 (3-3)	3 (3-3)	.047
EMS RTS, median (IQR)	6 (3-7)	4 (0-6)	.006
RSI available, n (%)	50 (56.8)	16 (21.6)	<.001
ED SBP, median (IQR)	95 (50-124)	87 (0-145)	.762
ED pulse, median (IQR)	88 (53-112)	85 (0-112)	.212
ED respirations, median (IQR)	0 (0-0)	0 (0-0)	.296
ED GCS, median (IQR)	3 (3-3)	3 (3-3)	.213
ISS, median (IQR)	34 (25-44)	38 (30-48)	.063
Head AIS, median (IQR)	4 (3-5)	5 (4-5)	.195
Face AIS, median (IQR)	0 (0-1)	0 (0-1)	.883
Chest AIS, median (IQR)	3 (0-4)	3 (0-4)	.733
Abdomen AIS, median (IQR)	0 (0-2)	2 (0-2)	.803
Extremities AIS, median (IQR)	2 (0-2)	2 (0-3)	.339
External AIS, median (IQR)	1 (0-1)	1 (0-1)	.997

Tables 4 and 5 show the results of the multivariable logistic regressions for in-ED arrest and hospital survival. After controlling for demographic and clinical characteristics, patients whose airways were managed with EGD were no more likely than patients whose airways were managed with ETI to experience traumatic arrest in the ED (Table 4; adjusted odds ratio [AOR], 0.91; 95% confidence interval [CI], 0.72-3.89); lower RTS and transport by an RSI-capable EMS system were associated with in-ED traumatic arrest. The type of airway placed was also not associated with overall hospital mortality (Table 4; AOR, 0.82; 95% CI, 0.36-2.30), although lower RTS and older patient age were associated with increased hospital mortality.

4. Discussion

We found higher rates of in-ED traumatic arrest among ground EMS trauma patients whose airways were managed with EGD, although that association was not sustained in the multivariable analysis controlling for potential confounding variables. There was no association between EGD placement and overall hospital mortality in either the bivariate or multivariable analysis. These findings are consistent with the anecdotal perception among our institution's staff of worse outcomes in trauma patients managed with EGD, while highlighting that observed traumatic arrest in the ED is not an objective measure of ultimate outcome.

The patients whose airways were managed with an EGD appeared more seriously injured than patients whose airways were managed with ETI, and this appears to (at least partially) explain the differences in observed in-ED traumatic arrest. Although ISS did not differ for the 2 groups, patients who had an EGD placed had lower respiratory rates and lower GCS than patients undergoing ETI. Patients managed with ETI were also more likely to have been transported by RSI capable paramedics; patients who require RSI for airway management are arguably less compromised than patients whose airways can be managed

Table 2
Outcomes and airway used

	ETI (n = 88)	EGD (n = 74)	Significance
Cardiac arrest in ED, n (%)	15 (17.1)	27 (36.5)	.005
Death, n (%)	62 (67.1)	56 (75.7)	.228
Hospital days, median (IQR)	3 (1-10)	1 (0-10)	.038
ICU days, median (IQR)	2 (0-7)	1 (0-8)	.118
Ventilator days, median (IQR)	2 (1-7)	1 (0-8)	.232