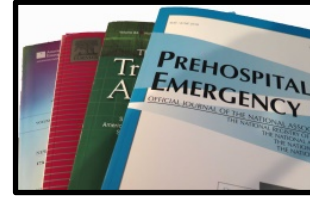


# **International Prehospital Medicine Institute**



## **IPHMI Literature Review**

Keeping You Up To Date with Current EMS Literature and Studies

### **Vol. 2.2**

1. **Prehospital Blood Product and Crystalloid Resuscitation in the Severely Injured Patient: A Secondary Analysis of the Prehospital Air Medical Plasma Trial.** Guyette FX, Sperry JL, Peitzman AB, et al. *Ann Surg.* 2019 Apr 13. doi: 10.1097/SLA.0000000000003324. [Epub ahead of print]
  2. **Randomized Comparative Assessment of Three Surgical Cricothyrotomy Devices on Airway Mannequins.** Dorsam J, Cornelius S, McLean J, et al. *Prehospital Emergency Care*, 2019;23; 411-419.
  3. **Emergency medical services oxygen equipment: a fomite for transmission of MRSA?** Gibson, CV. *Emerg Med J* 2019;36. doi:10.1136/emmermed-2018-207758 [Epub ahead of print. Dec 1, 2018]
  4. **A Systematic Review and Meta-analysis of Ketamine as an Alternative to Opioids for Acute Pain in the Emergency Department.** Karlow,N, Schlaepfer,C, Stoll,C, Doering,M, Carpenter,C, Colditz,G, et al *Acad Emerg Med* doi: 10.1111/acem.13502, 2018;25: 1086-1097
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Uncontrolled hemorrhage is the number one cause of preventable death in both the civilian and military trauma settings. Trauma centers have adopted the principles of damage control resuscitation, which includes minimizing crystalloid infusion while transfusing packed red blood cells (PRBC), plasma, and platelets. Additionally some centers have begun using whole blood in lieu of component therapy. These techniques are just beginning to be utilized in some prehospital systems.

Prehospital blood products (defined as PRBC, plasma, or both) are becoming more available in civilian helicopter EMS systems. Recently, the large PAMPer (Prehospital Air Medical Plasma) trial demonstrated an improvement in 30-day mortality for severely injured patient at risk for hemorrhagic shock who underwent prehospital plasma resuscitation. The investigators noted a 10% improvement in survival in patients who received plasma compared to standard crystalloid resuscitation. This study is a secondary analysis of their data looking specifically at which combination of prehospital fluid has the highest impact on survival.

The authors examined four possible resuscitation strategies. The options for resuscitation were crystalloid only, PRBC, plasma, and plasma with PRBCs (PRBC + plasma). All blood components were administered with or without additional crystalloid. Patients were eligible if they were transported by

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helicopter EMS to a PAMPer network trauma center, had hypotension (SBP 70-90 mmHg) and tachycardia (HR > 108 bpm), or severe hypotension (SBP < 70 mmHg) alone.

A total of 407 patients were enrolled in the study. There were 139 (34%) patients who received crystalloid only, 83 (20%) who received PRBC, 147 (36%) received plasma, and 38 (10%) received PRBC + plasma. The results demonstrated that all prehospital blood product groups had a significantly lower 30-day mortality than those who received crystalloid only resuscitation. The PRBC + plasma group had the greatest survival benefit with a 62% reduction in the risk of mortality. This was followed by the plasma group with a 43% reduction in the risk of mortality and the PRBC group with a 32% reduction in the risk of mortality.

This study confirms that any blood product resuscitation is superior to crystalloid resuscitation in terms of 30-day mortality. The greatest benefit was shown in those patients who received PRBC + plasma. Patients with findings of shock should receive prehospital blood products whenever possible. If both PRBC and plasma are available, patient should receive both. Crystalloid alone appears to be inferior to blood product administration. Additionally, the use of whole blood transfusion in the prehospital setting has gained traction and may be the superior option to component therapy. Further studies are required to explore this possibility further with expansion of blood and blood product administration from the helicopter EMS programs to ground-based EMS response systems.

### **2. Randomized Comparative Assessment of Three Surgical Cricothyrotomy Devices on Airway**

**Mannequins.** Dorsam J, Cornelius S, McLean J, et al. Prehospital Emergency Care, 2019;23; 411-419.

The ability to effectively manage an airway is a critical skill in prehospital care. Few alternatives are left for a prehospital provider in the “Can’t Ventilate, Can’t Oxygenate” scenario other than Surgical Cricothyrotomy (SC). Military providers know that airway obstruction is the second leading cause of preventable death on the battlefield. Tactical Combat Casualty Care (TCCC) teaches SC as a way to ventilate and oxygenate a casualty when less aggressive airway maneuvers fail. While taught and practiced in TCCC classes, SC failure rates (18%) are unacceptably high in field use with critical patients.

Current TCCC guidelines recommend the Control-Cric Kit (CC) which uses the Crik-Key combined knife and hook to access and stabilize the tracheal lumen for stylet pre-loaded tube placement as the preferred choice. The Tactical CricKit (TCK) is commonly taught in TCCC classes. It uses a hook to open the surgical gap in the cricoid cartilage after dissecting to it with a surgical blade. The tracheal tube is then inserted through the gap with an obturator. Lastly, the Bougie-Assisted Technique (BAT) can be used to first access the exposed tracheal lumen with an Introducer Adult Bougie and then inserting a tracheal tube over the Bougie.

Dorsam et al studied 25 naval corpsmen in a laboratory setting as they performed SC on new airway mannikins using each of the previously described equipment and procedures. The corpsmen volunteers all received TCCC equivalent training and practice on the equipment, procedures and mannikins to be used in the study. Their prior experience in SC varied with one-third of participants having no prior experience with the procedure and only one having performed a cricothyrotomy on a live human. The study looked at the time required for the procedure from first touching the equipment to successful placement of the tracheal tube (manual ventilation verified by auscultation of breath sounds). A user survey of preferences for effectiveness, ease of use and reliability of the SC equipment was performed after completion of the study. Additionally, participants were given the opportunity to answer open ended questions regarding suggestions for improvement on the equipment and their thoughts on the study design.

Successful placement was achieved 76% of the time using the BAT, 40% with the TCK and 48% using the CC. For time of incision to successful ventilation, TCK was the fastest (74-120 sec), BAT was second

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(103 – 146 sec) and CC the slowest (135 – 213 sec). Prior SC experience was predictive of faster times. Participants rated TCK and BAT favorably for use, effectiveness and reliability. CC scores were all consistently lower.

Participant evaluations of the trainings were 88% positive agreeing that “This educational opportunity was useful”. For the question, “If you could choose one kit which would it be?”, zero (0%) chose the CC. The TCK was favored at 58% followed by BAT at 42%. It is worth noting that the SC equipment with the fastest insertion times and was most favored by the study participants (TCK) had the least successful placement rate at only 40%. It is possible that familiarity, prior experience with the TCK during previous TCCC training, and the fact that it is commonly found in field aid bags made it a favorite amongst participants.

This study demonstrates a number of important issues that every EMS agency must consider if cricothyrotomy is included as an authorized airway management procedure:

1. The importance of rigorous and on-going education and practice with this invasive, potentially life-saving technique;
2. Without on-going practice and familiarity with the equipment, the failure rate is extremely high;
3. The existing products for performing cricothyrotomy are inadequate and require significant improvement.

### **3. Emergency medical services oxygen equipment: a fomite for transmission of MRSA? Gibson CV. Emerg Med J 2019;36. doi:10.1136/emered-2018-207758 [Epub ahead of print. Dec 1, 2018]**

Every day in Emergency Medical Systems (EMS) around the world, oxygen is administered to patients who are in extremis from a variety of situations ranging from moderate trauma to cardiac arrest and everything in-between. Oxygen therapy has been one of the cornerstone treatments by EMS providers since the early days of emergency response and continues to this day. This observational study looks not at the benefits or lack thereof of oxygen administration, but rather at the possible widespread contamination of the oxygen equipment used in its delivery.

The author of this study examined the surface of all onboard oxygen cylinders in a small ambulance service (9 ambulances) in the state of Alabama in the USA for the presence of methicillin-resistant *Staphylococcus aureus* (MRSA). Prehospital personnel routinely decontaminate equipment and other surfaces that come into direct contact with the patient or bodily fluids; however that typically does not include oxygen tanks and regulators. Each ambulance in this study was equipped with two portable oxygen cylinders for use at the patient’s side when tending to patients outside of the ambulance compartment. Samples were obtained from 9 cylinders used in ambulances. Further samples were taken from other surfaces in the patient care compartment and included other portable equipment and supplies. Of the oxygen cylinders tested, 100% were positive for methicillin-resistant *Staphylococcus aureus* (MRSA). The author compared this to other portable equipment in the ambulance and none grew MRSA. The only area in the back compartment of the ambulance that revealed the presence of MRSA was the floors of the patient compartment. The authors then cultured seventy (70) portable oxygen tanks stored at an off-site vendor, of which sixty-seven (67) grew MRSA.

While this study only looked at one, relatively small, ambulance service, the degree of MRSA contamination is alarming. While there are limitations to the study due to the small sampling size (one agency and vendor), it does bring into question the protocols and policies in place for the decontamination of oxygen delivery equipment (tanks and regulators) by both the ambulance providers and the oxygen vendors. It is apparent by the lack of contamination on other pieces of equipment and the patient compartment itself that a formal decontamination program for other areas of the patient care compartment is effective. Perhaps, more alarming is the finding of tanks at an offsite vendor that

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are contaminated with MRSA; one would assume a tank coming back from a vendor would be clean and uncontaminated and this study disputes that hypothesis. This study begs for further examination and evaluation by enrolling a larger sample size across many service providers and vendors to determine if this is a widespread issue or isolated to this one service. Ambulance providers should examine their own internal policies and protocols regarding the decontamination procedures of their oxygen administration equipment.

#### **4. A Systematic Review and Meta-analysis of Ketamine as an Alternative to Opioids for Acute Pain in the Emergency Department.** Karlow,N, Schlaepfer,C, Stoll,C, Doering,M, Carpenter,C, Colditz,G, et al Acad Emerg Med doi: 10.1111/acem.13502, 2018;25: 1086-1097

Many patients present to Emergency Medical services (EMS) or the Emergency Department (ED) with pain as a chief complaint or have pain as a result of an injury or medical condition. For many years, opioids have been used successfully to provide relief from acute pain. With the recent increase in opioid dependency, often iatrogenic in origin, a non-opioid and effective alternative medication for relief of acute pain is desirable. Recent evidence suggests that ketamine may be a safe and effective alternative for opioid analgesia.

Karlow et al conducted a systematic review and meta-analysis of the medical literature to quantify the one-hour efficacy of a single, low dose of IV push ketamine for pain relief. To be included in the meta-analysis, trials had to meet five criteria:

- They had to be randomized control trials.
- The trials needed to compare the effectiveness of a single dose of ketamine to an opioid which was converted to morphine equivalent dosing with a change in either the Visual Analog Score (VAS) or Numeric Rating Score (NRS) of pain within 60 minutes of administration.
- The trials had to be done within an ED.
- The patients had to be all adults with a presenting complaint of pain.
- Lastly, all studies had to be published in English.

Conversely, exclusion criteria for trials were no documented VAS or NRS, the use of a placebo group, or the co-administration of another drug within twenty minutes of ketamine or opioid administration. Three trials met the inclusion and exclusion criteria and included 261 adult patients.

Based on their meta-analysis, the authors believe low dose ketamine is a safe and effective treatment option for acute pain in the ER and is not inferior to using morphine. They felt that their results were consistent with other, broader reviews.

This study adds to the growing body of evidence that low dose ketamine is a viable alternative to opioids in both the Emergency Department and with EMS for acute pain relief.