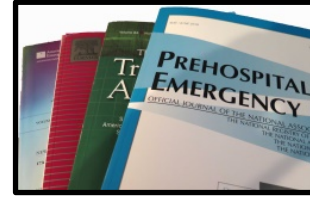


International Prehospital Medicine Institute



IPHMI Literature Review

Keeping You Up To Date with Current EMS Literature and Studies

Vol. 3.12

1. **Predictors of Inappropriate Helicopter Transport.** Brown C, Irfan W, Schoen JE, et al. *Am Surg.* 2021;87:248-252
2. **Police Transport of Firearm-injured Patients—More Often and More Injured.** Maher Z, Beard JH, Dauer E, et al. *J Trauma Acute Care Surg.* 2021;91:164–170.
3. **Tourniquet Application by Urban Police Officers. The Aurora, Colorado Experience.** Jerome J, Pons P, Haukoos J, Manson J, Gravitz S *J Spec Oper Med* 2021;21:71-76.
4. **Hypothermia versus Normothermia after Out-of-Hospital Cardiac Arrest.** Dankiewicz J, Cronberg T, Lilja TG, et al. *N Engl J Med.* 2021;384:2283-2294.

1. **Predictors of Inappropriate Helicopter Transport.** Brown C, Irfan W, Schoen JE, et al. *Am Surg.* 2021;87:248-252

Rapid transport of a severely injured trauma patient to definitive care is a cornerstone of a mature trauma system. Helicopter transport is often utilized to shorten transport time to definitive care and theoretically should improve survival. However, previous studies have given conflicting results on the effectiveness of helicopter transport to improve survival. Additionally, transport by helicopter is considerably more expensive compared to ground transportation, costing an estimated \$2.72 billion to the U.S. healthcare system each year.

It is still an unanswered question as to which patients ultimately benefit from helicopter transport. The authors of this study reviewed records over a three-year period of all trauma patients transported by helicopter to a Level I trauma center. They defined inappropriate transport as any patient who was evaluated by the trauma service and then discharged home from the emergency department or had a hospital length of stay less than one day. Patients who went to the intensive care unit or the operating room but were then discharged within one day were still considered to be an appropriate transport since a higher level of care was needed. Variables studied included gender, age, mechanism of injury, prehospital shock index (heart rate divided by systolic blood pressure), and Glasgow Coma Scale.

A total of 713 patients were transported to the trauma center by helicopter during the study period. Of these, 148 (20.8%) met the criteria for inappropriate helicopter transport. The following variables were associated with inappropriate helicopter transport: GCS > 8, shock index < 0.9, fall, and age > 55 years. The inappropriate transport group only had two patients who required an operation and there were no deaths. The appropriate transport group had 343 (61%) patients who required at least one operation and had a mortality rate of 14.3%.

Limitations of this study are that it was a retrospective review of a single trauma center database which limits the generalizability of the findings. Additionally, this trauma center serves both in urban and rural population and the authors recognize there are circumstances where helicopter transport from a rural setting is desirable.

International Prehospital Medicine Institute

In summary, while helicopter transport is a valuable tool for the prehospital provider, it is expensive and often over utilized. This study shows four types of trauma patients which may not benefit from helicopter transport: those with a GCS > 8, SI < 0.9, a fall mechanism, and age > 55. Further studies are warranted to continue to define which patients benefit from helicopter transport.

2. Police Transport of Firearm-injured Patients—More Often and More Injured. Maher Z, Beard JH, Dauer E, et al. *J Trauma Acute Care Surg.* 2021;91:164–170.

Transport of patients in emergency situations by means other than ambulances with trained responders has been the subject of much discussion and some thought provoking studies. This study looked specifically at Police Officers transporting firearm injured patients in their squad cars (PT). In the U.S. only 3% of all transports are PT. PT was introduced as a “practice” in Philadelphia in the 1980’s. By 2015, about 50% of penetrating trauma patients were PT and by 2018, 78% were PT. The authors hypothesized that, over time, the rates of patients injured by gunshot wounds has increased and that PT patients are more critical and have improved mortality rates.

This was a single center retrospective study looking at adults aged 18 years or older presenting to the level I trauma center with gunshot wounds between the years of 2012 and 2018. They included only patients transported by EMS or Police and did not include patients transported by private vehicle, transferred from other hospitals, or that walked in on their own. They also excluded patients with stab wounds citing “differences in presenting, physiology, injury severity, need for operative intervention and mortality rates.”

Patients were identified from the institutional trauma registry. Data collected included: demographic information mode of transport, physiologic arrival data, need for emergency thoracotomy (EDT), immediate operative intervention (within 2 hours), blood transfusion (at 3 and 24 hours), Injury Severity Score (ISS), Trauma and Injury Severity Score (TRISS), and outcome data.” Study endpoints were: Primary – In-hospital mortality, Secondary- mortality at 3 and 24 hours, complications, intensive care length of stay, hospital length of stay, and discharge disposition.

They identified 2,007 patients (93% male) transported by Police. PT patients were younger (29 vs 32 years, $p < 0.001$) and more injured on presentation than the EMS transports. They had lower initial systolic blood pressure (98 vs 110 mmHg, $p < 0.001$), lower Glasgow Coma Scale scores and more bullet wounds (3.5 vs 2.9, $p < 0.001$). PT transports more frequently arrived in cardiac arrest (20% vs 15%, $p = 0.004$) and had subsequent thoracotomies (19% vs 10%, $p < 0.001$). More PT transports also had laparotomies compared to EMS transports (22% vs 16%, $p < 0.001$). The un-adjusted in-hospital mortality for PT was 26% vs 19% ($p < 0.001$) for EMS transport but after adjusting for age, gender and ISS, there was no difference.

The limitations of this study include the limitations associated with retrospective studies in general, the exclusion of patients not transported by either PT or EMS, and the lack of availability of prehospital time data. In addition, the ISS underestimates the severity of gunshot victims. It is hoped that future utilization of the new ISS might improve this shortcoming. Perhaps most importantly, investigation of negative effects related to PT was not possible given the study design.

In summary, PT of gunshot wounded patients increased during the study period and while the PT transported patients were more severely injured than the EMS transports, they had similar in-hospital mortality. Additional study is required to determine the efficacy and negative effects of PT and other non-EMS transports.

International Prehospital Medicine Institute

3. Tourniquet Application by Urban Police Officers. The Aurora, Colorado Experience. Jerome J, Pons P, Haukoos J, Manson J, Gravitz S *J Spec Oper Med* 2021;21:71-76.

Eight years ago, the first of the Hartford Consensus group of papers and recommendations was released. Those publications advocated for an organized and practiced response to Active Shooter and Hostile Event Responses by public safety organizations, particularly law enforcement, in order to maximize trauma victim survival. The recommendations addressed the paramount need to control hemorrhage as soon as possible. All of the Hartford Consensus recommendations have continued to stress that hemorrhage control, and knowledge of hemorrhage control techniques, should be core law enforcement skills immediately after neutralizing or isolating the threat.

The United States Military embraced the use of tourniquets as a fast and effective means of controlling exsanguinating extremity hemorrhage. Tactical Combat Casualty Care (TCCC) is required training for service men and women going into harm's way. The civilian version of TCCC, Tactical Emergency Casualty Care (TECC), is available for public safety personnel as is an abbreviated, one day course version, Tactical Casualty Care for Law Enforcement and First Responders (TCC-LEFR), geared specifically toward modern day police operations. All of the various "Tactical" courses stress and practice the use of tourniquets to control hemorrhage.

Following the 2012 mass shooting at a movie theatre in Aurora, Colorado, the Aurora Police Department began training all their officers in hemorrhage control via TCC-LEFR. The Aurora Police Department consists of 729 sworn officers. Annually, those officers respond to an average of 2,000 violent crimes (80 gunshot wounds) and 13,000 motor vehicle crashes (MVC's). Violent crimes and MVC's combined result in 900 injuries or deaths annually.

The purpose of this paper was to evaluate the efficacy and appropriateness of officer applied tourniquets for hemorrhage control. A computerized search of dispatch and police records for the word "tourniquet", between March 2014 and December 2019, was conducted. The authors also looked at response times of police, fire and EMS to these incidents. This retrospective case review was designated as non-human subject by the local institutional review board.

Forty-three reports of an officer applied, department issued tourniquet to stop "severe" bleeding were identified and reviewed. The majority of these cases were for gunshot wounds. Officers treated themselves, other officers and civilians. The documented rationales for the majority of officer applied tourniquets were consistent with the indications for tourniquet use taught in civilian Stop the Bleed, TECC, and TCC-LEFR courses. There were two cases with questionable indications and one case where the tourniquet was applied distal to the reported injury. On average, Aurora police officers arrived on scene 4 minutes before EMS, adequate time for a victim to succumb to uncontrolled external hemorrhage if tourniquet application was delayed.

There were a number of limitations to this study. The study only looked at cases where tourniquets were applied and documented. It is possible that some tourniquet applications were not identified. In addition, other cases where tourniquets should have been used to stop hemorrhage but were not applied could not be found using the search methodology. Lastly, the authors were unable to access hospital records to determine the specific injury causing the hemorrhage.

This study showed that police officers are able to determine the need for rapid hemorrhage control from a variety of injuries and effectively stop the bleeding with the application of a department issued tourniquet. This model could save many more lives if it were to be universally adopted by law enforcement agencies. Officers can, and should, be trained to control hemorrhage and issued the proper tools to do so. Departments that adopt this philosophy would likely also benefit from refresher training in hemorrhage control at some point after their initial education.

International Prehospital Medicine Institute

4. Hypothermia versus Normothermia after Out-of-Hospital Cardiac Arrest. Dankiewicz J, Cronberg T, Lilja TG, et al. N Engl J Med. 2021;384:2283-2294.

Few things in the history of EMS have changed more or had as many studies performed as the management of non-traumatic cardiac arrest. Targeted hypothermia has been advocated to prevent or minimize neurologic damage in comatose patients post-cardiac arrest.

The authors of this multinational study examined the efficacy of hypothermia on patients post cardiac arrest. This prospective randomized study enrolled consecutive adult patients (over 18 years of age) admitted to the hospital post out-of-hospital cardiac arrest with return of spontaneous circulation (ROSC) for at least 20 minutes and no longer than 3 hours post ROSC. Patients who were enrolled in the study had a cardiac arrest that was either a primary cardiac event or an event of unknown origin. All patients enrolled in the study were unconscious and unable to follow commands. Patients were assigned on a 1:1 ratio to either the normothermic or hypothermic groups by a computer-based randomizer. Patients assigned to the hypothermia group were cooled to a target temperature of 33 degrees Celsius. The primary outcome measure was death at 6 months. Secondary outcome was functional outcome at 6 months.

During the study period from November 2017 to January 2020, nineteen hundred (1900) patients were enrolled. Thirty-seven of these patients were excluded due to consent issues. Of the patients enrolled in the study, 1850 were evaluated at six (6) months. Of the 925 patients in the hypothermia group, 465 had died (50%). In the normothermic group, 446 of the 925 patients had died (48%). Of the 1747 patients that survived beyond six months, functional outcome was assessed. In the hypothermic group, 488 out of 881 (55%) were determined to have moderately severe or greater disability. In the normothermic group, 479 out of 866 (55%) were assessed have a moderately severe or greater disability.

This study demonstrated no statistical difference between out-of-hospital cardiac arrest survivor patients who had received induced hypothermia post hospital admission and those who did not. There was also no difference at six months post arrest in the percent of survivors who were deemed to have incurred a moderate severe disability or greater.

This study and other similar studies help guide clinical practice both in the prehospital and hospital environments. Five to eight years ago, patients who were successfully resuscitated in the field either received hypothermia treatment immediately in the field or upon admission to the emergency department in most major cardiac centers. The tendency to make dramatic changes in clinical practice and cardiac arrest protocols based on single studies often lends itself to situations such as this that are reversed following subsequent studies with greater statistical power. In EMS we must be aware that much of what we do is supported by very few studies, many of which are retrospective in design or were only performed in the hospital setting.