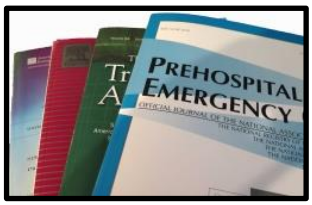
International Prehospital Medicine Institute



IPHMI Literature Review

Keeping You Up To Date with Current EMS Literature and Studies

Vol. 3.6

1. **Randomized Controlled Trial of Point-of-Care Ultrasound Education for the Recognition of Tension Pneumothorax by Paramedics in Prehospital Simulation.** Khalil PA, Merelman A, Riccio J, et al. *Prehosp Disaster Med.* 2021;36(1):74-78.
2. **Success Rate of Endotracheal Intubation Using Inline Stabilization with and without Cervical Hard Collar; a Comparative Study.** Tienpratarn W, Yuksen C, Aramvanitch K, et al. *Arch Acad Emerg Med. 2020; 8(1): e81*. Full text available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7682630/
3. **Use of ketamine for prehospital pain control on the battlefield: A systematic review.** de Rocquigny G, Dubecq C, Martinez T,,et al. *J Trauma Acute Care Surg 2020;88:*180-185.
4. **The Comparison of Manual and Mechanical Chest Compression on Survival and Long-Term Neurological Outcome of Non-traumatic Out-of-Hospital Cardiac Arrest patients.** Halhalli HC, Sanci E, Uslu T. *J Emerg Med* 2020;59:680-686.

1. **Randomized Controlled Trial of Point-of-Care Ultrasound Education for the Recognition of Tension Pneumothorax by Paramedics in Prehospital Simulation.** Khalil PA, Merelman A, Riccio J, et al. *Prehosp Disaster Med.* 2021;36(1):74-78.

Tension pneumothorax (TPTX) is a life-threatening and potentially fatal injury that may be encountered when caring for patients that have experienced significant thoracic trauma. Swiftly obtaining an accurate diagnosis and instituting an appropriate treatment plan can positively impact the patient outcome. The authors of this randomized simulation-based study attempt to determine if paramedics given a short training program in point-of-care ultrasound (POCUS) that was focused on diagnosis of pneumothorax compared to a similar group of practicing paramedics who have not been given the training.

Sixty (60) paramedics were enrolled in the study, thirty (30) in the POCUS trained group and thirty (30) in the control group using a computer-generated randomizer. The POCUS group received a thirty (30) minute lecture on lung and heart POCUS followed by conducting an exam on eleven (11) patients. The control group did not receive training. Following the training both groups took part in two (2) simulations on high-fidelity mannequins. One simulation was comprised of a unilateral TPTX and the other was a patient with undifferentiated shock. The information provided to participants was a "30-year-old male patient in extremis who was intubated by the fire department team prior with no information on the patient's prior medical history. Appropriate tube placement was confirmed by video laryngoscopy. The paramedic assumed care after intubation as the fire department team needed to respond to a fire." Throughout the scenario a siren was played at sixty-five (65) decibels to simulate the noise inside an ambulance during transport. In both simulations the patient remained hypoxic and hypotensive throughout. Both participant groups had access to identical equipment including POCUS.

Ultrasound images were provided if the probe was placed on the correct sticker on the mannequin. The primary endpoint of the study was the correct diagnosis of the TPTX during the scenario.

Seventy-seven (77) % of the paramedics in the POCUS group obtained a correct diagnosis of a TPTX compared to fifty-seven (57) % in the control group. However, the difference was not statistically significant. Interestingly eight (8) paramedics, four from each group who misdiagnosed the TPTX simulated patent, performed a bilateral thoracic decompression.

The authors concluded that "Despite being novice POCUS users, the paramedics were more likely to correctly diagnose TPTX during simulation after a brief POCUS educational intervention. However, this difference was not statistically significant."

The authors listed a limitation of the study as being conducted under indoor well-lit and temperature-controlled conditions "which is often not the case in the prehospital environment". They also comment that performing an ultrasound on a mannequin may be easier than on a live patient. Other aspects of the study that could bias the results include the fact that the POCUS group was trained in the use of US to diagnose TPTX and then inserted into a simulation. A participant could easily conclude that they would be presented with a scenario that represented the training just received. The control group that had no training would not have this potential advantage. In addition, the POCUS group did not actually have to obtain images. They only had to place the probe on the correct location on the mannequin marked by a sticker and then were given the images to interpret.

This study demonstrates that paramedics can interpret an ultrasound image and correctly diagnose tension pneumothorax. It does not, however, confirm the ability to obtain the necessary images on a live patient. Additional research needs to be done to better document the ability of EMS personnel to perform an unguided ultrasound, obtain adequate images (potentially in a moving vehicle), and correctly interpret those images.

2. **Success Rate of Endotracheal Intubation Using Inline Stabilization with and without Cervical Hard Collar; a Comparative Study.** Tienpratarn W, Yuksen C, Aramvanitch K, et al. *Arch Acad Emerg Med. 2020; 8(1): e81*. Full text available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7682630/

Oral endotracheal intubation of the trauma patient who has undergone cervical motion restriction has been a topic of discussion and study for years because of the concern for potentially worsening or creating a spinal cord injury.

The authors of this randomized comparative study attempt to determine if rigid cervical collars impede the success rate of first pass endotracheal intubation as compared to manual stabilization performed by a second rescuer.

A mix of paramedic students with no clinical experience (n= 89) and paramedic students with clinical experience (n=36) participated in the study and were randomized into one of two groups, manual stabilization only or manual stabilization plus rigid cervical collar. The clinically experienced and inexperienced students were equally divided into each group. The participants performed intubation attempts using the same standardized intubation equipment on an intubation head commonly used for airway training.

The authors reported a statistically significant greater success rate in the manually stabilized group vs. manual plus cervical collar group, 96.8% vs 88.7% for 1 to 2 intubation passes. On first pass attempts the results however were 82.5% for manual only vs. 80.6% for manual plus cervical collar. The authors conclude that removal of the cervical collar while maintaining manual inline stabilization could increase intubation success rate.

While the authors point to limitation of mannequin use and possible equipment degradation, there many facets of this study that must be taken into account in this study. The design of the study used paramedic students that have no or limited clinical experience and no real world patient management.

Using experienced field providers would have improved the strength of the data. The authors additionally used an endpoint for intubation success as a positive placement of up to 2 attempts to intubate. Most airway studies look to first pass success as the standard. Had that standard been applied in this study there would have been no statistical difference on the first pass success rate. Lastly, the study did not include any attempt to determine the degree of spine movement that may have occurred with the two techniques

3. **Use of ketamine for prehospital pain control on the battlefield: A systematic review.** de Rocquigny G, Dubecq C, Martinez T,,et al. *J Trauma Acute Care Surg 2020;88:*180-185.

Pain management is an important component of patient care, both on the battlefield and in the civilian environment. Poorly controlled acute pain can be associated with increased mortality and morbidity. Military prehospital providers face the additional challenges of providing care and pain management in austere and dangerous settings such as an active battlefield. Prehospital military analgesics need to combine logistical, medical and strategic qualities. An ideal analgesic would allow injured warriors to remain engaged and contribute to the fight as needed, work safely and quickly with minimal side effects and proven results, have multiple routes for administration, and be supplied in durable packaging

For many years, morphine sulfate has been the drug of choice for battlefield analgesia despite its slow rate of analgesic onset, associated respiratory depression and potential to cause hypotension in a casualty already in hemorrhagic shock. In 2014, the Tactical Casualty Combat Care (TCCC) guidelines were updated to include ketamine for battlefield analgesia. The evidence supporting this change in TCCC guidelines was based on the civilian postoperative and prehospital care use of ketamine as a dissociative analgesic and sedative agent.

The authors of this paper performed a systematic review to evaluate the quality and content of published data regarding military prehospital pain management using ketamine. The literature search was limited to papers on adult patients, published in English, between January 2000 and January 2019. Twenty four articles were identified for full text evaluation, of which, eight observational descriptive studies reported the use of ketamine for analgesia in the combat setting and were included in this review.

Of the 6 studies that included demographic information on patients, the casualty's average age was between 21 and 27 years of age and overwhelmingly male. Most were US coalition military casualties. The mechanism of injury for most patients was explosives (40% to 56%) followed by firearms (29%-41%). Over time, the studies demonstrated an increasing provider eagerness to use ketamine as an alternative to an opioid or as a supplement in conjunction with opioids, as an opioid sparing agent. Only three studies reviewed reported pain assessment prior to, and after, administration of an analgesic agent. Caregivers reported that moving patients, splinting and reducing fractures were easier to accomplish after the sedating effects of ketamine. Four of the studies addressed the potential side effects of ketamine, of which three reported no side effects. The fourth reported muscle movement and hallucinations. Survival rates and intensive care, ventilator and hospital stay days were the same across all analgesic agent groups.

Ketamine has relatively few contraindications. In one study, caregivers reported a trend for using ketamine less for patients exhibiting signs of traumatic brain injury, however elevated intracranial or intraocular pressure is no longer considered a contraindication to the use of ketamine for pain control.

The authors acknowledge several limitations with their paper. Only four of the studies reviewed collected data prospectively. The data in the studies were culled from prehospital documents which are often incomplete during point of injury care and evacuation care, given the combat setting. In addition,

ketamine was often given with other analgesics, making it difficult to assess the effects of each individual agent.

The authors conclude that multiple prospective studies document the safety and efficacy of 50-100 mg intravenous dose of ketamine. They noted that there is room for improvement in adherence to TCCC analgesia guidelines as a significant number of patients received little to no analgesia. Lastly, they suggest further investigation into devices such as autoinjectors to obviate the need for venous cannulation to provide for adequate doses of battlefield analgesia.

4. **The Comparison of Manual and Mechanical Chest Compression on Survival and Long-Term Neurological Outcome of Non-traumatic Out-of-Hospital Cardiac Arrest patients.** Halhalli HC, Sanci E, Uslu T. *J Emerg Med* 2020;59:680-686.

The utility and limitations of mechanical CPR have been debated for many years. Proponents argue that the precision and consistency afforded by mechanical CPR if important to improve survival and neurologic outcome while detractors describe the time needed to set the device up and the problems associated with improper or un-monitored use.

In this retrospective study, the authors compared the success rates and favorable outcomes of mechanical CPR using the LUCAS^{TM} device to manual CPR. The study took place in the Emergency Department (ED) of an academic center that sees 400,000 patients annually. Charts of patients that were brought to the emergency department from July 1, 2014 to July 1, 2018 were reviewed. Inclusion criteria included: patients 18 years of age or older with out of hospital cardiac arrest patients that received CPR by prehospital care personnel or bystanders. Patients with terminal disease, traumatic arrests, and patients younger than 18 years of age were excluded. The EMS system utilizes a "scoop and run" approach to these patients and performs manual CPR. On arrival at the hospital, mechanical or manual CPR was initiated based on the physician's preference, experience and the availability of the device. Outcome was classified based on whether or not return of spontaneous circulation was achieved, and survival at 24 hours and at 1, 3, 6, and 12 months.

Over the 48 months of the study period, 1095 patients were brought to the ED with out of hospital cardiac arrest. Of these, 223 patients were excluded. Of the remaining patients, 818 met inclusion criteria with 345 patients getting manual CPR (median age 71 years) and 473 getting mechanical CPR (median age 70 years).

Return of spontaneous circulation (ROSC) was achieved in 360 (44%) patients (160 manual and 200 mechanical), which was not statistically different. There was also no significant difference between mechanical and manual CPR in survival rates at 24 hours, 1 month, 3 months and 6 months although the survival with mechanical CPR was slightly higher. There was no difference in the percent of patients who survived with a favorable neurological status.

The authors described the limitations of their study that included a number of prehospital factors that went unmeasured such as time between EMS activation and arrival at the scene, duration of basic or advanced life support care given, cardiac rhythm upon arrival, end-tidal carbon dioxide values, quality of CPR, and patient comorbidities. The decision to apply one or the other type of CPR was left to the discretion of the treating physician which can introduce bias into the patient selection.

This study failed to show that one method of CPR was superior to the other in terms of patient outcome. It appears that the primary advantages of a mechanical device for CPR are that it can deliver uniform, measurable compressions and has the benefit of freeing up personnel for other functions required for the care of these critical patients, particularly in the out-of-hospital setting.