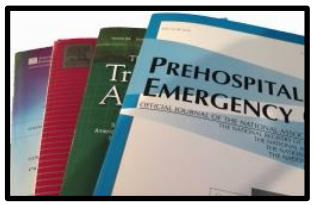
International Prehospital Medicine Institute



IPHMI Literature Review

Keeping You Up to Date with Current EMS Literature and Studies

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1. **Prehospital low titer group O whole blood is feasible and safe: Results of a prospective randomized pilot trial.** Guyette FX, Zenati M, Triulzi DJ, et al. *J Trauma Acute Care Surg.* 2022;92:839-847..

Trauma resuscitation has evolved significantly over the past decade, yet death from hemorrhage remains common. Low titer group O whole blood (LTOWB) usage has become increasingly common in the military and civilian settings and is considered the ideal resuscitation fluid since it is whole blood and is exactly what the patient is losing. This is in contrast to “component” therapy, which is commonly used. Whole blood is donated and spun down into their component parts – packed red blood cells, plasma, and platelets. These can then be individually infused as needed during resuscitation. Component therapy has been considered the standard of care and is the most used method of trauma resuscitation.

Evidence for LTOWB resuscitation safety and outcome benefit has been demonstrated for in-hospital resuscitation. Currently over seventy major trauma centers in the United States now use LTOWB resuscitation for trauma. When blood has been given for prehospital transfusions, it is typically packed red blood cells (PRBC) which are infused. This study is called the Pragmatic Prehospital Type O Whole blood Early Resuscitation (PPOWER) and is a pilot trial to assess the safety and benefit of prehospital whole blood transfusion. Positive results in this study could lead to a large multi-center randomized trial to assess the use of prehospital whole blood use.

This study is a single-center randomized trial of prehospital whole blood (LTOWB) transfusion versus the current standard of care – transfusion of PRBC. Patients transported by helicopter to the University of Pittsburgh Medical Center (UPMC) were used in the study. Inclusion criteria were trauma patients who had at least one episode of hypotension (SPB ≤ 90 mm Hg) and tachycardia (HR > 108 beats per minute) or an episode of severe hypotension defined as SBP ≤ 70 mm Hg. Patients were excluded if they were older than 90 or younger than 18 years of age. Prisoners were excluded. Additional exclusion criteria included patients who sustained penetrating brain injury, isolated fall from standing, CPR > 5

minutes without return of spontaneous circulation, isolated burns, hanging, or drowning, or with known pregnancy. The six air medical bases were randomized on a one-month basis to provide either LTOWB or PRBC transfusion to patients meeting criteria. All other care was provided per their standard protocols. The randomized transfusion was continued upon their arrival to the trauma center. The primary outcome was feasibility of transfusion as measured by enrollment and accrual rate. Safety and efficacy outcome for the pilot trial was 28-day mortality. Additional secondary outcomes included mortality over time within the first 24 hours, multiple organ failure, acute respiratory distress syndrome and nosocomial infection, blood component transfusion volumes at 24 hours, and any side effects such as transfusion reaction.

Of 102 patients who were eligible for the study, a total of 86 patients met all criteria and were included in the study. Of these, 40 patients were randomized to the LTOWB group and 46 were randomized to the standard of care (PRBC) group. The majority of participants (63%) were men. The median Injury Severity Score (ISS) was 16 (range 9-22). Scene transports comprised 67% of the patients, with the remainder being transfers. The 28-day mortality was not different between the groups (26.1% for the PRBC group versus 25.0% for the LTOWB group). There was no significant difference between the groups in early mortality (3-, 6-, and 24-hours post-injury). The incidence of nosocomial infection and multiple organ failure was slightly lower in the LTOWB group, but it did not reach statistical significance. Those randomized to the LTOWB group had a lower overall transfusion requirement at 6 and 24 hours. There was no documented case of transfusion reaction in either group.

Limitations to this study include the small number of patients and single-center study site. Adherence to the protocol was low and is concerning to study investigators. These clinical outcomes are not powered for definitive conclusions and are considered exploratory in nature.

This pilot study demonstrates equivalent and perhaps slightly better outcomes for prehospital trauma patients transfused with whole blood instead of packed red blood cells. Whole blood is more physiologic than component therapy and is now the standard of care in many large-volume trauma centers in the United States. This pilot study at a single-center of air medical trauma transport comparing whole blood to packed red blood cell transfusion suggests prehospital whole blood transfusion is feasible and may be more beneficial. The authors conclude a large-scale, multi-center study is feasible and should be considered.

2. Pre-hospital airway management and survival outcomes after paediatric out-of-hospital cardiac arrests. Tham LP, Fook-Chong S, Ahmad NSB, et al. *Resuscitation* 2022;176:9-18

Pediatric cardiac arrests are some of the most challenging calls that EMS providers face. Recent studies have questioned the evidence in support of endotracheal intubation (ETI) as the preferred method of advanced airway management. In the case of pediatric patients, ETI has not been shown to be superior to bag-mask ventilation.

The authors of this retrospective review used the Pan Asian Resuscitation Outcomes Study (PAROS) data to attempt to determine the effect of airway management technique on outcome for children presenting in cardiac arrest from January 2009 to June 2018 inclusively. This data was gathered from eleven (11) countries in the Asian-Pacific geographic region. The countries presented with a diverse population and EMS system design. The EMS system design for these populations range from physician staffed ambulances to BLS single tier response. End-points of the study were survival at 30 days post arrest and secondarily a positive Cerebral Performance Category (CPC) score of 1 or 2. A CPC of 1 is defined as no or mild deficit where as a 2 is defined as a moderate neurological deficit, but does not affect the ability to function independently in activities of daily living.

During the study period, 3131 children were enrolled in the cohort. Children who received bag-mask ventilation (BVM) as the primary form of ventilation totaled 2679 (85%) whereas81 (2.6%)

underwent endotracheal intubation (ETI) in the prehospital phase and 371 (11.8%) received some form of supraglottic airway (SGA). The study's authors classified both ETI and SGA as advanced airways. The median age for children receiving advanced airway placement was 13 years while the mean age for the BVM was 2 years old. The study data also demonstrated an increased scene time for the advanced airway group by a median time of 6 minutes (13 min. vs 7 min.). Survival at 30 days was 7.1% for patients undergoing advanced airway management versus 13.9% for those ventilated with bag-mask alone. In terms of neurologic outcome, 7.8% of patients treated with bag-mask ventilation had a CPC score of 1 or 2 compared to 2.0% of children treated with an advanced airway. Similar results were found when separately comparing ETI to bag-mask and SGA to bag-mask.

There are a number of limitations to this study. Regardless of etiology of the cardiac arrest (trauma, cardiac, respiratory, drowning, or other), all patients were grouped together in the analysis. Advance airway management is only documented when successful, therefore, failed attempts which required time to attempt would only be reported as bag-mask ventilation. The authors also noted that: "Patients who underwent longer resuscitation were more likely to receive intra-arrest interventions, including advanced airways. In some cases, whereby the patients achieved ROSC very quickly, there may not be time to place an advanced airway. This could introduce bias in favor of BVM". Lastly, response time to the scene was greater than 8 minutes in one-third of cases, which minimizes the likelihood of both survival and good neurologic outcome.

The authors conclude that: "Our study suggests that pre-hospital AAM was associated with decreased one-month survival and survival with favorable neurological status". Since this study demonstrated nearly a two-fold increase in survival for pediatric cardiac arrest when BMV was the primary airway, additional study is necessary to confirm this result.

3. **Prehospital Epinephrine Use in Pediatric Anaphylaxis by Emergency Medical Services.** Lowing D, Chung S, Luk J, Dingeldein L. *Pediatric Emerg Care* 2022; Published on-line ahead of print. doi: 10.1097/PEC.0000000000002783

Anaphylaxis is a life-threatening, "true emergency" that requires both prompt recognition and intervention. Treatment involves a weight based, intramuscular injection of epinephrine. Many patients with a known anaphylaxis history are prescribed epinephrine autoinjectors and are instructed to use them if they come into contact with or ingest a known allergen. Schools, summer camps, physician's offices and home health agencies often have epinephrine autoinjectors readily available to treat anaphylaxis.

The National Association of EMS Physicians recommends that all prehospital providers carry and administer epinephrine for patients experiencing an anaphylaxis reaction. Studies unfortunately suggest that there are low rates of prehospital epinephrine administration for anaphylaxis, with as many as 50% of paramedics failing to identify epinephrine as the treatment of choice and as few as 3% of patients with an atypical reaction receiving the life-saving drug. There have been few studies regarding anaphylaxis recognition and treatment in the prehospital pediatric population.

The authors of this paper conducted a four-year (ending April 2019), retrospective chart review of pediatric patients (age 0-18 years) with chief complaint of anaphylaxis or allergic reaction. All cases reviewed were from their EMS jurisdiction. Six hundred and forty-six charts were identified with a complaint of "allergic or anaphylactic reaction". Of those, only 150 met the criteria for anaphylaxis as described by the 2006 National Institute of Allergy and Infectious Disease (NIAID) and the Food Allergy and Anaphylaxis Network (FAAN) guidelines (Rapid onset of symptoms involving skin or mucosa and either hypotension and / or respiratory compromise; two or more of respiratory compromise, skin or mucosal involvement, hypotension, or gastrointestinal symptoms; hypotension after exposure to a known allergen).

Roughly one third (56) of the patients that met the anaphylaxis criteria received epinephrine prior to arrival of EMS. Of the remaining 94 patients, roughly 32% (30) received epinephrine from EMS providers. Diphenhydramine was given to 38.7% (58) of the patients and albuterol was given to 34% (51) of the pediatric patients. Both albuterol and diphenhydramine may help relieve the symptoms of anaphylaxis but do not treat the life-threatening root cause of the anaphylactic reaction. Ten percent of the patients (15) did not receive any medications. The mean age of the patients was 12 years of age

The authors found that epinephrine was more likely to be given in the prehospital environment if the patient had a known history of anaphylaxis and or was prescribed their own epinephrine autoinjector. School nurses often gave the first dose of epinephrine prior to the arrival of EMS. EMS doses of epinephrine were not always correct, and some patients received epinephrine via a subcutaneous injection rather than the protocol directed intramuscular route.

Limitations of this paper include the retrospective design of the study based on self-reported data from EMS run reports. Additionally, the only charts reviewed were ones with a chief complaint of anaphylaxis or allergic reaction. Charts with other symptoms from anaphylaxis may have been missed if those symptoms were identified as the patient's chief complaint. Missing from the study was the attending physician's diagnosis confirming or conflicting the diagnosis of anaphylaxis.

This study showed that only slightly more than half of patients with anaphylaxis were so identified and treated by EMS responders. The authors recommend additional training for EMS providers in the recognition of anaphylaxis, especially in the first-time reaction or a patient with atypical symptoms. EMS providers should look for anaphylaxis in patients (adult and pediatric) with symptoms that include gastrointestinal upset, respiratory compromise and or hypotension with skin or mucosal illness. The need for intramuscular epinephrine and not diphenhydramine or albuterol as the first medication to stop the anaphylactic reaction in the proper weight-based dose should also be reinforced with EMS providers. Epinephrine autoinjectors remove the human element and potential for mathematical error when dosing this life saving medication.

4. **Out- Impact of Trauma Center Designation Level on the Survival of Trauma Patients Transported by Police in the United States.** Saba GB, Bachir R, El Sayed M. *Prehosp Emerg Care,* 2022;26:582-589.

Police transport of trauma patients has gradually been increasing in the United States in recent years. Police officers are often the first public safety responders to arrive on scene and thus may be able to reduce the critical time between time of injury and presentation to the trauma team at the hospital. Although police officers typically have little medical training, previous studies have shown no difference in mortality compared to EMS transports.

This study sought to identify the impact of the trauma center designation level (I, II, or III) on the survival of trauma patients transported by police.

This was a retrospective study using the National Trauma Data Bank which collects data from more than 900 trauma centers. The study cohort included 2,788 patients that were documented to have been transported by law enforcement. Patients excluded from the study were pediatric patients under the age of 16 years and those with unknown age, patients with incomplete hospital records, unknown discharge disposition, left against medical advice, or transferred. The study population was predominantly male (85%) with a median age of 35 years old. Over half of the patients were African American. Most patients had a GCS score of 13-15. Only 17.4% were had severe injuries, most commonly blunt trauma. Overall, the most common injury mechanism was blunt trauma. Half of the injuries were due to an assault and most of the remainder were unintentional. Most common sites of injury were head and neck injuries (41%), followed by extremity trauma (27%), and torso trauma (25%) . Half of the patients were admitted, with 18.9% requiring surgery and 19.8% needing the ICU.

Most patients (76%) were transported to Level l Trauma Centers, while 18% were transported to Level ll Trauma Centers and 5.6% were transported to Level lll Trauma Centers. Survival to discharge was 93.2% overall. Survival was 91.6% for patients transported to Level 1 trauma centers, 98.2% for those taken to the Level ll Trauma centers, and 98.7% for patients that went to the level lll trauma centers. There was no statistically significant difference in survival rates between the three levels of trauma centers.

Limitations of this study are related to the fact that it is a retrospective study and due to the high number of included facilities, consistency in data reporting may differ. Another limitation may be that patients that were dead at the scene were not included in the study which may lead to overestimation of the survival rate. Another limitation is that secondary outcomes that would describe disability and functional status are not available in the database. Lastly, prehospital time was also not available as the police do not use EMS reporting mechanisms.

This study revealed no difference in the survival rates of trauma patients transported by police to the three different levels of trauma centers. The authors suggest that police transports may be directed to the closest trauma center regardless of the level without adversely affecting outcomes. This recommendation requires that if law enforcement is to be tasked with transport of trauma patients, they must be educated as which hospitals in their communities are trauma centers. Of importance, in terms of survival, all trauma patients in this study were grouped together regardless of mechanism of injury. Future studies are needed to look at specific trauma sub-populations based on mechanism and nature of injury which could provide further guidance on triage, transport, and destination of trauma patients.