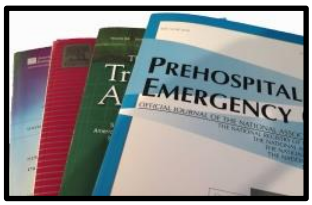
International Prehospital Medicine Institute



IPHMI Literature Review

Keeping You Up To Date with Current EMS Literature and Studies

Vol. 2.5

1. **Incidence of mortality due to rebound toxicity after 'treat and release' practices in prehospital opioid overdose care: a systematic review.** Greene JA, Deveau BJ, Dol JS, Butler MB. Emerg Med J 2019;36:219-224.
2. **Who Would Have Benefited from the Prehospital Use of Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA)? An Autopsy Study.** Henry R, Matsushima K, Henry RN ,et al. J Am Coll Surg. 2019;229:383-388.
3. **Effect of bystander CPR initiated by a dispatch centre following out-of-hospital cardiac arrest on 30-day survival: Adjusted results from the French National Cardiac Arrest Registry.** Noel L, Jaeger D, Baert V, Debaty G, Genin M, Sadoune S, et al Resuscitation 2019;144:91-98.
4. **Impact of Emergency Medical Services Activation of the Cardiac Catheterization Laboratory and a 24-Hour/Day In-Hospital Interventional Cardiology Team on Treatment Times (Door to Balloon and Medical Contact to Balloon) for ST-Elevation Myocardial Infarction.** Pulia M, Salman T, O'Connell TF, et al. Amer J Cardiol 2019;124:39-43.

1. Incidence of mortality due to rebound toxicity after 'treat and release' practices in prehospital opioid overdose care: a systematic review.

Greene JA, Deveau BJ, Dol JS, Butler MB. Emerg Med J 2019;36:219-224.

Deaths due to opiate overdoses have increased dramatically worldwide in the last five years placing a stress on EMS systems and first responders who respond daily to this epidemic as well as emergency departments that receive transported patients. Many of these patients are awakened on the scene by first responders and EMS personnel following the use of the opioid antagonist naloxone. Patients who are awakened and then refuse transport for further medical treatment and monitoring represent a conundrum for EMS providers and their Medical Directors as to the safety of this request.

The authors of this paper conducted a systematic literature review to discover the frequency of rebound toxicity resulting in death or serious adverse event within 48 hours after patients receive naloxone and are not transported to a medical facility. The authors found 1401 papers, reviewed eighteen, and selected seven (7) articles that met the inclusion criteria for the study. These seven (7) studies resulted in a total of 4912 patients from both the USA and Europe. All patients were attended to by either Paramedics or Prehospital Care Physicians. The average age was thirty-six (36) with males accounting for 80% of cases. Of these 4912 patients, four (4) patients (0.081%) died within the 48 hours set as the parameter for the study. Three of the four patients were classified by the medical examiner as death likely due to rebound toxicity of the opioid involved.

This review demonstrates that within the cohort of patients included in this study, most suspected of using heroin, very few patients experienced any significant rebound toxicity. However, the authors

point out that the studies reviewed for this paper pre-dated the recent widespread use of fentanyl as a recreational drug. Fentanyl has an extended of half-life of nearly 4 times that of heroin and double that of morphine. In addition, methadone has a half-life of several days. While this review demonstrates that the prehospital release of patients who have overdosed on heroin and been awakened by the use of naloxone appears safe without worry of severe rebound reaction, it cannot provide the same reassurance for fentanyl, morphine or methadone. Given that it is often difficult, if not impossible, to accurately determine what drug was actually used, implementing the findings of this study must be considered with great caution. Further studies need to be conducted using data from patients that have utilized longer acting opioids.

2. **Who Would Have Benefited from the Prehospital Use of Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA)? An Autopsy Study.** Henry R, Matsushima K, Henry RN ,et al. J Am Coll Surg. 2019;229:383-388.

Hemorrhage is the second leading cause of traumatic death in the civilian population, behind traumatic brain injury. The two types of hemorrhage are compressible and non-compressible. The most common type of compressible hemorrhage is an extremity injury in which bleeding can be controlled by direct pressure or a tourniquet. Non-compressible torso hemorrhage (NCTH) is bleeding which cannot be controlled by direct pressure or tourniquet and includes bleeding within the chest, abdomen, or pelvis. Prehospital management options for NCTH are very limited and mortality is nearly 50% in civilian NCTH. Recently, resuscitative endovascular occlusion of the aorta (REBOA) has become a useful adjunct in trauma centers for temporary control of NCTH until surgical control of bleeding can be achieved. Some have advocated the use of REBOA in the prehospital setting to achieve early control of NCTH. Proper patient selection remains a challenge however.

This is a retrospective study conducted at the Los Angeles County Level I Trauma Center. All trauma patients with prehospital cardiac arrest were evaluated (n=198). Those with no signs of life in the field by EMS examination were excluded (n=125), leaving 73 total patients to evaluate. These were patients who had signs of life in the field prior to cardiac arrest. Autopsy results were reviewed to determine cause of death. They defined a REBOA candidate as a patient with abdominal organ injuries and/or pelvic fractures as a source of NCTH and no associated severe head injury, defined as a Glasgow Coma Scale (GCS) $\geq$ 9.

Based on autopsy findings, 27 (13.6%) patients could have been candidates for prehospital REBOA. These were primarily blunt trauma patients (63%) with a mean transport time of 20 minutes. The majority of these patients (85%) sustained high-grade abdominal solid organ injuries (liver and spleen), with 65% having significant pelvic trauma. Some patients had a combination of both injury types. The authors identified three variables predicting benefit of prehospital REBOA in this patient population: GCS $\geq$ 9, systolic blood pressure (SBP) < 90 mmHg, and SpO2 of > 90%. Notably, having $\geq$ 2 of these 3 variables had a positive predictive value of 100% for being a possible REBOA candidate.

There are limitations to this study. This was a retrospective study utilizing autopsy data. Prospective trials are still needed. Patients with severe head injury were excluded from the study, although prospective trials may demonstrate a survival advantage to early hemorrhage control with REBOA. Finally, EMS response and scene times were not available and transport time was short (average of 20 minutes) and the results may not be generalizable to rural and austere settings where transport time is longer.

This study concludes that greater than 10% of patients with suspected NCTH who have a prehospital cardiac arrest following signs of life may benefit from early REBOA placement in the field. Prior prehospital REBOA placement has been limited to the austere military setting as well as a few advanced European EMS services staffed by physicians. Future prospective studies are necessary prior to concluding that prehospital REBOA is beneficial.

3. **Effect of bystander CPR initiated by a dispatch centre following out-of-hospital cardiac arrest on 30-day survival: Adjusted results from the French National Cardiac Arrest Registry.** Noel L, Jaeger D, Baert V, Debaty G, Genin M, Sadoune S, et al Resuscitation 2019;144:91-98.

The American Heart Association (AHA) describes five links for survival in Out of Hospital Cardiac Arrest (OHCA);

1. Recognition of cardiac arrest and activation of the emergency response system,
2. Early cardiopulmonary resuscitation (CPR) with an emphasis on chest compressions,
3. Rapid defibrillation,
4. Basic and advanced emergency medical services and advanced life support, and
5. Post-cardiac arrest care.

In France, 40,000 – 50,000 people annually are affected by OHCA. French EMS is two tiered with Fire Department Basic Life Support Ambulances (BLS) with follow on scene care provided by ACLS trained Mobile Medical Teams (MMTs) . Each county has its own Dispatch Center (DC) which will guide callers through Chest Compression only CPR for suspected OHCA. Additionally, all OHCA patients are recorded in a French National Cardiac Arrest Registry (Re'AC).

The authors conducted a retrospective, comparative, multicenter study using data from Re'AC for the time period from 1 January 2012 through 1 May 2018. Patient inclusion criteria were medical OHCA and patients who received ACLS care. Exclusion criteria were deceased individuals, non-medical OHCA, no ACLS, no CPR for greater than 60 minutes and patients with Do Not Resuscitate orders.

Patients included in the study were subdivided into three groups;

- Group A patients did not receive bystander CPR,
- Group B patients received bystander-initiated CPR, and
- Group C patients received bystander CPR after being prompted by a dispatch center.

Outcome data was evaluated for 30-day survival and neurological outcome (Cerebral Performance Category or CPC score of 1 or 2 was considered to be a good outcome). Of the identified 85,634 OHCA patients in the study's time frame, 18,185 met the inclusion criteria and were included in the study.

Thirty-day non-adjusted survival rate was highest with Group B patients (11.5%). Group C patients had slightly lower thirty-day survival (9.3%). Group A patients survival was the lowest (3.9%). After adjustment for potential confounders, 30 day survival for groups A, B, and C were 5.1%, 8.9% and 7.4% respectively. A non-shockable rhythm was documented in 70.5% of the overall patient population. Ventricular Fibrillation or pulseless V- Tach was seen in 25% of group A patients, 34% of Group B patients, and 36% of Group C patients. The authors noted that over 70% (71.7%) of the bystander CPR performed for Group C patients was done by family members. Of those patients who survived, a CPC score of 1-2 was recorded in 76% of Group A, 84% of Group B, and 83% of Group C.

This study has a number of limitations. This was a retrospective study and is limited by the data points entered into the cardiac arrest registry. In addition, while a shockable rhythm was found in

between one quarter and one third of patients, no information was provided about time to defibrillation.

As the AHA recommends, early (bystander) CPR in OHCA is one of the key links to survival. EMS programs should continue to promote bystander CPR and layperson CPR training. Additionally, EMS dispatch centers should work to quickly identify OHCA patients and direct the caller to immediately initiate compression only CPR. This study shows that despite a delay in initiating CPR until directed to do so by an emergency medical dispatcher, outcomes are very similar to the survival when CPR is immediately begun by a bystander.

4. Impact of Emergency Medical Services Activation of the Cardiac Catheterization Laboratory and a 24-Hour/Day In-Hospital Interventional Cardiology Team on Treatment Times (Door to Balloon and Medical Contact to Balloon) for ST-Elevation Myocardial Infarction. Pulia M, Salman T, O'Connell TF, et al. Amer J Cardiol 2019;124:39-43.

It has been well demonstrated that the sooner a patient with an ST-Elevation Infarction (STEMI) reaches the interventional cardiac care team in the cardiac catheterization lab the less the myocardial ischemic time and the better the patient outcome. This has been coined the door-to-balloon time (D2B). In the past decade, some hospitals have staffed interventional catherization laboratories 24-hours per day with the goal of decreasing the D2B time. In this same time frame, EMS systems have developed the ability to obtain, interpret, transmit and activate the Interventional cardiac team prior to arrival at the receiving facility.

The authors of this study retrospective study endeavor to corollate the effect of EMS activation on Door to Balloon time but also EMS (first medical) patient contact to balloon time (FMC2B) in a facility with 24 hour per day catheterization lab capability. The study cohort consisted of patients with STEMI from April 2009 to December 2015 at Loyola University Medical Center who were cared for in their interventional cardiac Cath lab. During this time 190 patients were entered into the study. They were divided into two groups, depending on whether the catheterization lab activation was initiated by the Emergency Department or by the responding EMS service. The baseline characteristics of both groups were similar, with the exception that the EMS activation group patients were more likely to have chest pain as the primary presenting symptom (96% vs 84%). D2B times were significantly shorter in the EMS activation group (37 vs 57) minutes. When looking at FMC2B times, again patients received interventional procedures in a much shorter time frame (52 vs 67) minutes.

The EMS authors note several limitations. All data was obtained from a single center. The EMS group had a higher percentage of patients with a primary presenting complaint of chest pain than did the Emergency Department group which could have shortened the ED evaluation time. Those patients without chest pain likely required additional, more complex evaluation and testing.

This study demonstrated that EMS activation of an in-house interventional cardiac team results in decreased total myocardial ischemic time. Unfortunately, the study did not look at any differences in patient outcome. It can be reasonably concluded that any significant decrease in myocardial ischemic time should result in better outcomes; however this aspect requires further study. It is also clear that in systems without in-house interventional cardiovascular services, early activation of the interventional team by EMS providers could result in even greater reductions in ischemic time. A secondary question to be studied is why the EMS group had a greater number of patients with a primary complaint of chest pain vs. the emergency department group and whether or not EMS needs better education in the recognition of atypical presentations of myocardial infarction.