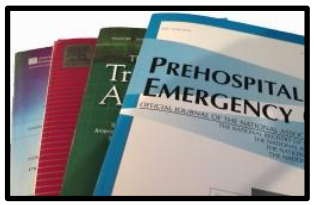
International Prehospital Medicine Institute



IPHMI Literature Review

Keeping You Up to Date with Current EMS Literature and Studies

Vol. 8.2

1. **Do not resuscitate (DNR) emergency medical services (EMS) protocol variation in the United States.** Breyre A, Merkle-Scotland E, Yang D, et al. *Amer J Emerg Med* 2025;97:123-128.
2. **Should Anything Else be done Besides Prehospital Cardiopulmonary Resuscitation (CPR)? The Role of CPR and Prehospital Interventions After Traumatic Cardiac Arrest.** McWilliam SE, Bach JP, Wilson KM, et al. *J Emerg Med* 2025;75:289–295.
3. **Tranexamic acid in trauma: A joint position statement and resource document of NAEMSP, ACEP, and ACS-COT**. Barrett WJ, Kaucher KA, Orpet RE, et al. *J Trauma Acute Care Surg*. 2025;99:357–363

1. **Do not resuscitate (DNR) emergency medical services (EMS) protocol variation in the United States.** Breyre A, Merkle-Scotland E, Yang D, et al. *Amer J Emerg Med* 2025;97:123-128.

Ever since the onset of cardiopulmonary resuscitation, there has been concern that adoption of universal resuscitative efforts might be detrimental to, or against the wishes and beliefs of some patients. Over the years, hospitals have adopted the use of Do Not Resuscitate (DNR), Do Not Attempt Resuscitation (DNAR) and Allow Natural Death (AND) orders for that subset of patients.

While most EMS systems have protocols that address the clear need for resuscitation, not all EMS systems have clear and concise protocols addressing the needs of the patient that does not want to be resuscitated. Strong DNR protocols have many benefits; eliminating unnecessary costly and the potentially dangerous transport of patients who do not want to be resuscitated, reduced provider stress and futile efforts for patients who will not survive or are no longer functioning at their desired quality of life. Questions also arise about the validity of pre-hospital DNR orders which include advanced directives, living wills, verbal requests from family or other decision-makers, formal medical orders, and even jewelry. An additional consideration for EMS providers is the extent of care a patient wishes to receive at the end of life and where they want to receive that care.

The intent of this Yale University IRB exempt, cross sectional designed study was to collect, examine and compare EMS DNR protocols from all 50 states, Washington D.C and the 50 most populous US cities. All data was publicly sourced and often located via Internet searches. In instances where cities used state protocols or when multiple cities used the same protocols, only one data source was used for the study.

The authors identified 64 protocols for review, of which, 84.4% contained a DNR protocol. Advanced directives were required 50% of the time to trigger a DNR protocol and 12.9% of protocols allowed a Living Will trigger. These numbers are slightly higher when combined with direct medical oversight for acceptance of advanced directives and Living Wills. Few protocols allowed acceptance of DNRs written out of state (20.3%). Forty-one percent of the protocols reviewed contained verbiage specifically not allowing verbal DNRs. In some cases, direct medical oversight was allowed to authorize EMS providers to honor verbal DNRs either from a healthcare provider (18.5%) or family member of the patient (29.6%). Portable Medical Orders (i.e. POLST) were allowed in 75.9% of DNR protocols. Portable Orders

for Life-Sustaining Treatment (POLST) provide actionable medical orders in a standardized format, allowing patients to identify their preferences for care in detail.

The authors identified some limitations of their work. They felt states without statewide protocols were under represented while geographical areas with multiple populous centers were over represented. Some of the protocols included may be better described as guidelines than protocols. They also acknowledge that states and regions may have laws and statues defining DNR and withholding care that are not expressly represented in the region's protocols.

While a DNR protocol can be found in many state and city EMS protocols, there is no format or document that can be uniformly accepted across all geographical boundaries. EMS providers and all healthcare workers should be sensitive to patients' end of life directives. A standardized, easy to read and comprehend form for all providers with EMS protocols enabling its immediate use would ease end of life care decisions by providers and ensure the patient's wishes are honored.

2. **Should Anything Else be done Besides Prehospital Cardiopulmonary Resuscitation (CPR)? The Role of CPR and Prehospital Interventions After Traumatic Cardiac Arrest.** McWilliam SE, Bach JP, Wilson KM, et al. J Emerg Med 2025;75:289–295.

Traumatic injury is one of the leading causes of death in the U.S. and 34% of trauma deaths occur prehospital before transport and arrival at the hospital. Overall survival from traumatic cardiac arrest varies between 2% to 8% This study sought to investigate factors associated with survivability from Traumatic Cardia Arrest (TCA) in patients receiving prehospital CPR.

The authors conducted a retrospective study of all adult trauma patients that had CPR performed on them in the field and were transported to an American College of Surgeons (ACS) verified academic, level 1 trauma center between January 1st 2014 and December 31st, 2022. Data were gathered from the EMS patient care report and the emergency department (ED). the trauma registry. Prehospital data included mechanism of injury, vital signs and Glasgow Coma Scale score and field interventions as well as upon ED arrival including GCS, Injury severity scale, AIS (abbreviated injury scale), blood products transfused and the need for hemorrhage control procedures (thoracotomy, angioembolization, laparotomy. Patients were divided into two cohorts: those with a palpable pulse on arrival at the ED (which was the primary outcome measure) and those that arrived pulseless. ED and hospital mortality, rates of organ donation, hospital and ICU length of stay for the survivors and days on ventilators were secondary outcomes.

Of the 244 trauma patients that had prehospital CPR performed on them, 72 or 30% arrived to the ED with a palpable pulse while 172 or 70% arrived pulseless. There were no differences in initial field vital signs between the two groups. Patients that arrived with a pulse were more likely to have blunt injury (76% vs 63%), have an advanced airway in place and be defibrillated. In general, and not surprisingly, patients arriving with a pulse had improved physiology including systolic blood pressure of 105 + 44, pulse of 111 + 31, GCS of 4 + 3, however 38% were still hypotensive (systolic less than 90). Those with a pulse received more blood products (7 + 14 vs. 1 + 6) and were taken for hemorrhage control procedures more often (26% vs. 0%). Those arriving with a pulse had a lower ED mortality (19% vs. 94%) and hospital mortality (65% vs. 100%). Survivors spent many days in the hospital (21 + 16), ICU (14 + 15) and on the ventilator (10 + 11). Overall, 25 or 10% of the 244 patients that presented to the ED following CPR for TCA in the field survived to discharge from the hospital.

The limitations of this study include the lack of standardized criteria for initiation of CPR, the length of time CPR was performed, and criteria for field pronouncement. This lack of standardization can affect the registry data. Subsequent review found that only 45.7% of state EMS Departments had a specific TCA protocol. While all protocols call for chest compressions and vascular access, there were differences for crystalloid resuscitation (93.8%) needle thoracostomy (93.8%), endotracheal intubation (56.3%) and

pelvic stabilization (37.5%). Finally, the study reviewed data from an 8-year period and changing policies and guidelines could have impacted the results.

The authors concluded that "Prehospital CPR for TCA is not futile" as 10% of all patients that had CPR performed on them survived to hospital discharge and 35% of the patients who arrived to the ED with a pulse after prehospital CPR survived to discharge. In addition, 17% were able to donate organs. Of patients arriving to the ED without pulses following CPR, 6% achieved ROSC and survived to hospital admission but none of these patients survived to discharge. The authors also noted that prehospital thoracostomy (needle or finger) was the only prehospital intervention associated with arriving to the ED with a pulse, likely due to relief of a tension pneumothorax.

This study points out the need to have specific criteria for the determination of futility and field pronouncement of death given that no patient without a pulse survived to hospital discharge. This is an important issue given the risks associated with emergency red lights and siren transport to the receiving facility.

3. Tranexamic acid in trauma: A joint position statement and resource document of NAEMSP, ACEP, and ACS-COT. Barrett WJ, Kaucher KA, Orpet RE, et al. *J Trauma Acute Care Surg*. 2025;99:357–363

The management of hemorrhage is a foundational aspect of prehospital trauma care. Tranexamic acid (TXA) is an antifibrinolytic medication which is now commonly used in prehospital trauma resuscitation. Despite the recent popularity of TXA, research studies are varied as to its actual usefulness. TXA is easy to administer and has few side effects. It works by helping to prevent the body's natural breakdown of clot as it is trying to form during hemorrhage. Due to the variability in the data on TXA, three groups met to review the literature and issue a position statement on TXA administration in trauma. The representatives were from the National Association of EMS Physicians (NAEMSP), American College of Emergency Physicians (ACEP), and the American College of Surgeons Committee on Trauma (ACS-COT).

The group performed a PubMed search on December 23, 2022 for all existing literature regarding TXA. An initial 138 articles were screened by the committee and narrowed to 17 which were used in the final analysis. The recommendations of the committee are summarized here.

Prehospital TXA administration may reduce mortality in adult trauma patients with hemorrhagic shock when administered after life-saving interventions. Studies vary regarding the short and long-term effectiveness of TXA. Short-term (24-hour) mortality may be improved with TXA administration, but long-term survival (measured at 28- or 30-days post-injury) do not appear to be improved. Additionally, no benefit was noted when TXA was given with prehospital packed red blood cells, indicating it was the blood transfusion and not the TXA administration which improved outcomes. It is also important to note the committee emphasized that TXA should only be administered after other life-saving interventions have been completed.

Prehospital TXA administration appears safe, with low risk of thromboembolic events or seizure. Theoretical concerns that TXA may increase the risk of thromboembolic events (DVT's and PE's) have not proved true.

The ideal dose, rate, and route of prehospital administration of TXA for adult trauma patients with hemorrhagic shock has not been determined. Current evidence suggests EMS agencies may administer either a 1-g intravenous/intraosseous dose (followed by a hospital-based 1-g infusion over 8 hours) or a 2-g intravenous/intraosseous dose as an infusion or slow push. The single 2-g dose is easier and quicker to administer and is recommended by the military's Joint Trauma System Damage Control Resuscitation guideline. The committee does not recommend one dose over the other.

Prehospital TXA administration, if used for adult trauma patients, should be given to those with clinical signs of hemorrhagic shock and no later than 3 hours post-injury. There is no evidence to date

to suggest improved clinical outcomes from TXA initiation beyond this time or in those without clinically significant bleeding. Careful patient selection is important. The CRASH-2 criteria for administration include systolic blood pressure < 90 mm Hg and/or a heart rate of >110 beats per minute who are < 3 hours post-injury.

Head-injured patients – The committee reviewed four articles that assessed survival and 6-month functional outcomes of traumatic brain injury (TBI) patients who received prehospital TXA. Patients with moderate to severe head injury – Glasgow Coma Scale (GCS) score < 12 given TXA had no improvement in 28-day survival or 6-month favorable neurological function. While TXA is likely safe in the head-injured patient it does not appear to confer any survival or functional advantage.

The role of prehospital TXA in pediatric trauma patients with clinical signs of hemorrhagic shock is unclear and standard dosing has not been established. If used, it should be given within 3 hours of injury.

The committee noted that TXA is safe but the available evidence is conflicting, and the benefit remains unclear. There are not clear parameters established on which patients will benefit the most and limited understanding on the optimal dosing strategy. Specifically for prehospital administration there are a few principles to keep in mind. Protocols should emphasize life-saving interventions before the use of TXA since it not clearly proven to improve mortality. Second, TXA should be given as soon as possible after injury and certainly within 3 hours post-injury. Finally, TXA use should be a collaborative effort between EMS and the local trauma system, including the trauma surgeons and emergency physicians.

There are a few noted limitations to the joint statement. The available literature has conflicting results – some studies support the use of TXA in trauma while others find no real benefit. The authors used a PubMed search for the articles, which limits the results to English-language articles only. The data included several military studies so the results may not apply to the civilian population.

The joint position statement concludes by noting the beneficial effect of TXA for adult trauma patients remains uncertain despite early initial excitement around the world. They agree it is safe to use with few potential side effects and should be administered only after other life-saving interventions have been completed. Further research is definitely needed. This document serves as an important guide for prehospital services developing TXA administration protocols.