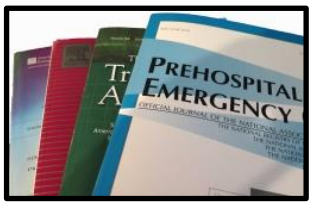
International Prehospital Medicine Institute



IPHMI Literature Review

Keeping You Up To Date with Current EMS Literature and Studies

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2. **Commercial and Improvised Pelvic Compression Devices. Applied Force and Implications for Hemorrhage Control.** Bailey R, Simon E, Kreiner A, et al. *J Spec Operations Med*. 2021;21:44-48.
3. **Comparison of the iGel Versus Cricothyrotomy by Combat Medics Using a Synthetic Cadaver Model.** Schauer SG, April MD, Fairley R, et al. *J Spec Operations Med.* 2020;20:68-72.
4. **Prehospital Needle Decompression Improves Clinical Outcomes in Helicopter Evacuation Patients With Multisystem Trauma: A Multicenter Study.** Henry R, Ghafil C ; Golden A, et al. J Spec Operations Med. 2021;21:49.54.

1. Prehospital Blood Product and Crystalloid Resuscitation in the Severely Injured Patient. Guyette FX, Sperry JL, Peitzman AB, et al. *Ann Surg.* 2021;273:358-364.

Resuscitation of the severely injured trauma patient involves minimizing crystalloid volume while transfusing packed red blood cells (PRBC), plasma, and platelets, or even whole blood. In most cases, this is done upon arrival to the hospital, although several EMS services have now begun the practice. The Prehospital Air Medical Plasma (PAMPer) trial has been described in the previous literature review. The authors of the trial demonstrated plasma administration in the prehospital aeromedical setting reduced 30-day mortality of severely injured patients at risk for hemorrhagic shock by 10% compared to patients receiving standard resuscitation. This study is a secondary analysis of the patients enrolled in the PAMPer trial. The authors sought to determine whether prehospital blood product resuscitation reduced 30-day mortality in patients at risk for hemorrhagic shock compared to those who received crystalloid resuscitation alone.

The PAMPer trial was a multicenter randomized trial of patients at risk for hemorrhagic shock who were transported by helicopter EMS (HEMS). There were nine trauma center sites with 27 HEMS bases participating in the trial. Eligible patients received either standard care resuscitation based on local protocols or 2 units of thawed plasma. Some HEMS bases also transfused up to 2 units of type O-PRBC as part of their local protocol. Four prehospital resuscitation groups were studied: crystalloid only; PRBC; plasma; and PRBC+plasma. The primary outcome was 30 day mortality.

A total of 407 patients were included in the trial population. There were 139 (34%) patients who received only crystalloid, 83 (20%) who received PRBC, 147 (36%) who received plasma, and 38 (10%) received PRBC+plasma. There was a significant reduction in 30- day mortality per unit of prehospital PRBC (32%) and per unit of plasma transfused (43%). The greatest survival benefit was found in patients who received PRBC+ plasma (62% reduction). In patients who received a prehospital blood product, each liter of crystalloid was associated with a 65% increase in the hazards of 30- day mortality. However,

among patients who received crystalloid only, the volume of crystalloid was not associated with 30- day mortality.

The results of this study demonstrate that any blood product resuscitation was associated with lower mortality than crystalloid resuscitation alone. PRBC and plasma transfusion alone have similar improvements in mortality. PRBC plus plasma had the greatest reduction in mortality. There was also a dose-response noted, meaning survival increased with each unit of PRBC or plasma administered in the prehospital setting. Among patients who met criteria for blood product transfusion, crystalloid increased mortality in a dose-response manner.

Limitations of this study should be noted. Although this was a multicenter randomized trial, this study is a secondary observational analysis of the previously obtained data. While all groups did receive some crystalloid, the increase in mortality associated with crystalloid use could be due to higher volume requirements from critical illness. The patients in this study population were transported via helicopter to a trauma center, so the results may not be applicable to other clinical situations.

In conclusion, patients in this trial of prehospital HEMS trauma patients at risk for hemorrhage had a mortality improvement if they received PRBC+plasma, with an improvement noted with each unit given. Transfusion of either PRBC or plasma alone also improve mortality but to a lesser extent. Crystalloid administration was not helpful and potentially harmful.

2. Commercial and Improvised Pelvic Compression Devices. Applied Force and Implications for Hemorrhage Control. Bailey R, Simon E, Kreiner A, et al. *J Spec Operations Med*. 2021;21:44-48.

It is estimated that annually, approximately 120,000 civilians experience pelvic ring injuries in car crashes and falls with historical mortality rates of around 54%. In the military, blast injuries are the most common cause of pelvic fractures and data from Iraqi and Enduring Freedom Operations report a 48% mortality rate from anterior compression injuries.

The Tactical Combat Casualty Care (TCCC) guidelines call for "application of a pelvic compression device to all patients who experience severe blast or blunt traumatic injury and exhibit one or more of the following: pelvic pain, unconsciousness, shock, major lower extremity amputation or near amputation, or examination results suggestive of pelvic injury". In the civilian setting, the guidelines for Tactical Emergency Casualty Care (TECC) also recommend the application of pelvic binders for trauma patients with a mechanism of injury consistent with a possible pelvis fracture and hemodynamic instability.

While a number of different commercial devices are available, mass casualty and austere environments the demand can exceed the availability of these devices. In these situations, medical providers have used improvised devices when commercial devices are not available.

The authors sought to compare the compressive forces applied by improvised devices with commercial devices. To measure the force required they used commercially available force assessment devices that were approved by the FDA. The study group included 13 male and 17 female volunteers.

Pelvic compression devices were applied to the greater trochanters of each of the volunteers and data were collected over a 3 minute interval. The commercial and improvised devices evaluated were: the Sam Pelvic Sling II, a SAM Splint with combat application tourniquet (CAT) (researchers connected two tourniquets together using the buckle and taped the double tourniquet to the splint), a Sam Splint and cravat (researchers created keyholes in the splint and passed the cravat through them to wrap and secure the splint around the greater trochanters), cravats alone (two cravats joined together) and a military belt.

Their hypothesis was that the SAM Pelvic Sling would apply greater force to the pelvis than any of the improvised devices and therefore was used for comparison purposes. Surprisingly, the SAM Splint with the CAT tourniquets applied the greatest force but the difference between it and the SAM Pelvic

Sling was not statistically different. Similarly, the cravats also did not differ statistically with the force applied by the SAM Pelvic Sling. The belt applied significantly less force than the SAM Pelvic Sling as did the combination SAM Splint with the cravats.

The limitations of this study include the fact that these were healthy volunteers and not patients with suspected pelvic injuries. Pain from pelvic compression was not assessed in the volunteers.

While the SAM Pelvic Sling may be a standard commercial device for the management of unstable pelvis fractures, in situations where it is not available, the ability to use improvised devices may be vital. This study suggests that the SAM Splint with the CAT attached as well as two cravats tied together perform as well as the SAM pelvic sling and could be an option when time and tactics permit and commercially manufactured devices are not available.

3. Comparison of the iGel Versus Cricothyrotomy by Combat Medics Using a Synthetic Cadaver Model. Schauer SG, April MD, Fairley R, et al. *J Spec Operations Med.* 2020;20:68-72.

For almost two decades, the US Military's Tactical Combat Casualty Care (TCCC) course taught cricothyrotomy as the definitive treatment for airway obstruction, the second leading cause of death on the battlefield, if patient positioning or nasopharyngeal airway placement are unsuccessful in relieving the obstruction. In the 2019 TCCC standards, the iGel supraglottic airway was added as an intermediary stage in airway control between nasopharyngeal airways and cricothyrotomy.

Cricothyrotomy is recognized as being technically challenging and anxiety provoking with a high risk of complications. The authors set out to determine if combat medics would have a higher first pass success rate using the iGel supraglottic airway than performing a cricothyrotomy as well as the time required for successful completion of each skill. The test medium was synthetic cadaver models.

Combat medics (68W's) were selected from various areas at Fort Sam Houston in Texas. Medics were briefed on this US Army Institute of Surgical Research IRB waived study. Participants viewed a manufacturer's video on proper iGel placement technique, as this was a new skill. None of the participants had experience with the iGel during their initial medical training, nor were they allowed to practice with the device prior to use in the study. No instruction was provided for cricothyrotomy as this was a previously taught and tested technique. Medics were allowed to use the equipment and technique of their choice for cricothyrotomy. Sixty-eight participants volunteered for the study. Five of those failed to complete the required paperwork leaving 63 for inclusion in the final results. Participants had an average age of 32 years and 50% had previous deployment experience. Fifteen had attempted, or performed, a cricothyrotomy on an actual casualty. This study utilized synthetic cadaver models (mannequins) for the procedures. For both procedures, correct tube placement was confirmed either by board certified emergency physicians or certified registered nurse anesthetists.

For testing, the iGel was placed next to the mannequin and timing was initiated when the participant indicated he or she was beginning. An attempt was defined as inserting the iGel fully into the mannequin's oral cavity. Timing stopped when the participant indicated they were satisfied with the device's placement.

An assortment of equipment was provided at each mannequin for cricothyrotomy, including a bougie. Participants were allowed to set up the equipment per their personal preference. Again, participants indicated when they were beginning the procedure. A cricothyrotomy attempt was defined as an insertion of a tube into the mannequin. Timing stopped when the participant indicated they were satisfied with the placement of the cricothyrotomy tube.

First pass success rate for the iGel versus cricothyrotomy was the same (68.2% vs. 69.8% respectively). Overall successful placement was also not statistically different (73% for the iGel versus 82.5% for cricothyrotomy, P=0.2). However, there was a much faster time to successful placement with

the iGel (21.8 seconds vs. 63.8 seconds, P<0.001)). Fifty-nine percent of the participants reported preferring the iGel over cricothyrotomy.

This study was limited by the fact that a mannequin was used for both the iGel placement and cricothyrotomy. Over time and with repeated use, the anatomy becomes somewhat distorted. The study was performed in a well-lit, controlled setting which does not resemble the actual operational environment. Lastly, the iGel was a completely new device to the participating medics and they did not receive any refresher training on cricothyrotomy.

Given the fact that the participants received no prior hands on training with the iGel and were not allowed to practice with the device, yet obtained equal first pass success rates as the practiced cricothyrotomy procedure in a consistently shorter amount of time, the iGel would appear to be a good option to relieve an obstructed airway before resorting to an invasive surgical procedure. For patients whose airways cannot be maintained by positioning and placement of a nasopharyngeal airway, the iGel can be inserted quickly and effectively. For patients who cannot tolerate the iGel or in whom the iGel cannot be successfully placed, cricothyrotomy remains the tertiary airway in TCCC.

4. **Prehospital Needle Decompression Improves Clinical Outcomes in Helicopter Evacuation Patients With Multisystem Trauma: A Multicenter Study.** Henry R, Ghafil C; Golden A, et al. J Spec Operations Med. 2021;21:49-54.

Needle decompression (ND) for the treatment of suspected tension pneumothorax has been available to prehospital providers for well over three decades. However, its application has waxed and waned and in recent years the efficacy of the procedure has come into question. Studies performed by the US military have shown that in the combat theater, tension pneumothorax is the second leading cause of preventable death, after uncontrolled bleeding.

The purpose of this retrospective study was to determine the efficacy of ND in traumatic situation in a civilian aeromedical setting. Data from one aeromedical service with multiple base locations that served seventy-nine (79) trauma centers in 12 states was reviewed and abstracted. From January 2011 to November 2011 a total of one-hundred-forty-three (143) patients received ND with one hundred seventy-two (172) attempts. Nearly 75% of the patients were male with a mean age of 44 years of age. Blunt trauma was the predominate cause of the injuries in 89% of the patients. Eighty-three percent of the patients that had ND performed demonstrated absent of diminish breath sounds, with 61% demonstrating low O2 saturation (below 90%) and 45% presenting with hemodynamic instability. Eighty percent (80%) of the placements were deemed successful based upon clinical improvement with no statistical difference between training of the provider (flight nurse vs. paramedic). Upon decompression, providers noted that in eighty (80) percent of the patients a rush of air and or blood was observed. Seventy-one (71) percent demonstrated an improvement in oxygenation. Seventeen (17) percent were observed to have an improvement in hemodynamics.

This study demonstrates that ND of suspected tension pneumothorax improved the clinical condition of the patient. This was best demonstrated by an increase in O2 saturation post ND. Surprisingly, improvement of hemodynamic instability was only demonstrated in seventeen (17) percent of the patients during the study period.

The authors point to study limitations with the primary being the retrospective study design. Other limitations included the lack of consistent clinical indications or protocols for ND across the many operating areas. The study also did not address complication rates from the procedure or report patient outcome.

This retrospective chart review demonstrated that ND appears to be a safe procedure for improving the respiratory status of trauma patients from suspected tension pneumothorax in the prehospital aeromedical setting. However, the classic indications for needle decompression for suspected tension

pneumothorax, such as hemodynamic compromise, were present in fewer than half the patients. The finding of diminished breath sounds, which was the primary reason for performing ND, does not, by itself, indicate the presence of a tension pneumothorax, although the risk of converting a simple pneumothorax into a tension pneumothorax is an important consideration when taking a patient to a higher altitude in an unpressurized aircraft. Further studies using more rigorous criteria for the clinical diagnosis of tension pneumothorax should be performed and should include outcome data that may support a positive survival benefit from this procedure.