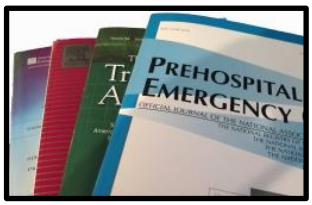
# ***International Prehospital Medicine Institute***




## IPHMI Literature Review

Keeping You Up To Date with Current EMS Literature and Studies

## Vol. 2.3

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3. **HFSA/SAEM/ISHLT Clinical Expert Consensus Document on the Emergency Management of Patients with Ventricular Assist Devices.** Givertz M, DelFilippis E, Colvin M, et al . J Heart Lung Transplant 2019;38:677-698.
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### 1. Old Age with a Traumatic Mechanism of Injury Should Be a Trauma Team Activation Criterion.

Bardes J, Benjamin E, Schellenberg M, Inaba K, Demetriades D. J Emerg Med, 2019;57:151-155.

Based on the anatomical and physiological changes our bodies undergo as we age elderly patients are at greater risk for mortality and severe injury from traumatic events. The American College of Surgeons (ACS) Committee on Trauma (COT) recommendations for Trauma Team Activation (TTA) do not include age as a criterion.

The authors' urban, ACS verified Level 1 Trauma Center, adopted an age > 70 years criterion for Trauma Team Activation. Given the cost of trauma team activations, both fiscally and in resources expended, the authors examined the question of whether this locally adopted criterion correctly identifies patients at risk or does it over-triage an excessive number of patients for TTA? The authors conducted a five-year, Institutional Review Board approved, retrospective, review of all trauma registry patients > 70 years of age at their institution, with the exception of patients seen for a ground level fall.

The study identified 739 patients that met the age criterion. The three most common causes of injuries were pedestrians struck by a vehicle (41.4%), falls from heights (25.7%) and motor vehicle crashes (14.4%). The overall over-triage rate was 30%.

Patients were categorized into two groups. The first group (n=198) included patients that met standard trauma triage criteria (TTA-S). Standard criteria include systolic blood pressure < 90mm/hg, heart rates > 120 beats/minute, Glasgow Coma Scale <9, gunshot wounds to the neck or torso or any transferred patient receiving blood products. Mortality in the TTA-S group was 60.1%. The over triage rate for this group was only 4%.

The second group of 541 patients were trauma team activations for age > 70 (TTA-A). This group had a mortality rate of 9.1%. While this group had a lower mortality rate, it still represented a population with significant traumatic injuries. Greater than half (56.6%) required admission to the Intensive Care Unit. Only 50% of this group were discharged directly home; 22.2% went to a rehabilitation facility first and 15.9% were discharged to skilled nursing facilities. Forty patients (7.4%) went emergently to the operating room, 9.1% died and 13.3% required endotracheal intubation in the emergency room. The over triage rate for this group was calculated at 39.6%, whereas for the standard activation group the overtriage rate was 4%.

Often, elderly trauma patients do not meet the standard physiologic criteria for trauma team activation. Initial vital signs may be within "normal" limits for a variety of reasons despite having serious underlying injuries. Comorbidities such as beta blocker controlled hypertension, atherosclerotic vessels limiting vasoconstriction and the potential for chronic dehydration can contribute to a delayed response to blood loss. The authors rightly point out that various other factors, notably age, may confound the assessment of the trauma patient and hence the decision to activate the trauma team. This paper supports the use of Trauma Team Activation criteria that include age as a criterion. Previous publications (Resources for the Optimal Care of the Injured Patient ACS COT) recommend acceptable over triage rates to be between 25% and 35%. This urban trauma center feels that their TTA-A criteria's over triage rate of 39.6% is not excessive and acceptable to help decrease mortality in this vulnerable population.

2. **What is the impact of physicians in prehospital treatment for patients in need of acute critical care? – An overview of reviews**. Valentin G, Jensen LG. International J. Tech Assessment Health Care 2019;35:27-35.

Worldwide, EMS systems are structured in many different configurations. Some use Basic Life Support (BLS) providers only, others offer Advanced Life Support (ALS) using paramedics, and some staff with physicians (anesthesiologists or emergency medicine physicians) or a combination of non-physician and physician providers. The authors of this paper conducted a review of the medical literature to determine if physicians decrease mortality when deployed to care for critical patients in the prehospital phase of medical care.

The authors conducted a literature search for review articles that evaluated the impact of physician level prehospital care compared to non-physician care. Using the EMBASE and MEDLINE data bases produced over 1600 references. After reviewing the identified publications for inclusion and study bias, 10 articles met the inclusion criteria for this study.

The authors looked at outcomes in five (5) categories of critical response as identified by the European Resuscitation Council:

- Cardiac Arrest,
- Chest Pain,
- Respiratory Insufficiency,
- Stroke, and
- Severe trauma to include TBI.

The- included reviews were then grouped into three categories;

- Physician-based treatment versus non–physician-based treatment,
- ALS versus BLS (physician-based ALS versus non–physician based BLS or physician-based ALS versus non–physician-based ALS), and
- Physician-based prehospital endotracheal intubation (ETI) versus non–physician-based prehospital ETI.

The articles did not discriminate between modes of transportation (air vs. ground) or crew and response criteria (primary versus secondary physician response).

The authors conclude that current evidence suggests a benefit from prehospital physician care in cardiac arrest patients and, to a lesser degree, in severe trauma. There was insufficient evidence from this review of any improvement in outcome with physician interventions during the prehospital phase in the other categories; chest pain, respiratory insufficiency and stroke. The studies reviewed did indicate that physician success rate at endotracheal intubation was significantly higher than that of non-physician providers.

This review shows that greater evaluation of EMS systems worldwide needs to be completed, looking at crew configuration and response profiles to better determine the effect on mortality and also morbidity. One of the difficulties identified in this systematic review is the differing training of the various groups of prehospital providers. Most of the studies reviewed took place in the USA, Europe and Australia. While the initial training of physicians is somewhat comparable, there was no mention of post graduate training or specialization. For example, many of the physicians that provide prehospital care in Europe are anesthesiologists, which may account for some of the difference in intubation success rates. For non-physician EMS providers, it is less clear how the training varies among the many different studies and countries included. Future studies should attempt to perform a gap analysis to assess the differences in care between physician and non-physician ALS and determine why there is an improved outcome with on-scene physician interventions. This knowledge would be instrumental in determining future curriculums for non-physician providers with the hope of closing the gap in outcomes between the two groups. Finally, none of the studies reviewed attempted to perform a cost-benefit analysis regarding the use of physicians in the field.

3. **HFSA/SAEM/ISHLT Clinical Expert Consensus Document on the Emergency Management of Patients with Ventricular Assist Devices.** Givertz M, DelFilippis E, Colvin M, et al . J Heart Lung Transplant 2019;38:677-698.

A greater number of patients with end-stage heart failure (HF) live in our communities dependent upon Ventricular Assist Devices (VADs). VADs are commonly used as a Bridge to Transplant (BTT), to allow for cardiac recovery after a myocardial infarction, or for Definitive Therapy (DT) in those patients ineligible for transplantation. EMS providers at all levels should have a basic understanding of the physiology, mechanics and emergency management of VADs.

Givertz et al published this consensus document to educate clinicians, both in and out of hospital, about the emergency management of patients with mechanical circulatory support (MCS). The typical VAD consists of four components; a continuous flow pump surgically implanted at the patient's cardiac apex and ascending aorta, a percutaneous driveline connecting the pump to a controller, the controller and a battery pack / power-based unit. Patients, families and providers are taught how to trouble shoot and correct problems with the three external components of a VAD.

MCS patients should be evaluated as would any other patient. A focused history and targeted physical exam should be completed paying attention to findings specific to VADs. The continuous flow nature of most VADs creates a challenge obtaining vital signs because of the continuous flow nature of the circulation provided by the pump. Vascular Doppler sonography is often used to determine blood pressure with the opening first sound correlating to the patient's mean arterial pressure, which should be approximately 80 mm Hg or slightly less. Palpating a pulse is difficult; therefore a cardiac monitor should be applied. Pulse oximetry is often unobtainable or inaccurate. Clinical signs such as skin color and level of consciousness are important to assess the patient's physiology.

All VAD's will alarm when equipment failures and difficulties are identified. Both patients and their families are trained to correct these problems before patients are released to the community. Patients typically travel with spare batteries and device controllers, both of which can be easily switched to correct and prevent equipment failures.

Cardiac arrest and unstable dysrhythmias are often difficult to determine clinically. Pulselessness and the inability to obtain a blood pressure are normal findings in VAD patients. Unresponsiveness, apnea and the absence of a mechanical hum on cardiac auscultation are better indicators of cardiac arrest. The authors, as well as the American Heart Association, recommend manual CPR for VAD patients found as above. The authors do not recommend the use of mechanical chest compression devices with VAD patients. Symptomatic dysrhythmias, including ventricular fibrillation, should be treated using standard ACLS algorithms.

Advanced Trauma Life Support principals and protocols apply to all VAD patients who sustain a blunt or penetrating traumatic injury. All patients with VAD's receive anti-thrombotic therapy and this should be considered during trauma triage. The greatest risk to an MCS during a traumatic event is the dislodgment or damage to the pump and/or driveline. An X-ray of the driveline should be obtained upon arrival to the hospital to confirm pump position and integrity.

Infection and sepsis are common complications of MCS and can have serious implications for VAD patients, specifically DT patients. Common VAD related infections include driveline infections ranging from erythema of the skin, cellulitis and deep infections encompassing the fascia and muscle. Pocket infections involve the "pocket" where the pump is surgically implanted. These often result in fluid collecting within the pocket. Bloodstream infections occur in up to 30% of VAD patients, usually within the first three months of MCS implantation and may be related to the pump, driveline, pocket or other sources. MCS patients are also at risk for community-acquired infections such as urinary tract infections and pneumonias. The management for VAD associated infections is based on the type and extent of the infection.

This article provides information about implanted VADs, the best methods of assessing the function of the device as well as the patient's status, and the management of equipment-related emergencies. As more and more patients return to our communities with VAD's, providers be knowledgeable in managing device related emergencies that may occur in this patient population. Device specific field guides may be used as a resource for VAD related emergencies and can be found at www.mylvad.com/medical-professionals/resource-library/ems-field-guides.

4. **A Preliminary Investigation of Civilian Clinician Perspective & Just-in-Time Guidance for Tourniquet Use to "Stop the Bleed".** Lowndes B, Law K, Abdelrahman A, et al. Mil Med 2019;184(Suppl. 1):28-36.

Control of external hemorrhage is a key component in decreasing preventable death after traumatic injury. Tourniquet application has gained widespread acceptance as an important method of bleeding control from injured extremities.

This publication examines the use of Just-In-Time instructions for the application of tourniquets using various instructional sets. The investigators used PGY 1 Surgical residents, medical students and Research fellows during an educational event. The test groups were given a pre-enrollment questionnaire that determined the extent of prior training and utilization of tourniquets. A total of 30 subjects were enrolled in the first phase of the study and 20 in the second. In the first phase, the participants were randomized into 3 groups, each of which used a different instruction sheet. Group one used the CAT (generation 7) tourniquet instructional sheet that comes pre-packaged with the device. Group two was given the instructional sheet prepared by the American College of Surgeons (ACS). Group three used the Department of Homeland Security (DHS) directions. The subjects were

briefed on the simulated trauma incident, given verbal instructions and an opportunity to ask task related questions prior to starting. The simulation consisted of a lower leg mannequin with a simulated hemorrhaging wound. Located next to the mannequin was a CAT-7 tourniquet, a set of instructions appropriate for the particular group, and a marker to denote the time of application. Prior to the second phase of the study, the ACS changed their instructional sheets. The second cohort was divided into two groups, the first using the original instructional set and the second the new revised one.

Analysis of the first cohort showed that in both those participants who had prior training in tourniquet application as well as those who were untrained, the ACS instructional sheet had the fastest completion time of the tasks at an average of 70 seconds. This was followed by the DHS sheet at 105 seconds and lastly the included CAT-7 instructions at 137 seconds. The ACS sheet also had a significantly lower combined failure rated across the 10 steps of tourniquet application evaluated in the study. The subjects in the second phase of the study demonstrated a lower average application time using the ACS version 2 instructions (73 secs.) over the ACS version 1 set (89 secs). However, both times were longer than that recorded using the ACS version 1 instructions in the first phase of the study.

Military experience and subsequent civilian use have clearly demonstrated that the quick and correct application of tourniquets give the patient with exsanguinating hemorrhage from an extremity the best possible chance of survival. This study demonstrated that the ACS instructions (both version and 2) provided a quicker application time and demonstrated less missed or incorrectly performed steps compared to the DHS instructions or the included manufacturer instructions. The ACS sheets were primarily a pictorial depiction with few keywords or cues. The DHS sheet and the manufacturer's instructions are a combination of pictorial and instructional narrative.

The study does have some major limitations as far as its applicability to the general civilian population. First the subjects, whether or not they had any prior experience with tourniquet application, were none the less medically trained (medical students, surgical residents or fellows). Their advanced knowledge of the anatomy and physiology of bleeding combined with their ability to read, comprehend, and complete medical tasks differentiates them from most of the non-medically trained population. The simulation used during the study did not include the real-life expected endpoint of stopping the simulated bleeding because the mannequin used could not simulate occlusion of the extremity and thus the cessation of bleeding. It is also crucial to note that none of the three instruction sets were developed as or intended to be Just-In-Time instructions.

The development of the best possible Just-In-Time tourniquet application instructions, particulary for non-medically trained individuals, is imperative when dealing with sudden extremity trauma resulting in life threatening hemorrhage. This study showed that even medically sophisticated but tourniquet inexperienced individuals have difficulty successfully applying a tourniquet using existing directions as a Just-In-Time guide. Although not a component of this study, it lends support to the recommendation that hands-on training and education is required. This study may provide a road map for future studies that involve non-medically trained subjects. Finally, higher fidelity, inexpensive mannequins that allow for the measurement of blood loss and cessation of bleeding in the extremity should be developed and used.