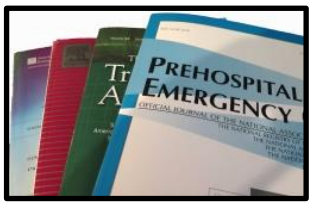
International Prehospital Medicine Institute



IPHMI Literature Review

Keeping You Up To Date with Current EMS Literature and Studies

Vol. 4.5

1. **Tourniquet Application for Bleeding Control in a Rural Trauma System: Outcomes and Implications for Prehospital Providers.** Bedri H, Ayoub H, Engelbart JM, Lilienthal M, Galet C, Skeete DA. *Prehosp Emerg Care,* DOI: 10.1080/10903127.2020.1868635. Published on-line Feb 2021
2. **Outcomes following Naloxone Administration by Bystanders and First Responders.** Farkas A, Westover R, Pizon AF, Lynch M, Martin-Gill C. *Prehosp Emerg Care,* 2021;25:740-746. https://doi.org/10.1080/10903127.2021.1918299
3. **Disparities in Emergency Medical Services Time Intervals for Patients with Suspected Acute Coronary Syndrome: Findings from the North Carolina Prehospital Medical Information System.** Cui ER, Fernandez AR, Zegre-Hemsey JK, et al. *Jrnl AmerHeart Assoc* 2021;10. Open Access, Full text available at: https://www.ahajournals.org/doi/epub/10.1161/JAHA.120.019305
4. **Use of intramuscular ketamine by paramedics in the management of severely agitated patients.** Bernard S, Roggenkamp R, Dolorenzo A, et al. *Em Med Australasia.* 2021;33:875-882.

1. Tourniquet Application for Bleeding Control in a Rural Trauma System: Outcomes and Implications for Prehospital Providers.

Bedri H, Ayoub H, Engelbart JM, Lilienthal M, Galet C, Skeete DA. *Prehosp Emerg Care,* DOI: 10.1080/10903127.2020.1868635. Published on-line Feb 2021

The efficacy of tourniquet application has been well documented in the military setting and in the urban EMS environment, however little research has been conducted in the rural environment. The authors of this study looked at the use of tourniquets in a rural environment.

This retrospective study reviewed the trauma database and medical records from a level I trauma center for the time period between July 2015 and December 2018. They identified patients who had a prehospital tourniquet placed. Appropriate indications for tourniquet application included hemorrhagic shock (systolic BP less than 90 mmHg), amputation, arterial or venous injury requiring surgical repair, or significant bleeding as reported by responders. The study goal was to determine the safety of tourniquet application in rural settings.

A total of ninety-two (92) patients were identified, of whom 77% were male. Fifty-nine percent (59%) were due to penetrating trauma. Ninety-two percent (92%) were applied in the prehospital setting and the remaining were placed in referring hospitals. Two of 7 tourniquets placed in referring hospitals were deemed inappropriate and twenty one percent (21%) applied in the field did not have appropriate indications. All tourniquets placed in the hospital were effective however almost 10% placed in the field were ineffective due to persistent bleeding or the presence of distal pulses. Two patients had nerve palsies. Both were deemed to have appropriate indications for the tourniquet and both were transferred from another hospital. The time from injury to trauma center admission was 2.75 hours in one case and 1.67 hours in the second case. When comparing their data to published data from an urban study, the average tourniquet time was 123 minutes in the rural setting versus 48 minutes in

the urban environment. The authors note that there were no statistical differences in mortality, amputation, and incidence of nerve palsy between the two settings, urban and rural.

This study demonstrates that tourniquet application in the rural environment faces the same challenges as in the urban environment with over twenty-one percent (21%) inappropriate tourniquet applications. The need for further training in the use of direct pressure prior to tourniquet application or the conversion of tourniquets to direct pressure, wound packing and pressure dressing is needed both in the rural and urban environments, particularly for potentially prolonged applications. This limited study showed that the longer tourniquet times associated with rural injuries do not adversely affect patient outcome or cause more complications.

2. **Outcomes following Naloxone Administration by Bystanders and First Responders.** Farkas A, Westover R, Pizon AF, Lynch M, Martin-Gill C. *Prehosp Emerg Care,* 2021;25:740-746 https://doi.org/10.1080/10903127.2021.1918299

Opioid overdoses are a leading cause of death in the United States. Fentanyl and other strong synthetic narcotics are major contributors to the large number of overdose deaths. Many communities have embraced layperson naloxone programs in an attempt to improve survival from opioid overdose. Having naloxone immediately available to friends and family of opioid as well as first responders who have naloxone on their apparatus, decreases the time from recognition of an overdose to first dose naloxone administration. Even with readily available naloxone, many EMS systems see multiple subsequent doses of naloxone given by their providers during an opiate overdose resuscitation. The authors of this paper tried to determine if patient presentation to and naloxone redosing by paramedics contribute to complications resulting in hospital admission.

This IRB approved, retrospective, observational, cross-section study looked at patients that received pre-hospital naloxone and were transported by the City of Pittsburg EMS between 1 April 2013 and 31 December 2016. Manual EMS chart reviewed further culled the patient cohort down to patients that either received naloxone from bystanders or first responders prior to the arrival of EMS. Standard patient demographics were recorded along with the paramedic's Glasgow Coma Scale (GCS) score for the patient. Hospital records were reviewed for this identified group of patients. If the hospital record could not be found, the patient was excluded. The goal was to determine the patient's primary outcome including inpatient and observational admissions. Psychiatric admissions were not counted. Additionally, researchers attempted to determine the overdose agent and if the patient was not an overdose, the etiology of the patient's altered mental status.

Initially, 1,831 patient contacts who received prehospital naloxone were examined. Of that number, 359 met the inclusion factor of layperson or first responder naloxone prior to the arrival of EMS. A total of 357 had a documented GCS measurement in their EMS run report. The number of patients that arrived at a hospital with a GCS of 15 was 285 (85%). Of the 194 patients thought to have an opioid overdose and who received naloxone from first responders or bystanders, 132 (68%) presented to the responding paramedic unit with a GCS > 12 and without any additional naloxone by responding paramedics, 182 (94%) arrived at the hospital with a GCS > 12. For patients with poor neurological status (GCS < 12) on arrival of paramedics, the administration of additional doses of naloxone was not associated with a higher GCS score (>12) on arrival at a hospital.

This study showed that the administration of additional doses of naloxone for suspected opioid overdose after bystander or first responder naloxone does not improve patient outcomes. Prehospital providers should instead focus on other conditions that may be causing the patient's central nervous system (CNS) depression, such as anoxic brain injury, respiratory acidosis, sepsis, hypoglycemia, seizure, intracranial hemorrhage, and intoxications from other depressants such as ethanol or benzodiazepines.

EMS providers should consider shifting their end points for naloxone directed opioid resuscitation from normalizing mentation to maintaining adequate ventilatory effort and rates.

3. **Disparities in Emergency Medical Services Time Intervals for Patients with Suspected Acute Coronary Syndrome: Findings from the North Carolina Prehospital Medical Information System.** Cui ER, Fernandez AR, Zegre-Hemsey JK, et al. *Jrnl AmerHeart Assoc* 2021;10. Open Access, Full text available at: https://www.ahajournals.org/doi/epub/10.1161/JAHA.120.019305

Early recognition of and response to patients suspected of experiencing acute coronary syndrome has long been the standard for getting patients early access to the diagnostic tools and treatments needed for the best possible outcomes. Towards this end, many EMS systems impose benchmarks on response, scene and transport times for these patients.

In this study, researchers performed a population based, retrospective study using the North Carolina PreHospital Medical Information System. This is a statewide database of all EMS patient care reports. They looked at the data on patients complaining of chest pain and suspected cardiac events and documented myocardial ischemia on prehospital ECGs or prehospital activation of the cardiac care team. They analyzed the patients care records in the data base from 2011 to 2017. They sought to determine if the previously proposed response time of 11 minutes and scene time of 15 minutes benchmarks were being met.

They found 4,667 patients meeting their eligibility criteria. The median response time was 8 minutes, the median scene time was 16 minutes and the median transport time as 17 minutes. Scene times were comparable across population densities but rural counties have longer response and transport times. Overall, 62% of the responses met the 11-minute response time benchmark and 49% met the scene time benchmark. They also found that adherence to scene time benchmarks decreased with older aged patients and female patients as well as getting 12-lead ECGs and venous access. Interestingly, a provider impression of chest pain that is likely cardiac in origin was associated with shorter scene times.

It should not come as a surprise that there were differences in response and transport times between urban and rural settings. Interventions such as 12 lead ECG were found to prolong the scene time but are, in fact, essential when considering STEMI activation. They suggested that further studies to reduce scene times as much as possible should be developed and evaluated.

4. **Use of intramuscular ketamine by paramedics in the management of severely agitated patients.** Bernard S, Roggenkamp R, Dolorenzo A, et al. *Em Med Australasia.* 2021;33:875-882.

Prehospital personnel are routinely called to manage combative or severely agitated patients. These patients are often having a psychiatric emergency, alcohol intoxication, or have overdosed. They pose a risk of harm to themselves, bystanders, and healthcare workers. Since intravenous (IV) access is difficult to obtain in a combative patient, intramuscular (IM) options are required.

In the 10 ambulance services in Australasia, four use IM midazolam, three use IM droperidol, and three use IM ketamine as the initial sedating drug in these patients. Ketamine has a rapid onset of action, while maintaining airway reflexes and breathing as well as hemodynamic stability. Potential disadvantages of ketamine include excessive salvation, hypertension, laryngospasm, and emergence reactions.

In Victoria Australia, paramedics have been administering 4 mg/kg IM ketamine for severe agitation since 2015. The authors reviewed all prehospital patients treated with IM ketamine. Their catchment area includes 6.1 million people over 227,000 km2. Their treatment protocol includes awaiting the arrival of the police to secure the scene prior to patient contact. Once the patient is physically

restrained, ketamine is administered IM into the lateral thigh. Once the patient is sedated, oxygen is administered and vital signs are taken. The patient is monitored using pulse oximetry. In the event of recurrence of agitation during transport, repeat IM ketamine or IV midazolam is given. Trauma patients requiring ketamine for agitation prior to planned intubation for traumatic brain injury or for pain relief were excluded from the study.

This five-year retrospective study reviews their results and complications. The primary study outcome was the time to adequate sedation, defined as the time from administration of the first IM dose of ketamine to the time when physical restraint of the patient was no longer required. Secondary outcomes measured were adverse events including hypoxia, excessive salvation, requirement for intubation, and emergence phenomena. An emergence reaction was defined as the return of agitation, anxiety, distress, or hallucination. The Richmond Agitation Sedation Scale (RASS) was used to measure the patient's agitation level.

A total of 358 prehospital patients received IM ketamine for severe agitation during the study period. Of these patients, 305 (85.2%) were able to be matched to hospital emergency department records. The median age of the patients was 31 years and most were male (71%). required sedation for A presumed substance-induced episode was the indication in over half (64%) of the patients. A presumed mental health episode accounted for the remainder (36%). Adequate sedation was achieved in 96.9% of cases. The median time from administration to adequate sedation of five minutes. Midazolam IM was given in 23.5% of patients prior to IM ketamine occurred, however there was no significant difference in the time to effective sedation. A total of 12 (3.4%) patients required a second dose of IM ketamine during transport. On arrival to the hospital the median RASS score for all patients was -3 (indicating "moderate sedation").

Adverse events noted during the prehospital phase of care included transient hypoxia in 5% of patients, hyper-salvation in 4.2%, and emergence reactions in 0.8% of patients. Upon arrival to the hospital, hypoxia was noted in 4.3% of patients. Intubation was performed in 45 patients: 2 prehospital, 43 in-hospital. The in-hospital intubation rate varied considerably with one receiving ED intubating over 50% of the patients it received and another intubating none of the sedated patients. This disparity could not be explained. There were no documented cases of hyper- salvation or emergence reactions in the hospital.

Limitations to this study include its retrospective nature. Additionally, the authors were unable to follow-up on all patients who received IM ketamine.

The authors conclude that the prehospital use of 4 mg/kg IM ketamine for sedation of the agitated patient appears safe and effective. They note a rapid onset of action with few side effects. These findings suggest ketamine may be an effective pharmacological agent for managing patients with severe agitation in the prehospital setting.