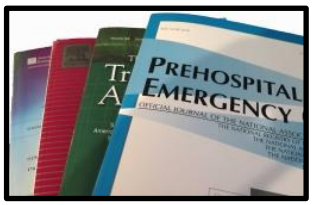
# ***International Prehospital Medicine Institute***




## IPHMI Literature Review

Keeping You Up To Date with Current EMS Literature and Studies

## Vol. 3.3

1. **The Impact of Accidental Hypothermia on Mortality in Trauma Patients Overall and Patients with Traumatic Brain Injury Specifically: A Systematic Review and Meta-Analysis.** Rosli D, Schnuriger B, Candinas D, Haltmeier T. *World J Surg* 2020; Published on-line https://link.springer.com/article/10.1007/s00268-020-05750-5.
2. **Ability of Critical Care Medics to Confirm Endotracheal Tube Placement by Ultrasound.** Joyce M, Tozer J, Vitto M, Evan, D. *Prehosp Disaster Med* 2020; Published online ahead of print, doi:10.1017/S1049023X20001004
3. **Effectiveness of the combat application tourniquet for arterial occlusion in young children.** Kelly JR, Levy MJ, Reyes J, Anders J. *J Trauma Acute Care Surg*. 2020;88:644–647.
4. **Ease of Use of Emergency Tourniquets on Simulated Limbs of Infants: Deliberate Practice.** Kragh JF, Wright-Aldossari B, Aden JK, Dubick MA. *J Special Operations Medicine* 2019;19(2):41-47

### 1. The Impact of Accidental Hypothermia on Mortality in Trauma Patients Overall and Patients with Traumatic Brain Injury Specifically: A Systematic Review and Meta-Analysis.

Rosli D, Schnuriger B, Candinas D, Haltmeier T. *World J Surg* 2020; Published on-line https://link.springer.com/article/10.1007/s00268-020-05750-5.

Hypothermia, defined as a core body temperature less than 35 C, has long been known to be a predictor for worse outcomes in the trauma patient. Multiple studies have pointed to increased mortality if the patient suffers from accidental or unintentional hypothermia, especially in the prehospital environment.

The authors of this paper conducted a systematic review and meta-analysis to investigate the effects of accidental hypothermia on mortality of trauma patients as a group and patients with traumatic brain injury (TBI) as a sub-group. The authors performed a review of articles related to accidental hypothermia and trauma patients using the Medline/PubMed database. A total of 264 articles from the search were reviewed, twenty-four (24) met the inclusion criteria, and fourteen (14) were included in the analysis after excluding studies with overlapping data. Four (4) studies specifically investigated accidental hypothermia in patients that had experienced TBI. The studies reviewed were rated satisfactory with twelve studies receiving 9 out of 9 stars, one eight and one seven stars.

The meta-analysis demonstrated that trauma patients who presented to the hospital with hypothermia had a significantly increased mortality with an odds ratio (OR) for death of 5.18 for all trauma patients and 2.38 for those with TBI compared to those trauma patients who presented to the hospital normothermic.

This study is limited by the fact that the majority (11) of studies included in the analysis were retrospective and only three were prospective. In addition, the degree of hypothermia in the various

patient populations studied was difficult to estimate an only two papers provided the mean or median body temperatures.

This article clearly points to the need to prevent unintentional hypothermia of trauma patients in the prehospital environment. Furthermore, a worse outcome for those patients suffering from hypothermia and TBI was demonstrated. While all prehospital providers are trained to try to prevent hypothermia by removing wet clothing and providing rewarming in patients with potential cold exposure, hypothermia after trauma is often a forgotten complication. In addition, civilian immediate responders should be trained, as part of any bleeding control course, to take preventative measures to include removing wet cloths, providing blankets or coverings or moving patients to a warm environment prior to EMS arrival. All prehospital providers should remember that preventing hypothermia is much easier than correcting it once the process has started.

2. **Ability of Critical Care Medics to Confirm Endotracheal Tube Placement by Ultrasound.** Joyce M, Tozer J, Vitto M, Evan, D. *Prehosp Disaster Med* 2020; Published online ahead of print, doi:10.1017/S1049023X20001004

Confirmation of proper endotracheal tube (ET) placement is of paramount importance when this life-saving procedure is performed, whether it be in the hospital or in the prehospital environment. In recent years waveform capnography was added to the arsenal of detection devices that are available to the prehospital provider. Most recently, ACLS and the American College of Emergency Physicians added ultrasound confirmation to the tools available for determining proper placement of the ET tube.

The authors of this article examined the feasibility of training critical care paramedics in the use of portable ultrasound devices to identify the proper placement of ET tube placement. A three hour course was developed consisting of a brief didactic session on fundamentals of ultrasound, followed by hands on training conducted on live models by four emergency physicians that had advanced training in Ultrasound. Hands on training consisted of how to visualize the trachea, esophagus and lungs. Following this the paramedics were individually given five (5) different cases that simulated a patient that was just intubated. For each case three simulated video images were presented on one screen. The Paramedics were then asked to interpret the location of the tube based on the supplied images.

Twenty (20) critical care paramedic volunteers were chosen to take part in this observation study. All twenty (20) paramedics completed the training and testing session and were able to correctly identify the ET tube placement in 92.5% of the cases. The average time to confirmation was 10.6 seconds for properly placed ET tubes and 15.5 seconds for esophageal placement. The authors concluded that “based on this pilot study, critical care medics can be taught to correctly interpret ultrasound images of ETT placement using a short instruction model.”

There are a number of limitations to this study. Only 5 cases were presented and the ultrasound images chosen were all previously obtained and selected because of their high quality. In actual care, ultrasound images can vary significantly, making interpretation more difficult. In addition, this study did not take into account the time required to actually perform the ultrasound and acquire adequate images. Of note, the study does not describe the cost of obtaining and maintaining the ultrasound machine and supplies for an EMS system. Lastly, the medics who participated in the study did not represent a random sample of all paramedics but rather a self-selected group of volunteers from critical care paramedics.

This study demonstrated success to its stated endpoint: the identification of ET tube placement using 3 video images. Even though ACEP added ultrasound for the confirmation of proper placement of ET tubes in the ED in 2016, it did so with many caveats, the most compelling being “Ultrasound imaging may be used to reliably confirm endotracheal tube placement. However, this should be performed by someone who is experienced in this technique”. While ultrasound may be a valuable tool in the trained

operators' hands, this study falls short of demonstrating the feasibility of actual use by paramedics. It did not take into account the many factors encountered by paramedics in the field. Importantly, skill maintenance/degradation is a huge factor in any procedure introduced whether it be in the hospital or prehospital setting. While certain paramedics involved in aeromedical systems may perform enough ultrasound exams to maintain this high acuity skill, few paramedics working in standard 911 EMS systems will perform enough exams in their normal working environment to maintain proficiency. Additional study must be done before the paramedic use of ultrasound for confirmation of proper ET tube placement can be considered a standard component of prehospital patient management.

3. **Effectiveness of the combat application tourniquet for arterial occlusion in young children.** Kelly JR, Levy MJ, Reyes J, Anders J. J Trauma Acute Care Surg. 2020;88:644–647.

The use of tourniquets for the control of limb hemorrhage in adults has become relatively well accepted, however, little research has been published regarding the use of these devices in pediatric aged patients. The authors of this study sought to determine the effectiveness of the combat application tourniquet (CAT) on preschool and school-aged children.

Children ages 1year to 8 admitted to a single university hospital for elective surgery were eligible for entry into the study. Informed consent to participate was given by the parents or legal guardians and for children ages 7 and 8 years additional consent was obtained from the patient. The study consisted of application of a CAT limb tourniquet to either an upper limb, lower limb, or both at the discretion of the family. Distal pulses were evaluated using Doppler. The tourniquet was applied as proximal as possible and tightened until the Doppler pulse was eliminated or the tourniquet could no longer be tightened. The CAT was left in place for 30 seconds of arterial occlusion and then removed.

A total of 13 children participated in the study and 24 limbs (11 upper and 13 lower) were evaluated. Participating children were ages 2 to 7 years with an average of 4.2 years. The tourniquet successfully occluded the artery in 100% of cases.

This study clearly demonstrates the ability of the CAT to be used for controlling external limb hemorrhage in preschool and school-aged children. It is important to note however that this was a small sample size and the minimum limb circumference required for successful CAT placement was not determined. In addition, given the short application time, no information about potential complications was obtained.

4. **Ease of Use of Emergency Tourniquets on Simulated Limbs of Infants: Deliberate Practice.** Kragh JF, Wright-Aldossari B, Aden JK, Dubick MA. *J Special Operations Medicine* 2019;19(2):41-47

Although rare, when managing limb hemorrhage in infants and children, the circumference of their limbs becomes an important factor when considering the potential application of a tourniquet such as the combat application tourniquet (CAT). As the circumference of the limb decreases with younger ages, the working length of the chosen tourniquet may exceed the limb size.

The authors of this paper conducted a study using the CAT and simulated infant limbs of 5.25, 4.25, and 3.25 inches circumference. The simulated limbs were metal pipes that corresponded to the size of limbs of infants aged 3 to 5 months with the 5.25 inch circumference pipe approximating the 25$^{th}$ percentile for the mid-arm size of male infants ages 3-5 months.

A number of modifications to standard application had to be implemented in order to apply the tourniquet. In the case of the 5.25 inch circumference, in order to adhere the band to itself, the band had to be placed between the clips and not over them as would be standard because the buckle and plate abutted each other. The windlass rod could be turned and secured in the clips as usual. In the case of the 4.25 inch circumference, in addition to adhering the band through the clips, it was found that

the rod could not be secured into the clips because the circumference was so small, the rod ended up perpendicular to the clip. A work-around was identified by using the excess, unused band to wrap around the twisted rod in a figure 8 pattern which then secured the rod and maintained adequate tension. Lastly, it was found that the tourniquet could not be used at all in the 3.25 circumference simulation.

This study, although a simulation, showed that the CAT will fit the limbs of most infants aged 3 to 5 months, although with modification to the application technique. Fortunately, the need for such intervention is exceedingly rare. Even in the military experience in Iraq, the number of times a tourniquet was applied to an infant because of exsanguinating limb hemorrhage was vanishingly small. It is important to remember that if a tourniquet is unavailable or cannot be applied for whatever reason, direct pressure on the bleeding site will help control hemorrhage in most trauma patients, especially infants and children.