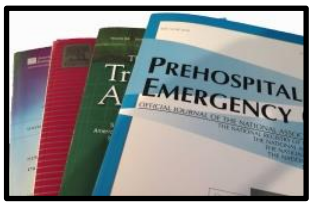
International Prehospital Medicine Institute



IPHMI Literature Review

Keeping You Up To Date with Current EMS Literature and Studies

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1. **Prehospital definitive airway is not associated with improved survival in trauma patients.** Tsur AM, Nadler R, Tsur N, et al. J Trauma Acute Care Surg. Epub ahead of print. 2020. DOI: 10.1097/TA.0000000000002722
2. **A potential method of identifying stroke and other intracranial lesions in the prehospital setting.** Saviluoto A, Harve-Rytsala H, Laaperi M, et al. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2020;28:article 39. Open access article available at: https://doi.org/10.1186/s13049-020-00728-7
3. **Shotgun Wounds: Nationwide Trends in Epidemiology, Injury Patterns, and Outcomes From US Trauma Centers.** Schellenberg M, Owattanapanich N, Cremonini C, et al. J Emerg Med 2020;58:719-724. https://doi.org/10.1016/j.jemermed.2020.02.021
4. **Utilizing End-Tidal Carbon Dioxide to Diagnose Diabetic Ketoacidosis in Prehospital Patients with Hyperglycemia.** Hunter C, Putman M, Foster J, et al. Prehosp Disast Med 2020;35:281-284. doi:10.1017/S1049023X20000485

1. **Prehospital definitive airway is not associated with improved survival in trauma patients.** Tsur AM, Nadler R, Tsur N, et al. J Trauma Acute Care Surg. Epub ahead of print. 2020.

Establishment of a definitive airway in a trauma patient with a known or impending compromised airway remains a common practice throughout the world. It is routinely taught in prehospital trauma courses; however, data supporting this practice is scarce and conflicting. A definitive airway is defined as a tube successfully placed in the trachea with an inflated cuff below the vocal cords and is usually preceded by basic maneuvers. In the prehospital setting a definitive airway is obtained by either endotracheal intubation or cricothyroidotomy. The objective of this study was to investigate the association between a definitive airway in a prehospital trauma patient when it was determined by the prehospital provider that it was necessary and the patient's survival.

This is a retrospective review of all trauma patients treated by the Israel Defense Forces (IDF) Medical Corps from 2006 to 2018 for whom a prehospital attempt at a definitive airway was documented. The airway management protocol for the IDF is to initially attempt basic airway maneuvers such as suctioning, head-tilt chin-lift, jaw thrust, and oropharyngeal airway with bag valve mask ventilation. The indications for definitive airway management include impending airway failure not resolved by the basic airway interventions, apnea, or airway compromise. Of note, supraglottic devices such as a laryngeal mask airway (LMA), are only used by the Airborne Combat Rescue and Evacuation unit and therefore were not included in the study. The IDF treats both civilian and military patients, although only the military patients are followed long-term. Two subgroups were analyzed. The first group consisted of trauma patients who underwent only

endotracheal intubation attempts without any attempts at cricothyroidotomy. The second subgroup analysis was of military trauma patients who were followed long-term in the registry. Since, only four female soldiers were treated, this analysis was limited to male soldiers.

A total of 15,793 patients were recorded in the registry between 2006 and 2018. Of these, 566 (3.6%) patients underwent attempts at a definitive airway (successful in 425 and unsuccessful in 141). Breaking down the options for definitive airway, endotracheal intubation only, cricothyroidotomy only, and both were attempted in 471 (83.2%), 31 (5.5%), and 64 (11.3%), patients respectively. The mechanism of injury was blunt 34% in penetrating in 50%. Documented injury patterns and patient characteristics were similar among the groups who underwent successful and failed definitive airway attempts. Prehospital survival rates were also similar between the groups (77.6% versus 78%, p= 0.928). In the subgroup of patients who underwent only endotracheal intubation without attempt at cricothyroidotomy, a successful definitive airway was not associated with improved prehospital survival. In the subgroup of soldiers who were analyzed long-term, a successful definitive airway was not associated with improved prehospital survival, 48 hour survival, or 30 day survival.

There are a number of limitations to this study. It is a retrospective chart review study and suffers from the inherent weaknesses associated with such a study. Long-term follow-up was only available for soldiers and not civilians. Many paramedics and physicians in the IDF are younger and less experienced so their results may not translate into a setting with experienced prehospital providers. Lastly, there are a number of missing cases such that individual data points do not always add up to the total number of patients reported. This discrepancy and the rationale for not including these cases are not explained in the paper.

This study found a similar survival rate in trauma patients who needed a definitive prehospital airway in the opinion of the treating medic, whether or not that airway was successfully obtained. This similar survival rate was persistent after adjustment for injury characteristics and in the subgroups of endotracheal intubation attempts only, and of male soldiers with longer follow-up. Most significantly, this study noted that most patients survived even when the prehospital provider felt the patient needed a definitive airway but was unable to secure one.

In this study, patient survival was not improved by attempts to provide definitive airway control, which adds scene time and has known complications. We can add this study to the growing body of literature questioning the role of prehospital intubation and cricothyroidotomy in the trauma patient.

2. **A potential method of identifying stroke and other intracranial lesions in the prehospital setting.** Saviluoto A, Harve-Rytsala H, Laaperi M, et al. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2020;28:article 39.

Prehospital personnel are often called to evaluate patients with altered level of consciousness. Common causes of prehospital altered level of consciousness include seizures, hypoglycemia, alcohol intoxication, drug overdose, and an intracranial lesion such as stroke. Identifying the specific cause can sometimes be extremely challenging. Early diagnosis of a stroke is critical as an outcome benefit has been demonstrated if the patient can be rapidly transported to an appropriate hospital capable of caring for a neuro critical-care patients. The authors of this study hypothesized that the initial prehospital systolic blood pressure (SBP) and pulse along with the patient's age could be used to predict the presence of an intracranial lesion (stroke) in an unconscious patient.

This was a retrospective case-control study comparing the initial prehospital SBP, heart rate, and age of patients with and without an intracranial lesion. This study utilized the FinnHEMS database where all missions of every helicopter emergency medical service (HEMS) in Finland are entered.

The authors included only the patients from the busiest HEMS unit in Finland (FinnHEMS 10) as they had the most carefully validated data of intubated patients. The study period included all patients from 2014 as well as patients from March 2015 to December 2016. All adult patients (age > 16 years) with an altered mental status who required intubation were included. Excluded patients were those with obvious trauma and status post cardiac arrest with return of circulation. The first SBP and heart rate acquired by the first EMS unit on scene was used for the study. The patients were grouped into two cohorts: those having an intracranial lesion (stroke or any other lesion that could raise intracranial pressure) and those without. A scoring system was then devised to predict the probability of an unresponsive patient having an intracranial lesion or stroke as their underlying cause.

During the study period, 1071 patients were intubated by the HEMS crew. After excluding the patients who did not meet criteria, 425 patients were analyzed. Of these, 127 (30%) were noted to have an intracranial lesion and 298 (70%) as not having a lesion. Of those with an intracranial lesion, 41 had an intracerebral hemorrhage, 31 had a subarachnoid hemorrhage, and 21 had a cerebral infarction. In addition, 21 patients had an intracranial injury (18 with subdural hematomas) and 8 with other etiologies. These patients were found to have a higher SBP, lower heart rate, and higher age. The authors developed the HeSA scoring system (derived from Heart rate, Systolic BP, and Age) to predict which unresponsive patients may have an intracranial lesion.

Variable		**HeSA-Score Points**
Systolic Blood Pressure	< 140 mmHg	0
	140-170 mmHg	1
	> 170 mmHg	2
Heart Rate	≥ 100/min	0
	< 100/min	1
Age	< 50 years	0
	50-70 years	1
	> 70 years	2

A score ≥ 2 is consistent with a sensitivity of greater than 0.9 for an intracranial lesion, while a score of 3 gives a good combination of sensitivity (0.8) and specificity (0.79). This correlates to clinical common sense – a patient with an intracranial lesion is often hypertensive with a slower heart rate consistent with the Cushing reflex.

There are several limitations to this study. It is a retrospective chart review of a database. The study population consisted of patients too obtunded to get an adequate physical exam looking for signs of a stroke as well as those patients requiring intubation. It is not known if this scoring system could be applied to less ill patients. Finally, a single HEMS unit was used in the study, which creates a possible source of bias. This scoring system will need to be validated in other patient populations.

This is an interesting study focusing on obtunded patients requiring prehospital intubation and attempting to predict if they are having a stroke. While it has many serious limitations, if this scoring system proves accurate, it could help direct these patients to a neuro-critical care center for more expedited care.

3. **Shotgun Wounds: Nationwide Trends in Epidemiology, Injury Patterns, and Outcomes From US Trauma Centers.** Schellenberg M, Owattanapanich N, Cremonini C, et al. J Emerg Med 2020;58:719-724.

While all penetrating trauma is of concern to prehospital providers, ballistic trauma in general, including the variations in wounding patterns, the outcomes of certain weapons, and the demographics of victims have been well described. . The authors of this retrospective observational study looked at the wounding patterns, severity and populations that sustain their injuries from shotgun wounds.

The authors queried the National Trauma Data Base (NTDB) for patients that sustained injuries from shotgun blasts during the years of 2007 to 2016. . Data collected included demographic information, body systems injured, outcome as well as wounding intent.

The data base revealed a total of 15,463 patients injured during the study period. Patients were excluded from the study if they were transferred from an outside hospital or had a missing procedure code, leaving 11,292 patients enrolled for analysis. Males predominated (88%). Intentional assault accounted for 60% of cases, accidents for 19%, and self-inflicted 17%. Overall, 14% of the study group died due to their injuries. Of those, 669 (7%) were pronounced in the Emergency Department and 256 (3%) were dead on arrival. Three thousand two hundred and ninety-two (3292) required surgical intervention, most within 24 hours of admission. Of note, at the time of emergency department arrival, only 13% of patients were tachycardic and 11% were hypotensive.

The most severely injured body area was the head; whereas the most commonly injured body areas were the lower extremities and then the upper extremities. The abdomen and chest, respectively, were the two most common areas that needed surgical intervention. Almost 80% of patients were injured in more than one body area.

This study clearly demonstrates the subset of wounds caused by shotguns is different than that of other firearms. The scatter and variable size of shotgun pellets complicates the assessment and management of these patients. Patients have a higher likelihood of presenting with apparently stable vital signs; therefore vigilance during transport is necessary to recognize any change in patient condition.

4. **Utilizing End-Tidal Carbon Dioxide to Diagnose Diabetic Ketoacidosis in Prehospital Patients with Hyperglycemia.** Hunter C, Putman M, Foster J, et al. Prehosp Disast Med 2020;35:281-284.

Diabetic ketoacidosis (DKA) is a serious, sometimes life-threatening medical problem typically experienced by patients with Type 1 diabetes and less commonly Type 2 diabetes. DKA happens when blood sugar rises (hyperglycemia) without an appropriate corresponding insulin response. This results in the breakdown of fat which produces ketones causing metabolic acidosis. Once the body's bicarbonate buffering system becomes overwhelmed, end tidal CO_2 ($ETCO_2$) levels will decrease since less carbon dioxide can be produced. Usually, altered mental status along with laboratory findings of hyperglycemia, decreased blood PH, and ketonuria lead to the diagnosis of DKA. When encountering a patient with altered mental status, prehospital providers typically perform a quick and simple blood glucose level (BGL) as part of their exam.

The goal of this study was to see if the inclusion of $ETCO_2$ levels could be used to facilitate an accurate pre-hospital diagnosis of DKA and earlier treatment of this life-threatening condition. The authors conducted an IRB approved, retrospective cohort study of hyperglycemic patients encountered by a single urban EMS service that were transported to a single, tertiary medical center. Inclusion criteria consisted of adults (18 years or older) with a BGL >200 mmol/L and a full set of prehospital vital signs including $ETCO_2$. Chart review was conducted via a single abstractor, blinded to the hypothesis of the study and trained by the principal investigator.

One hundred and nineteen patient charts met the inclusion criteria (one case was excluded due to missing hospital data). Of the 118 eligible patients, six (5%) were ultimately diagnosed to be in DKA. The level of prehospital $ETCO_2$ was significantly lower in DKA diagnosed patients (15mmHg) compared to those patients that were not (35mmHg).

The study suggests that low $ETCO_2$ levels are indicative of DKA in prehospital patients with hyperglycemia. For patients ultimately diagnosed with DKA, $ETCO_2$ levels were less than 25mmHg. However, while finding that all patients diagnosed with DKA had prehospital $ETCO_2$ values less than 25 mmHg, the authors were unable to predict the threshold $ETCO_2$ value for an accurate diagnosis of DKA, given the small number of patients with the disease. $ETCO_2$ may have value in adding evidence to further suggest the diagnosis of DKA in conjunction with an accurate patient history, exam and vital signs to include a blood glucose level.