

International Prehospital Medicine Institute



IPHMI Literature Review

Keeping You Up To Date with Current EMS Literature and Studies

Vol. 1.8

1. **Avoid the Goose! Paramedic Identification of Esophageal Intubation by Ultrasound.** Lema P, O'Brien M, Wilson J, et al. *Prehosp Disaster Med.* 2018;33(4):406–410.
2. **Civilian Prehospital Tourniquet Use Is Associated with Improved Survival in Patients with Peripheral Vascular Injury.** Teixeira PGR, Brown CVR, Emigh B, et al. *J Am Coll Surg* 2018;226:769-776.
3. **Comparison of The Force Required For Dislodgement Between Secured And Unsecured Airways.** Davenport, C, Martin-Gil, C, Wang, H, Mayrose, J, and Carlson, J. *Prehosp Emerg Care.* 2018;22:778-781.
4. **A Descriptive Analysis of Tactical Casualty Care Interventions Performed by Law Enforcement Personnel in the State of Wisconsin, 2010-2015.** Stiles CM, Cook C, Sztajnkrzyer MD. *Prehosp Disaster Med* 2017;32:1-5.
5. **A Qualitative Study of Paramedic Duty to Treat During Disaster Response.** Smith E, Burkle F. Jr, Gebbie K, et al. *Disaster Med Public Health Preparedness* 2018 Published on-line, <https://doi.org/10.1017/dmp.2018.15>

1. **Avoid the Goose! Paramedic Identification of Esophageal Intubation by Ultrasound.** Lema P, O'Brien M, Wilson J, et al. *Prehosp Disaster Med.* 2018;33(4):406–410.

Unrecognized esophageal intubation by EMS field providers remains problematic. While continuous waveform capnography is the “Gold Standard”, the authors examine the use of point-of care ultrasound (POCUS) as a tool to identify location of endotracheal tubes placed by field paramedic personnel.

This prospective observational study took place between March 2014 and December 2015 using local paramedics volunteers with various demographics and years of experience. The end point of the study was correct identification of the randomly placed (trachea vs. esophagus) endotracheal tube on fresh cadaver models utilizing POCUS. Each of the fifty-eight (58) subjects were enrolled into one (1) of twelve (12) study sessions that was comprised of lecture and practical training session conducted by fellowship trained ultrasound emergency physicians. Separate cadavers were used for training and final study sessions.

A total of 228 intubations occurred during the study period. Of those, 113 were pre-placed in the trachea and 115 in the esophagus by the investigators with verification of placement by a second investigator. Paramedics were able to identify tube location in 158 (69.3%) by utilization of POCUS. The mean time to make an identification was 44.9 seconds. Of note, esophageal intubations were identified 9.47 seconds faster than tracheal intubations. When the study participants were allowed to manipulate

International Prehospital Medicine Institute

the tube during the US procedure they were able to increase successful identification to 85.0%. When the results were dissected for demographics and paramedic experience, no difference in performance was found across all groups of novice ultrasound users.

The stated goal for the study was to assess paramedic ability to confirm correct ETT placement and inadvertent esophageal placement. The study shows that paramedic study participants can correctly identify placement of the ETT using POCUS when manipulation is performed 85% of the time. While the authors recognize that waveform capnography is the current gold standard for confirming correct ETT placement in the trachea, they comment that there are limitations of EtCO₂ monitoring: specifically that the availability of wave form capnography in the prehospital setting is low and that diminished pulmonary blood flow during cardiac arrest and the need for ventilation compromise its utility.

While this paper was published in 2018, it is important to note that the availability of EtCO₂ monitoring equipment has increased since the start of the study in 2014. Most medical directors and State EMS offices have mandated the use of these devices, which has made EtCO₂ monitoring equipment available on most if not all units that perform ETT intubation. Further concern is the average time to perform the US exam at 44.9 seconds. This was a “laboratory” study where everything needed to perform the POCUS evaluation was readily at hand. Whether or not the 45 second time frame will hold true in actual field settings remains to be determined.

Pre-hospital use of POCUS to identify ETT location is limited. While this study shows that paramedics can be trained to identify ETT position using POCUS, it leaves many questions as to its efficacy over EtCO₂ monitoring. Is the increased time to perform the exam warranted? Skill degradation needs to be studied and re-training intervals established. Would the subset of patients that EtCO₂ monitoring would not identify be worth the investment in ultrasound technology?

2. Civilian Prehospital Tourniquet Use Is Associated with Improved Survival in Patients with Peripheral Vascular Injury. Teixeira PGR, Brown CVR, Emigh B, et al. J Am Coll Surg 2018;226:769-776.

Evidence of tourniquet use for hemorrhage control dates back several centuries and has been proven to reduce mortality in the modern combat setting. However, data demonstrating a survival benefit secondary to civilian tourniquet use is still lacking. This study was based on the hypotheses that civilian use of the tourniquet improves mortality in patients who sustained peripheral vascular injuries.

A multicenter retrospective review was conducted of all patients who sustained peripheral vascular injuries and were admitted to 11 Level I Texas trauma centers during a 6-year time period (ending December 2016). During this time period 1,026 patients were admitted with peripheral vascular injuries. The patients were then divided into two groups; patients who had a tourniquet placed prior to admission and patients admitted without a tourniquet. Multiple variables were analyzed to ensure equal comparison among both groups.

Of the 1,026 patients reviewed, 181 (17.6%) patients had a tourniquet applied prior to arrival at the trauma center. Average time a tourniquet was in place averaged 77.3 minutes (39.0 to 92.3 minutes). The unadjusted mortality in the patient group admitted with a tourniquet in place was 3.9% whereas the mortality rate in the group without a tourniquet was 5.2%. After conducting multivariable analysis to control for age, gender, other injuries, and traumatic amputation, the prehospital application of tourniquets was independently associated with survival. Traumatic amputations occurred in 98 patients with 35 of the 98 (35.7%) amputations having had a tourniquet placed in the field. Mortality for patients with a traumatic amputation was 2.9% if a tourniquet was applied versus 7.9% without one. Patients in the non-tourniquet group had a significantly lower rate of thromboembolic complications (3.4%)

International Prehospital Medicine Institute

compared to the tourniquet group (7.2%). No significant differences were found in other comparisons between the two groups (e.g. length of hospital stay, pulmonary, cardiac or systemic complications).

Some limitations were identified in the study. Because of the retrospective design patients could not be assessed for specific tourniquet complications such as nerve palsy and compartment syndrome. Another limitation was the lack of information about the use of other prehospital hemostatic adjuncts and interventions such as hemostatic bandages and tranexamic acid.

The application and utilization of tourniquets for hemorrhage control in patients with peripheral vascular injuries in the civilian prehospital remains an underused intervention. Multiple studies, both in military and civilian operations, have proved the mortality benefits of tourniquets to control hemorrhage. Tourniquets are safe to use if applied correctly and should be readily available for both medical and non-medical personnel. Hemorrhage control kits should be as readily available for public use as are AEDs.

3. Comparison of The Force Required For Dislodgement Between Secured And Unsecured Airways.

Davenport, C, Martin-Gil, C, Wang, H, Mayrose, J, and Carlson, J. *Prehosp Emerg Care*. 2018;22:778-781.

Airway device placement is a crucial prehospital skill. Once a device is confirmed in place, it is paramount that it stays in place, as providers often have limited opportunities for successful airway management. In addition to the traditional endotracheal tube (ETT), more and more prehospital agencies are using supra-glottic devices for airway management. This study evaluates the force needed to dislodge correctly placed airway devices when using manufacturers recommend securing methods versus when they are unsecured.

This study utilized 4 common prehospital airway devices (endotracheal tube [ETT], laryngeal mask airway [LMA], King laryngeal tube [King] and iGel) to compare the force required to dislodge the airway from 5 different mannequins with and without a retention device. After spraying with a saliva substitute, the airways were placed in mannequins, correct placement was confirmed and, where appropriate, cuffs inflated per manufacturer recommendations. A digital force measuring device was attached to the distal end of each airway and pulled vertically and perpendicular to the mannequin until the airway device was dislodged, defined as at least 4 cm of movement of the airway device.

The authors determined that for the various supraglottic devices tested, it takes almost twice the dislodgement force (median force for dislodgement in pounds [interquartile range]) to move a secured airway versus an unsecured airway (King 21.7 secured VS 10.6 unsecured, LMA 16.6 secured VS 8.4 unsecured and iGel 8 secured VS 3.9 unsecured) and almost three times the force to dislodge the ETT (ETT 13.3 secured VS 4.5 unsecured). The King LT was the most resistant to dislodgement compared to the other airway devices in the study.

While the results of this study probably come as no surprise, it demonstrates the importance of securing all airway devices, including supra-glottic, in the pre-hospital setting and the relative ease with which an unsecured device may be dislodged, potentially leading to a patient care airway catastrophe.

4. A Descriptive Analysis of Tactical Casualty Care Interventions Performed by Law Enforcement Personnel in the State of Wisconsin, 2010-2015. Stiles CM, Cook C, Sztajnkrzyer MD. *Prehosp Disaster Med* 2017;32:1-5.

Tactical casualty care training programs have grown in popularity and importance over the last decade. While there are several different courses being offered based on the level of medical expertise of the intended audience, they all follow the guidelines originally described in the Tactical Combat

International Prehospital Medicine Institute

Casualty Care (TCCC) curriculum and are updated regularly. While there have been studies that looked at the effectiveness of the training in preparing providers to perform assessments and skills, this study looked at the effectiveness of the interventions on patients treated by law enforcement.

This study was a descriptive analysis of a convenience sample of cases managed by police officers trained in TCCC after the provision of successful patient care, between January 2010 and December 2015. Fifty-six episodes of care were reported by 19 agencies with four cases involving injured police officers (7.1%) with the other 52 or 92.9% involving civilians or suspects.

Forty-five (82.1%) of the patients sustained extremity injuries with forty-two receiving tourniquets and 15 hemostatic dressings. Seven patients had improvised tourniquets, of which, only one was effective. Chest seals were used in 7 patients, one of whom developed signs of a tension pneumothorax following placement of an unvented seal.

The authors reported several limitations to their study. First, because it is a convenience sample of patients, voluntarily reported, it is biased towards agencies that are aggressive and invested in this training. Secondly, the study specifically evaluated “saves” and the captured cases therefore have a positive outcome bias. It is possible/probable that negative outcomes were not reported. This study would also have missed cases where skills could have been but were not applied. Lastly, the information submitted was a summary statement and not detailed patient reports.

The authors concluded that their study demonstrates the lifesaving potential for trained and properly equipped law enforcement personnel. Whether there was a single or multiple victims, the TCCC skills were effective in caring for trauma patients.

While this study points to the potential lifesaving capabilities of well equipped, trained responders, it is rather limited in scope. It included only patients that were voluntarily reported and perceived to have a positive outcome after the interventions provided. The TCCC guidelines and interventions have clearly been shown to improve trauma patient outcome in the military combat setting. While we believe that the same benefit will be seen, in order to truly review the effect and value of these interventions on civilian trauma victim outcomes, a large prospective study is needed.

5. A Qualitative Study of Paramedic Duty to Treat During Disaster Response. Smith E, Burkle F. Jr, Gebbie K, et al. *Disaster Med Public Health Preparedness* 2018 Published on-line, <https://doi.org/10.1017/dmp.2018.15>

Disaster responses can place what may be overwhelming demands on emergency response personnel and, depending on the nature of the incident, can test personal commitment as a healthcare responder. Guidelines and Codes of Ethics are largely silent on this issue providing little to no guidance as to what is expected of EMS providers regarding how they should approach their duty to treat in the face of risk. This study explored how paramedics in Australia viewed their duty to treat during disasters.

The authors employed qualitative methods to gather perspectives from 44 Australian paramedics, age range 21 to 57 years, from five different states through seven non-compensated focus groups. Seventy-nine per cent of the participants were male and the remainder female. Of the 44 participants, 82% had more than 10 years of experience working as a paramedic.

Responses from the study participants to the question of what they thought of the concept of duty to treat during a disaster and their obligations in that regard varied widely. A few of the participants felt there was a clear duty to respond and treat while most felt their duty to act cannot be considered an absolute obligation. All participants felt that the decisions about their own safety and willingness to work during disasters was an individual choice. Some participants expressed conflict between their duty to respond as a healthcare provider versus their duty to their family. All participants expressed their belief that the ambulance service has an obligation to provide education, resources, and support for EMS providers in preparation for and during a disaster response as well as identifying and understanding

International Prehospital Medicine Institute

risks based on the disaster or epidemic. Participants felt that education regarding duty to treat and appropriate equipment use (e.g. PPE) during a disaster must start with entry level programs and continue for experienced providers through continuing education programs.

Limitations identified in the study included that the comments came from a small group of paramedics, most of whom were male with 10 years or more of experience working as a paramedic. The study did not address moral or legal aspects that may influence a paramedic's decision to respond.

This study's findings were consistent with existing literature suggesting there is a lack of clarity and consensus of what is expected of healthcare workers during disaster or epidemic response. Prior surveys of hospital-based healthcare providers, including physicians, revealed that, depending on the nature of the incident, between 7% and 77% would not report for work. A majority of the study participants express beliefs that they do not have an unlimited duty to treat even though they recognize a professional obligation, to what extent was unclear. Ideally, evidence-based education should be developed and provided for all healthcare workers that better defines risks, protection resources, and limitations for disaster or epidemic responses as well as other responses that involve personal risks. This study was limited to moral and ethical discussions and decisions, legal responsibilities were not addressed. While this study was conducted with paramedics in Australia, it is likely that the results would be similar in other countries. Ultimately, the decision by EMS providers regarding professional obligations involving duty to treat will largely depend on their individual risk assessment, perception of risk, and their personal value system.