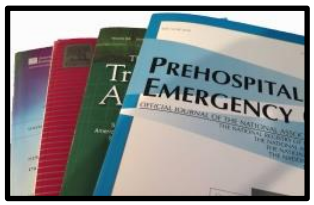
International Prehospital Medicine Institute



IPHMI Literature Review

Keeping You Up to Date with Current EMS Literature and Studies

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2. **Prehospital Administration of Norepinephrine and Epinephrine for Shock after Resuscitation from Cardiac Arrest.** Wender ER, Counts CR, Van Dyke M, Sayre MR, Maynard C, Johnson NJ. *Prehosp Emerg Care* 2024;28:3, 453-458.
3. **Tranexamic Acid for Traumatic Injury in the Emergency Setting: A Systematic Review and Bias-Adjusted Meta-Analysis of Randomized Controlled Trials**. Jarvis JL, Panchal AR, Lyng JW, et al. *Ann Emerg Med* 2024;83:435-445.
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1. Accuracy of Prehospital Services' Estimated Time to Arrival for Ground Transport to the Emergency Department. Fozard J, Becker B, Lurie T, Dasti A. *J Emerg Med* 2024;66: e581–e588

The efficient functioning of every Emergency Department (ED) depends on several factors, including anticipation of patient in-flow that allows for accurate allocation of resources. The accuracy of the estimated time of arrival (ETA) given by EMS while en route to the ED is important to ensure that personnel aren't diverting time and attention from other patients while waiting for EMS to arrive. An overestimated ETA results in the patient arriving earlier than expected by the ED, potentially leaving the staff unprepared to render care in a timely manner. An underestimated ETA may redirect personnel from other patients while waiting for EMS arrival.

This study is a single-center, prospective, observational study examining the accuracy of ETA reported by EMS ground ambulances transporting patients to the ED. The study ED is large, Level 1 trauma center, regional chest pain center, and certified stroke center in a medium-sized community in Pennsylvania. The catchment area is a mix of urban, suburban, and rural areas with transport times ranging from less than 5 minutes to greater than 45 minutes. The authors excluded helicopter transports and any alert with missing data. The ETA was recorded by an ED nurse or clerk, as were patient demographics. The actual time of arrival (ATA) was defined as the time the patient arrived and a time-stamp was generated by the ED. The primary study outcome measure was the median difference between the ETA and the ATA. Secondary outcome measured were the differences between ETA and ATA among select subgroups, including medical vs trauma patients, suspected acute coronary syndromes (ACS), suspected strokes, and cardiac arrests. The study occurred over four months: August and December 2018, and January and February 2019.

A total of 1176 transports were included for analysis. Medical transports comprised 86% of patients, while trauma accounted for 14%. Subgroups included trauma activations (1.7%), ACS (9.4%), stroke (2.4%), and cardiac arrest (0.6%). Statistically significant differences between ETA and ATA were noted for all groups. The overall median difference between ETA and ATA was 3 minutes. EMS underestimated

the ETA in 81.7% of cases and overestimated the ETA in 10.3% of cases. EMS was correct within 1 minute in 8% of cases. Based on time of day, the largest median difference was from 16:00-16:59 (5 minutes) and 07:00-07:59 (4.75 minutes). The smallest differences occurred between 06:00-06:59 and 09:00-09:59 (2 minutes).

This study has several weaknesses. It is a single center study, and its results may not translate to hospitals in different geographic areas, such as purely urban or rural. It only occurred over a 4-month period, so discrepancies could occur during other months. Approximately 25% of calls were missing data and not included in the study. Multiple staff collected the data so methods may not have been consistent. Computerized Global Positioning System (GPS)-based navigation technology is widely available, but the extent of its use in this study is unclear.

This study demonstrates that EMS personnel are relatively accurate in predicting their time of arrival. It is a good example of a study in which the results may be statistically significant, but that doesn't mean they are clinically significant. The median difference between ETA and ATA was only 3 minutes and is unlikely to disrupt the workflow of ED personnel. It is a good study to help dispel the myth that EMS personnel are unable to accurately estimate their ETA to the hospital.

2. **Prehospital Administration of Norepinephrine and Epinephrine for Shock after Resuscitation from Cardiac Arrest.** Wender ER, Counts CR, Van Dyke M, Sayre MR, Maynard C, Johnson NJ. *Prehosp Emerg Care,* 2024;28:3, 453-458.

The goal of management of every out of hospital cardiac arrest (OHCA) is to obtain the return of spontaneous circulation (ROSC). Ideally ROSC should be sustainable and result in the patient's eventual discharge from the hospital neurologically intact. It is not uncommon for a period of shock state immediately following ROSC. Similarly, OHCA patients may rearrest prior to arrival at a hospital.

This was an institutional review board approved retrospective study of one EMS agency's OHCA data for the eight year period ending December 2021. The authors of this study compared rearrest rates between patients that were given epinephrine and norepinephrine to treat immediate post arrest shock. Both medications are vasopressors that target beta-1 adrenergic and alpha-1 adrenergic receptors. The difference between the two is epinephrine's greater affinity for beta-1 adrenergic receptors and norepinephrine's primary alpha-1 effects. The choice of vasopressor was left to the field provider in collaboration with an on-line medical control physician. Both epinephrine (2mg / 250 ml D5W) and norepinephrine (8 mg / 250 ml D5W) were infused via micro drip tubing and titrated by hand to maintain a systolic blood pressure of 90 mmHg. Infusion pumps were not used to control either vasopressor. Hospital data were available to the researchers via a robust system wide cardiac arrest registry.

In total 3,679 OHCA patients were treated. Of these, 3,288 were excluded. Exclusion criteria included pediatric patients, patients without ROSC, basic life support care only, patients with do not resuscitate orders, patients who did not receive epinephrine or norepinephrine infusions, patients who received both vasopressors and patients dead on scene or whom resuscitation was terminated in the field. This resulted in 451 patients included in the study, 253 (56%) received norepinephrine and 198 (44%) received epinephrine infusions.

Patient demographics were similar between both vasopressor groups. It was noted that the norepinephrine group were slightly younger, median age of 63 versus 67. Almost all patients were treated with an advanced airway (99%). The most common advanced airway was an endotracheal tube (94%). Most (82%) received their advanced airway prior to the administration of a vasopressor.

Patients in the epinephrine group were more likely to rearrest by a substantial margin (55% vs 25%). Subsequently, incidence of pulses upon arrival at the hospital were lower in the epinephrine group. For patients that did arrive at the hospital with sustained ROSC, there was no difference in survival to

discharge (14%) or favorable neurological status (10%) at discharge (Cerebral Performance Category score of 1 or 2).

The authors acknowledge several limitations of their work. The first being the retrospective design of their study. The choice of vasopressor was at the paramedic discretion and not randomized. The largest limitation is the system's lack of infusion pumps during the study period. Due to this limitation no exact doses of epinephrine or norepinephrine were documented. Timing of the vasopressor infusion was not recorded. Patients may have received the vasopressor infusion after they had experienced a rearrest.

The authors found that epinephrine given as a post arrest vasopressor infusion resulted in a higher rearrest state for OHCA patients after ROSC was obtained. They advocate for future randomized control studies comparing these commonly used vasopressors. Field providers and medical directors should consider the options for vasopressors within their EMS system, and which works best for unique patient groups. Ideally, all prehospital medication infusion should be administered via an IV pump or controller to ensure accurate dosing of the medication.

3. **Tranexamic Acid for Traumatic Injury in the Emergency Setting: A Systematic Review and Bias-Adjusted Meta-Analysis of Randomized Controlled Trials.** Fouche PF, Stein C, Nichols M, et al. *Ann Emerg Med.* 2024;83:435-445.

Tranexamic acid (TXA) is an antifibrinolytic medication which prevents the breakdown of clot and reduces bleeding. It has been advocated for use in most, if not all, trauma victims.

The authors of this paper sought to compare TXA to placebo by performing a systematic review and meta-analysis combining updated data on the benefits of TXA?" Two researchers working independently performed comprehensive reviews of Medline, EMBASE and the Cochrane Central Register of Controlled Trials from their inception up to May 1, 2023. Studies included for analysis were randomized controlled trials. The primary outcome measure was 1-month mortality and secondary outcomes included 24-hour mortality and vascular occlusive events at 1-month including myocardial infarction, stroke, deep venous thrombosis and pulmonary embolism.

The search identified 363 articles and after abstract screening and removing duplicates, 7 trials were included in their review and analysis. All seven of these were randomized double blinded studies. Three of the studies were conducted in prehospital settings and none included pediatric patients. Three were on general trauma and the other four focused on brain injuries.

Regarding the primary outcome of one-month and 24-hour mortality, the analysis suggested a moderate benefit for TXA (OR .89). This would amount to preventing one additional death per month per 61 patients treated with TXA. In looking at the four trials that reported 24-hour mortality, a similar moderate benefit was found for TXA. They did not demonstrate evidence of an increase in vascular occlusive events.

In looking at the timing of TXA administration, there were insufficient studies reporting on the administration of TXA more than 3-hours post injury to allow meta- analysis. They did point out that the CRASH-2 trial reported an 11% reduced risk of death when TXA is administered less than 3 hours post trauma compared to those that received it after 3 hours. The CRASH-3 trial looking at TBI patients described a benefit for mild and moderate head injury patients who received TXA early.

In comparing in-hospital versus prehospital data, the odds of death for the prehospital patients were 22% less with TXA versus placebo while for in-hospital patients TXA patients had a 9% less chance of death over those receiving a placebo.

The limitation of this study was the inability to pool patient-centered outcomes such as neurologic status as the trials did not include this in their reporting. In addition, no information was provided about

the fibrinolytic status of the patients which could introduce significant heterogeneity to the study groups and affect the potential benefit of TXA.

This metaanalysis shows that patients receiving TXA had an 11% reduction in odds of death at 1-month over patients that received placebo, which when translated to the risk of death at one month comes to 1.7% fewer trauma deaths and which equates to 1 less death for every 61 trauma patients treated with TXA. The results of this study are consistent with previous meta-analysis regarding TXA use in trauma patients. TXA appears to be more effective when used prehospital versus in-hospital.

4. **Evidence-Based Guideline for Prehospital Airway Management.** Reiter A, Strahl A, Kothe S, et al. *Prehosp Emerg Car,* 2024;28:4, 545-557.

Airway management of the critically ill or injured patient is one of the foundational aspects for successful patient outcomes. However, in the last few years, the long-standing method of endotracheal intubation has come into question in the prehospital arena. The goal of this paper was to review and grade the Agency for Healthcare Research and Quality (AHRQ) systematic review of currently available literature to develop a scientific basis for prehospital airway management protocols by a panel of experts in Emergency and EMS medicine, research and evidence evaluation.

For patients with out of hospital cardiac arrest (OHCA) both Bag-Valve-Mask (BVM) and Supraglottic Airway (SGA) devices are recommended options. Additionally, either BVM alone or Endotracheal Intubation (ETI) can be considered. Both recommendations were considered conditional based on low to very low certainty of the evidence. When ETI proficiency is lacking, SGA is preferred over ETI for adult OHCA cases, while in systems with high ETI proficiency, either SGA or ETI is suggested, with a conditional recommendation supported by low to moderate evidence.

For pediatric OHCA patients, both BVM and SGA are conditionally recommended, with very low evidence. BVM ventilation alone is favored over ETI, supported by low-level evidence, and SGA is preferred over ETI with a conditional recommendation and very low evidence.

In adult trauma cases, either BVM or SGA devices are suggested for airway management, as a conditional recommendation with very low evidence. Ventilation with either BVM alone or Endotracheal Intubation (ETI) is also recommended, supported by low-level evidence. Additionally, either SGA or ETI can be considered for adult trauma cases, with a very low evidence base.

For pediatric trauma patients, there is insufficient evidence to recommend BVM alone over SGA. However, both BVM alone and ETI are suggested options for airway management, with a low-level evidence base. Favoring SGA over ETI is suggested, but with very low evidence.

Medical emergencies requiring airway management were also reviewed by the panel for both adult and pediatric groups. This revealed that there was insufficient evidence in most categories to make recommendations regarding BVM alone. They made conditional recommendations that either SGA or ETI could be performed for both adults and pediatrics with very low certainty of evidence.

The authors note the major limitation of this paper is the lack of quality evidence for the scientific evaluation of prehospital airway management. In all of the emergency situations presented, the airway management recommendations were conditional or no recommendation and the evidence certainty was low or very low. This limitation, as with many other issues in prehospital care, points out the need for high quality, controlled studies to guide EMS Medical Directors and providers in the practice of prehospital medicine.