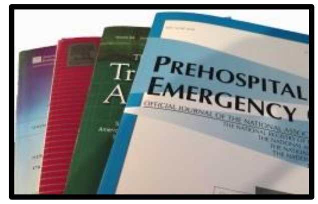
International Prehospital Medicine Institute

IPHMI Literature Review



Keeping You Up To Date with Current EMS Literature and Studies

Vol. 3.7

1. **Tranexamic Acid During Prehospital Transporting Patients at Risk for Hemorrhage After Injury A Double-blind, Placebo-Controlled, Randomized Clinical Trial.** Guyette FX, Brown JB, Zenati MS, et al. *JAMA Surg.* 2021;156(1):11–20. doi:10.1001/jamasurg.2020.4350 Full text available at: https://jamanetwork.com/journals/jamasurgery/article-abstract/2771225
2. **Association of Police Transport with Survival Among Patients With Penetrating Trauma in Philadelphia, Pennsylvania.** Winter E, Hynes AM, Schultz K, Holena DN, Malhotra NR, Canon JW. *JAMA Netw Open.* 2021;4(1):e2034868. doi:10.1001/jamanetworkopen.2020.34868 Full text available at https://jamanetwork.com/journals/jamanetworkopen/article-abstract/2775605

    Invited Commentary: Police Transport for Penetrating Trauma—Lessons From Patients in Philadelphia. Inaba K, Jurkovich GJ. JAMA Network Open. 2021;4(1):e2035122. doi:10.1001/jamanetworkopen.2020.35122 Full text available at: https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2775600
3. **Pre-hospital critical care management of severe hypoxemia in victims of Covid-19: A case series.** Mæhlen JO, Mikalsen R, Heimdal HJ, Rehn M, Hagemo JS, Ottestad W. *Scand J Trauma, Resusc, and Emerg Med* 2021;29:16. https://doi.org/10.1186/s13049-021-00831-3 Full text available at: https://sjtrem.biomedcentral.com/articles/10.1186/s13049-021-00831-3
4. **Effect of Machine Learning on Dispatcher Recognition of Out-of-Hospital Cardiac Arrest During Calls to Emergency Medical Services. A Randomized Clinical Trial.** Blomberg SN, Christensen HC, Lippert F, et al JAMA Network Open. 2021;4(1):e2032320. doi:10.1001/jamanetworkopen.2020.32320 Full text available at: https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2774644

1. Tranexamic Acid During Prehospital Transporting Patients at Risk for Hemorrhage After Injury A Double-blind, Placebo-Controlled, Randomized Clinical Trial. Guyette FX, Brown JB, Zenati MS, et al. JAMA Surg. 2021;156(1):11–20.

Tranexamic Acid (TXA) has for many years played a part in the management of no-traumatic hemorrhage in a variety of situations. Since the publication of the CRASH-2 study, TXA has been advocated for use in trauma patients in many parts of the world as well as by the military for injured soldiers. Few studies in the civilian setting have demonstrated that TXA administration in the prehospital phase makes a tangible effect on patient outcome. However, the studies that have been performed demonstrated that there was no or little harm in its administration.

This randomized, double-blind, placebo-controlled study examined the administration of TXA on 30-day mortality outcomes after traumatic injury. Trauma patients transported by ground ambulance or helicopter to one of four participating level one trauma centers were included.

The study took place between May 1, 2015 and October 31, 2019. Inclusion criteria included the patients between the ages of 18-90 years, a documented hypotensive and or tachycardic episode, availability of an IV or IO line and potential for hypovolemia. Patients transferred from a referring emergency department were also eligible if they were transferred within 2 hours of the time of injury. Exclusions included pregnancy, prisoners, spinal cord injury and penetrating brain trauma. Patients in the TXA arm received 1 gram of TXA in 100 cc of normal saline over 10 minutes during transport and, as necessary, completed after arrival in the hospital. Patients that received TXA prehospital were allocated into one of 3 standard and repeat dosage regimens after admission to the trauma center. The primary outcome measure was 30 day mortality.

A total of 927 patients were enrolled in the study; 447 were randomized into the TXA arm and 456 into the placebo arm. Overall, there was no statistical difference in mortality between the TXA group and the placebo group (8.1% vs 9.9% respectively). There were also no statistical differences in 24 hour mortality, in-hospital mortality, or blood and blood component requirements. The study also demonstrated no difference in complications (deep vein thrombosis, pulmonary embolism, or seizures) between the groups. The authors evaluated subgroups of patients with severe shock (Systolic BP less than 70 mm hg) and found a positive treatment effect for the TXA group (mortality 18.5% vs 35.5%). In addition, there was a mortality benefit if TXA was given with 1 hour of the time of injury (4.6% vs 7.6%). In the severe traumatic brain injury (TBI) sub-group, mortality was slightly higher in the placebo group (25.6%) vs the TXA group (21.1%) although it was not statistically significant.

The study has a number of limitations. The overall need for blood transfusion indicating significant hemorrhage was low as was the overall injury severity of the patients. The number of patients in the subgroups was small and the authors recommend "appropriate powered trials for these subgroups. Lastly, the study was based in trauma center and prehospital systems that have robust trauma care capabilities. These results may be different in prehospital and hospital systems with different capabilities.

Not defined in this study was the number of ALS providers present on the scene and during subsequent transport of the patient. If only one ALS provider was available, were other important procedures potentially omitted or delayed to prepare, administer and monitor the TXA. Not reported in the study was a comparison of scene times for the two groups compared to standard trauma care prior to implement of the study to determine if the implementation of this study increased scene times.

This double blind randomized study demonstrated that there was no statistical difference in outcome between the placebo group and the group receiving TXA. While patients in the severe shock sub-group and the severe TBI showed a somewhat better outcome, the number of patients was small and did not meet statistical significance.

2. **Association of Police Transport with Survival Among Patients With Penetrating Trauma in Philadelphia, Pennsylvania.** Winter E, Hynes AM, Schultz K, Holena DN, Malhotra NR, Canon JW. *JAMA Netw Open.* 2021;4(1):e2034868.

   Invited Commentary: **Police Transport for Penetrating Trauma—Lessons From Patients in Philadelphia.** Inaba K, Jurkovich GJ. JAMA Network Open. 2021;4(1):e2035122.

Trauma patients are traditionally treated by EMS personnel and transported in ambulances to an appropriate destination. It is not unusual for law enforcement officers to arrive to the scene of penetrating injury (gunshot wound or stabbing) prior to the ambulance and have to wait for the arrival of the EMS personnel. In some communities, police officers facing this situation take it upon themselves to transport these victims in their own vehicles.

This retrospective study compares the mortality of patients with penetrating trauma transported by Police Officers with that of patients transported by ambulance in one large urban city. Patients with penetrating trauma that were transported by Police or EMS directly to level 1 or level 11 trauma centers in Philadelphia from January 1, 2014 to December 31, 2018 were identified in the Pennsylvania Trauma Outcomes Registry (PTOS). Exclusions included patients younger than 18 years of age, pregnant women, and incarcerated patients, those transported by private vehicles, walk-ins and transfers from other facilities. Patients were divided into two cohorts: EMS transport or Police transport.

Review of the registry revealed 5,620 patients who sustained penetrating trauma, of which 3,485 met initial inclusion criteria, and after detailed data review, 3,313 were included for further analysis. Of these, 1205 patients were transported directly to trauma centers by Fire Rescue and 138 were transported by ambulance. During this same time period, 1,970 patients were transported by Police.

Police transport of penetrating trauma patients increased significantly between 2014 (328) and 2018 (489) while EMS transports of similar patients remained unchanged. Patients transported by the police tended to be more severely injured and hypotensive. Mortality for the entire cohort revealed the police transports had significantly higher mortality than patients transported by EMS. Mortality for police transports was 560 of 1,970 (28.4%) while for EMS it was 236 of 1,343 (17.6%). Within the entire cohort, there were 870 patients in each transport group with matching criteria. After controlling for significant differences, the mortality for these two groups was the same.

The authors suggest that a formal policy allowing for police transport of penetrating trauma patients could be safe and complimentary to EMS response and transport, particularly in urban areas.

This study, as with any retrospective registry-based study, is limited by the data available in the database. Of particular note, prehospital response, scene and transport times were not described, which is important as the core of police transport decisions is rapid identification and transport of critical patients. The registry also did not include records of prehospital interventions that might have affected survival such as hemorrhage control interventions including tourniquet placement. Lastly, since the study only looked at penetrating trauma, these results might not apply to other injuries or illness.

The importance of this study and others like it was underscored by the invited editorial in the same issue. In their commentary entitled "Police Transport for Penetrating Trauma-Lessons from Philadelphia" Kenji Inaba, MD and Gregory J. Jurkovich, MD discussed the history of trauma care from the "Golden Hour" to "Stop the Bleed" and the importance on minimizing time in the field for critical patients needing to be at a trauma center as soon as possible for definitive care. They point out that there are few studies that look at whether or not alternative transport methods improve trauma patient survival, possibly because there often are no "official" policies or guidelines regarding police transport. They point out that the rear passenger compartment of virtually all police vehicles is not conducive to patient transport. Lastly, they comment that routine adoption of police transport should wait until such time as a clear benefit to this practice is demonstrated, with the possible exception of hot zone tactical scenes where EMS either has not yet arrived or cannot enter safely.

3. **Pre-hospital critical care management of severe hypoxemia in victims of Covid-19: A case series.** Mæhlen JO, Mikalsen R, Heimdal HJ, Rehn M, Hagemo JS, Ottestad W. Scand J Trauma, Resusc, and Emerg Med 2021;29:16.

The current COVID-19 pandemic has challenged healthcare providers of all levels worldwide. It has required adapting and reconsidering conventional treatment therapies and diagnostic examinations. Emergency Medicine and EMS personnel are often the first medical providers to provide direct care for COVID-19 patients. Guidelines encourage patients to isolate and stay home when they exhibit the first signs of COVID-19 infection. Vague symptoms of fever and cough may unknowingly progress to respiratory failure and hypoxemia without air hunger. "Silent Hypoxia" has become a term used to describe awake and cooperative COVID-19 patients who are hemodynamically stable with rapid respiratory rates and critical hypoxemia.

The authors of this paper used three case studies, all with tragic endings, to advocate for three alternate interventions instead of and before moving to endotracheal intubation for oxygen alone refractory hypoxemia: 1) Administering oxygen using a tight fitting bag-mask (BVM) device with oxygen flow rates that exceed the patient's intrinsic minute volume, 2) Initiating continuous positive airway pressure (CPAP) with high FiO2 levels, and 3) Placing cooperative patients in a prone position.

Case 1 was a male in his sixties with fever, cough and tachypnea. With the addition of oxygen, the patient's pulse oximetry continued to decline from 72% to 55%. The patient initially refused to tolerate a nonrebreather mask. Eventually he consented and with 12 l/minute of O2 his SpO2 remained the same. Once in the hospital his respiratory efforts were supported by non-invasive ventilation (NIV). He eventually tired, was placed on a ventilator and died 3 weeks later of COVD-10.

The second case was a female in her fifties with comorbidities. There was a familial history of COVID -19 and this patient's symptoms of fever and cough rapidly increased to worsening dyspnea and cyanosis with supplemental O2. Her SpO2 was 52% with a non-rebreather mask at 12 l/minute of O2. Her respirations were assisted with a BVM fitted with a PEEP valve and 12 l/minute of O2. Her SpO2 only increased to 66%. In the hospital, she became fatigued, was intubated and sustained a cardiac arrest during the intubation from which she was resuscitated. She ultimately died a few weeks later of COVID-19.

The last case was a male in his fifties, again with comorbidities. He presented severely hypoxic and was immediately started on prehospital CPAP without improvement. The CPAP was transitioned to a non-rebreather mask at 10 l/minute of oxygen. He was tachypneic at 50 breaths per minute and had SpO2 levels of 32%. He became apneic while providers were preparing for intubation. He was ventilated and an endotracheal tube placed on the first attempt. The patient arrested as he was being loaded into the ambulance. Less than a minute of CPR resulted in a return of spontaneous circulation. His SpO2 levels never rose above 60% with the endotracheal tube. The patient re-arrested in the emergency department and after 25 minutes of resuscitative efforts, he was pronounced dead.

The authors discuss possible mechanisms why COVId-19 patients become profoundly hypoxic and do not respond to supplemental oxygen, including pulmonary shunting and dorsal pulmonary consolidation in the lungs of COVID-19 patients.

Reversing COVID-19-induced hypoxemia in the prehospital setting often involves more interventions than simply providing supplemental oxygen. Providers should consider providing oxygen via a tight fitting BVM with high enough flow rate to exceed the patient's ventilatory minute volume. CPAP with high FiO2 levels can be considered which may require administering additional oxygen by a nasal cannula under the CPAP mask. Lastly, some patients may do better in the prone position which may help reduce dorsal pulmonary congestion and atelectasis.

It must be noted that use of a BVM, CPAP, and the placement of an endotracheal tube in the enclosed space of an ambulance will potentially expose providers to increased airborne secretions. The number of personnel present during the procedure should be limited to essential personnel only. All providers present should be wearing appropriate PPE to include adequate respiratory protection. The vehicle and all equipment should be appropriately decontaminated prior to re-use or being placed back into service.

4. **Effect of Machine Learning on Dispatcher Recognition of Out-of-Hospital Cardiac Arrest During Calls to Emergency Medical Services. A Randomized Clinical Trial.** Blomberg SN, Christensen HC, Lippert F, et al JAMA Network Open. 2021;4(1):e2032320.

Bystander CPR and early access to automated external defibrillators (AED) improve survival rates in out of hospital cardiac arrest (OHCA). For the AED and CPR naïve caller, Emergency Medical Dispatchers (EMD) provide instructions on how to use an AED and how to perform CPR. For each minute that an OHCA victim goes without CPR, the chance of survival decrease by 10%. The shortest time to recognition of OHCA by the EMD will provide the cardiac arrest patient the greatest chance of survival.

The authors of this ethics committee approved, randomized clinical trial sought to determine if machine learning, speech recognition software (artificial intelligence) aided caller interrogation would result in earlier recognition of OHCA and subsequent initiation of CPR and or AED use. Dispatchers were grouped into one of two groups: 1)A control group using standard EMD protocols, and 2) a machine alert group, using the speech recognition software. The trial was active between September 1, 2018 and December 31, 2019. Machine software was available for 74% of the 226,130 emergency calls received. Scheduled server downtime accounted for the remaining 26%. Dispatchers in the machine learning group received a computer-generated alert whenever the software detected key words indicating OHCA.

A total of 654 calls were analyzed. Of those calls the control group of dispatchers recognized OHCA in 296 of 318 calls (93.1%). The machine learning intervention group recognized OHCA in 304 0f 336 calls (90.5%). The control group recognized OHCA 0.02 minutes sooner than the intervention group. The machine learning software proved to have higher sensitivity rate (77.5% vs 85%) but a lower specificity rate (99.6% vs 97.4%) than the control group. The machine learning software identified and alerted for OHCA more often, generating more false positive responses; however, if all machine learning alerts were heeded by the dispatchers, an additional 54 OHCA cases would have been identified and responded to.

While this study did not demonstrate that a medical learning software improved recognition of OHCA by dispatchers, it did demonstrate that artificial intelligence may be beneficial in the future to aid dispatchers in recognizing critical patient scenarios by identifying common key words during the medical interrogation. Appropriate protocols and training will also be required effectively integrate machine learning artificial intelligence into day to day dispatch and EMS operations.