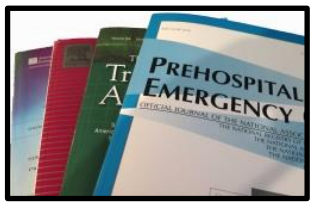
International Prehospital Medicine Institute



IPHMI Literature Review

Keeping You Up to Date with Current EMS Literature and Studies

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3. **Prehospital Crystalloid Resuscitation: Practice Variation and Associations with Clinical Outcomes**. Weykamp MB, Stern KE, Brakenridge SC, et al. *Shock* 2023;59:28–33.
4. **Effect of Noninvasive Airway Management of Comatose Patients With Acute Poisoning. A Randomized Clinical Trial**. Freund R, Viglino D, Cachanado M et al. *JAMA* 2023;330:2267-2274.

1. **Association of Prehospital Transfusion With Mortality in Pediatric Trauma.** Morgan KM, Abou-Khalil E, Strotmeyer S, et al. *JAMA Pediatr.* 2023;177(7):693-699.

One of the most common causes of preventable death in children is hemorrhagic shock. Hemorrhagic shock is challenging to identify in children, as they typically have a significant physiologic reserve that allows them to maintain a normal blood pressure until they are on the verge of circulatory collapse. Prompt treatment of hemorrhagic shock in the prehospital setting with blood transfusion has been shown to improve mortality in the adult trauma population. The prehospital use of blood and plasma transfusion for adults is becoming more common, but has not been rigorously studied in the pediatric trauma population.

This study is a retrospective review of the Pennsylvania Trauma Systems Foundation registry, which is a database of over 50 trauma centers in the state. Children aged 0-17 years who received a red blood cell transfusion in either the emergency department (EDT) or in the prehospital setting (PHT) during the time period of January 2009 to December 2019 were identified. Patients with isolated burns or who were interfacility transfers were excluded. The primary outcome of interest was 24-hour mortality. Secondary outcomes included in-hospital mortality and in-hospital complications. Propensity score matching was used to minimize the selection bias between the transfusion groups.

A total of 559 children were included in the final analysis. Of these, 70 children (13%) received a PHT and 489 (87%) received an EDT. The children who received a PHT had higher rates of shock and blunt trauma, but otherwise there was no difference in age, sex, GCS, or rate of severe traumatic brain injury. Children who received a PHT were more likely to be transported by helicopter EMS but there was no difference in prehospital EMS levels of care among the providers. Both 24-hour (16% vs 27%) and in-hospital mortality (21% vs 32%) were lower for the PHT group compared to the EDT group. There was no difference in in-hospital complications between the groups. The number of patients needed to transfuse in the prehospital setting to save 1 child's life was 5.

The major limitation of this study was the small sample size, which is due to the infrequency of PHT in children. The study was a retrospective study of a statewide database, so may not be applicable to

other trauma systems. Other treatments rendered, such as tranexamic acid administration or use of other hemostatic adjuncts, were not recorded.

This study is the largest to date looking at the effect of PHT in injured children. The authors demonstrated that injured children who received a prehospital blood transfusion had a lower 24-hour and overall in-hospital mortality compared to those that didn't receive a transfusion until arrival to the emergency department. These data are congruent with that seen in the adult trauma population. Additional multicenter, prospective trials are needed to confirm these findings, but this study certainly points in a positive direction on the benefits of early PHT in injured children.

2. Patient Demographics Are Associated with Differences in Prehospital Pain Management among Trauma Patients. Supples MW, Vaizer J, Liao M, et al. *Prehosp Emerg Care* 2023;27:1048-1053

It is estimated that approximately 20% of EMS patients report experiencing pain, sometimes severe. Prehospital providers should assess and treat for patient pain accordingly. The lack of treatment, or undertreatment, of pain has been termed oligoanalgesia. Some will argue that the ongoing opioid epidemic has contributed to the current state of oligoanalgesia for fear of expanding the epidemic. An important question is whether patient demographics also affect prehospital providers' adherence to analgesia protocols. The authors of this paper attempted to answer that question for a third service EMS agency in a metropolitan area within the United States.

This was a university IRB approved retrospective review of electronic medical records of adult patients who had no medical comorbidity that experienced an isolated traumatic event. The retrospective time frame was 1 January 2018 until 30 June 2020. Patient demographics evaluated included race, age and sex. Actual EMS transport times were also looked at, along with initial Glasgow Coma Scores. EMS providers assess pain on a 1 – 10 scale with 10 being the most severe. Providers have acetaminophen (PO), ketorolac IM & IV) and fentanyl (IV and IN) available for patient pain relief. Local EMS protocols allow providers to consider analgesia for all patients with a pain complaint and system medical directors recommend administering analgesia to all patients with a 4 or greater pain assessment score.

The study city has a population of 800,000 (59% White, 29% African American 10% Hispanic). Overall, 17% of the city's population lives at or below the poverty level. Within the study time frame, the EMS agency responded to 205,225 EMS calls. Simple breakdown of the calls by type were 168,101 (81.9%) medical, 32,463 (15.8%) isolated trauma and 4,638 (2.3%) a combination of both. Of the 32,463 charts reviewed for isolated trauma, the two most common mechanism of injury were falls (40.2%) and motor vehicle crashes (31%).

Over half (53%) of the patients were identified as "White". Half were female and the mean age was 45. The median initial pain assessment score was "5". Fentanyl was the most commonly administered analgesic (94%) with ketorolac (5.3%) and acetaminophen (0.7%) trailing far behind. Only 4,989 of the isolated trauma patients received analgesia. The remaining patients (85%) did not receive any pain medication. Higher pain scores were seen more often with African American and female patients. Non-white patients and women were less likely to receive analgesia medications.

The authors noted that the overwhelmingly used analgesia medication was the opiate fentanyl. They opined that compliance with analgesia protocols might improve with education and medical direction emphasizing non-opiate choices for pain reduction and relief.

There are a number of limitations of this study. The first being that they only included traumatic injuries identified by the EMS providers and not other causes of pain that could require treatment. The use of a single EMS agency's data limits data that is not biased by local practice and culture. Documentation did not include patients that were offered but refused analgesia. Communication

barriers between providers and patients were not considered either. Lastly, patient sex was limited to male or female and did not include non-binary persons.

Prehospital patients, whether trauma, medical or a combination of both should be assessed and treated for pain. This is a fundamental precept of patient care. Not all pain has to be treated with opiates. Protocols should allow for the administration of alternative medications such as non-steroidal anti-inflammatory medications, and alternate routes of administration for opiates, such as intranasal. Reduction of pain is the correct and humane thing to do for all patients and will result in an improved overall patient experience.

3. Prehospital Crystalloid Resuscitation: Practice Variation and Associations with Clinical Outcomes. Weykamp MB, Stern KE, Brakenridge SC, et al. *Shock*, 2023;59:28–33.

While some EMS systems offer prehospital blood transfusion for trauma victims in shock, the mainstay of resuscitation for injury victims in the prehospital environment remains intravenous crystalloids. Despite the use of crystalloids for decades, there is a lack of evidence available to guide the use of crystalloids for trauma resuscitation. Given this lack of evidence to guide crystalloid use in trauma resuscitation in the face of the higher quality of data available regarding prehospital blood transfusions, the authors sought to provide a higher level of evidence for the use of crystalloids.

The authors obtained data from the Pragmatic, Randomized Optimal Platelet and Plasma Ratios (PROPPR) data repository. This repository contains data obtained from trauma patients predicted to require massive transfusions and were treated at 12 North American level 1 Trauma Centers.

Both in hospital and prehospital quantities of crystalloid and blood product infusion during the first 24hours after admission were determined. Hypertonic solutions were not included in the analysis. Crystalloid volumes were divided into the amounts administered from 0-6 hours and 7-24 hours after admission. They measured the potential effect of prehospital crystalloid volume (PHC) on initial lab abnormalities measured upon arrival focusing on values used to assess end-organ perfusion (base deficit, lactate, pH) and coagulopathy/anemia (INR, PT, PTT, platelet count and hematocrit)." The primary clinical outcome was the development of Acute Respiratory Distress Syndrome (ARDS). The secondary clinical outcome was the risk of developing acute kidney injury (AKI).

The study included 680 patients, largely male (80%) and severely injured. The 30-day mortality was 24%. Overall, 14% of the patients developed ARDS and 23% developed AKI. The median PHC volume was 300mL. The volume of crystalloid administered prehospital varied from a low of 0 ml to 1,200 ml. A threshold of 1,000mL was used for adjusted analysis. Patients that received more than 1,000mL of PHC had lower hematocrit and platelets and higher base deficit, INR, PT and PTT. Patients that received over 1,000mL PHC had a higher incidence of ARDS than those that received less while the incidence of AKI was similar in both groups. Each additional 500 ml of PHC was associated with an increased odds ratio of 1.28 for developing ARDS.

While prior studies have advised conservative approaches that minimize PHC infusion, universal adoption of these recommendations has yet to occur. These findings highlight the importance of PHC resuscitation practices. While trends favor less crystalloid infusion, there is concern that too little PHC might increase the risk of AKI. Additional study in needed to determine optimal PHC infusion to address AKI risk without increasing ARDS or pulmonary consequences. The authors also called for increased attention to be paid to prehospital data including monitoring of implementation and compliance with protocols.

4. Effect of Noninvasive Airway Management of Comatose Patients with Acute Poisoning. A Randomized Clinical Trial. Freund R, Viglino D, Cachanado M et al. *JAMA* 2023;330:2267-2274.

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Emergency Medical Service (EMS) professionals worldwide often encounter patients who are unresponsive or in a coma due to acute poisonings. Most of these poisonings are linked to acute alcohol toxicity or overdosing on medication. Traditionally, the common practice has been to secure the patient's airway as quickly as possible, aiming to reduce the risk of aspiration. Depending on the provider's level of training and scope of practice, oral endotracheal intubation has been the preferred method.

The researchers investigated the impact of withholding intubation in comatose patients with acute poisoning compared to routine practice. Aspiration risk in patients with decreased consciousness can lead to complications, but the benefits and risks of intubation in these cases remain debated.

This multicenter unblinded, randomized study involved the French EMS system and 20 emergency departments in France. The French EMS system utilizes prehospital physicians for advanced prehospital care.

Patients with a clinical suspicion of acute poisoning and a Glasgow Coma Scale (GCS) score less than 9 were either assigned to a strategy of withholding intubation or the routine practice of endotracheal intubation. The primary outcome included in-hospital death, length of ICU stay, and total length of hospital stay, with secondary outcomes assessing the need for mechanical ventilation, pneumonia, adverse events from intubation, and more. Patients included in the study group would be intubated if they exhibited seizure, respiratory distress with hypoxia, vomiting or shock. The decision to intubate a patient in the study group was up to the attending prehospital physician.

A total of 237 adult patients were entered into the study. After exclusions, 219 patients (112 in the restricted intubation group and 107 in the standard protocol group) were analyzed. No deaths occurred in either group. Withholding intubation resulted in a lower median length of ICU stay (0 vs. 24.0 hours) and hospital stay (21.5 vs. 37.0 hours). The restricted-intubation group eventually had 10 patients that required subsequent intubation but overall had fewer admissions to the ICU (39.7% vs. 66.1%) and less frequent mechanical ventilation (18.1% vs. 59.6%). Adverse events from intubation were lower in the non-intubation group (6.0% vs. 14.7%). The analysis suggested a clinical benefit for patients who were not intubated.

The study challenges the routine practice of intubation of comatose patients with suspected acute poisoning and GCS score less than 9. It suggests that withholding intubation is associated with favorable outcomes, including reduced ICU and hospital stays, lower rates of mechanical ventilation, and fewer adverse events. The findings emphasize the importance of individualized approaches, considering the risks and benefits of intubation in these cases.

The authors have noted that the study has several limitations. First, the trial wasn't unblinded which comes with its own set of limitations. Second, even though the main endpoints of the study involved a combination of factors such as death, time spent in the intensive care unit (ICU), and time spent in the hospital, there were no deaths in either group of people being studied, and one out of every five patients didn't need admission to the ICU. The primary benefit observed, a reduction in time spent in the ICU, is mostly due to fewer patients being admitted to the ICU. Third, some patients needed intubation either in the emergency department (ED) or the ICU, not before reaching the hospital. This might affect the study results, especially for unconscious patients. Fourth, people were included in the study if there was a suspicion of poisoning, but this suspicion wasn't confirmed for all patients. However, this approach mirrors real-life medical practice when prehospital providers can't always confirm the cause of unconsciousness.

The authors concluded that among comatose patients with suspected acute poisoning, withholding intubation showed a greater clinical benefit, challenging the conventional practice of routine intubation. The study suggests a need for personalized approaches and further research to refine guidelines in managing such cases.

Although this study provided valuable insights into the potential clinical benefits of refraining from intubating unconscious patients with suspected acute poisoning, it is crucial to assess whether implementing such protocol changes would be advantageous in specific Emergency Medical Service (EMS) systems. An important aspect not addressed by the authors is the transportation time. The study did not document the duration it took for EMS to transport patients to the emergency department. It appears reasonable to assume that with longer transportation times, not managing the airway could increase the risk of complications. In addition, this study involved physicians as the prehospital provider. Therefore, additional research across different EMS systems that involve non-physician prehospital care providers is necessary to further investigate this matter.