**** IPHMI Literature Review ****

Keeping You Up To Date with Current EMS Literature and Studies

Vol. 2.10

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5. **Decreasing time to first shock: Routine application of defibrillation pads in prehospital STEMI.** Felder S, Van Aarsen K, Davis M. Canad J Emerg Med 2020;22:82-85.

Prehospital cardiac arrest patients have had a substantial increase in positive outcomes over the past decade as a result of team focused and choreographed efforts by EMS personnel. The time to initial defibrillation is a proven prime metric in increasing survivability. The authors set out to determine if the routine placement of defibrillation pads in patients presenting with ST-elevation myocardial infarction decreased time to initial shock in the event of cardiac arrest.

The authors conducted a 4 year retrospective analysis of 446 adult patients (age greater than 17 years) that had a prehospital diagnosis of STEMI. Halfway through this time period, the standard protocol changed to have providers routinely apply defibrillation pads to patients with suspected STEMI. The time to defibrillation, when needed, for the before and after groups was compared. Of the 446 patients, 11 experienced an out of hospital cardiac arrest (OOHCA). Pads were placed after cardiac arrest in 7 patients and before arrest, upon initial diagnosis of STEMI, in 4 patients. The time to initial defibrillation in the “pads on protocol” was significantly faster than in those who did not have pads placed prophylactically (mean time 17.7 seconds versus 72.7 seconds). All 4 patients enrolled in the “pads on” study survived to discharge compared to 6 of the 7 patient in the delayed application group.

This study was limited by the very small size of the two study groups and the lack of analysis for other variables that might have affected the results.

The study demonstrated that there was a significant reduction in time (55 seconds faster on average) to the initial defibrillation in patients with pads applied prior to cardiac arrest compared to those who had defibrillation pads placed after arrest. However, cardiac arrest in STEMI patients is a relatively rare event, estimated to be approximately 4%, therefore a cost-benefit analysis regarding the use of defibrillation pads is warranted. A much larger study is needed to determine the ultimate benefit in terms of patient outcome.

1. **The Reliability of Noninvasive Blood Pressure Measurement Through Layers of Autumn/Winter Clothing: A Prospective Study.** Woloszyn P, Baumberg I, Baker D, Phil M. Wild Environ Med.2019;30:227-235.

Non-invasive blood pressure (NIBP) measurement has long been available to prehospital providers. Nearly 15 years ago major defibrillation manufactures began incorporating NIBP into units aimed at and marketed to the EMS providers. All manufacturers’ literature currently suggests that the cuff should be placed directly on the patient’s bare skin. While this is easily accomplished in the Emergency Department or clinic or in summer months, undressing a patient during winter months to obtain a blood pressure on a bare arm would be time consuming and may also lead to hypothermia in colder climates.

The authors of this prospective study compared the values obtained from NIBP while wearing simulated winter clothing and a bare arm in both healthy volunteers and emergency department patients. One hundred and one (101) healthy volunteers were recruited for the first phase of this study. A second group in this study included fifty (50) patients seen in the ambulance, emergency department patients and admitted ICU patients. The study did not have any inclusion or exclusion criteria and all volunteers were accounted for in the final results. A Zoll X-Series defibrillator monitor with integrated Welch Allyn automated blood pressure was used for all subjects of this study. Two test sleeves were developed to simulate 2 and 3 layers of clothing that would normally be worn in the fall/winter season and were used with each study subject.

Within the group of 101 volunteers that were enrolled in the study, twenty-four (24) had a BP greater than one hundred and forty (140) mmHg and none (0) had a BP less than 90 mmHg. Within the patient group forty-two (42) were medical patients and eight (8) were trauma. Severity of the illness or injury was not listed in the study. Twenty-four (24) of the patient group were unconscious, five (5) had a systolic BP of less than ninety (90) mmHg and three (3) demonstrated clinical signs of shock. Overall there was no significant difference between the BP measurements obtained on the bare arm versus the simulated winter clothing. Of interest was that eight (8) patients in the ICU setting had indwelling arterial lines with continuous waveform pressure monitoring which could be used to compare BP readings. In this group one patient had a BP of 90 mmHg. This patient demonstrated a higher NIBP by 11- 20 mmHg on the systolic BP and 25-26 mmHg on the diastolic using the two sleeves. The information regarding the other two patients that showed clinical signs of shock was not called out directly in the study.

The authors of this study conclude the study shows “that NIPB can be reliably measured through layers of sleeves on the arm even if autumn/winter clothing is being worn”. Limitations of the study included only one model of NIBP device used and that hypotensive patients only represented 10% of the total patient group.

While this study demonstrates that the majority of participants could reliably have their BP measured non-invasively over winter clothing, it does not definitively demonstrate that these findings are accurate in patients in shock. Care should be taken when using NIBP over clothing and clinical gestalt should be used when making treatment decisions. A study using patients who are in extremis should be conducted to determine the reliability of NIBP measurement in these patients.

1. **Outcomes after prehospital tracheal intubation in suburban/rural pediatric trauma.** Hawkins RB, Raymond SL, Hamann HC, et al. J Surg Research. 2020;249:138-144.

The leading cause of death in pediatric patients over the age of one year, responsible for nearly 10,000 deaths in the United States annually, is trauma. The need for endotracheal intubation is an indicator of injury severity and increases the risk of morbidity and mortality. There are many options for pediatric airway management including bag-mask ventilation, supraglottic airway device placement, as well as endotracheal intubation. Intubation on scene can increase prehospital time and delay access to definitive care. In the urban setting, many have advocated the use of only bag-mask ventilation for pediatric trauma patients as transport times are often short. The best airway for pediatric trauma patient in a suburban or rural setting where the transport time maybe longer is not clear. The purpose of this study is to evaluate outcomes among pediatric trauma patients requiring endotracheal intubation in a suburban/rural trauma system.

This was a retrospective chart review of all pediatric trauma admissions to a level I Trauma Center over a ten-year period. Patients were divided into three categories: intubation at the scene, intubation at a referring hospital, or intubation at the trauma center. Data collected included age, gender, mechanism of injury, injury severity, complications, and mortality.

Over the 10 year period, 288 patients (mean age 9.5 years, 60% male) were included in the analysis. Thus, mechanism of injury was motor vehicle collision (45%), followed by fall, burn, and all-terrain vehicle collision. Most patients (54%) were intubated at the scene of injury, 19% were intubated at a referring hospital, and 25% were intubated at the trauma center. Patients intubated on scene had a higher injury severity score and a lower GCS. Patients intubated on scene also had a higher mortality rate (30%) compare with those intubated at a pediatric trauma center (5.6%). In examining airway complications by provider, 52% of complications occurred in patients intubated by EMS personnel, 9% by those intubated by a resident physician, and 33% in those intubated by an attending physician.

This study is being reviewed as an example of why it is important to completely read and analyze a study prior to accepting the conclusions of the authors. This study is an example of selection bias, in which the sickest patients have the worst outcomes. The study notes a higher rate of complications when a patient is intubated in the prehospital setting or by an attending physician at the pediatric trauma center. The lowest rate of complications occurred when the patient was intubated by a resident physician (a physician in training). Clearly this doesn’t make complete sense. The most difficult intubations in a trauma center are often done by the attending. Patients who require prehospital intubation are often sicker than those who can wait until arrival to the hospital so naturally they will have a worse outcome.

In summary, this study states that patients in a suburban/rural setting intubated in the prehospital setting (and in referring hospitals) have higher mortality and morbidity. However, after multivariate analysis, patient age, injury severity, and neurologic status were the main prognostic factors, not location of intubation. Further studies are needed to determine the optimal airway management for pediatric trauma patients in a suburban/rural setting.

1. **Characterization of Children with Septic Shock Cared for by Emergency Medical Services.** Depinet H, Eckerle M, Semenova O, Meinzen-Derr J, Babcock L. Prehosp Emerg Care 2019;23:491-500.

Sepsis and septic shock continue to be a costly, deadly and progressive disease process that is often overlooked, or difficult to identify, in the pre-hospital setting. Sepsis in pediatric patients is even more difficult to recognize and treat by EMS. Sepsis is the systemic progression of an infection identified by a multitude of related clinical findings. Septic shock is that continued progression resulting in cardiovascular dysfunction and eventually collapse. Early recognition and care of septic patients including antibiotic therapy are key to reducing sepsis mortality and improving patient outcomes. Many EMS agencies have adopted screening tools to aid providers in identifying sepsis in the adult population in order to alert receiving facilities. Unfortunately, similar screening adjuncts to assist prehospital providers in identifying pediatric sepsis do not exist.

The authors conducted a three year, IRB approved, retrospective analysis of pediatric septic shock patients, ages 0 to 21 years, that either self-presented, or arrived by 150 EMS agencies, at an urban United States pediatric emergency department (ED). The goal was to identify patient characteristics, the care they received and treatment outcomes between EMS arriving patients and patients that self-presented to the emergency Room. They also looked at EMS assessments for common sepsis indicators and how those indicators compare to ED triage scoring.

The study identified 854 patient that met criteria for entry into the study. Of these, 165 (19.3%) arrived via EMS, but complete and usable EMS data was only available for 116 of those patient contacts. Children arriving by EMS were more likely to have public insurance, were less likely to have been referred by another healthcare provider, and were more likely to be male. EMS arriving patients were also more likely to be hypotensive on arrival to the ED, 10.3% vs. 4.5%. Tachypnea and tachycardia rates were similar for both groups of patients. The EMS arriving patents had similar ED triage scoring as the self-presenting group. However, EMS patients were more likely to be initially treated in the resuscitation suite (69.8% vs. 21.9%) and receive their initial fluid bolus sooner (33 minutes vs. 58 minutes). EMS patients were also more likely to be given vasopressors (15.5% vs. 7.6%) and be placed on a ventilator within the first 24 hours of their hospital stay (31% vs. 8.1%).

While not specifically identifying parameters for or developing an EMS Pediatric Sepsis Screening Tool, the authors did identify the frequency that variables commonly used in such tools were documented by EMS. Heart rate was reliably captured by EMS. Hypotension, while a late sign of sepsis, was often only captured by EMS as a systolic measurement and would need to be both a systolic and diastolic reading. Patient temperature (hyper- or hypothermia) was only captured by EMS in 33% of their patients. Blood glucose levels were only obtained on 22% of the EMS patients. A pre-hospital pediatric sepsis tool will need to be succinct and contain variables that are easily, and reliably, obtained by pre-hospital providers. The authors did not specifically address point of care lactate measurements; however they did acknowledge that as this technology becomes more readily available to EMS, it should most likely be included in sepsis screening tools.

A pediatric sepsis screening tool for prehospital providers would offer a useful adjunct for identifying this potentially life-threatening problem. Such a tool must include standard parameters obtained by EMS and EMS must reliably measure and report these data.